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Sudden Gains Can Occur in Psychotherapy Even When the Pattern of Change Is Gradual

Cannon Thomas<sup>1,2</sup> and Jacqueline B. Persons<sup>3,4</sup>

<sup>1</sup>San Francisco Group for Evidence-Based Psychotherapy

<sup>2</sup>University of California, San Francisco

<sup>3</sup>San Francisco Bay Area Center for Cognitive Therapy

<sup>4</sup>University of California, Berkeley

All correspondence should be addressed to Cannon Thomas; San Francisco Group for Evidence-Based Psychotherapy; 1777 Union Street; San Francisco, CA, 94123.

Email: [thomas@sfpsychology.com](mailto:thomas@sfpsychology.com). Phone: 415.771.9999. Fax: 415.771.9990.

## Abstract

Certain large decreases in symptoms between consecutive sessions of psychotherapy, called sudden gains, have been characterized as unique, pivotal events in the course of change. We asked whether a sudden gain is necessarily a qualitatively distinct change, or whether it might be the largest and most stable gain occurring in a gradual course of change. We conducted simulations that showed that sudden gains with most of the characteristics reported in prior research occurred even when change followed a gradual course, and we performed regression analyses that showed that sudden gains did not add any unique predictive power to the ability of the slope of early gradual change to predict post-treatment outcome.

*Keywords* sudden gains; psychotherapy; depression; Beck Depression Inventory

## Sudden Gains Can Occur in Psychotherapy Even When the Pattern of Change Is Gradual

The pattern of symptom change in individual patients over the course of psychotherapy has attracted attention from researchers who have proposed that understanding the pattern of symptom change can shed light on the nature of the change process in psychotherapy ((Foa & Kozak, 1986; Hayes et al., 2007), (Ilardi & Craighead, 1999) 1999; (Tang & DeRubeis, 1999b; Thompson, Thompson, & Gallagher-Thompson, 1995)).

One body of research on the pattern of change that has drawn particular attention was introduced by (Tang & DeRubeis, 1999b). They observed that psychotherapy patients often show a strikingly large reduction in symptoms between two consecutive sessions. They labeled this pattern of change a sudden gain. They showed that sudden gains occur often, in about 40% of psychotherapy patients, and are large, accounting on average for more than 50% of a patient's total improvement in treatment.

The sudden gains phenomenon has been replicated repeatedly in cognitive therapy for depression (Busch, Kanter, Landes, & Kohlenberg, 2006; Tang, DeRubeis, Beberman, & Pham, 2005; Vittengl, Clark, & Jarrett, 2005), and has been shown to occur in manualized supportive expressive therapy for depression (Tang, Luborsky, & Andrusyna, 2002), systematic behavioral family therapy (Gaynor et al., 2003), nondirective supportive therapy (Gaynor, et al., 2003), a group version of Lewinsohn's behavior therapy (Kelly, Roberts, & Ciesla, 2005), CBT for social anxiety disorder (Hofmann, Schulz, Meuret, Moscovitch, & Suvak, 2006), prolonged exposure for posttraumatic stress disorder in children and adolescents (I. Aderka, Appelbaum-Namdar, Shafran, &

Gilboa-Schechtman, 2011), supportive-expressive therapy for generalized anxiety disorder (Present et al., 2008), heterogeneous samples of outpatients treated without a manualized protocol (Hardy et al., 2005; Stiles et al., 2003), and psychotherapy of various sorts for adolescents (Gaynor, et al., 2003). The presence of a sudden gain predicts a good treatment outcome (I. Aderka, et al., 2011; Gaynor, et al., 2003; Hardy, et al., 2005; Stiles, et al., 2003; Tang & DeRubeis, 1999b; Tang, et al., 2002) and a good long-term outcome (I. Aderka, et al., 2011; Tang & DeRubeis, 1999b; Tang, DeRubeis, Hollon, Amsterdam, & Shelton, 2007). A recent meta-analysis has confirmed the significance of the relationship between a sudden gain and outcome both at the end of treatment and follow up (I. M. Aderka, Nickerson, Boe, & Hofmann, 2012). Some research has also shown that sessions of cognitive-behavioral therapy (CBT) for depression that precede sudden gains involve more cognitive change than control sessions (Tang & DeRubeis, 1999b; Tang, et al., 2005), suggesting that cognitive change may be the mechanism underpinning sudden gains.

In the studies reported here, we asked whether sudden gains necessarily represent a qualitatively distinct change that happens following one session, or whether they might simply be the largest and most stable gains within a gradual course of change. We define gradual change as a course of change in which the average rate of change remains steady over the course of treatment, with single weekly changes varying around that average rate of change in a roughly normal distribution. In such a model, some changes will be larger than others, but none differ so substantially from the others that they are qualitatively distinct or create a discontinuity in the overall trend of improvement.

In contrast, Tang and DeRubeis (1999b)(Tang & DeRubeis, 1999b)(Tang & DeRubeis, 1999b) argued that a sudden gain reflects a process of change that is qualitatively different from other changes occurring during treatment. They proposed “the following three-stage model of CBT for sudden-gain responders.

1. Preparation stage. At the beginning of the therapy, the therapist begins to teach the patient the cognitive model and basic cognitive techniques, and they begin to establish a therapeutic alliance. At the time, these activities produce relatively few cognitive changes, and only minor symptom improvement, but they lay the foundation for future improvements. . . .

