

Changes in Affective and Cognitive Distortion Symptoms of Depression are Reciprocally Related during Cognitive Behavior Therapy

Manuscript submitted for publication August 2022

Jacqueline B. Persons,^{a, b} Craig D. Marker,^c and Emily Nicole Bailey^c

^aOakland Cognitive Behavior Therapy Center

^bUniversity of California, Berkeley

^cMercer University

We thank the patients and therapists who contributed their data, and Genevieve Freedman, Selena Cuevas, Caroline Harris, and Jane Li for their assistance with literature review, references, and formatting.

Correspondence concerning this article should be addressed to Jacqueline B. Persons, Oakland Cognitive Behavior Therapy Center, 5625 College Avenue, Suite 215, Oakland, CA, 94618. E-mail: persons@oaklandcbt.com

Abstract

We tested the predictions from Beck's cognitive theory that change in cognitive distortions precedes and predicts change in affective symptoms of depression, and his secondary prediction that change in affective symptoms precedes and predicts change in cognitive distortions during the course of cognitive behavior therapy (CBT; Beck, 1963). We used bivariate latent difference score modeling to examine change in affective and cognitive distortion symptoms of depression over time in a sample of 1402 depressed and anxious patients who received naturalistic outpatient CBT. Patients completed the Beck Depression Inventory (BDI) at each therapy session. We selected items from the BDI to create measures of affective and cognitive distortion symptoms that allowed us to assess change in those phenomena over the course of treatment. We examined BDI data from up to 12 sessions of treatment for each patient. As predicted by Beck's theory, we found that change in cognitive distortion symptoms preceded and predicted change in affective symptoms of depression, and that change in affective symptoms preceded and predicted change in cognitive distortion symptoms. Both effects were small in size. These findings support the notion that change in affective and cognitive distortion symptoms of depression each precedes and predicts the other – that is, they are reciprocal in nature during cognitive behavior therapy. We discuss implications of our findings for the nature of the change process in CBT.

Changes in Affective and Cognitive Distortion Symptoms of Depression are Reciprocally Related during Cognitive Behavior Therapy

Despite the fact that cognitive behavioral therapy (CBT) is one of the most effective treatments available for depression, large numbers of patients fail to respond to it (Cuijpers et al., 2014). There is wide agreement that an understanding of the change process in CBT can help us increase its effectiveness (Kazdin, 2007; Lorenzo-Luaces et al., 2015). However, despite the large body of research on this topic, the nature of the change process in patients who receive CBT remains unclear (Lorenzo-Luaces et al., 2015).

Beck's seminal contribution was a new conceptualization of depression that led him to develop a new treatment. He proposed that distorted cognitions cause and maintain the affective symptoms (e.g., sadness, anhedonia) and other symptoms of depression (Beck, 1963). His conceptualization deviated from the prevailing view of depression as "a primary, severe disorder of mood with resultant disturbance of thought and behavior" (American Psychiatric Association, 1952). Beck (1963) offered the contrary hypothesis that "the typical depressive affects are evoked by the erroneous conceptualizations." (p. 44). Based on that theory, Beck (1964) proposed that the route to changing the affective symptoms was to change the erroneous thoughts, and he developed cognitive therapy to do just that (Beck et al., 1979).

Evidence supporting the hypothesis that change in cognitive distortions precedes and causes change in the affective and other symptoms of depression is mixed. Some studies show that cognitive change precedes change in depressive symptoms during CBT, including the work by Tang and colleagues showing that cognitive changes preceded and predicted large symptom improvements from one session to another (DeRubeis et al., 1999; Tang et al., 2005), the work by Schmidt et al. (2019) showing that patient-reported cognitive change during cognitive therapy for depression predicted subsequent symptom change, and the work by Jarrett et al. (2012) showing that elevated scores on a measure of dysfunctional attitudes predicted symptom relapse in previously-depressed individuals.

However, several studies report findings that are not supportive of the notion that change in cognitions predicts and precedes change in affective and other symptoms of depression. Lemmens et al. (2017) failed to find that cognitions predicted symptoms of depression when they used latent difference score models to examine temporal change in cognitions and symptoms of depression in patients receiving CBT. Jarrett et al. (2007) assessed cognitions and depressive symptoms repeatedly during and after cognitive therapy for recurrent depression and concluded that "change in cognitive content . . . parallels but does not account for or predict change in depressive symptoms." (p. 440). Oei et al. (2006) reported that a model in which reductions in depressive symptoms contributed to reductions in automatic thoughts and beliefs fit their data better than a model in which cognitive change contributed to symptom change. Several studies show that patients in CBT experience marked reductions in depressive symptoms even before the introduction of interventions targeting problematic cognitions (Longmore & Worrell, 2007). Thus, Beck's hypothesis that cognitive change leads to change in the emotions and other symptoms of depression does not receive consistent strong support in the current literature.

