THE IMPACT OF COGNITIVE DISTORTIONS ON NEGATIVE SOCIAL COMPARISONS AND DEPRESSIVE SYMPTOMS: A SIX-MONTH LONGITUDINAL STUDY

A Thesis
Submitted to the Faculty of Graduate Studies and Research
In Partial Fulfillment of the Requirements
For the Degree of
Master of Arts
in
Clinical Psychology
University of Regina

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August, 2019
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Abstract

Depression is a debilitating mental disorder associated with impairment in social, family, and educational functioning, along with higher rates of comorbid anxiety disorders, poorer physical health, and a decrease in overall quality of life. The predictive cognitive model of depression states that negative cognitions may increase the risk of developing depression. However, there remains a lack of longitudinal studies examining whether baseline negative cognitions predict follow-up levels of depression. Consistent with the cognitive theory of depression, biased interpretations of the external world may be associated with increased negative social comparisons among individuals with a vulnerability to depression, which may in turn exacerbate depressive symptoms. The concept of negative social comparisons has recently been expanded to include feelings of anger, envy, and resentment towards others, negative evaluative thoughts about the self, and beliefs about distributive injustice, collectively known as socio-emotional comparisons. There is a paucity of research on whether socio-emotional comparisons are a consequence of, or a cause of, depressive symptoms, and whether social comparisons are linked with negative cognitive processes (e.g., cognitive distortions) known to exacerbate depression. In this six-month longitudinal study, I investigated the relationships among cognitive distortions, socio-emotional comparisons, and depressive symptoms. Participants were recruited online, using the crowdsourcing platform Amazon’s Mechanical Turk. A total of 644, 468, and 391 participants were recruited at baseline, three months, and six months, respectively. All participants completed questionnaires assessing socio-emotional comparisons, cognitive distortions, and depressive symptoms at each assessment period. Results indicated that both cognitive distortions and socio-emotional comparisons at baseline were correlated with three-
month and six-month depressive symptoms. However, neither cognitive distortions, nor socio-emotional comparisons, were significant predictors of three-month and six-month depressive symptoms after accounting for age, gender, and baseline depressive symptoms. Finally, three-month socio-emotional comparisons partially mediated the association between baseline cognitive distortions and six-month depressive symptoms, even after controlling for baseline depressive symptoms. The results of this study suggest that cognitive distortions and negative socio-emotional comparisons are both a by-product of depressive thinking; however, continually heightened cognitive distortions may fuel socio-emotional comparisons, which may in turn act as a partial predictor for future depression regardless of severity of initial depressive symptoms.
Acknowledgement

First and foremost, I would like to thank my supervisor, Dr. Shadi Beshai, whose expertise was invaluable in the formulation of my research topic and methodology. His continued guidance was instrumental in helping me complete my thesis. I would also like to acknowledge my committee members for their constructive feedback. Thank you kindly for your valuable comments that helped strengthen the quality of this project. Furthermore, I would like to express gratitude towards my friend, Ola, for inspiring hope during my graduate school endeavour, challenging me to go beyond, and teaching me that if you don’t give up, you’ll get through. Last, but certainly not least, I would like to thank my mother, brother, and father for their unwavering support throughout the ebbs and flows of graduate school. Without their unconditional love, this achievement would not have been possible. Grazie mille.
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INTRODUCTION

Major depressive disorder (MDD) affects approximately 11% of Canadians at some point in their life and over 300 million people worldwide (Knoll & MacLennan, 2017; World Health Organization [WHO], 2017). A substantial portion of individuals experience symptoms of depression without meeting formal criteria for MDD (Lépine, 2001; Karsten, Hartman, Ormel, Nolen, & Penninx, 2010). The predictive cognitive model of depression describes how negative cognitions impact the development and maintenance of depressive symptoms (Beck, 2002). In addition to the potential impact of negative cognitions on depression, biased information processing may also be related to negative social comparisons in the context of depression (Buunk & Brenninkmeyer, 2000). A newly formulated concept known as socio-emotional comparisons will be used in this study to expand the definition of negative social comparisons. Socio-emotional comparisons can be broadly defined as negative cognitions and emotions resulting from unfavourably comparing oneself to other people (Mishra, Beshai, Feeney, & Novakowski, in preparation).

Although there is empirical support for the relationship between negative social comparisons and depression, and between negative cognitions and depression, few studies have examined how negative social comparisons may be linked with cognition in the context of depression. In the following literature review, I will outline the diagnostic criteria for MDD and the importance of research pertaining to the experience of elevated symptoms of depression that do not meet criteria for MDD. I will then discuss the cognitive theory of depression including both cross-sectional and longitudinal research on the association between negative cognitions and depression. Subsequently, I will highlight the importance of negative social comparisons in the context of depression,
which will include a discussion of Festinger’s social comparison theory, along with the newly formulated concept of *socio-emotional comparisons*. Finally, the rationale and an outline of my proposed research project will then be described.

1.1 Depression

MDD is a debilitating condition with considerable personal, societal, and economic impact. Individual-level impairment associated with depression includes a decrease in cognitive functioning and overall quality of life (Hammar & Ardal, 2009; Papakostas, Petersen, Mahal, Mischoulon, Nierenberg, & Fava, 2004). Depression has also been found to be highly comorbid with anxiety disorders, substance use disorders, and eating disorders, along with various physical health conditions, including cardiovascular disease, stroke, chronic pain, cancer, and fibromyalgia (Chang et al., 2015; Hackett & Pickles, 2014; Krebber et al., 2013; van Hecke et al., 2017). Furthermore, depression is associated with a substantial economic burden. Depression has been found to cost the Canadian economy at least $32.4 billion dollars due to lost work productivity alone (Conference Board of Canada, 2017). The total economic burden of depression in other countries exceeds $175 billion dollars in Europe (Sobocki, Jönsson, Angst, & Rehnberg, 2006) and $105 billion dollars in the United States (Greenberg, Kessler, Birnbaum, Leong, Lowe, Berglund, & Corey-Lisle, 2003).

Some of the most significant factors that are associated with both the onset and maintenance of depression are social in nature (Hirschfeld et al., 2000). Depression has been associated with strained relationships between partners, parental burden associated with managing a child’s depressive symptoms, and occupational impairment (Lépine & Briley, 2011; Kessler, 2012; Muscroft & Bowl, 2000). Further, depression is linked with difficulties with affiliation and attachment, deficits in interpersonal problem solving,
impaired social communication, and dysfunctional social networks (Hirschfeld et al., 2000; Kupferberg, Bicks, & Hasler, 2016; Thoma, Schmidt, Juckel, Norra, & Suchan, 2015).

1.2 Categorical versus Continuous Measures of Depression

According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, (DSM-5; American Psychiatric Association [APA], 2013), MDD is defined as the presence of five or more symptoms for a duration of two weeks or more, with at least one of the symptoms being either a depressed mood or a loss of interest or pleasure in different activities. Other symptoms of MDD include significant weight/appetite changes, sleep disturbances, abnormal psychomotor behaviour, fatigue/loss of energy, worthlessness/guilt, difficulty concentrating, and recurrent thoughts of death (APA, 2013). To meet diagnostic criteria for MDD, these symptoms must cause clinically significant impairment in social, occupational, or other important areas of functioning.

Importantly, although MDD is one of the most impairing psychological disorders, individuals who do not meet formal criteria for MDD but report heightened symptoms of the condition also experience significant impairment of functioning (Lépine, 2001; Karsten, et al., 2010). The collection of clinical symptoms of depression that are not of sufficient severity to meet diagnostic criteria for MDD is known as subthreshold depression (Fergusson, Horwood, Ridder, & Beautrais, 2005; Pietrzak, Kinley, Afifi, Enns, Fawcett, & Sareen, 2013). Compared to more euthymic mood states (i.e., low or minimal depressive symptoms), subthreshold depressive symptoms have been associated with worse physical and social functioning, along with lower perceived current health (Karsten et al., 2010; Cuijpers, de Graff, & van Dorsselaer, 2004).
Although there is a categorical distinction between MDD and subthreshold depression, there is evidence to suggest that various levels of depression are not stable over time. A 15-year prospective community-based cohort study examining the stability of MDD found that over 90% of individuals with minor depression, 51% of individuals diagnosed with MDD, and 44% of those diagnosed with recurrent brief depression met current criteria for another subtype of depression (Angst, Sellar, & Merikangas, 2000). The shifting manifestation of depressive symptoms over time has led numerous authors to conclude that the classification of depression should be operationalized through the use of a continuum based on symptom severity. This continuum would identify individuals who endorse no or minimal depressive symptoms on one end of the spectrum, while individuals with a high number of depressive symptoms would be on the opposite end (Angst et al., 2000; Hankin, Fraley, Lahey, & Waldman, 2005). Although a diagnosis of MDD using explicit cut-off criteria can be achieved using a clinical interview, the assessment of depressive symptoms as a continuum can be collected using self-report questionnaires. A significant association has been found between elevated depressive symptoms and functional impairment (Radloff, 1977; Kroenke, Spitzer, Williams, & Lowe, 2010; Spitzer, Kroenke, & Williams, 1999). As subthreshold depression has consistently been associated with an increased risk of developing MDD, conducting research with individuals experiencing subthreshold depression is important for prevention and early intervention of the disorder (Lee et al., 2018).

1.3 Beck’s Cognitive Theory of Depression

One of the most widely known and tested theories of both MDD and subthreshold symptoms of depression is Beck’s cognitive theory of depression. According to Beck’s cognitive theory of depression, there are at least three separate
levels of information processing that occur below conscious awareness and directly impact an individual’s perception of the world, including schemas, dysfunctional attitudes, and automatic thoughts. These three separate levels of information processing generally occur below conscious awareness and directly impact an individual’s conscious perception of the world (Beck, 1963; Beck & Dozois, 2011; Reinecke, 2007). Furthermore, according to Beck’s cognitive theory of depression, the way in which individuals with depression consciously perceive the world are through situation-specific perceptual filters, known as cognitive distortions (Beck, 1963; Reinecke, 2007).

**Schemas.** Schemas are defined as deeply-engrained organized structures of stored information that contain individuals’ perceptions of self and others, along with specific goals, expectations, and memories (Beck & Dozois, 2011). These elements are well organized within individual schemas and directly influence the screening, coding, and interpretation of self-relevant stimuli, along with the retrieval of stored information, that allow for an individual to interpret his or her experiences in a meaningful way (Beck, 1967; Beck & Dozois, 2011). Schemas can be adaptive insofar as they allow for more efficient processing of experiences by directing the individual to filter environmental stimuli in such a way that it is consistent with the schema itself (Anmuth, 2011; Beck & Dozois, 2011; Beck, Rush, Shaw, & Emery, 1979; Kërqeli, Kelpi, & Tsigilis, 2013). However, in the context of depression, a maladaptive schema results in rigid and persistently negative screening, coding, and interpretation of self-relevant stimuli (Beck, 1967; Beck et al., 1979). In depression, schemas are self-perpetuating, in that they skew the processing of information in a way that is consistent with the negative schema content (Beck & Dozois, 2011). Maladaptive schemas are theorized to directly impact the development of dysfunctional attitudes, negative automatic thoughts about the
self, and situation-specific cognitive distortions that constitute the affective and cognitive symptoms of depression (Beck, 1976; Poote, 2013).

**Dysfunctional attitudes.** Dysfunctional attitudes are an excessively rigid set of rules and assumptions about how an individual perceives the world (Beck et al., 1979). The content of dysfunctional attitudes often involves unrealistic and perfectionistic standards by which individuals judge themselves and others. Dysfunctional attitudes typically take the form of if/then statements (e.g., “If others dislike me, then I’ll never be happy”; “If I do not perform as competently as others, then I must be a loser,”) (Brown, 1998).

**Automatic thoughts.** Beck’s cognitive theory of depression defines the cognitive triad as negatively biased automatic thoughts about one’s self, the external world, and the future (Beck et al., 1979; Weissman & Beck, 1978). As a result of negatively skewed automatic thoughts, individuals with depression often view a) themselves as inadequate or worthless due to presumed deficits, b) the world as unfair, and c) current difficulties as likely to continue in the future (Beck et al., 1979; Weissman & Beck, 1978). Examples of negative automatic thoughts include general statements such as “I feel like a failure”, “I am disappointed in myself”, and “I feel utterly worthless” (Beck, 1976; Beck, Steer, & Brown, 1996).

**Cognitive distortions.** Cognitive distortions have been defined as negatively skewed methods of processing social information and appraising self-relevant information from the external environment (Beck, 1963; Beck et al., 1979). Schemas, dysfunctional attitudes, and negative automatic thoughts are all unconscious and rigid patterns that do not generally change based on an individual’s experience in different situations (Beck, 1967; Beck et al., 1979); however, cognitive distortions involve
conscious awareness and can change based on one’s interpretation of each individual situation (Beck, 1967; Beck et al., 1979). For example, one cognitive distortion in depression is known as selective abstraction, which refers to the process of focusing on a specific detail taken out of context, while ignoring other more salient features of the situation (Beck, 1967). For example, a worker may compare himself to his co-worker and conclude that he is less intelligent solely on the basis of a single criticism from his co-worker, despite receiving mostly positive feedback on a well-written report. The worker may be engaging in selective abstraction if he comes to this conclusion on the basis of this single critical comment while ignoring the positive feedback, and may then conclude that that he is less intelligent than his co-worker (Beck, 1967; Beck et al., 1979).