In addition, much of the evidence testing Beck's theory is based on assessments of cognitions and depressive symptoms that were conducted concurrently at only two time points, and thus cannot determine the order of change in cognitive distortions and other symptoms of depression nor rule out the possibility that change in cognitive distortions and other symptoms of

depression occurred simultaneously (e.g., Christopher et al., 2009; Gallagher-Thompson et al., 2008; Garratt et al., 2007). Another limitation of many studies of Beck's model is that they examine the *absolute level* of cognitions and symptoms, not *change* in cognitions and symptoms. Cross-lagged regression models, for example, test the hypothesis that the level of dysfunctional cognitions predicts the level of later symptoms. Finally, most studies testing Beck's model examine the relationship between distorted cognitions and symptoms of depression; these two phenomena are not independent, as distorted cognitions are an important symptom of depression.

To address these limitations in the current literature, in the study reported here we controlled for temporal confounds, we examined the relationship between *change* in cognitive distortions and *change* in affective symptoms, and we examined the relationship between cognitive distortions and *affective symptoms* rather than the relationship between cognitive distortions and *all symptoms of depression*. We examined changes in cognitive distortions and affective symptoms of depression over time using up to 12 observations of cognitive distortions and affective symptoms in longitudinal data collected during CBT from a large sample of outpatients. We used bivariate latent difference score growth modeling to test the hypothesis that changes in the cognitive distortion symptoms precede and predict changes in the affective symptoms of depression. We predicted, in line with Beck's theory, that change in cognitive distortions would precede and predict change in the affective symptoms of depression.

Although his primary and most important hypothesis was that cognitive distortions cause depressed mood, Beck also predicted a reciprocal relationship between cognitive distortions and mood in the development of a depressive episode, such that "once a depressive affect has been aroused, it will facilitate the emergence of further depressive-type cognitions. A continuous interaction between cognition and affect may, consequently, be produced and, thus, lead to the typical downward spiral observed in depression." (Beck, 1963, p. 44). In line with this prediction by Beck and similar predictions by others (see review by Gaddy & Ingram, 2014), we predicted that an upward spiral would happen during the treatment process, with change in cognitive distortions leading to change in affective symptoms that itself promotes a change in cognitive distortions. Thus, we predicted a reciprocal relationship between affective and cognitive distortion symptoms during the treatment of depression, with changes in cognitive distortion symptoms preceding and predicting changes in affective symptoms, and changes in affective symptoms preceding and predicting changes in cognitive distortion symptoms.

Method

Participants

Participants were 1402 adults who received individual naturalistic cognitive behavior therapy during the years 1981 to 2009 from the first author or one of 19 other therapists at the group private practice providing cognitive behavior therapy that she established in 1995. The patients studied here were drawn from the Naturalistic CBT Archival Database, a database of 1470 adults who were treated during the years 1981 to 2009 from the first author or one of her colleagues during the years 1981 to 2009 and gave written permission for use of data from their clinical record in research. The database is described in detail in (Persons et al., in press). Patients in the Naturalistic CBT Archival Database were included in the sample studied here if they had completed the Beck Depression Inventory on at least one occasion within the first twelve therapy sessions.

Measures of Affective and Cognitive Distortion Symptoms of Depression

We created scales assessing the affective and cognitive distortion symptoms of depression by selecting items from the Beck Depression Inventory (BDI) that was developed by Beck and his colleagues (Beck et al., 1961). The BDI is a widely used, 21-item self-report measure of the severity of depressive symptoms that has been shown to have good internal consistency ($\alpha = 0.86$ for psychiatric patients) and good convergence with other measures of depressive symptoms (Beck et al., 1988). We used the version of the BDI that appears in Beck, Rush, Shaw, & Emery (1979). We consulted Beck's statements of his theory about the nature of the cognitive distortions and affective symptoms of depression to create our scales assessing the affective and cognitive distortion types of symptoms of depression.

Affective Symptoms of Depression. Beck, Rush, Shaw and Emery (1979, pp. 96 and 169-182) listed the following as affective symptoms of depression: sadness, loss of gratification, apathy, loss of feelings and affection toward others, loss of mirth response, anxiety, crying, guilt, anger, anxiety, and shame. We included in our scale of Affective Symptoms of depression the BDI items that assessed any of these symptoms, namely: sadness (item 1), loss of gratification (item 4), guilt (item 5), crying (item 10), irritability (item 11), loss of feelings toward others (item 12), and apathy (item 15). Beck (1967) identified one more affective symptom: negative emotions toward the self (item 7), stating (p. 19), "The patients appear to distinguish feelings of dislike for themselves from negative attitudes about themselves such as "I am worthless." Item 7 assesses "disappointed in myself" and "hate myself.") Thus, based on Beck's statements about the nature of affective symptoms in depression, we created a measure of Affective Symptoms of depression that was made up of the following items from the Beck Depression Inventory: items 1, 4, 5, 7, 10, 11, 12, and 15. The internal consistency of this scale in the present sample is 0.839.