1.4 Descriptive versus Predictive Cognitive Models of Depression

Beck’s cognitive theory of depression (1967) represents both a descriptive model that applies to individuals with depression, and a predictive model in understanding how negative cognitions can increase one’s vulnerability to depression.

Descriptive cognitive model of depression. The descriptive model states that individuals with depression interpret themselves and the world around them by using negatively-skewed cognitive structures, including dysfunctional attitudes, negative automatic thoughts, and cognitive distortions (Beck, 1963, 1967, 1976; Beck & Dozois, 2011). A review by Alloy, Salk, Stange, and Abramson (2017) found strong empirical support for the descriptive model of Beck’s cognitive theory of depression based on cross-sectional studies that have consistently uncovered an association between elevated depressive symptoms and dysfunctional attitudes. Another review by Poote (2013) found strong empirical support for the cross-sectional association between depressive
symptoms and maladaptive schemas. Furthermore, a robust cross-sectional association between negative automatic thoughts and elevated depressive symptoms has also been reported (Batmaz, Kaymak, Koçbıyık, & Turkçapar, 2015; Beshai, Dobson, & Adel, 2012; Beshai, Dobson, Adel, & Hanna, 2016; Blackburn, Jones, & Lewin, 1986; Lamberton & Oei, 2008). Finally, cross-sectional research suggests that individuals who suffer from depression are significantly more likely to employ negatively skewed, rigid methods of processing social information (i.e., cognitive distortions) (Beck, 1967; Beck et. al., 1979; Haaga, Dyck, & Ernst, 1991; Dobson, Poole, & Beck, 2018).

**Predictive cognitive model of depression.** While cross-sectional research has consistently linked negative schemas, dysfunctional attitudes, negative automatic thoughts, and cognitive distortions with symptoms of depression, the *predictive cognitive model of depression* stipulates that negative cognitions directly contribute to increased susceptibility for the development of depressive symptoms over time (Beck, 1967; Beck et al., 1979; Beck, 2002; Clark & Beck, 1999). Research has attempted to validate hypothesis of the predictive cognitive model of depression by examining baseline negative cognitions in the prediction of depressive symptoms over time using a longitudinal research design.

Although there is a plethora of research pertaining to cross-sectional associations between negative cognitions and symptoms of depression, there remains a paucity of research on longitudinal associations between baseline negative cognitions and follow-up levels of depression. With regards to maladaptive schemas, one study of university students found a significant correlation between maladaptive schemas and five-month follow-up depressive symptoms (Cámara & Calvete, 2012). Another study examining patients with MDD 9 months after the onset of a major depressive episode found that
negative self-schema assessed at baseline was correlated with 9-month follow-up depressive symptoms (Woolfolk, Gara, Ambrose, Williams, Allen, Irvin, & Beaver, 1999). With regards to dysfunctional attitudes, studies of undergraduate students have found that baseline dysfunctional attitudes were correlated with follow-up depressive symptoms within a 5-week interval (Hankin, Abramson, Miller, & Haeffel, 2004; Klocek, Oliver, & Ross, 1997) and at three-month follow-up (Dykman & Johll, 1998; Hawley, 2006; Kwon & Oei, 1992). Other studies among MDD patients found that baseline dysfunctional attitudes were significantly correlated with depressive symptoms between one-month and six-month follow-ups (Beever, Wells, & Miller, 2007; Katz, Laposa, Hawley, Quigley, & Rector, 2019).

Several studies have attempted to define cognitive vulnerability as a combination of different negative cognitions in predicting follow-up levels of depression. One study of university students with no psychological disorders found that students with high cognitive risk (assessed based on cognitive distortions and dysfunctional attitude scale) were significantly more likely to develop major, minor, and hopelessness depression than students with low cognitive risk over a 2.5-year period (Alloy, Abramson, Whitehouse, Hogan, Panzarella, & Rose, 2006). Moreover, high cognitive risk significantly predicted first onsets and recurrences of MDD and hopelessness depression and predicted first onsets of minor depression more strongly than recurrences of depressive episodes (Alloy et al., 2006). Furthermore, a study by Hamilton and Abramson (1983) found that while psychiatric inpatients with MDD scored significantly higher on dysfunctional attitudes than nondepressed psychiatric inpatients and healthy controls, approximately two weeks later, there was no significant difference between dysfunctional attitudes across the three groups (Hamilton & Abramson, 1983). In another
study among university students, researchers found that both baseline maladaptive schemas and dysfunctional attitudes were correlated with depressive symptoms at 1 and 2-month follow-ups (Cankaya, 2006).

One major problem in interpreting the findings of correlational studies and between-group designs studies is that these studies do not often account for baseline symptoms of depression. Therefore, it is difficult to ascertain whether baseline cognitions are associated with follow-up levels of depression over-and-above baseline levels of depression. There have been mixed longitudinal findings about the relationship between negative cognitions and follow-up depressive symptoms after controlling for baseline levels of depression, with the vast majority of research conducted using undergraduate populations. With regards to dysfunctional attitudes, in one study among university students, researchers found that dysfunctional attitudes significantly predicted three-month follow-up depressive symptoms for female, but not male, participants after controlling for baseline depression (Dykman & Johll, 1998). In addition, researchers found that dysfunctional attitudes significantly predicted worst period of depressive symptoms during a 12-month interval among undergraduate women after controlling for baseline depression (Zuroff, Igreja, & Mongrain, 1990). However, in another study, one researcher found that dysfunctional attitudes were not a significant predictor of two-month follow-up depressive symptoms after controlling for baseline depression (Cankaya, 2006). Moreover, in another study of undergraduate students, researchers found that baseline dysfunctional attitudes did not significantly predict 10-week depressive symptoms after controlling for baseline depressive symptoms (Klocek et al., 1997).
With regards to maladaptive schemas, researchers examining patients with MDD nine months after the onset of a major depressive episode found that negative self-schema uniquely predicted follow-up levels of depression after controlling for baseline levels of depression and baseline dysfunctional attitudes (Woolfolk et al., 1999). A study by Eberhart et al. (2011) found specific negative schemas (e.g., interpersonal, autonomy) significantly predicted 5-week follow-up depressive symptoms among female university students after controlling for baseline depressive symptoms (Eberhart, Auerbach, Bigda-Peyton, & Abela., 2011). Finally, Cámara and Calvete (2012) found that emotional deprivation schemas significantly predicted five-month follow-up depressive symptoms after controlling for baseline depression among university students. In another study with university students with a history of depressive episode but who are not currently meeting criteria for the disorder, Machado (2016) found baseline interpersonal and achievement-oriented negative schemas, cognitive distortions, and dysfunctional attitudes were not significant predictors of three-month recurrence of a major depressive episode. Similar non-significant findings were reported when examining three-month negative cognitions in predicting six-month recurrence of depressive episodes (Machado, 2016). After controlling for baseline depressive symptoms, baseline interpersonal cognitive distortions as well as maladaptive interpersonal schemas, but not interpersonal dysfunctional attitudes, significantly predicted three-month self-report depressive symptoms (Machado, 2016). None of these three baseline interpersonal cognitions were significant predictors of six-month self-report depressive symptoms, nor were three-month interpersonal cognitions significant predictors of six-month self-report depressive symptoms. Finally, achievement-related cognitive distortions, dysfunctional attitudes, and maladaptive schemas were not significant predictors of three-month or six-month
depressive symptoms (Machado, 2016). Thus, these longitudinal study findings about the relationship between negative cognitions and follow-up depressive symptoms after controlling for baseline levels of depression appear to be mixed.

Another way to measure the impact of negative cognitions in predicting follow-up depressive symptoms is to examine the stability of negative cognitions over time in relation to fluctuating depressive symptoms. Dobson and Dozois (2001) found that individuals who remained clinically depressed endorsed more negative schema content than individuals whose depression had remitted at six-month follow-up. Similar findings were reported among females with current stable MDD and female patients with remitted MDD, where Dozois (2007) found that negative automatic thoughts only decreased in individuals whose depressive symptoms remitted at six-month follow-up. Finally, Lewinsohn and colleagues found no difference in automatic thoughts between individuals with a history of depression who became depressed between baseline and 8-months follow-up compared to individuals with a history of depression who did not become depressed during baseline and 8-month follow-up (Lewinsohn, Steinmetz, Larson, & Franklin, 1981). Thus, most of these longitudinal studies suggest that negative cognitions may vary as a function of different levels of depressive symptoms.

Based on the review above, it is important to note that the variability in both baseline versus follow-up duration and the specific types of negative cognitions measures render definitive conclusions about predictive cognitive model of depression difficult to draw. Moreover, a significant proportion of the studies reported above only include university students, and findings from studies with undergraduate students may not be generalizable to other adult populations. Thus, an important area of future research would be to examine baseline cognitions and follow-up levels of depressive symptoms.
symptoms using a more representative sample, while statistically controlling for baseline levels of depression.

1.5 Negative Social Comparisons in Depression

A specific area of depression research related to negative information processing involves how individuals with depression engage in social comparisons (Ahrens & Alloy, 1997; Beshai, Mishra, Meadows, Parmar, & Huang, 2017; Giordano, Wood, & Michela, 2000; Swallow & Kuiper, 1988). Individuals with elevated symptoms of depression frequently engage in social comparisons to evaluate their personal, social, and economic standing in relation to others (Beshai et al., 2017; Festinger, 1954; Swallow & Kuiper, 1988). A review of the literature on social comparisons in depression suggested that one of the main functions of social comparisons for individuals with depression is to confirm their negative beliefs about themselves (Buunk & Brenninkmeyer, 2000). Individuals with elevated symptoms of depression consistently view themselves as less superior and are significantly more likely to engage in negative social comparisons compared to others who are not depressed, as such comparisons are consistent with their maladaptive schemas (Ahrens & Alloy, 1997; Buunk & Brenninkmeyer, 2000).

1.6 Social Comparison Theory

A prominent theory that has strongly influenced social comparison research in depression is known as social comparison theory (Festinger, 1954). Festinger (1954) argued that people are driven to evaluate themselves by engaging in social comparisons to create benchmarks of their own abilities and opinions. Festinger (1954) stipulated that in most instances, “to the extent that objective, non-social means [of comparison] are not available, people evaluate their opinions and abilities by comparison respectively with the opinions and beliefs of others.” (p. 118) In other words, people can use objective
means of comparison that exist in the real world, such as grades on an exam or physical strength, but in the absence of objective measures, subjective social comparison of one’s own opinions and abilities in relation to others are frequently employed (Festinger, 1954).

Given a range of potential individuals for comparison, people routinely select someone who is close to one’s own abilities or opinion to form the basis of comparison (Festinger, 1954). One example of the difference between how individuals without depression are able to compare themselves to others more favourably than individuals with depression involves ruling out what are called non-ability factors (Kelley, 1971; Goethals & Darley, 1977; Swallow & Kuiper, 1988). Examples of non-ability factors include age, years of experience, or physical strength, which may account for the superior performance of others. It has been argued that “the best way to rule out these non-ability factors is to ensure that one is as similar as possible to the comparison target, with respect to these factors.” (Swallow & Kuiper, 1988, p. 67) Thus, a person can attribute others’ superior performance in relation to their own performance to differences in non-ability factors, rather than actual ability differences between the person and his or her comparison target. This process illustrates what is called the discounting principle (Kelley, 1973; Mills & Grant, 2009; Swallow & Kuiper, 1988). Moreover, “the use of the discounting principle may sometimes serve as an effective strategy for attenuating the negative self-evaluative consequences of an unfavorable social comparison.” (Swallow & Kuiper, 1988, p. 67) For example, if a rookie basketball player were to compare his or her basketball abilities to a professional basketball player, although the athlete may find him or herself to be inferior, there are other non-ability factors, including age, experience, and physical strength, that may better account for this
difference. Thus, the rookie athlete may not necessarily conclude that she is a poor basketball player (Mills & Grant, 2009; Swallow & Kuiper, 1988).

The majority of research that has uncovered the finding that individuals with elevated symptoms of depression frequently fail to employ the discounting principle when engaging in social comparisons has been conducted over 25 years ago (See Swallow & Kuiper, 1988 and Swallow, 1990, for review). Results from a handful of more recent studies also suggest that failure to employ the discounting principle is related to negative affect (Webster, Powell, Duvall, & Smith, 2006) and low self-esteem (Major, Kaiser, & McCoy, 2003; Major, Quinton, & Schmader, 2003). Furthermore, there is empirical evidence to suggest that a failure to employ the discounting principle in upward social comparisons may be a factor in the onset or maintenance of depressive self-evaluations (See Swallow & Kuiper, 1988 for review).

More recent research has attempted to operationalize the concept of social comparisons when examining the effect of social comparisons on depression, negative emotions, and low self-esteem when using social media (de Vries & Kühne, 2015; Feinstein, Hershenberg, Bhatia, Latack, Meuwly, & Davila, 2013; Fox & Moreland, 2015; Lee, 2014; Lup, Trub, & Rosenthal, 2015; Nesi & Prinstein, 2015; Vogel, Rose, Roberts, Eckles, 2014). Several researchers have operationalized the concept of social comparison in terms of frequency of engagement in social comparisons (Lee, 2014; Nesi & Prinstein, 2015), feedback-seeking behaviours (Nesi & Prinstein, 2015), comparing oneself to others who are better/worse off than oneself (Vogel, Rose, Roberts, Eckles, 2014), and number of friends on a social media cite (Lee, 2014). However, one important caveat of these definitions is that it is difficult to understand how individuals are emotionally responding to different social comparisons. Further, it is difficult to apply
some of these social media-related definitions of social comparisons to other non-computerized social comparisons. Another way in which social comparisons has been operationalized in relation to mental health outcomes involves the degree to which individuals feel inferior or superior in comparison to others (Feinstein et al., 2013; Lee, 2014; Lup et al., 2015). However, it has been argued that social comparisons are significantly more complex than the resulting feelings of inferiority/superiority that often accompany negative and positive social comparisons (Mishra et al., in preparation).

1.7 Socio-Emotional Comparisons

In conjunction with the challenges of defining negative social comparisons, the concept of comparing oneself negatively in relation to others has recently been expanded to include multiple components under the newly formulated term known as socio-emotional comparisons (Mishra et al., in preparation). There are three main components to socio-emotional comparisons, including 1) feelings of anger, envy, and resentment towards others, 2) negative thoughts about the self, and 3) beliefs about distributive injustice (Mishra et al., in preparation).

Feelings of anger, envy, and resentment are directly associated with negative social comparisons. More specifically, negative affect, such as feelings of anger or resentment, may ensue if individuals believe that they do not measure up to others on specific attributes (Beshai et al., 2017; Swallow & Kuiper, 1988). This negative affective response (i.e., an emotional response of frustration, anger, and/or resentment) to unfavourable social comparisons based on desired or deserved outcomes relative to others has been associated with poorer mental health (Callan, Kim, & Matthews, 2015; Mishra & Carleton, 2015) and heightened depressive symptoms (Beshai et al., 2017).
The second factor of socio-emotional comparisons pertains to negative thoughts and evaluations of the self (Mishra et al., in preparation). Self-esteem is an inherently comparative process that involves establishing our self-worth in personally-relevant domains by comparing our own abilities to the abilities of other people within our social environment (Rosenberg, 1989). There is a strong relationship between negative self-esteem and depression. A meta-analysis of longitudinal studies examining the nature of this relationship found support for the vulnerability model, which states that low self-esteem contributes to depression, over and above the scar model, which states that depression erodes self-esteem (Sowislo & Orth, 2013). Researchers also found that this effect is not significantly influenced by gender, age, measures of self-esteem and depression, or time lag between assessments (Sowislo & Orth, 2013). Negative automatic thoughts, which include negative thoughts about the self, have also been strongly associated with elevated depressive symptoms (See Automatic thoughts section above).

The third factor of socio-emotional comparisons is known as distributive injustice, which is defined as the belief that the rewards one receives from completing a task are not proportional to the effort put into completing the task (Colquitt, 2001). A meta-analysis found that both trait (i.e., negative feelings across time and situations) and state negative affect (i.e., the varying experience of negative feelings based on individual situations) were associated with perceptions of distributed injustice (Barsky & Kaplan, 2007). Researchers have also uncovered a negative association between symptoms of depression and distributive injustice (Lang, Bliese, Lang, & Adler, 2011; Spell & Arnold, 2007; Ybema & Van den Bos, 2010). Overall, the full concept of socio-emotional comparisons has been found to be significantly correlated with depression,
anxiety, stress, and problem gambling (Mishra et al., in preparation). However, the mechanisms by which negative social comparisons may be linked to depressive symptoms, and the directionality of influence between these two concepts, have yet to be explored.

### 1.8 Link between Social Comparisons, Cognitions, and Depression

Although research on the concept of socio-emotional comparisons is in its infancy, there is preliminary cross-sectional evidence to suggest that individuals who score high on socio-emotional comparisons engage in similar mechanisms as other individuals who are depressed. The cognitive theory of depression describes why people with elevated frequency of depressive symptoms are significantly more likely to engage in negative social comparisons. A pilot project was conducted to examine the links between socio-emotional comparisons, measured by a newly developed Socio-Emotional Comparison Scale-12 (SEC12), cognitive distortions, and depressive symptoms. Among a sample of 230 individuals recruited using a crowdsourcing platform, a significant positive correlation was found between scores on the SEC12 and scores on a cognitive distortions scale \((r = .45, p < .001)\), SEC12 and depressive symptoms \((r = .51, p < .001)\), as well as cognitive distortions and depressive symptoms \((r = .44, p < .001)\).

Subsequently, linear regression analysis was computed to examine whether scores on SEC12 and scores on a cognitive distortions scale significantly predicted symptoms of depression (Wuth, 2018). The results of the regression indicate that both cognitive distortions and socio-emotional comparisons explained 31% of the variance in depressive symptoms, \(R^2 = .31, F(2, 1147) = 261.13, p < .001\). Individually, both cognitive distortions \((\beta = .26, p < .001)\) and socio-emotional comparisons \((\beta = .39, p < .001)\) significantly predicted symptoms of depression.
Furthermore, a mediation analysis was conducted to examine whether socio-emotional comparisons mediate the relationship between cognitive distortions and depression (Wuth, 2018). First, cognitive distortions significantly predicted depressive symptoms without controlling for socio-emotional comparisons \((b = .11, \text{SE} = .01, p < .001)\). Second, the effect of cognitive distortions on depressive symptoms through socio-emotional comparisons was significant \((b = .05, \text{SE} = .01, p < .001)\). Thus, the effect of cognitive distortions on depressive symptoms through socio-emotional comparisons was diminished compared to the first model without socio-emotional comparisons. In other words, the impact of cognitive distortions on depressive symptoms was partially mediated by socio-emotional comparisons (Wuth, 2018). Accordingly, socio-emotional comparisons may be a mechanism by which people experience an exacerbation of their depressive symptoms over time.

1.9 Scar Hypothesis

In addition to Beck’s cognitive theory of depression, there is another theory of depression that hypothesizes the relationship between socio-emotional comparisons and depressive symptoms over time. The scar hypothesis states that individuals who have recovered from an episode of major depression continue to experience more vicious cognitive biases (Rohde, Lewinsohn, & Seeley, 1990). Subsequently, these individuals with negative interpretation biases are hypothesized to be at elevated risk for developing a new depressive episode in the future (Zeiss & Lewinsohn, 1988). With regards to socio-emotional comparisons, based on the scar hypothesis, it can be theorized that baseline depressive symptoms would give rise to socio-emotional comparisons at 3-month follow-up, which would then predict 6-month depressive symptoms. Unfortunately, there has been a paucity of literature on the longitudinal relationship
between baseline depressive symptoms, 3-month socio-emotional comparisons, and 6-month depressive symptoms in order to empirically validate the scar hypothesis.

2. CURRENT INVESTIGATION

2.1 Purpose

The current investigation focused on expanding the empirical literature on the longitudinal association between cognitive distortions, socio-emotional comparisons, and depressive symptoms. Given the strong links between both cognitive distortions and negative social comparisons in depression, it is plausible that negative social comparisons may arise from cognitive distortions used during information processing of social situations in depression. Specifically, in this study, I sought to understand (a) whether baseline cognitive distortions and socio-emotional comparisons are correlated with depressive symptoms at three-month and six-month follow-up periods; (b) whether baseline cognitive distortions and socio-emotional comparisons predict depressive symptoms at three-month and six-month follow-up periods; (c) whether baseline depressive symptoms predict cognitive distortions and socio-emotional comparisons at three- and six-month follow-up periods and (d) whether the relationship between cognitive distortions and depressive symptoms is mediated by levels of socio-emotional comparisons. The findings of this study can ultimately help improve the identification of individuals who may be at risk of depression and can also provide empirical support for the implementation of therapeutic strategies related to reducing the impact of negative social comparisons. The hypotheses outlined below are based on a combination of theoretical supposition from the cognitive model of depression and the social comparison hypothesis, along with longitudinal evidence supporting the cognitive vulnerability model for depression (Dozois & Dobson, 2001; Machado, 2016, Wuth, 2018).
2.2 Hypotheses

1. Baseline cognitive distortions will be significantly and positively correlated with depressive symptoms at three-month and six-month follow-ups.
2. Three-month cognitive distortions will be significantly and positively correlated with six-month depressive symptoms.
3. Baseline socio-emotional comparisons will be significantly and positively correlated with depressive symptoms at three-month and six-month follow-ups.
4. Three-month socio-emotional comparisons will be significantly and positively correlated with six-month depressive symptoms.
5. Both baseline cognitive distortions and socio-emotional comparisons will significantly predict depressive symptoms at three-month and six-month follow-ups.
6. Both three-month cognitive distortions and socio-emotional comparisons will significantly predict six-month depressive symptoms.
7. Three-month socio-emotional comparisons will partially mediate the relationship between baseline cognitive distortions and six-month depressive symptoms.

2.3 Participants

Participants were recruited through Amazon Mechanical Turk (AMT; Litman, Robinson, & Abberbock, 2016), an online crowdsourcing platform that has been used extensively in behavioural and clinical research (Chandler & Shapiro, 2016; Mason & Suri, 2012). Crowdsourcing platforms have been used previously when conducting longitudinal research in psychology (e.g., Daly & Natarajan, 2015; Mishra & Carleton,
The use of online recruitment methods such as AMT offers unique access to subjects who would not otherwise have access, such as individuals living in remote regions who do not have access to research conducted at a university (Mason & Suri, 2012; Smith & Leigh, 1997). The inclusion of a more representative sample using crowdsourcing is contrasted with many studies relying on less representative convenience sampling (e.g., undergraduate students). (Mishra & Carleton, 2017; Peer, Brandimarte, Samat, & Acquisti, 2017).

2.4 Measures

**Demographics.** All participants were asked to provide their age, gender, country where they reside, race/ethnicity, primary language, highest level of education, current employment status, number of children, and personal/household annual income (See Appendix A).

**Mental Health Questionnaire.** To obtain a more comprehensive clinical history and control for the effects of MDD diagnosis and treatment, participants were asked a number of questions about their mental health and help seeking behaviour. Specific questions included asking about a lifetime diagnosis of MDD, the last time an individual experienced symptoms of depression, the use of prior and current psychological and pharmacological treatments for depression, and change in depression treatment within the last three months (See Appendix B).

**Socio-Emotional Comparison Scale.** The *Socio-Emotional Comparison Scale* (SEC12) is a 12-item self-report measure assessing appraisals used in and negative emotional consequences of comparison of one’s self to others (e.g., “When I compared myself to other people, I think that I am no good.”) (Mishra et al., in preparation) (See Appendix C). Items are rated on a seven-point Likert scale from “1” (strongly disagree)
to “7” (strongly agree), and higher scores are indicative of greater severity of negative socio-emotional comparisons. The SEC12 has been found to possess good internal reliability (α = .92) as well as strong construct validity related to personal relative deprivation, self-esteem, social comparison orientation, negative and positive affect, justice sensitivity, and the HEXACO personality traits (Mishra et al., in preparation).

Significant correlations have also been demonstrated between SEC12 and various mental health outcomes, including depression, anxiety, stress, and problem gambling (Mishra et al., in preparation). Finally, the SEC12 was found to significantly contribute to variance in depression, anxiety, and stress, over and above demographic variables, such as age, gender, education, marital status, and income (Mishra et al., in preparation).

**Cognitive Distortions Scale.** The *Cognitive Distortions Scale* (CDS) is a 20-item scale that asks participants to rate how often they engage in 10 different types of cognitive distortions (*Mind reading, catastrophizing, all-or-nothing thinking, emotional reasoning, labeling, mental filter, overgeneralization, personalization, should statements, and minimizing the positive*) (Covin, Dozois, Ogniewicz, & Seeds, 2011). Participants were asked to rate how often they engage in each cognitive distortion when in two types of situations: interpersonal (i.e., being with friends, partner, or family) and achievement (i.e., school and/or work) situations. The CDS is scored on a seven-point Likert scale ranging from “1” (never) to “7” (all the time), and higher scores are indicative of greater frequency of cognitive distortions (See Appendix D). The CDS has been found to possess good internal reliability (α = .85-.93) (Covin et al., 2011; Özdel, Taymur, Guriz, Tulaci, Kuru, & Turkcapar, 2014). The CDS has also demonstrated construct validity through significant correlations with depressive symptoms, anxiety symptoms, dysfunctional attitudes, and negative automatic thoughts, as well as
discriminant validity in differentiating between clinical and non-clinical samples (Covin et al., 2011; Özdel et al., 2014).

**Patient Health Questionnaire-9.** The *Patient Health Questionnaire-9* (PHQ9) is a nine-item scale that assesses the frequency of depressive symptoms according to the Diagnostic Statistical Manual IV (DSM-IV) criteria of depression (e.g., little interest or pleasure in doing things; feeling down depressed, or hopeless; trouble falling or staying asleep/sleeping too much; etc.) (Kroenke, Spitzer, & Williams, 2001). The PHQ9 is scored using a four-point Likert scale ranging from “0” (*not at all*) to “3” (*nearly every day*), and greater scores are indicative of higher frequency of depressive symptoms (See Appendix E). Participants were asked to rate how often they experience symptoms of depression over the past two weeks (Kroenke et al., 2001). The PHQ9 has been used extensively in depression research (Grool, van der Graaf, Mali, & Geerlings, 2011; Shankman, Nadelson, McGowan, Sovari, & Vidovich, 2012; Zuithoff, Vergouwe, King, Nazareth, van Wezep, Moons, & Geerlings, 2010). The PHQ9 has been found to possess good internal reliability (α = .86-.89) (Kroenke et al., 2001). The PHQ9 has demonstrated criterion validity through the significant relationship with an MDD diagnosis obtained using a clinical interview based on DSM criteria (Kroenke et al., 2010; Manea, Gilbody, & McMillan, 2015). Finally, the PHQ9 possesses good construct validity through its significant relationship with functional impairment, disability days, symptom-related difficulty, and clinic visits (Kroenke et al., 2001).