Cognitive Distortion Symptoms of Depression. Beck et al (1979, p. 97) distinguished between *cognitive symptoms* like indecision (item 13) and *cognitive distortions*. It is the cognitive distortions we are interested in, as Beck's theory predicts that changes in cognitive distortions lead to changes in affect. Beck et al. (1979) stated that "the depressed patient . . . tends to perceive his present, his future, and the outside world (the cognitive triad) in a negative way. . . perceiving the self as either ugly, diseased, undesirable, or deficient; and regarding external problems as overwhelming and insoluble." (p. 99). Based on this description of the cognitive triad, we selected items of the BDI that appear to assess cognitive distortions. We selected items 2 (pessimism about the future (future)), 3 (feeling like a failure (self)), 6 (feeling I am being punished (self)), 8 (self-criticism (self)), and 14 (I look ugly (self)). The internal consistency of the Cognitive Distortions scale in our sample is 0.761.

Treatment and Assessment

Treatment consisted of individual naturalistic cognitive behavior therapy (CBT), typically provided weekly and based on a case formulation-driven mode of treatment (Persons, 2008) that called for the therapist to develop, with the patient, an individualized formulation of the case, to set idiographic treatment goals, and to collect progress monitoring data in every session. Because the treatment was provided in a private practice setting, not as part of a research study, it was naturalistic, and many patients received adjunctive pharmacotherapy or another psychosocial treatment (e.g., couples therapy or AA) in addition to receiving CBT. Most therapists who provided CBT were Ph.D. psychologists; one was a social worker.

The Beck Depression Inventory was part of the standard packet of measures administered to all patients in the practice before their first session. When patients reported elevated scores on their initial BDI, their therapist asked them to complete the BDI in the waiting room before each session. The therapist typically scored the measure and plotted the score at the beginning of the session, reviewed the data with the patient, and used the data to guide decision-making in the session.

Statistical Analysis

We used bivariate latent difference score modeling, which allows the researcher to create latent change scores (McArdle & Hamagami, 2001) that overcome some of the deficiencies of other change models (Cronbach & Furby, 1970). It allows a change score to be created that does not assume error of measurement as does time-lagged regression. We can create a change variable from one session to the next on each variable. Bivariate latent difference score modeling also allows researchers to see how one change process affects another change process, which is an ideal way to model mechanisms of change in therapy. That is, we can evaluate whether change in cognitive distortions affects change in affective symptoms and whether change in affective symptoms affect change in cognitive distortions. Interested readers are referred to McArdle and Hamagami (2001) and Ferrer & McArdle (2010) for the technical background and to Hawley et al. (2006, 2007), Teachman et al. (2008, 2010), and Marker & Bailey (2021) for examples of applications.

Transparency and Openness

The procedures used to establish and maintain the Naturalistic CBT Archival Database used in this study were reviewed and approved by the Institutional Review Board of the Behavioral Health Research Collective. The first author will review requests to use the Database from investigators who contact her directly. Computer code and syntax needed to reproduce analyses reported here are available from the second author. The study and analysis plan were not pre-registered.

Results

Patient and Treatment Characteristics

Patients in the sample had an average age of 36.78 years ($SD = 12.60$) and had completed an average of 16.58 years ($SD = 2.65$) of education. 60.3% of patients identified as female and 85.0% were Caucasian. Diagnoses were assigned by the treating therapist based on the most current version of the Diagnostic and Statistical Manual of Mental Disorders (e.g., American Psychiatric Association, 1994) at the time the patient was treated. 59.3% of participants had a diagnosis of depression, 67.9% had a diagnosis of an anxiety disorder, and 37.8% had co-morbid anxiety and depression diagnoses. 23.3% of patients received adjunctive psychosocial treatment (e.g., group therapy or couple therapy), and 55.6% received adjunctive pharmacotherapy.

Tests of hypotheses about the relationships between change in Cognition Distortion Symptoms and change in Affective Symptoms during CBT

The number of sessions in which participants completed the BDI was highly variable, ranging from 1 to 395 per participant, with a mean of 11.58 ($SD = 20.85$). We estimated models with 12, 25, and 40 sessions of data. The models with 12 and 25 sessions had quite similar

results. The model with 40 sessions had difficulty converging on solutions and likely less reliable results, probably because few participants provided 40 sessions of data. Thus, we present results based on the model with 12 sessions. We used multiple strategies for estimation, including Bayesian and maximum likelihood. Results of the different estimation procedures did not vary greatly; we present the estimates from the maximum likelihood model.

Latent difference score models use all available information provided by a patient. We included up to 12 sessions of data for each participant in the sample we studied here. When patients provided only one session of data, their data did not contribute to estimates of change, but did contribute to estimation of the intercept.

We made two assumptions to restrict the number of estimates so that the models could converge. First, we assumed the factor loadings were invariant over time (i.e., the factor loading for sadness is the same for session 1 through 12). Second, we assumed that the change process between Cognitive Distortion and Affective Symptoms was invariant over time.

To explain the bivariate latent difference score model, we can break it down into three stages (although the three stages are estimated simultaneously). In the first stage (Figure 1), we created two factors (Affective Symptoms and Cognitive Distortions). By creating factors, we avoid some of the difficulties of cross-lagged regression (i.e., assuming perfectly measured variables). In the bivariate latent difference score model, the variance is split into an error and a “pure” construct. The factor includes the scores on the items of the BDI (indicated by the rectangles). The BDI items have two components: the error of that item and the common factor amongst the items.

Insert Figure 1 about here

In the second stage of the model, shown in Figure 2, we created a latent change variable that indicates the change between one session and the subsequent session for each of the two factors, Cognitive Distortions and Affective Symptoms. Then, in the third section of the model, also shown in Figure 2, we drew arrows between the latent change variables to depict the way our model calculates how change in one factor (e.g., Cognitive Distortions) affects change in the other (e.g., Affective Symptoms). Figure 2 presents a simplified version of the model that only shows three sessions, but we modeled twelve sessions of data for each participant. Our model evaluates the degree to which change in Cognitive Distortions between sessions n and $n + 1$ predicts subsequent change in Affective Symptoms between sessions $n + 2$ and $n + 3$. In the example of three sessions shown in Figure 2, the model evaluates the degree to which change in Cognitive Distortions between sessions 1 and 2 predicts change in Affective Symptoms between sessions 2 and 3, and the degree to which change in Affective Symptoms between sessions 1 and 2 predicts change in Cognitive Distortions between sessions 2 and 3.

Insert Figure 2 about here

We estimated the model depicted in Figure 2 for the 1402 participants in our sample. As we predicted, we found that change in Cognitive Distortions was a small but statistically significant predictor of subsequent change in Affective Symptoms (.28, $p < .05$, $d = .018$). We also found that change in Affective Symptoms predicted subsequent change in Cognitive Distortions (.34, $p < .05$, $d = .020$); this change, too, was small but statistically significant. These findings provide support for Beck's proposal that change in cognitive distortions leads to change in affective symptoms of depression, and that change in affective symptoms also leads to change in cognitive distortions, in a reciprocal process.

Discussion

Our findings, based on longitudinal symptom data collected during cognitive behavior therapy that were analyzed using bivariate latent difference score modeling, support Beck's (Beck et al., 1979) primary hypothesis that changes in cognitive distortions precede and predict changes in affective symptoms of depression during the course of cognitive behavior therapy. Our study is one of the few published studies that tests hypotheses about the order of change in cognitive distortions and affective symptoms of depression using a design that allows us to discern temporal effects. As Lorenzo-Luaces et al. (2015, 2016) point out, most studies examining change in cognitions and change in emotions and other symptoms of depression do so in a study design that examines these phenomena at two time points and thus cannot identify the order in which they change. We studied a mean of 11.58 sessions per participant, a sufficient number of observations to examine the order in which changes in cognitive distortions and change in affective symptoms of depression occurred.

Our findings also support Beck's secondary hypothesis that affective symptoms activate cognitive distortions and change in affective symptoms precedes change in cognitive distortions. The proposal that depressed affect activates distorted cognition contributed to the development of mindfulness-based cognitive therapy (MBCT; Segal et al., 2013) for prevention of depressive relapse. MBCT teaches the person who is not currently depressed but who is vulnerable to relapse to observe the distorted thoughts that can occur during a depressed mood state as a tool to protect the person from being captured by the thoughts and pulled into another episode of depression. Although MBCT was originally developed as a relapse-prevention tool, it has recently been shown to be effective for treatment of depression (Barnhofer et al., 2015; Kuyken et al., 2010). Our demonstration that emotional change can lead to change in cognitive distortions is also consistent with work by Adele Hayes and colleagues (Grosse Holtforth et al., 2012; Hayes et al., 2005; Hayes et al., 2007) showing that behavioral interventions can activate emotional arousal that, when combined with cognitive processing, leads to symptom change.