**2.5 Procedures**

Ethics approval for this study were obtained from the University of Regina Research Ethics Board. All self-report questionnaires were created using Qualtrics, an online surveying software. Subsequently, a link to the study questionnaires was uploaded
to the crowdsourcing website AMT, so that all participants with an AMT account could view the study. The entire sample was recruited using AMT. This study was distributed to the same participants over three separate assessment time-points, including at baseline, three-month follow-up, and six-month follow-up. Participants were informed that the purpose of this research was to determine the impact of both negative thinking patterns and social comparisons on symptoms of depression.

A G*Power (Fritz & Mackinnon, 2007) calculation confirmed that a sample size of 178 would be sufficient to detect meaningful differences in a study examining a mediation with an alpha-level of .05 and a power of .8 (Fritz & Mackinnon, 2007). However, attrition bias is one of the major threats to longitudinal studies when conducting crowdsourcing research (Schleider & Weisz, 2015). Thus, to maintain at least 178 participants during the six-month follow-up, a significantly greater number of participants must be recruited at baseline. Very few studies have examined attrition rates of longitudinal research longer than one-month duration using crowdsourcing samples. Two of these longitudinal studies using crowdsourcing data have noted attrition rates that vary between 25% and 48% after two months (Daly & Natarajan, 2015; Schleider & Weisz, 2015), around 44% to 48% attrition after 4 months (Daly & Natarajan, 2015), and 62% attrition after 8 months (Daly & Natarajan, 2015). Thus, using a conservative estimate of 75% attrition over a period of 6 months, a total baseline sample of approximately 700 participants was required to ensure that a minimum of 178 participants were available to complete the six-month follow-up study visit.

To be included in the study, participants were required to speak English proficiently and be at least 18 years old (Beshai et al., 2017). Participants completed all study measures at baseline and subsequently at three-month and six-month follow-ups.
To preserve the integrity of the data collected, two attention check items specifically designed for online crowdsourcing participants was included (Mishra & Carleton, 2017). Participants were compensated $1.00 US for baseline, then $1.50 at the three-month follow-up, and $2.00 for the six-month follow-up for this 10-20 minute study (Chandler & Shapiro, 2016). This staggered payment method was designed to improve rates of attrition, as the rate is higher than the median hourly wage for tasks performed on AMT of approximately $1.38 US (Horton & Chilton, 2010; Shapiro, Chandler, & Mueller, 2013). A study examining payment and data quality of Mechanical Turk found that although amount of compensation was not related to data quality, increasing compensation did increase the rate of recruitment (Buhrmester, Kwang, & Gosling, 2011).

2.6 Statistical Analyses

Descriptive, correlational, mediation, and regression analyses in this study were computed using IBM SPSS version 23 (IBM Corp., 2015).

**Descriptive analyses.** Prior to data analysis, the data for baseline, three-month, and six-month follow-up measures of negative social comparisons, cognitive distortions, and depressive symptoms were checked for accuracy and completeness. All outcome variables were then examined for normality. To do this, three different methods were used, including the Shapiro-Wilk test of normality as well as skewness and kurtosis. If the Shapiro-Wilk test indicated significant deviations from normality (i.e., \( p < .05 \)), skewness and kurtosis analyses were conducted to determine the size of the deviation from normality. Deviation from normality were determined using cut-off values of 1.0 for skewness and 1.5 for kurtosis (Tabachnick & Fidell, 2007). The data were then graphically examined to detect outlier scores among both predictor and outcomes.
variables. Subsequently, frequency and chi-square analyses of baseline, three-month
were used to examine age, gender, and clinical characteristics. Moreover, descriptive
statistics and repeated-measures ANOVA (i.e., mean, standard deviation) were used to
examine baseline, three-month, and six-month age as well as cognitive distortions, socio-
emotional comparisons, and depressive symptoms.

Primary analyses. Hypotheses 1-4 were examined using Pearson correlations
between cognitive distortions, socio-emotional comparisons, and depressive symptoms.
Hypotheses 5-6 were examined using step-wise hierarchical linear regression analyses.
Hypotheses 5-6 included cognitive distortions and socio-emotional comparisons as
independent variables, depressive symptoms as the dependent variable, and demographic
as well as baseline or three-month depressive symptoms as control variables. As there
are significant differences in the prevalence of depression with regards to younger age
and female gender (Pearson, Janz, & Ali, 2013), age and gender were entered on the first
step of the regression. Furthermore, to account for overlapping variance with predictor
variables and control for initial levels of depression, baseline or three-month PHQ9
scores were entered into each model prior to the CDS and SEC12.

With regards to hypotheses 5-6, the first regression analysis included baseline
demographics (i.e., age and gender) in block 1, baseline PHQ9 in block 2, baseline CDS
and SEC12 in block 3, and PHQ9 at three-months as the dependent variable. The second
regression analysis included baseline demographics (i.e., age and gender) in block 1,
baseline PHQ9 in block 2, baseline CDS and SEC12 in block 3, and PHQ9 at six-months
as the dependent variable. The third regression analysis included three-month
demographics (i.e., age and gender) in block 1, three-month PHQ9 in block 2, three-
month CDS and SEC12 in block 3, and PHQ9 at six-months as the dependent variable.
Prior to conducting regression analyses, the data for each model was examined separately to ensure all statistical assumptions were met. More specifically, multicollinearity was examined using significant correlations above .7 between all three variables (Field, 2013). The assumption of linearity was examined using significant correlations greater than .3 (Field, 2013). The assumption of homoscedasticity was examined using the linearity of the scatterplot of the standardized residuals and the standardized predicted values. The assumption of normality of residual distribution was examined using a normal P-P plot of the regression standardized residuals. The assumption of independence of residuals was examined using the Durbin-Watson statistic between 1.5 and 2.5 (Blackmon-Mosely, 2011; Durbin & Watson, 1950).

Finally, hypothesis 7 was addressed using mediation analysis based on model 4 of Hayes PROCESS macro in SPSS with three-month SEC12 as the mediator, baseline CDS as the independent variable, six-month PHQ9 as the dependent variable, and baseline PHQ9 as the covariate.

3. RESULTS

3.1 Data Cleaning

Figure 1 describe flow charts for baseline, three-month, and six-month follow-up studies that documents all participants deleted due to failing the attention check questions or due to having less than 80% completed data for SEC12, CDS, and/or PHQ9. In total, 644 participants at baseline, 468 participants at three-month follow-up, and 391 participants at six-month follow-up were included in data analyses.

3.2 Normality and Outliers Test
A Shapiro-Wilk test was conducted to examine deviations from normality. The Shapiro-Wilk test indicated that scores on PHQ9 at baseline ($W = .90, p < .001$), three-month ($W = .89, p < .001$), and six-months ($W = .88, p < .001$) significantly deviated from a normal distribution. Subsequently, out of all skewness and kurtosis calculations (Table 1), PHQ9 three-month and six-month variables had skewness statistics that were slightly beyond the cut-off score. Results presented in this study are pertaining to non-transformed data. However, similar results of the square-root function transformed data for baseline, three-month, and six-month PHQ9 scores are presented in Appendix F (Tabachnick & Fidell, 2007). Finally, the box-plot graphs indicated no significant outliers for baseline, three-month, and six-month CDS, SEC12, or PHQ9.

### 3.3 Demographic Characteristics

Summaries of the demographic characteristics of participants who completed baseline, three-month, and six-month follow-up assessments are presented in Table 2. There was no significant difference in the proportion of gender at baseline and three-month follow-up ($p = 1.00$), baseline and six-month follow-up ($p = 1.00$), and three-month and six-month follow-up ($p = 1.00$). Repeated measures ANOVA indicated that there was no significant difference in age between baseline, three-month, and six-month follow-ups [$F(2, 610) = 2.95, p = .053$].

### 3.4 Clinical Characteristics

All clinical characteristics are reported in Table 3 for baseline, three-months, and six-month follow-up assessments. No significant difference was found between baseline, three-month, and six-month CDS [$F(2, 610) = 2.40, p = .092$] or PHQ9 [$F(2, 610) = 1.55, p = .213$]. There was also no significant difference in the proportion of participants
Figure 1. *Baseline, three-month, and six-month flow chart*

- 748 participants completed baseline study visit
- 515 participants completed three-month study visit
- 426 participants completed six-month study visit

- 104 participants failed baseline attention check
- 47 participants failed three-month attention check
- 35 participants failed six-month attention check

- 0 participants completed < 80% of baseline CDS, SEC12, or PHQ9
- 0 participants completed < 80% of baseline CDS, SEC12, or PHQ9
- 0 participants completed < 80% of baseline CDS, SEC12, or PHQ9

- 644 participants used in baseline analyses
- 468 participants used in three-month analyses
- 391 participants used in six-month analyses
with PHQ9 scores greater or equal to 10 between baseline and three-months ($p = .90$), baseline and six-months ($p = .56$), and three-months and six-months ($p = .48$). However, there was a significant difference between baseline, three-month, and six-month SEC12 [$F(2, 610) = 6.38, p < .001$]. Post-hoc analyses revealed that baseline SEC12 was significantly higher than three-month SEC12 ($p = .002$) and six-month SEC12 ($p = .02$).

Furthermore, there was no significant difference in the proportion of individuals diagnosed with MDD at baseline and three-month follow-up ($p = .32$), baseline and six-month ($p = .51$), and three-month and six-month follow-up ($p = .06$). There was no significant difference in terms of the recency of last depressive symptoms at baseline and three-month follow-up ($p = .66$), baseline and six-months follow-up ($p = .77$), and three-month and six-month follow-ups ($p = .43$). There was no significant difference in current depression treatment at baseline and three-month follow-up ($p = .35$) and three-month and six-month follow-ups ($p = .17$). However, baseline participants were significantly more likely to be in current treatment participants at six-month follow-ups ($p = .01$).

Baseline participants were significantly more likely to be receiving current antidepressant medication ($p < .001$), cognitive therapy ($p = .02$), and interpersonal therapy ($p = .02$), than three-month participants. No significant differences for another form of psychotherapy ($p = .18$) or other specified treatment ($p = .69$) was found between baseline and three-month follow-ups. Furthermore, baseline participants were significantly more likely to be receiving current antidepressant medication ($p < .001$) and cognitive therapy ($p = .006$) than six-month participants. No significant differences for interpersonal therapy ($p = .10$), another form of psychotherapy ($p = .18$) or other specified treatment ($p = .25$) was found between baseline and six-month follow-ups. Finally, no significant differences for current antidepressant medication ($p = .25$),
cognitive therapy ($p = .86$), interpersonal therapy ($p = .73$), another form of psychotherapy ($p = 1.00$) or other specified treatment ($p = 1.00$) was found between three-month and six-month follow-ups.

There were significant differences for change in treatment between baseline and three-month follow-up ($p = .001$) and baseline and six-month follow-up ($p < .001$), but not for three-month and six-month follow-ups ($p = .31$). Upon closer inspection, it appears that a higher percentage of baseline participants had depression treatment stay the same compared with three-month participants, while a higher percentage of three-month participants had a decrease in depression treatment compared to baseline participants. Furthermore, it appears that a higher percentage of six-month participants had depression treatment increase compared to baseline participants, while a higher percentage of baseline participants had a decrease in depression treatment than six-month participants.

Baseline participants were significantly more likely to be receiving lifetime antidepressant medication ($p < .001$) and interpersonal therapy ($p = .007$) than three-month participants. However, three-month participants were significantly more likely to be receiving lifetime cognitive therapy ($p < .001$) than baseline participants. No significant differences for lifetime other form of psychotherapy ($p = .33$) or other specified treatment ($p = .18$) was found between baseline and three-month follow-ups. Furthermore, baseline participants were significantly more likely to be receiving lifetime antidepressant medication ($p < .001$), interpersonal therapy ($p < .001$), and another form of psychotherapy ($p = .02$) than six-month participants. However, six-month participants were significantly more likely to be receiving lifetime cognitive therapy ($p = .03$) than baseline participants. No significant differences for lifetime other specified treatment ($p$
=.18) was found between baseline and six-month follow-ups. Finally, six-month participants were significantly more likely to be receiving lifetime antidepressant medication \((p = .02)\) than three-month participants. No significant differences for lifetime cognitive therapy \((p = .72)\), interpersonal therapy \((p = .34)\), other form of psychotherapy \((p = .24)\), or other specified treatment \((p = .45)\) was found between three-month and six-month follow-ups.

With regards to specific correlations, baseline age was negatively correlated with baseline PHQ9 \((r = -.24, p < .001)\), three-month PHQ9 \((r = -.22, p < .001)\), and six-month PHQ9 \((r = -.22, p < .001)\), which indicated that younger age is significantly associated with higher PHQ9 across the three time-points. Further, females scored significantly higher than males on baseline, three-month, and six-month PHQ9 (Table 4).