We found that change in cognitive distortions and change in affective symptoms of depression each preceded and predicted the other. These reciprocal effects could play out in therapy in a helpful way, with a reduction in cognitive distortions producing a reduction in negative affect, which then produces a further reduction in cognitive distortions, in an upward spiral of improvements in cognitive distortions and affective symptoms. As a result, although the sizes of the effects in our sample of cognitive distortions on affective symptoms and of change in affective symptoms on cognitive distortions were small, the fact that the two effects were reciprocal suggests that feedback effects have the potential to magnify small effects to produce therapeutic benefits in depressed patients during treatment. This notion is reminiscent of the concept of compound interest, where one change builds interest, which benefits another change,

which then further benefits the first. That is, each change, whether in cognitive distortions or negative affect, moves the system forward, and has the more general effect of increasing the patient's sense of control and self-efficacy. According to Mirowsky and Ross (1998), this sense of control is the most important factor in change. The more small steps we take, the more we feel we can do. Another useful metaphor is that of the water finding its way downhill by following, at each moment, the path of least resistance. At any given moment during treatment, the therapist and patient might find it easiest to strive for a change in perspective (cognition) or a change in affect, and it doesn't matter which they choose. Following the path of least resistance forward can lead to a recovery.

Our study has several limitations. Our methods did not allow us to test hypotheses about causal relationships (Bullock et al., 1994; Wilkinson & Task Force on Statistical Inference, 1999). Our methods allowed us to demonstrate temporality, a key element of a causal demonstration, and thus our results are consistent with the hypothesis that changes in cognitive distortions and affective symptoms of depression reciprocally cause each other, but they did not demonstrate causality because our analyses did not rule out alternative causal factors that might account for the relationships we demonstrated. In fact, the small effect size we obtained suggests that alternative causal factors likely contribute to the effects we found. Other weaknesses include the assessment of cognitive distortions and affective symptoms of depression using brief and unvalidated items selected from a single self-report measure, the lack of reliable diagnostic information about the patients in the sample, and the fact that our analyses did not control for therapist effects.

Our study also has several important strengths. One is the use of bivariate latent difference score modeling to evaluate up to 12 time points over the course of CBT, an improvement over the large number of tests of Beck's theory that examine only two time points and thus do not yield information about the order of effects or allow for the test of the reciprocal relationships between change in cognition and change in emotion that we found in our sample. Another strength is that we studied *change* in cognitive distortions and affective symptoms over time, as these are the phenomena that treatment providers are interested in. That is, we focused on how much a person changed and what affected that change rather than the absolute level of distortions or affect. A final strength is our large sample size of over 1400 participants who received naturalistic CBT in the community.

Can our findings about the change process in CBT help strengthen the therapy? We offer two ideas. Our data suggest that change in depressed affect and distorted cognitions each precedes and predicts the other. And of course, our demonstration of reciprocal effects is supported by data from the treatment literature showing that interventions (e.g., cognitive restructuring) that target distorted cognitions and interventions that target negative affect (e.g., the exposure interventions in the Hayes et al. intervention or the mindfulness interventions in MBCT) are all effective in treating depressed symptoms (Lorenzo-Luaces et al., 2015, 2016). These findings suggest that therapists may be able to be more helpful to their patients if they flexibly draw on *all* these interventions in their treatment of all their depressed patients, using assessment data and conceptualization skills and results of progress monitoring data they collect in each session to guide their work rather than relying on a treatment manual for a single empirically supported treatment (Persons, 2008).

A second and related idea is that our results hint at the notion that patients might be differentially responsive to interventions that target distorted cognitions and negative affective states. In our study, effect sizes of the predictive relationship from one session to the next of change in cognitive distortions on change in affective symptoms and vice-versa were small and the associated variance around those numbers were large. These facts suggest that patients may differ in their response to treatment, with some having larger changes in distortions that precede changes in affective symptoms, and others having large changes in emotional symptoms that precede changes in cognitive distortions. Future studies might be able to examine which individuals fit in the cluster of those who show change in cognitive distortions first and those who show affective change first, in order to identify which patient is most likely to respond to which treatment. These predictors might be candidates for the battery of factors that DeRubeis and colleagues (2014) are collecting to identify which depressed patient is most likely to respond to which treatment.

References

- American Psychiatric Association. (1952). *Diagnostic and statistical manual of mental disorders (1st ed.)*. American Psychiatric Association.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders (DSM-IV)*. American Psychiatric Association.
- Barnhofer, T., Crane, C., Brennan, K., Duggan, D. S., Crane, R. S., Eames, C., Radford, S., Silverton, S., Fennell, M. J. V., & Williams, J. M. G. (2015). Mindfulness-based cognitive therapy (MBCT) reduces the association between depressive symptoms and suicidal cognitions in patients with a history of suicidal depression. *Journal of Consulting and Clinical Psychology, 83*(6), 1013–1020. PsycINFO. <https://doi.org/10.1037/ccp0000027>
- Beck, A. T. (1963). Thinking and Depression: I. Idiosyncratic Content and Cognitive Distortions. *Archives of General Psychiatry, 9*(4), 324. <https://doi.org/10.1001/archpsyc.1963.01720160014002>
- Beck, A. T. (1964). Thinking and Depression: II. Theory and Therapy. *Archives of General Psychiatry, 10*(6), 561. <https://doi.org/10.1001/archpsyc.1964.01720240015003>
- Beck, A. T., Rush, J. A., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy for depression*. New York: Guilford Press.
- Beck, A. T., Steer, R. A., & Garbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review, 8*, 77–100. [https://doi.org/10.1016/0272-7358\(88\)90050-5](https://doi.org/10.1016/0272-7358(88)90050-5)
- Beck, A. T., Ward, C. H., Mendelsohn, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 4*, 561–571. <https://doi.org/10.1001/archpsyc.1961.01710120031004>
- Bullock, H. E., Harlow, L. L., & Mulaik, S. A. (1994). Causation issues in structural equation modeling research. *Structural Equation Modeling: A Multidisciplinary Journal, 1*(3), 253–267. <https://doi.org/10.1080/10705519409539977>
- Christopher, M. S., Jacob, K. L., Neuhaus, E. C., Neary, T. J., & Fiola, L. A. (2009). Cognitive and Behavioral Changes Related to Symptom Improvement Among Patients with a Mood Disorder Receiving Intensive Cognitive-behavioral Therapy. *Journal of Psychiatric Practice, 15*(2), 95–102. <https://doi.org/10.1097/01.pra.0000348362.11548.5f>
- Cronbach, L. J., & Furby, L. (1970). How we should measure “change”: Or should we? *Psychological Bulletin, 74*(1), 68–80. <https://doi.org/10.1037/h0029382>
- Cuijpers, P., Karyotaki, E., Weitz, E., Andersson, G., Hollon, S. D., & van Straten, A. (2014). The effects of psychotherapies for major depression in adults on remission, recovery and improvement: A meta-analysis. *Journal of Affective Disorders, 159*, 118–126. <https://doi.org/10.1016/j.jad.2014.02.026>
- DeRubeis, R. J., Cohen, Z. D., Forand, N. R., Fournier, J. C., Gelfand, L. A., & Lorenzo-Luaces, L. (2014). The Personalized Advantage Index: Translating research on prediction into individualized treatment recommendations. A demonstration. *PloS One, 9*(1), e83875.
- DeRubeis, R. J., Gelfand, L. A., Tang, T. Z., & Simons, A. D. (1999). Medications versus cognitive behavior therapy for severely depressed outpatients: Mega-analysis of four randomized comparisons. *American Journal of Psychiatry, 156*, 1007–1013.
- Ferrer, E., & McArdle, J. J. (2010). Longitudinal modeling of developmental changes in psychological research. *Current Directions in Psychological Science, 19*(3), 149–154. <https://doi.org/10.1177/0963721410370300>