### 3.5 Correlations

Baseline CDS was significantly correlated with three-month PHQ9 \((r = .51, p < .001)\). Furthermore, three-month CDS was significantly correlated with six-month PHQ9 \((r = .50, p < .001)\). Finally, baseline CDS was significantly correlated with six-month PHQ9 \((r = .49, p < .001)\). Baseline SEC12 was also significantly correlated with three-month PHQ9 \((r = .50, p < .001)\). Furthermore, three-month SEC12 was significantly correlated with six-month PHQ9 \((r = .56, p < .001)\). Finally, baseline SEC12 was significantly correlated with six-month PfHQ9 \((r = .53, p < .001)\).

### 3.6 Regression analyses

With regards to the regression examining baseline CDS and SEC12 predicting three-month PHQ9 after controlling for age, gender, and baseline PHQ9, evidence of multicollinearity was not present. Furthermore, the assumptions of linearity,
Table 1. *Skewness and kurtosis*

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<th>Kurtosis Statistic</th>
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*Note.* <sup>a</sup> = Patient Health Questionnaire-9
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<th>Six-Month ($n = 391$)</th>
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<td>4 (1.02)</td>
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<td>3 (.76)</td>
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<td>1 (.26)</td>
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<td>78 (16.67)</td>
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<th>Divorced/ Separated</th>
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<td>188 (48.08)</td>
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<tr>
<td></td>
<td>184 (28.57)</td>
<td>141 (30.13)</td>
<td>112 (28.64)</td>
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<td>19 (2.95)</td>
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<tr>
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<td>68 (10.56)</td>
<td>51 (10.90)</td>
<td>48 (12.28)</td>
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<th>Number of children</th>
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<td>313 (48.60)</td>
<td>224 (47.86)</td>
<td>182 (46.55)</td>
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<tr>
<td></td>
<td>109 (16.93)</td>
<td>76 (16.24)</td>
<td>70 (17.90)</td>
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<tr>
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<td>130 (20.19)</td>
<td>92 (19.66)</td>
<td>77 (19.69)</td>
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<td>57 (8.85)</td>
<td>43 (9.19)</td>
<td>41 (10.49)</td>
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<td></td>
<td>34 (5.28)</td>
<td>32 (6.84)</td>
<td>19 (4.86)</td>
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<th>$30,001 - $50,000</th>
<th>$50,001 - $75,000</th>
<th>$75,001 - $100,000</th>
<th>&gt; $100,000</th>
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<td>70 (10.87)</td>
<td>229 (35.56)</td>
<td>165 (25.62)</td>
<td>119 (18.48)</td>
<td>41 (6.37)</td>
<td>19 (2.95)</td>
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<td>41 (8.76)</td>
<td>181 (29.84)</td>
<td>108 (20.93)</td>
<td>93 (11.37)</td>
<td>30 (6.41)</td>
<td>15 (3.12)</td>
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<td>28 (7.16)</td>
<td>150 (24.36)</td>
<td>91 (15.22)</td>
<td>80 (12.01)</td>
<td>26 (4.68)</td>
<td>16 (3.69)</td>
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<table>
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<th>Household income</th>
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<th>$10,000 - $30,000</th>
<th>$30,001 - $50,000</th>
<th>$50,001 - $75,000</th>
<th>$75,001 - $100,000</th>
<th>&gt; $100,000</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>11 (1.71)</td>
<td>141 (21.89)</td>
<td>166 (25.78)</td>
<td>157 (24.38)</td>
<td>93 (14.44)</td>
<td>75 (11.65)</td>
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<td></td>
<td>9 (1.92)</td>
<td>103 (20.02)</td>
<td>109 (23.29)</td>
<td>119 (25.43)</td>
<td>70 (14.96)</td>
<td>58 (12.39)</td>
</tr>
<tr>
<td></td>
<td>6 (1.53)</td>
<td>87 (22.25)</td>
<td>92 (23.53)</td>
<td>97 (24.81)</td>
<td>63 (16.11)</td>
<td>46 (11.76)</td>
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</table>

<table>
<thead>
<tr>
<th>Employment</th>
<th>Full-time</th>
<th>Part-time</th>
<th>Unemployed not looking for work</th>
<th>Unemployed looking for work</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>391 (60.71)</td>
<td>286 (61.11)</td>
<td>251 (64.19)</td>
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<tr>
<td></td>
<td>239 (37.01)</td>
<td>199 (34.52)</td>
<td>160 (40.36)</td>
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<tr>
<td></td>
<td>9 (1.38)</td>
<td>5 (0.89)</td>
<td>5 (1.26)</td>
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</table>

<table>
<thead>
<tr>
<th>Employment</th>
<th>Full-time</th>
<th>Part-time</th>
<th>Unemployed not looking for work</th>
<th>Unemployed looking for work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>110 (17.08)</td>
<td>75 (16.03)</td>
<td>65 (16.62)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>58 (9.01)</td>
<td>37 (7.91)</td>
<td>22 (5.63)</td>
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</tr>
<tr>
<td></td>
<td>48 (7.45)</td>
<td>29 (6.20)</td>
<td>21 (5.37)</td>
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<td></td>
<td>Belgium (122)</td>
<td>Canada (100)</td>
<td>USA (108)</td>
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<tr>
<td>---------------------</td>
<td>---------------</td>
<td>--------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td>34 (5.28)</td>
<td>40 (8.55)</td>
<td>29 (7.42)</td>
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<td>Never employed</td>
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<td>1 (.21)</td>
<td>3 (.77)</td>
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Table 3. Clinical characteristics of baseline, three-month, and six-month participants

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<tr>
<th></th>
<th>Baseline (n = 644)</th>
<th>Three-Month (n = 468)</th>
<th>Six-Month (n = 391)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>PHQ9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.09 (6.51)</td>
<td>6.18 (5.96)</td>
<td>6.10 (5.93)</td>
</tr>
<tr>
<td>CDS&lt;sup&gt;b&lt;/sup&gt;</td>
<td>75.24 (23.89)</td>
<td>71.36 (23.76)</td>
<td>73.36 (24.19)</td>
</tr>
<tr>
<td>SEC12&lt;sup&gt;c&lt;/sup&gt;</td>
<td>37.79 (16.79)</td>
<td>34.64 (16.35)</td>
<td>36.29 (16.20)</td>
</tr>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>PHQ9&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 10</td>
<td>450 (69.88)</td>
<td>343 (73.29)</td>
<td>291 (74.42)</td>
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<tr>
<td>≥ 10</td>
<td>194 (30.12)</td>
<td>125 (26.71)</td>
<td>100 (25.58)</td>
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<tr>
<td>Past MDD Diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>458 (71.12)</td>
<td>357 (76.28)</td>
<td>280 (71.61)</td>
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<tr>
<td>Yes</td>
<td>186 (28.88)</td>
<td>111 (23.72)</td>
<td>111 (28.39)</td>
</tr>
<tr>
<td>Last time depressed for 2 weeks</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Never</td>
<td>159 (24.69)</td>
<td>123 (26.28)</td>
<td>96 (24.55)</td>
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<tr>
<td>Less than a month</td>
<td>170 (26.40)</td>
<td>108 (23.08)</td>
<td>102 (26.09)</td>
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<tr>
<td>1-3 months</td>
<td>100 (15.53)</td>
<td>79 (16.88)</td>
<td>45 (11.51)</td>
</tr>
<tr>
<td>4-6 months</td>
<td>41 (6.37)</td>
<td>31 (6.62)</td>
<td>27 (6.91)</td>
</tr>
<tr>
<td>7-12 months</td>
<td>36 (5.59)</td>
<td>21 (4.49)</td>
<td>25 (6.39)</td>
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<tr>
<td>1-2 years</td>
<td>40 (6.21)</td>
<td>27 (5.77)</td>
<td>28 (7.16)</td>
</tr>
<tr>
<td>More than 2 years</td>
<td>98 (15.22)</td>
<td>79 (16.88)</td>
<td>68 (17.39)</td>
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<tr>
<td>Current depression treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>528 (81.99)</td>
<td>390 (83.33)</td>
<td>321 (82.10)</td>
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<tr>
<td>Yes</td>
<td>116 (18.01)</td>
<td>78 (16.67)</td>
<td>70 (17.90)</td>
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<td>Type of current depression treatment</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Antidepressant medication</td>
<td>102 (15.84)</td>
<td>70 (14.96)</td>
<td>61 (15.60)</td>
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<tr>
<td>Cognitive therapy</td>
<td>35 (5.43)</td>
<td>19 (4.06)</td>
<td>17 (4.35)</td>
</tr>
<tr>
<td>Interpersonal therapy</td>
<td>18 (2.80)</td>
<td>8 (1.71)</td>
<td>10 (2.56)</td>
</tr>
</tbody>
</table>
Another form of psychotherapy
   8 (1.24)  3 (.64)  3 (.77)
Other
   4 (.62)  2 (.43)  1 (.26)

| Change in depression treatment within the last three months |
|----------------|----------------|----------------|
| Stayed the Same | 74 (11.49) | 47 (10.04) | 45 (11.51) |
| Increased       | 24 (3.73)  | 15 (3.21)  | 18 (4.60)  |
| Decreased       | 18 (2.80)  | 16 (3.42)  | 7 (1.79)   |

Type of past treatment

<table>
<thead>
<tr>
<th>Type of treatment</th>
<th>Patient Health Questionnaire-9</th>
<th>Cognitive Distortions Questionnaire</th>
<th>Socio-Emotional Comparisons Scale-12</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>359 (55.75)</td>
<td>274 (58.55)</td>
<td>222 (56.78)</td>
</tr>
<tr>
<td>Antidepressant medication</td>
<td>227 (35.25)</td>
<td>152 (32.47)</td>
<td>129 (32.99)</td>
</tr>
<tr>
<td>Cognitive therapy</td>
<td>111 (17.24)</td>
<td>83 (17.74)</td>
<td>87 (22.25)</td>
</tr>
<tr>
<td>Interpersonal therapy</td>
<td>100 (15.53)</td>
<td>64 (13.68)</td>
<td>55 (14.07)</td>
</tr>
<tr>
<td>Another form of psychotherapy</td>
<td>23 (3.57)</td>
<td>17 (3.63)</td>
<td>11 (2.81)</td>
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<tr>
<td>Other</td>
<td>13 (2.02)</td>
<td>7 (1.50)</td>
<td>4 (1.02)</td>
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*Note.*  

<table>
<thead>
<tr>
<th>a</th>
<th>Patient Health Questionnaire-9</th>
<th>b</th>
<th>Cognitive Distortions Questionnaire</th>
<th>c</th>
<th>Socio-Emotional Comparisons Scale-12</th>
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</thead>
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<tr>
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Table 4. *T*-Test comparison of gender and PHQ9

<table>
<thead>
<tr>
<th>PHQ9 Measure</th>
<th>Males Mean (SD)</th>
<th>Females Mean (SD)</th>
<th>t</th>
<th>df</th>
<th>p-value</th>
<th>Effect size (d)</th>
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</thead>
<tbody>
<tr>
<td>Baseline PHQ9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.19 (6.29)</td>
<td>7.66 (6.55)</td>
<td>-2.85</td>
<td>638</td>
<td>.005</td>
<td>.23</td>
</tr>
<tr>
<td>Three-month PHQ9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.19 (5.71)</td>
<td>6.50 (5.94)</td>
<td>-2.31</td>
<td>433</td>
<td>.021</td>
<td>.22</td>
</tr>
<tr>
<td>Six-month PHQ9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.06 (5.47)</td>
<td>6.51 (5.95)</td>
<td>-2.33</td>
<td>353</td>
<td>.020</td>
<td>.25</td>
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*Note.* <sup>a</sup> = Patient Health Questionnaire-9
homoscedasticity, and normality of residual distribution were all met. Finally, the assumption of independence of residuals was met ($d = 2.15$).

Coefficients for the first regression are summarized in Table 5. This overall model significantly predicted 62% of the variance in three-month PHQ9 [$R^2 = .62; F(5, 429) = 141.74, p < .001$]. In this model, the $R^2$ change when baseline age and gender were added to the model was significant ($R^2_{\text{change}} = .06, p < .001$). Both baseline age and gender significantly predicted three-month PHQ9 (Table 5). The $R^2$ change when baseline PHQ9 was added to the model was also significant ($R^2_{\text{change}} = .56, p < .001$). Baseline PHQ9 significantly predicted three-month PHQ9 (Table 5). Finally, the $R^2$ change when baseline CDS and SEC12 were added to the model was not significant ($R^2_{\text{change}} = .002, p = .315$). After controlling for age gender, and baseline PHQ9, neither baseline CDS, nor baseline SEC12, were significant predictors of three-month PHQ9 (Table 5).

With regards to the regression examining baseline CDS and SEC12 predicting six-month PHQ9 after controlling for age, gender, and baseline PHQ9, multicollinearity was not present. Furthermore, the assumptions of linearity, homoscedasticity, and normality of residual distribution were all met. Finally, the assumption of independence of residuals was met ($d = 2.06$).