- Gaddy, M. A., & Ingram, R. E. (2014). A meta-analytic review of mood-congruent implicit memory in depressed mood. *Clinical Psychology Review, 34*(5), 402–416. <https://doi.org/10.1016/j.cpr.2014.06.001>
- Gallagher-Thompson, D., Gray, H. L., Dupart, T., Jimenez, D., & Thompson, L. W. (2008). Effectiveness of Cognitive/Behavioral Small Group Intervention for Reduction of Depression and Stress in Non-Hispanic White and Hispanic/Latino Women Dementia Family Caregivers: Outcomes and Mediators of Change. *Journal of Rational-Emotive and Cognitive-Behavior Therapy: RET, 26*(4), 286–303. <https://doi.org/10.1007/s10942-008-0087-4>
- Garratt, G., Ingram, R. E., Rand, K., & Sawalani, G. (2007). Cognitive processes in cognitive therapy: Evaluation of the mechanisms of change in the treatment of depression. *Clinical Psychology: Science and Practice, 14*(3), 224–239.
- Grosse Holtforth, M., Hayes, A. M., Sutter, M., Wilm, K., Schmied, E., Laurenceau, J.-P., & Caspar, F. (2012). Fostering cognitive-emotional processing in the treatment of depression: A preliminary investigation in exposure-based cognitive therapy. *Psychotherapy and Psychosomatics, 81*(4), 259–260.
- Hawley, L. L., Ho, M. R., Zuroff, D. C., & Blatt, S. J. (2006). The relationship of perfectionism, depression, and therapeutic alliance during treatment for depression: Latent difference score analysis. *Journal of Consulting and Clinical Psychology, 64*(5), 930–942.
- Hawley, L. L., Ho, M. R., Zuroff, D. C., & Blatt, S. J. (2007). Stress reactivity following brief treatment for depression: Differential effects of psychotherapy and medication. *Journal of Consulting and Clinical Psychology, 75*(2), 244–256.
- Hayes, A. M., Beevers, C. G., Feldman, G. C., Laurenceau, J.-P., & Perlman, C. (2005). Avoidance and processing as predictors of symptom change and positive growth in an integrative therapy for depression. *International Journal of Behavioral Medicine, 12*(2), 111.
- Hayes, A. M., Feldman, G. C., Beevers, C. G., Laurenceau, J.-P., Cardaciotto, L., & Lewis-Smith, J. (2007). Discontinuities and cognitive changes in an exposure-based cognitive therapy for depression. *Journal of Consulting and Clinical Psychology, 75*(3), 409–421. <https://doi.org/10.1037/0022-006X.75.3.409>
- Jarrett, R. B., Minhajuddin, A., Borman, P. D., Dunlap, L., Segal, Z. V., Kidner, C. L., Friedman, E. S., & Thase, M. E. (2012). Cognitive reactivity, dysfunctional attitudes, and depressive relapse and recurrence in cognitive therapy responders. *Behaviour Research and Therapy, 50*(5), 280–286. <https://doi.org/10.1016/j.brat.2012.01.008>
- Jarrett, R. B., Vittengl, J. R., Doyle, K., & Clark, L. A. (2007). Changes in cognitive content during and following cognitive therapy for recurrent depression: Substantial and enduring, but not predictive of change in depressive symptoms. *Journal of Consulting and Clinical Psychology, 75*(3), 432–446. <https://doi.org/10.1037/0022-006X.75.3.432>
- Kazdin, A. E. (2007). Mediators and mechanisms of change in psychotherapy research. *Annual Review of Clinical Psychology, 3*, 1–27.
- Kuyken, W., Watkins, E., Holden, E., White, K., Taylor, R. S., Byford, S., Evans, A., Radford, S., Teasdale, J. D., & Dalgleish, T. (2010). How does mindfulness-based cognitive therapy work? *Behaviour Research and Therapy, 48*(11), 1105–1112. <https://doi.org/10.1016/j.brat.2010.08.003>
- Lemmens, L. H. J. M., Galindo-Garre, F., Arntz, A., Peeters, F., Hollon, S. D., DeRubeis, R. J., & Huibers, M. J. H. (2017). Exploring mechanisms of change in cognitive therapy and

- interpersonal psychotherapy for adult depression. *Behaviour Research and Therapy*, *94*, 81–92.
- Longmore, R. J., & Worrell, M. (2007). Do we need to challenge thoughts in cognitive behavior therapy? *Clinical Psychology Review*, *27*, 173–187.
- Lorenzo-Luaces, L., German, R. E., & DeRubeis, R. J. (2015). It's complicated: The relation between cognitive change procedures, cognitive change, and symptom change in cognitive therapy for depression. *Clinical Psychology Review*, *41*, 3–15. <https://doi.org/10.1016/j.cpr.2014.12.003>
- Lorenzo-Luaces, L., Keefe, J. R., & DeRubeis, R. J. (2016). Cognitive-Behavioral Therapy: Nature and Relation to Non-Cognitive Behavioral Therapy. *Behavior Therapy*, *47*(6), 785–803. <https://doi.org/10.1016/j.beth.2016.02.012>
- Marker, C. D., & Bailey, E. N. (2021). Uniting the unit: Trivariate latent difference score modeling of the parent–child triad. *Journal of Family Psychology*. <https://doi.org/10.1037/fam0000837>
- McArdle, J. J., & Hamagami, F. (2001). *Latent difference score structural models for linear dynamic analyses with incomplete longitudinal data*. 139–175. *New methods for the analysis of change*. <https://doi.org/10.1037/10409-005>
- Mirowsky, J., & Ross, C. E. (1998). Education, personal control, lifestyle and health: A human capital hypothesis. *Research on Aging*, *20*(4), 415–449. <https://doi.org/10.1177/0164027598204003>
- Oei, T. P. S., Bullbeck, K., & Campbell, J. M. (2006). Cognitive change process during group cognitive behaviour therapy for depression. *Journal of Affective Disorders*, *92*(2–3), 231–241. <https://doi.org/10.1016/j.jad.2006.02.004>
- Persons, J. B., Thomas, C., Hsaio, M., & Courry, R. (in press). How to build a research database using data collected in routine clinical practice. *Cognitive and Behavioral Practice*.
- Persons, J. B. (2008). *The case formulation approach to cognitive-behavior therapy*. New York: Guilford Press.
- Schmidt, I. D., Pfeifer, B. J., & Strunk, D. R. (2019). Putting the “cognitive” back in cognitive therapy: Sustained cognitive change as a mediator of in-session insights and depressive symptom improvement. *Journal of Consulting and Clinical Psychology*, *87*(5), 446–456. <https://doi.org/10.1037/ccp0000392>
- Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2013). *Mindfulness-based Cognitive Therapy for Depression*. New York: Guilford. Second edition.
- Tang, T. Z., DeRubeis, R. J., Beberman, R., & Pham, T. (2005). Cognitive changes, critical sessions, and sudden gains in cognitive-behavioral therapy for depression. *Journal of Consulting and Clinical Psychology*, *73*(1), 168–172. <https://doi.org/10.1037/0022-006X.73.1.168>
- Teachman, B. A., Marker, C. D., & Clerkin, E. M. (2010). Catastrophic misinterpretations as a predictor of symptom change during treatment for panic disorder. *Journal of Consulting and Clinical Psychology*, *78*(6), 964–973.
- Teachman, B. A., Marker, C. D., & Smith-Janik, S. B. (2008). Automatic associations and panic disorder: Trajectories of change over the course of treatment. *Journal of Consulting and Clinical Psychology*, *76*(6), 988–1002. <https://doi.org/10.1037/a0013113>
- Wilkinson, L., & Task Force on Statistical Inference. (1999). Statistical methods in psychology journals. *American Psychologist*, *11*. <https://doi.org/10.1037/0003-066X.54.8.594>

Figure 1. Cognitive Distortion and Affective Symptom Factors created from BDI items

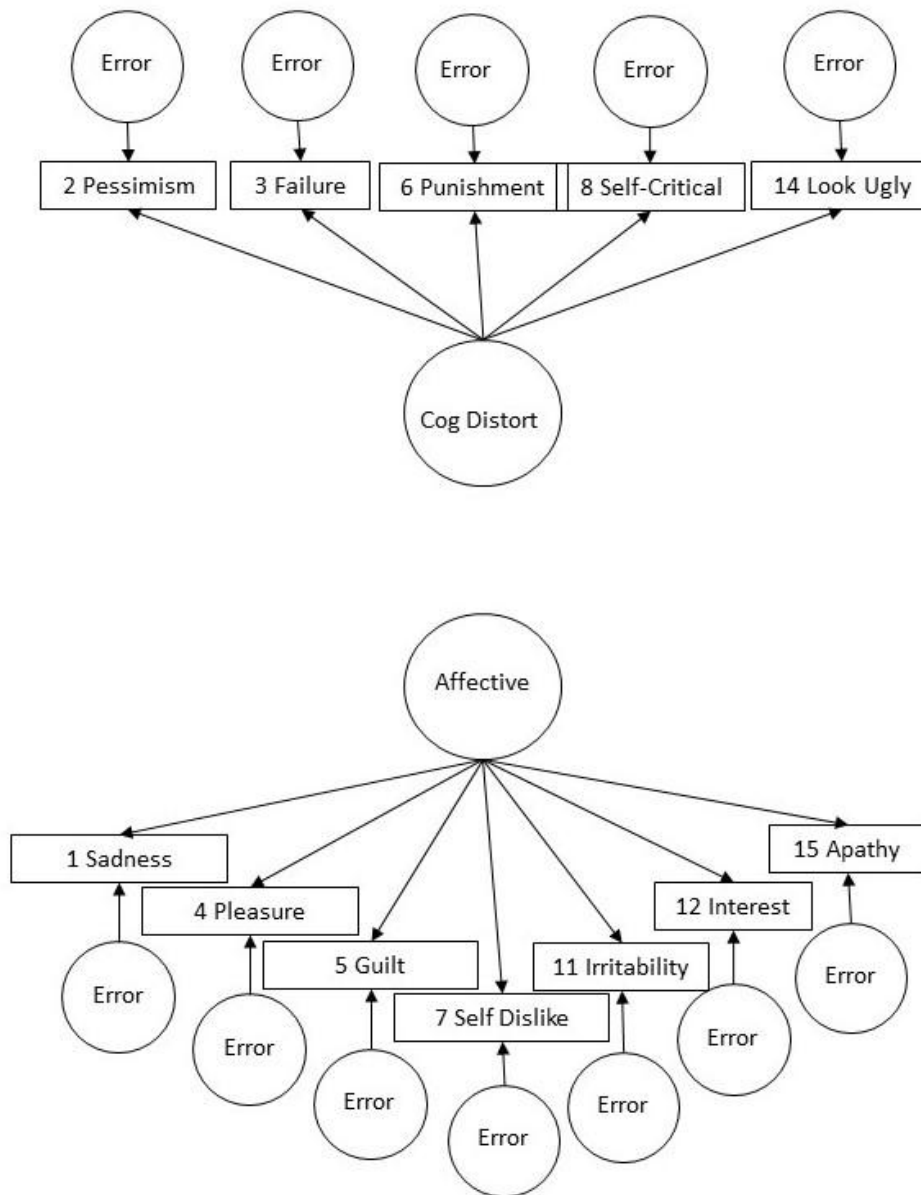


Figure 2. Bivariate Latent Difference Score Model of COGNITIVE DISTORTION and AFFECTIVE SYMPTOM Factors