Coefficients for the second regression are summarized in Table 6. The second model significantly predicted 62% of the variance in six-month PHQ9 [$R^2 = .62, F(5, 349) = 114.90, p < .001$]. In this model, the $R^2$ change when baseline age and gender were added to the model was significant ($R^2_{\text{change}} = .06, p < .001$). Both baseline age and gender significantly predicted six-month PHQ9 (Table 7). The $R^2$ change when baseline PHQ9 was added to the model was also significant ($R^2_{\text{change}} = .56, p < .001$). Baseline PHQ9 significantly predicted six-month PHQ9 (Table 7). Finally, the $R^2$ change when
Table 5. *Baseline CDS and SEC12 predicting three-month PHQ9*

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>T</th>
<th>p-value</th>
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<td><strong>Block 1</strong></td>
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<tr>
<td>Age</td>
<td>-.10</td>
<td>.02</td>
<td>-.22</td>
<td>-4.73</td>
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<td>Gender</td>
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<td>.56</td>
<td>.13</td>
<td>2.78</td>
<td>.006</td>
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<td><strong>Block 2</strong></td>
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<tr>
<td>Baseline PHQ9&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.75</td>
<td>.03</td>
<td>.77</td>
<td>25.23</td>
<td>.000</td>
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<tr>
<td>Baseline CDS&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>.01</td>
<td>.06</td>
<td>1.50</td>
<td>.133</td>
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<td>Baseline SEC12&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-.01</td>
<td>.02</td>
<td>-.03</td>
<td>-.78</td>
<td>.434</td>
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</table>

*Note.* <sup>a</sup> = Patient Health Questionnaire-9; <sup>b</sup> = Cognitive Distortions Questionnaire; <sup>c</sup> = Socio-Emotional Comparisons Scale-12
Table 6. Baseline CDS and SEC12 predicting six-month PHQ9

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>t</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Block 1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.10</td>
<td>.02</td>
<td>-.22</td>
<td>-4.26</td>
<td>.000</td>
</tr>
<tr>
<td>Gender</td>
<td>1.59</td>
<td>.61</td>
<td>.14</td>
<td>2.61</td>
<td>.010</td>
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<td>Block 2</td>
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<tr>
<td>Baseline PHQ9(^a)</td>
<td>.76</td>
<td>.03</td>
<td>.77</td>
<td>22.71</td>
<td>.000</td>
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<tr>
<td>Block 3</td>
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<tr>
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<td>-.01</td>
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<td>Baseline SEC12(^c)</td>
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<td>.02</td>
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Note. \(^a\) = Patient Health Questionnaire-9; \(^b\) = Cognitive Distortions Questionnaire; \(^c\) = Socio-Emotional Comparisons Scale-12
baseline CDS and SEC12 were added to the model was not significant ($R^2_{\text{change}} = .001, p = .519$). After controlling for age gender, and baseline PHQ9, neither baseline CDS, nor baseline SEC12, were significant predictors of six-month PHQ9 (Table 6).

With regards to the regression examining three-month CDS and SEC12 predicting six-month PHQ9 after controlling for age, gender, and three-month PHQ9, multicollinearity was not present. Furthermore, the assumptions of linearity, homoscedasticity, and normality of residual distribution were all met. Finally, the assumption of independence of residuals was met ($d = 2.01$).

Coefficients for the third regression are summarized in Table 7. The third model significantly predicted 61% of the variance in six-month PHQ9 [$R^2 = .61, F(5, 321) = 98.83, p < .001$]. In this model, the $R^2$ change when three-month age and gender were added to the model was significant ($R^2_{\text{change}} = .06, p < .001$). While three-month age was significantly associated with six-month PHQ9, gender was not (Table 7). The $R^2$ change when three-month PHQ9 was added to the model was also significant ($R^2_{\text{change}} = .53, p < .001$). Three-month PHQ9 significantly predicted six-month PHQ9 (Table 7). Finally, the $R^2$ change when three-month CDS and SEC12 were added to the model was significant ($R^2_{\text{change}} = .02, p < .001$). However, after controlling for age gender, and baseline PHQ9, neither baseline CDS, nor baseline SEC12, were significant predictors of three-month PHQ9 (Table 7).

3.7 Mediation analyses

Mediation analyses indicated that after controlling for baseline PHQ9, there was no significant total effect of baseline CDS on six-month PHQ9 ($b = .01, SE = .01, p = .221$; Figure 2). After controlling for baseline PHQ9, there was no significant direct effect of baseline CDS on six-month PHQ9 ($b = .00, SE = .01, p = .912$). However, there
<table>
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<td>.059</td>
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</tbody>
</table>

*Note.* \(^a\) = Patient Health Questionnaire-9; \(^b\) = Cognitive Distortions Questionnaire; \(^c\) = Socio-Emotional Comparisons Scale-12
was a significant direct effect of baseline CDS on three-month SEC12 \((b = .23, SE = .04, p < .001)\) as well as three-month SEC12 on six-month PHQ9 \((b = .05, SE = .02, p = .001)\). Finally, after controlling for baseline PHQ9, there was a significant indirect effect of baseline CDS on six-month PHQ9 mediated by three-month SEC12 \((b = .01, SE = .01, 95\% CI = [.003, .02])\).

3.8 Exploratory Analyses

In order to empirically validate the scar hypothesis for SEC, a mediation was completed with baseline PHQ9 as the independent variable, three-month SEC12 as the mediator, and six-month PHQ9 as the dependent variable (Figure 3). Mediation analyses indicated that there was a significant total effect of baseline PHQ9 on six-month PHQ9 \((b = .78, SE = .03, p < .001)\). There was a significant direct effect of baseline PHQ9 on six-month PHQ9 \((b = .70, SE = .04, p < .001)\). There was also a significant direct effect of baseline PHQ9 on three-month SEC12 \((b = 1.59, SE = .13, p < .001)\) as well as three-month SEC12 on six-month PHQ9 \((b = .05, SE = .01, p < .001)\). Finally, there was a significant indirect effect of baseline PHQ9 on six-month PHQ9 mediated by three-month SEC12 \((b = .08, SE = .03, 95\% CI = [.02, .15])\).

4. DISCUSSION

Despite the cross-sectional association between depressive symptoms and negative cognitions (Alloy et al., 2017; Poote, 2013) as well as negative social comparisons (Beshai et al., 2017; Buunk & Brenninkmeyer, 2000; Swallow & Kuiper, 1988), there is a paucity of research examining whether these maladaptive strategies predict follow-up depressive symptoms. Furthermore, given the strong links between negative cognitions and negative social comparisons in depression, it can be theorized that cognitive distortions directly impact negative social comparisons, which then
Figure 2. Mediation model of baseline CDS, three-month SEC12, and six-month PHQ9 controlling for baseline PHQ9

* = p < .01  
** = p < .001  
^ = Total effect of baseline CDS on six-month PHQ9 without controlling for three-month SEC12
Figure 3. Mediation model of baseline PHQ9, three-month SEC12, and six-month PHQ9 controlling for baseline SEC12

** = p < .001

* = Total effect of baseline PHQ9 on six-month PHQ9 without controlling for three-month SEC12
subsequently predict follow-up levels of depression. However, longitudinal studies examining the temporal association between cognitive distortions, negative social comparisons, and depressive symptoms are sorely lacking. The primary objective of this study was to investigate the longitudinal impact of cognitive distortions and socio-emotional comparisons in predicting follow-up depressive symptoms. The secondary objective was to understand the relationship between baseline cognitive distortions, three-month socio-emotional comparisons, and six-month depressive symptoms. A crowdsourcing approach was used to recruit participants over three different timepoints, including at baseline, three-month, and six-month follow-up periods.

Results indicated that cognitive distortions and socio-emotional comparisons were not significant predictors of follow-up depressive symptoms after controlling for baseline depressive symptoms. Furthermore, baseline cognitive distortions and socio-emotional comparisons remained significant predictors of follow-up distortions/socio-emotional comparisons, even after controlling for baseline depressive symptoms. Baseline cognitive distortions were found to have an indirect effect on six-month depressive symptoms with three-month socio-emotional comparisons as the mediating variable after controlling for baseline depressive symptoms. Finally, baseline depressive symptoms were found to have an indirect effect on six-month depressive symptoms with three-month socio-emotional comparisons as the mediating variable after controlling for baseline socio-emotional comparisons. Ultimately, this study addressed a significant knowledge gap pertaining to negative cognitions and negative social comparisons as risk factors for the development of follow-up depressive symptoms.

Hypotheses 1-4 were fully supported; baseline cognitive distortions and levels of socio-emotional comparisons were significantly correlated with three-month and six-
month depressive symptoms. Further, three-month cognitive distortions and socio-emotional comparisons were also significantly correlated with six-month depressive symptoms. However, hypotheses 5-6 were not supported. Baseline levels of cognitive distortions and socio-emotional comparisons did not significantly predict three- or six-month depressive symptoms after controlling for age, gender, and baseline depressive symptoms. Similarly, three-month cognitive distortions and socio-emotional comparisons did not predict six-month depressive symptoms after controlling for age, gender, and baseline depressive symptoms. Finally, hypothesis 7 was supported; three-month socio-emotional comparisons partially mediated the relationship between baseline cognitive distortions and six-month depressive after controlling for baseline depressive symptoms.

The correlational findings of hypotheses 1-4 between .49-.51 are consistent with results of previous longitudinal research. Researchers examining the associations of negative cognitions and depression symptoms have found significant correlations between .25-.64 for baseline dysfunctional attitudes/maladaptive schemas and follow-up depressive symptoms among non-clinical (Dykman & Johll, 1998; Hankin et al., 2004; Hawley, 2006; Klocek, Oliver, & Ross, 1997; Kwon & Oei, 1992) and clinical samples (Beever, Wells, & Miller, 2007; Katz et al., 2019; Woolfolk et al., 1999). Furthermore, the non-significant regression results of hypotheses 5-6 are consistent with some previous findings that cognitive distortions, maladaptive schemas, and dysfunctional attitudes were not significant predictors of follow-up depressive symptoms after controlling for baseline depression among university students (Cankaya, 2006; Klocek et al., 1997; Machado, 2016). However, it should be noted that the non-significant regression results of hypothesis 5-6 are not consistent with other studies with female
university students, whereby dysfunctional attitudes and maladaptive schemas significantly predicted follow-up depressive symptoms after controlling for baseline depression (Cámara & Calvete, 2012; Dykman & Johll, 1998; Eberhart, Auerbach, Bigda-Peyton, & Abela., 2011; Zuroff et al., 1990). Furthermore, there remains a paucity of literature supporting the significant regression results of hypothesis 5-6 related to the significance of cognitive distortions/socio-emotional comparisons after controlling for baseline depressive symptoms.

The results of the mediation analysis suggest that individuals with higher levels of cognitive distortions are more likely to experience an increase in socio-emotional comparisons, which then subsequently predict the development of depressive symptoms over time. Although Baron and Kenny (1986) stipulated that a significant total effect is required in order for mediation to occur, Preacher and Hayes (2004) stated that mediation can occur with a significant indirect effect in the absence of a significant direct effect. The direct effect of baseline cognitive distortions on six-month depressive symptoms is likely reduced by suppression, which occurs due to the high interrelationships among predictor variables (Rucker et al., 2011). This finding is similar to the cross-sectional association between cognitive distortions, socio-emotional comparisons, and depressive symptoms uncovered during the pilot study reported above (Wuth, 2018). However, there remains a paucity of longitudinal research empirically validating the mediation hypothesis between baseline cognitive distortions, three-month socio-emotional comparisons and six-month depressive symptoms (Abramson, Metalsky, & Alloy, 1989; Ahrens & Alloy, 1997; Needles & Abramson, 1990).

Finally, the results of the exploratory mediation analysis suggest that individuals with higher levels of baseline depressive symptoms are more likely to experience an
increase in SEC, which then subsequently predict the development of depressive symptoms over time. What is interesting to note is that the direct effect of baseline depressive symptoms on three-month SEC, as well as the direct effect of three-month SEC on 6-month depressive symptoms were significant. This finding provides preliminary support for the role of SEC within the scar hypothesis, which states that initial depression increases one’s cognitive vulnerability, which then subsequently predicts future risk of developing depression over time (Rohde, Lewinsohn, & Seeley, 1990; Zeiss & Lewinsohn, 1988).

The findings of this study can be best understood within the framework of Beck’s cognitive model of depression, which states that maladaptive strategies (e.g., cognitive distortions) predict follow-up depression (Beck, 1967; Beck et al., 1979; Beck, 2002; Clark & Beck, 1999). Firstly, the finding that cognitive distortions and socio-emotional comparisons did not predict follow-up depressive symptoms after controlling for baseline depressive symptoms (i.e., hypotheses 5-6) points toward a refined cognitive model of depression, which postulates that cognitive distortions and negative social processes (e.g., negative comparisons) are the consequences of elevated depressive symptoms. Finally, the mediation findings of hypothesis 7 suggests that both cognitive distortions and socio-emotional comparisons significantly impact the experience of follow-up depressive symptoms.

To understand the differences between the findings of the current study, it is important to differentiate between two different classifications of cognitive models of depression (Kwon & Oei, 1992; Parry and Brewin, 1988). The two general categories of cognitive models include an integrated model and a symptom model (Parry & Brewin, 1988). According to Parry and Brewin (1988), the integrated model postulates that
depression can be precipitated by either negative life events or pre-existing cognitive vulnerabilities (Kwon & Oei, 1992). In contrast, the symptom model states that negative cognitions reflect changes in the clinical state of depression, rather than pre-existing vulnerability (Kwon & Oei, 1992; Parry and Brewin, 1988). While Beck’s cognitive theory is consistent with the integrated model of depression, the regression findings of this study support the both the integrated model as well as the symptom model of depression (Kwon & Oei, 1992; Parry & Brewin, 1988).

A possible explanation of the study findings is to acknowledge the existence of a vicious cycle between cognitive distortions, socio-emotional comparisons, and depressive symptoms within a refined cognitive model of depression (Kwon & Oei, 1992). In other words, the findings suggest a reciprocal relationship in which depressive symptoms increase the accessibility of cognitive distortions and socio-emotional comparisons, while both maladaptive strategies maintain follow-up depressive symptoms (Katz et al., 2019; Teasdale, 1983). In theory, individuals with a pre-existing vulnerability to internalizing disorders (e.g., early childhood experiences, genetics, family dynamics, personality) would be significantly more likely to develop negative biases in seeing and interpreting the world around them through the use of cognitive distortions and socio-emotional comparisons. Individuals with elevated cognitive distortions and socio-emotional comparisons would then be more likely to experience depressive symptoms. Subsequently, an increase in depressive symptoms would then exacerbate negative biases in seeing and interpreting the world (i.e., cognitive distortions and socio-emotional comparisons), which in turn would directly contribute to the maintenance of elevated depressive symptoms. A diagram in Appendix G documents the refined cognitive model of depression.
4.1 Implications

Results of this study have important implications for depression research and treatment. The uniqueness of this longitudinal design allows for broader implications than results obtained from a cross-sectional study. The findings pertaining to cognitive distortions fit well with cognitive behaviour therapy (CBT) interventions for depression, designed to identify, test, and dismantle cognitive distortions. (Beck, 1976; Beck 2011; Beck & Haigh, 2014; Butler, Chapman, Forman, & Beck, 2006; Katz et al., 2019). Psychotherapy for depression provides acute symptom relief and can bring about remission from a current depressive episode (Nierenberg, Petersen, & Alpert, 2003; Robinson, Berman, & Neimeyer, 1990). CBT in particular can equip patients with skills necessary to combat maladaptive strategies (e.g., cognitive distortions, socio-emotional comparisons) that leave them vulnerable to the maintenance of elevated depressive symptoms (Machado, 2016).

As this longitudinal study provided empirical support for the impact of socio-emotional comparisons on follow-up depressive symptoms, these results provide a rationale for the development of new interventions, or the validation of existing ones to target elevated socio-emotional comparisons to prevent the recurrence of MDD (Wisco & Nolen-Hoeksema, 2010). Based on the current research, it can be hypothesized that the likelihood of recurrence is reduced for patients who are able to manage their reactions to social interactions (Hawley, 2006). If so, standard therapeutic interventions, such as cognitive restructuring, can be modified to address negative social comparisons (Hawley, 2006). In particular, cognitive restructuring in depression treatment can target negative evaluations of oneself in relation to others by clarifying how to appraise
different social interactions in a helpful and accurate manner (Cuijpers, Smit, & Van Straten, 2007; Hawley, 2006).

The findings of this study may also be applied to patient-focused research in clinical settings, with the goal of improving treatment outcome by monitoring patient progress (Hawley, 2006). Using the symptom model outlined above, it is possible to establish predictive models about how changes in cognitive distortions and socio-emotional affect trajectories of depressive symptoms (Hawley, 2006). Using these trajectories as guideline, sessional indicators of a patient’s progress can be monitored throughout therapy and inform clinicians when the patient may be a risk of relapse (Hawley, 2006). Thus, the findings of this study can help improve the identification of at-risk individuals to better understand the role of cognitive distortions and socio-emotional comparisons in the process by which an individual develops MDD (Cuijpers & Smit, 2004).

4.2 Strengths

One of the strengths of this longitudinal study is that the findings have addressed a significant knowledge gap pertaining to the relationship between cognitive distortions, socio-emotional comparisons, and follow-up depressive symptoms. This study also controlled for the effects of baseline depression, age, and gender, which is important when considering that very few longitudinal studies actually account for these important covariates (Dykman & Johll, 1998; Hankin et al., 2004; Klocek et al., 1997; Kwon & Oei, 1992). Thirdly, the length of the longitudinal follow-up periods used in this study fits well with the median length of major depressive episodes, which is approximately 3-4 months in duration (Solomon et al., 1997; Spijker, De Graaf, Bijl, Beekman, Ormel, & Nolen, 2002). Moreover, the operationalization of socio-emotional comparisons as a
multi-dimensional construct better accounts for the process of negative social comparisons than the previous narrowly defined social comparison measures (Lee, 2014; Vogel, Rose, Roberts, Eckles, 2014). This study included a large sample size over six-month follow-up using crowdsourcing participants, who are more representative than undergraduate student samples commonly used to examine the predictive cognitive model of depression (Hankin, Abramson, Miller, & Haefel, 2004; Klocek, Oliver, & Ross, 1997). This study included participants with the average age of 39 at baseline, so the results may not be generalizable to specific age groups, including older adults as well as adolescents. Finally, as this study’s primary goal was to examine whether cognitive distortions and SEC were risk factors for follow-up depressive symptoms after controlling for baseline depressive symptoms, study findings could have been strengthened through the use of to individuals who have never experienced a depressive episode.

4.3 Limitations

Despite these strengths, the current study had several limitations that pave the way for future research. Firstly, there were specific limitations about the generalizability of the results to clinical populations. Participants were selected from a crowdsourcing population, so the findings may not be generalizable to individuals meeting diagnostic thresholds (Shashoua, 2015). Another limitation is that the use of a self-report measure of depressive symptom frequency may impact the accuracy of reporting depressive symptoms. Self-report questionnaires tend to have weaker sensitivity and specificity than gold-standard clinical interviews in detecting psychiatric symptoms (Stuart et al., 2014). However, due to the shifting manifestation of depressive symptoms over time, operationalizing depression using a continuum of symptom severity improves our
understanding of risk factors that predict the transition from subthreshold depressive symptoms to a formal diagnosis of MDD (Angst et al., 2000; Hankin, Fraley, Lahey, & Waldman, 2005).

Secondly, there were several limitations associated with online administration. The crowdsourcing sample consisted of mainly Caucasian, English-speaking adults from the United States who were largely well-educated. Therefore, some caution must be exercised in expanding these findings to individuals with a different set of demographic characteristics (Williams, 2016). Furthermore, although participants were scheduled to complete each follow-up assessment exactly three-months after completion of the previous assessment, participants were given a grace period of one week to complete the questionnaires online. Therefore, there may have been slight (i.e., a few days) variation between each completed assessment, so the three-month period between time-points was not exactly equal across all participants (Machado, 2016). Finally, common to all online experimentation is the fact that ecological validity cannot be guaranteed, since there is no easy way for researchers to fully control the experimental setting. For example, there are several factors left to vary that could impact the accuracy of reporting, such as browser type and distractions in the physical environment (Kittur, Chi, & Suh, 2008). However, this study used two separate attention check questions to improve the data quality from the crowdsourcing sample (Buhrmester, Kwang, & Gosling, 2011; Kees, Berry, Burton, & Sheehan, 2017). One possible limitation of the sample itself is that it is unclear whether the inclusion of all participants who failed the attention would alter the findings of this study.

There were also several limitations associated with choice of statistical analyses. The Hayes’ PROCESS mediation analysis used in my study does not account for random
measurement error when estimating relevant effects involving latent variables as a part of structural equation modeling. However, researchers have noted that the selection of structural equation modeling or PROCESS mediation analyses makes little difference in calculating point estimations of model parameters, indirect effects, and standard errors when examining observed variables in larger samples (Hayes, Montoya, & Rockwood, 2017). Furthermore, although this study reported correlation, regression, and mediation analyses, state-of-the-art longitudinal analyses (e.g., latent growth modeling) were not completed. Third, significant deviations from normality were identified when examining baseline, three-month, and six-month PHQ9 distributions. Therefore, correlation, regression, and mediation analyses using square-root transformed PHQ9 scores were conducted (Appendix F). Transformed results were found to be similar to the raw data correlation, regression, and mediation analyses.

4.4 Future research

The reviewed limitations highlight unique opportunities for future research to replicate and extend findings of the present study. As this study used a crowdsourcing sample, future longitudinal research should examine the study hypotheses using MDD samples and gold-standard diagnostic interviews. Furthermore, given the relatively homogenous ethnic background of the current sample, future research should focus on recruiting participants from the general population with a more diverse set of demographic characteristics to increase the generalizability of the findings. Moreover, in order to determine whether cognitive distortions and SEC are risk factors for follow-up depressive symptoms after controlling for baseline depression analyze the hypotheses of this study with adolescents and young adults with no prior history of a depressive episode and follow them over time. Finally, as the refined cognitive model of depression
has very recently been described in this study, future research is needed to empirically validate the model by clarifying the temporal association between vulnerabilities to internalizing disorders (e.g., early childhood experiences, genetics, family dynamics, personality), cognitive distortions, socio-emotional comparisons, and depressive symptoms over time.

Future research can add to the findings of this study through the use more state-of-the-art statistical techniques to examine the temporal relationship between cognitive distortions, socio-emotional comparisons and depressive symptoms. For example, future research can employ structural equation modeling to account for measurement error. Future research can also use random intercept/slope latent growth modeling to examine longitudinal changes in depressive symptoms to account for individual differences in baseline depressive symptoms (Bollen & Curran, 2006; Edmonds, Hadjistavropoulos, Schneider, Dear, & Titov, 2018). Finally, it is important to note that the research on the concept of socio-emotional comparisons is in its infancy, and future research can help clarify the role of socio-emotional comparisons in predicting follow-up levels of depression.

**4.5 Conclusions**

This study added significantly to the literature on cognitive predictors of depressive symptoms by examining the long-term effects of cognitive distortions and socio-emotional comparisons in predicting depressive symptoms over the course of six months. The longitudinal nature of the current design addressed several major gaps in the literature, as most studies examining negative cognitions, negative social comparisons, and depression are cross-sectional in nature. The current findings established a link between negative thinking patterns, social emotions and interpretations, as well as
depressive symptoms assessed longitudinally. Furthermore, the mediating role of socio-emotional comparisons sheds more light on risk factors for the maintenance of depressive symptoms over time. The results of the current study highlight that factors instigating the onset of depressive symptoms may not be the same as those that maintain depression over time (Machado, 2016). These findings can aid in the prevention of depressive relapse by developing therapeutic strategies that target the appraisal of different social interactions among individuals who are depressed or who show elevated symptoms of the condition. Given the recurrent nature of depression, it is time to focus our research efforts on developing therapeutic strategies in line with important risk factors for the maintenance of depressive symptoms over time (Machado, 2016).
References


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Zuroff, D. C., Igreja, I., & Mongrain, M. (1990). Dysfunctional attitudes, dependency,
Appendix A: Demographics Questionnaire

Please answer the following demographic questions truthfully and to the best of your ability.

1. What is your age? ___

2. What is your gender?
   - Male
   - Female
   - Trans*
   - Other

   [If Other clicked]: Please specify what gender you identify as ____________________

3. What country are you currently living in? [Drop-down menu of 208 responses]

4. Which category best describes you? Select all answers that apply. You may select more than one response.
   - White
   - South Asian (e.g., East Indian, Pakistani, Sri Lankan, etc.)
   - Chinese
   - Black or African American
   - Filipino
   - Hispanic, Latino or Spanish
   - Middle Eastern or North African
   - Southeast Asian (e.g., Vietnamese, Cambodian, Laotian, Thai, etc.)
   - West Asian (e.g., Iranian, Afghan, etc.)
   - Korean
   - Japanese
   - Aboriginal (e.g., Navajo, Mayan, Métis, Cree, etc.)
   - Other

   [If Other clicked]: Please specify what other category you identify with ____________________

5. What is your primary language at home?
   - English
   - Other

   [If Other clicked]: Please specify what your primary language is ____________________
6. What is the highest level of education you have completed?
   • Did not complete high school
   • High school (or equivalent)
   • College/university
   • Post-graduate (e.g., graduate, professional, doctoral, etc.)

7. What is your current marital status?
   • Currently dating, not cohabiting
   • Single, never married
   • Divorced or separated
   • Married or cohabiting
   • Widowed

8. What is your current employment status?
   • Employed full time
   • Employed part time
   • Unemployed looking for work
   • Unemployed not looking for work
   • Never employed
   • Retired

9. How many children do you have? _____

10. What is your personal income before tax (USD)?
    • No income
    • $10,000 - $30,000
    • $30,001 - $50,000
    • $50,001 - $75,000
    • $75,001 - $100,000
    • Greater than $100,000

11. What is your household income before tax (USD)?
    • No income
    • $10,000 - $30,000
    • $30,001 - $50,000
    • $50,001 - $75,000
    • $75,001 - $100,000
    • Greater than $100,000
Appendix B: Mental Health Questionnaire

1. Has a psychologist, psychiatrist, or another mental health professional ever diagnosed you with major depression?  Yes/No

2. Depression is characterized by symptoms experienced for at least a two-week period, such as feeling sad, having little interest in doing things, significant weight or appetite changes, fatigue, difficulty concentrating, thoughts of worthlessness, and/or recurrent thoughts of death. When was the last time you felt depressed for at least two weeks?
   o Never
   o Less than a month
   o 1-3 months
   o 4-6 months
   o 7-12 months
   o 1-2 years
   o More than 2 years ago

3. Are you currently receiving treatment for depression?  Yes/No

3a. [If 3. Yes selected], What kind of treatment are you receiving for depression? Please check all that apply:
   o Cognitive Therapy
   o Interpersonal Therapy
   o Another Form of Psychotherapy
   o Antidepressant Medication
   o Other ___________

3b. [If 3. Yes selected] In the past three months, have any of the previously listed treatments for depression:
   o Increased
   o Decreased
   o Stayed the Same

4. What kind of treatment have you received in the past for depression? Please check all that apply:
   o None
   o Cognitive Therapy
   o Interpersonal Therapy
   o Another Form of Psychotherapy
   o Antidepressant Medication
   o Other ___________
Appendix C: Socio-Emotional Comparisons Scale-12 (SEC12)

Please indicate how much you agree or disagree with each of the following statements.

1. Compared to others, it upsets me that I don’t get rewarded for how hard I work.
2. Feelings of envy constantly torment me.
3. No matter what I do, envy always plagues me.
4. I feel ill will toward people I envy.
5. Seeing other people achievements makes me resent them.
6. When I compare myself to other people, I think that I am no good.
7. When I compare myself to others, I feel like a loser.
8. All in all, I am inclined to feel that I am a failure.
9. Compared to others, I don’t get rewarded for how hard I work.
10. Compared to others, I get less than what I deserve given how hard I work.
11. Compared to others, I don’t get what I deserve given how much effort I put in.
12. I feel that I am a person of worth, at least on an equal plane with others.

Rating scale:
1 = Strongly disagree
2 = Disagree
3 = Somewhat disagree
4 = Neither agree nor disagree
5 = Somewhat agree
6 = Agree
7 = Strongly agree
Appendix D: Cognitive Distortions Scale (CDS)

Instructions: We would like to find out about the different types of thinking you use. In this questionnaire, you will read about 10 types of thinking. You will be given a description of each thinking type. You will also read two case examples that help explain the thinking type. There will always be two case examples: one dealing with social relationships (such as friends, partners and family) and one that deals with personal achievements (such as passing a test or failing a task at work). These case examples are used to help you understand how each type of thinking might look in a real life scenario.

Your task is to try and understand the thinking type that is described. Then, you are asked to estimate how often you use that type of thinking. You will be asked to think about how often you use that type of thinking in the two domains previously described (social and achievement scenarios). Please take time to think about your answers.

1. MIND READING
People will sometimes assume that others are thinking negatively about them. This might occur even though the other person has not said anything negative. This is sometimes called mindreading. To illustrate this, please read the following passages:

A. Sonya is having coffee with her boyfriend Jim. Jim is quiet, and Sonya asks if anything is wrong. Jim replies that he is ‘Okay.’ Sonya does not believe Jim. She starts to think that he is unhappy with her.

B. Bob has been working on a project for weeks. He finally gives the final product to his boss, and is curious about his boss’ opinion of his work. After a few days pass, Bob starts to worry that his boss thinks he is incompetent.

Please estimate how often you engage in Mindreading when in social situations (like when you’re with friends, partners or family):

<table>
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<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tr>
<td>Never</td>
<td>Sometimes</td>
<td>All The Time</td>
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Please estimate how often you engage in Mindreading when in achievement situations (such as school or work):

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2. CATASTROPHIZING
People can make negative predictions about the future. When there isn’t much evidence for these predictions, it is called Catastrophizing. To illustrate, please read the following passage:

A. John is in his first year of university. He just received a 70 on his Biology exam. He immediately starts to worry that he will end up with a low grade in the course, and that he’ll have a tough time getting into medical school.

B. Tina’s boyfriend just gave her some feedback about their relationship. He told her
that he would like to spend a little more time with his friends. Based on his feedback, Tina starts to predict that they will start to become distant, and eventually break-up.

**Please estimate how often you engage in Catastrophizing when in social situations (like when you’re with friends, partners or family):**

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**Please estimate how often you engage in Catastrophizing when in achievement situations (such as school or work).**

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**3. ALL-OR-NOTHING THINKING**

When people make evaluations, they can view things as being “either-or.” For example, a concert can be considered to be either good or bad. On the other hand, people can also see shades of gray when making evaluations. For example, a concert can have some negative aspects, but be considered fairly good overall. When a person considers something as being either good or bad, we call that all-or-nothing thinking. To illustrate this point further, please read the following passages:

A. Brian gets a B+ on an exam. He is disappointed because it was not an A. He tends to view success on exams as follows: ‘I either do great, or my performance is a failure.’

B. Erin is the type of person who either likes a person, or dislikes them. You’re either in her “good book” or you’re not.

**Please estimate how often you use All-or-Nothing Thinking when in social situations (like when you're with friends, partners or family):**

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**Please estimate how often you use All-or-Nothing Thinking when in achievement situations (such as school or work).**

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</table>
4. EMOTIONAL REASONING
People can believe something to be true because it “feels” that way. To illustrate, please read the following passages:

A. Kim’s friends told her that she could not come to the concert with them because they were unable to get enough tickets for everyone. Kim knows they probably didn’t exclude her on purpose, but she feels rejected. Therefore, part of her believes she was rejected.

B. Ted’s boss told him that his performance at the company has been good. Yet, Ted wonders if he could have done better. In fact, he feels like a failure. Consequently, he starts to believe he is a failure.

Please estimate how often you engage in Emotional Reasoning when in social situations (like when you’re with friends, partners or family):

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Please estimate how often you engage in Emotional Reasoning when in achievement situations (such as school or work).

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5. LABELING
People can label themselves as being a certain kind of person. If this occurs after something bad happens, it is called labeling. To illustrate, please read the following passages:

A. While at a social event, John asks a woman if she would like to dance. She turns him down. As a result, John considers himself to be a loser.

B. During class, Allison’s teacher asks if anyone knows the answer to a question. Allison raises her hand and gives an answer. Her teacher says ‘Unfortunately, that is incorrect. Does anyone else know the answer?’ Allison tells herself that she is a moron.

Please estimate how often you engage in Labeling when in social situations (like when you’re with friends, partners or family):

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Please estimate how often you engage in Labeling when in achievement situations (such as school or work).
6. MENTAL FILTER
People sometimes have a filter for information. When there is positive and negative information, they only focus on the negative information. This is called Mental Filtering. To illustrate, please read the following passages:

A. Lauren overhears her new boyfriend, Tom, telling his friends about her. He says ‘Yeah, things are going great so far. She’s really smart and fun to be with, and we have a lot in common. She can be a bit demanding at times, but that’s OK.’ Although Tom had mostly positive things to say, Lauren dwelled on the one negative comment, and felt bad.

B. Ed is a high school student. He is reading comments from his teacher regarding his recent essay. His teacher wrote ‘Ed, you have an excellent way of expressing ideas. I really enjoy the way you write. However, you should try and make better transitions from one idea to another.’ Despite the fact that Ed clearly performed well, he could only think about the one piece of criticism, and felt poorly about himself.

Please estimate how often you engage in Mental Filtering when in social situations (like when you’re with friends, partners or family):

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Please estimate how often you engage in Mental Filtering when in achievement situations (such as school or work).

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7. OVERGENERALIZATION
When a negative event occurs, people might assume more bad things are going to happen. They see the negative event as the start of a pattern. To illustrate, please read the following passages:

A. Janet’s boyfriend just broke up with her. She thinks to herself: ‘I am never going to get into a stable relationship.’

B. William recently failed his math exam. He thinks to himself: ‘I’ll probably fail the exams in my other courses as well.’

Please estimate how often you engage in Overgeneralization when in social situations (like when you’re with friends, partners or family):

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<td>Never</td>
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</table>
8. PERSONALIZATION
People can believe they are responsible for negative things, even though they’re not. In other words, they take a negative event, and assume they are the cause of it. This is called Personalization. To illustrate, please read the following passages:

A. Sally’s company did not get an important contract. Although many people worked hard on this project, she assumes that it is her fault.

B. Chris’ best friend has been in a bad mood lately, and it has been hard to get in contact with him. Chris assumes that he must have personally done something wrong to make his friend act this way.

Please estimate how often you engage in Personalization when in achievement situations (such as school or work):


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Please estimate how often you engage in Personalization when in social situations (like when you’re with friends, partners or family):


<table>
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<tr>
<th>Never</th>
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9. SHOULD STATEMENTS
People sometimes think that things should or must be a certain way. To illustrate, please read the following passages:

A. “Billy is upset with getting an 85 on his exam because he thinks he should get at least a 90. He often has these thoughts for many things (e.g., he feels he should never drop a pass when playing football; his room should be organized a certain way).”

B. “Anne believes that she must be funny and interesting when socializing.”

Please estimate how often you tend to make Should Statements when in social situations (like when you’re with friends, partners or family):


<table>
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<th>7</th>
<th>All The Time</th>
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</thead>
</table>
Please estimate how often you tend to make Should Statements when in achievement situations (such as school or work).

1 2 3 4 5 6 7
Never Sometimes All The Time

10. MINIMIZING OR DISQUALIFYING THE POSITIVE
People can sometimes ignore the positive things that happen to them. This is called Minimizing or Disqualifying the Positive. To illustrate, please read the following passages:

A. “Brenda works as a real estate agent. Her boss recently told her that she did a wonderful job on a recent sale. In her head, she dismisses her achievement because she probably ‘just got lucky.’

B. “Cory is getting ready for a big first date. His friends tell him he looks good. He dismisses their complement because he thinks they’re just trying to be nice.”

Please estimate how often you tend to Minimize or Disqualify the Positive when in social situations (like when you’re with friends, partners or family):

1 2 3 4 5 6 7
Never Sometimes All The Time

Please estimate how often you tend to Minimize or Disqualify the Positive when in achievement situations (such as school or work).

1 2 3 4 5 6 7
Never Sometimes All The Time
Appendix E: Patient Health Questionnaire-9 (PHQ9)

Over the last 2 weeks, how often have you been bothered by any of the following problems?

1. Little interest or pleasure in doing things.
2. Feeling down, depressed, or hopeless.
3. Trouble falling or staying asleep, or sleeping too much.
4. Feeling tired or having little energy.
5. Poor appetite or overeating.
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down.
7. Trouble concentrating on things, such as reading the newspaper or watching television
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual.
9. Thoughts that you would be better off dead or of hurting yourself in some way.

Rating scale:
0 = Not at all
1 = Several days
2 = More than half the days
3 = Nearly every day
Appendix F: PHQ9 Square-Root Transformation Analyses

Table 8. Correlation hypotheses using transformed PHQ9

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<tr>
<td>1. Baseline CDS</td>
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<tr>
<td>2. Three-Month CDS</td>
<td>.79*</td>
<td>–</td>
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<tr>
<td>3. Baseline SEC12</td>
<td>.52*</td>
<td>.62*</td>
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<tr>
<td>4. Three-Month SEC12</td>
<td>.54*</td>
<td>.65*</td>
<td>.78*</td>
<td>–</td>
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<tr>
<td>5. Three-Month PHQ9</td>
<td>.53*</td>
<td>.55*</td>
<td>.52*</td>
<td>.62*</td>
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<td></td>
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<tr>
<td>6. Six-Month PHQ9</td>
<td>.50*</td>
<td>.51*</td>
<td>.55*</td>
<td>.58*</td>
<td>.81*</td>
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**Bold** = Hypothesis Testing

*p< .001
Table 9. *Baseline CDS and SEC12 predicting three-month transformed PHQ9*

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<th>Variables</th>
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<th>SE B</th>
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<tr>
<td>Age</td>
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<td>.004</td>
<td>-.22</td>
<td>-4.79</td>
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<tr>
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<td>Baseline PHQ9(^a)</td>
<td>.79</td>
<td>.03</td>
<td>.79</td>
<td>26.84</td>
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<td>Block 3</td>
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<tr>
<td>Baseline CDS(^b)</td>
<td>.003</td>
<td>.002</td>
<td>.07</td>
<td>1.68</td>
<td>.095</td>
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<tr>
<td>Baseline SEC12(^c)</td>
<td>-.003</td>
<td>.003</td>
<td>-.05</td>
<td>-1.12</td>
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*Note.* \(^a\) = Patient Health Questionnaire-9; \(^b\) = Cognitive Distortions Questionnaire; \(^c\) = Socio-Emotional Comparisons Scale-12
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<td>.80</td>
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<tr>
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<td>.002</td>
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<tr>
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<td>.003</td>
<td>.09</td>
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<td>.07</td>
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*Note. a = Patient Health Questionnaire-9; b = Cognitive Distortions Questionnaire; c = Socio-Emotional Comparisons Scale-12*
Table 11. *Baseline CDS and SEC12 predicting six-month transformed PHQ9*

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<th>Variables</th>
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<td>Baseline CDSb</td>
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*Note.* a = Patient Health Questionnaire-9; b = Cognitive Distortions Questionnaire; c = Socio-Emotional Comparisons Scale-12
Figure 4. Mediation model of baseline CDS, three-month SEC12, and transformed six-month PHQ9 controlling for transformed baseline PHQ9

* = p < .01
** = p < .001

* = Total effect of baseline CDS on six-month transformed PHQ9 without controlling for three-month SEC12
Appendix G: The Refined Cognitive Model of Depression

Individual Vulnerability (e.g., early childhood experiences, genetics, family dynamics, personality)

Negative Interpretation Bias (e.g., cognitive distortions, socio-emotional comparisons)

Depressive Symptoms

Increase in Negative Interpretation Bias (e.g., cognitive distortions, socio-emotional comparisons)

Increase in Depressive Symptoms