2. Critical session/sudden gain. In the pregain session, the patient experiences critical belief changes and schema changes. This leads to a large decrease in the level of depressive symptomatology—the sudden gain.

3. Upward spiral. The resulting cognitive changes . . . sustain symptom relief and eventually lead to recovery.” (p. 902)

Thus, Tang and DeRubeis, in their three-stage model, suggest that the change occurring in the pregain session is qualitatively distinct from the changes occurring before and after that point in treatment. The Tang and DeRubeis view has been generally adopted, and sudden gains researchers have widely assumed that a sudden gain is an indicator of non-gradual change, as reflected in the opening statement of the recent meta-analysis by (I. Aderka, Nickerson, Boe, & Hoffman, 2012): "For many individuals, reductions in symptoms are not experienced gradually throughout the course of treatment. Rather, some individuals experience sudden reductions in symptoms that occur between consecutive sessions." (p.93).

Our idea that the sudden gain might be better characterized as the largest and most stable gain occurring in a gradual course of change arose from our examination of plots of session-by-session outcome data for individual psychotherapy patients like those presented in Figure 1. These cases were drawn from a sample of outpatients that we describe in detail later in this paper. The events marked in bold in the figure meet criteria for sudden gains. As we examined them, they did not appear to us to represent events that were qualitatively distinct from the other fluctuations around the general trend lines presented in the figures. The magnitude of deviation of these events from the regression line did not seem to us to fall outside of the range of deviations of other changes occurring during treatment, and we also did not see any visual discontinuities in the trend lines at the points of the sudden gains. Instead, the sudden gains seemed to be relatively large gains that fell within the range of other gains and losses occurring across the course of psychotherapy.

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Insert Figure 1 about here.

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Our notion that change in psychotherapy might follow a gradual course also has an empirical foundation; many psychotherapy researchers have found that gradual models of the course of change adequately describe change in psychotherapy (Barkham et al., 1996; Howard, Kopta, Krause, & Orlinsky, 1986; Lambert, Hansen, & Finch, 2001; Lutz, Martinovich, & Howard, 1999; Thompson, et al., 1995). Within a gradual course of change, we expect that events meeting sudden gains criteria (Tang, et al., 2005) would occur. Given the typical level of fluctuation in BDI scores, a seven-point shift is a

relatively common occurrence (criterion 1). As Tang et al. have noted, criterion 2, a 25% decrease in the BDI score during the gain, is almost always met if criterion 1 is met. In addition, if there is a gradual trend towards lower BDI scores, the BDI scores in the three pregain sessions will often be significantly higher than in the three post-gain sessions (criterion 3). Consequently, we hypothesized that sudden gains could readily occur even if change is gradual.

To test the hypothesis that sudden gains can occur within a gradual course of change, we simulated scores on the BDI that would be expected to occur in psychotherapy under conditions of gradual change, and we examined whether the simulations produced sudden gains with the same characteristics as in psychotherapy samples.

We also evaluated whether the finding that sudden gains predicts post-treatment psychotherapy outcome could be accounted for by the overall rate of change of symptoms early in treatment. By definition, a steeper rate of change produces better post-treatment outcome. A steeper gradual rate of change is also more likely than less steep change to produce events meeting sudden gains criteria. Figure 2 illustrates this point. It shows two gradual trend lines. The deviations from the trend lines are identical in both cases. However, only when the slope of the trend is steep do these deviations result in events meeting sudden gains criteria (marked in bold). The hypothesis that rapid early response (that is, a steep rate of early change) predicts better treatment outcome is supported by numerous studies (Beckham, 1989; Fennell & Teasdale, 1987; Hayes, Feldman, et al., 2007; Ilardi & Craighead, 1994, 1999; Renaud et al., 1998; Santor &

Segal, 2001). The question here is whether the predictive power of sudden gains is unique – over and above that of rapid early response.

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Insert Figure 2 about here.

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We carried out two studies to test hypotheses that properties of sudden gains established in prior research are consistent with a gradual course of change. In Study 1, we simulated scores on the BDI that would be expected to occur in psychotherapy under conditions of gradual change, and we examined whether the simulations produced sudden gains with the same characteristics as in psychotherapy samples. We also assessed whether a strong correlation between sudden gains and post-treatment outcome occurs even when data are defined as following a course of gradual change. In Study 2, we performed a series of regression analyses using a dataset from a naturalistic sample of psychotherapy patients to determine whether the average rate of response early in treatment could account for the finding that sudden gains predict outcome.

#### Study 1: Sudden Gains Occurring during Courses of Gradual Change

In Study 1, we first examined whether the characteristics (e.g., frequency, magnitude) of the sudden gains phenomenon occur even when change is gradual. We simulated BDI scores that would occur during psychotherapy if change occurred gradually.

We selected two types of gradual trend curves for study: linear change (Figure 3, panel A) and curvilinear change, which involves more rapid improvement early in treatment that tapers off later in treatment (Figure 3, panel B). We selected these gradual



trend curves because a large numbers of psychotherapy researchers view linear (Thompson, et al., 1995) and curvilinear (Barkham, et al., 1996; Howard, et al., 1986; Ilardi & Craighead, 1994; Lambert, et al., 2001; Lutz, et al., 1999) trends as providing credible descriptions of change in psychotherapy.

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Insert Figure 3 about here.

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## Method

### *Data Simulations*

Data were simulated (1) to follow gradual courses of change that produced outcomes consistent with psychotherapy outcomes in Tang and DeRubeis (1999b) and (2) to fluctuate around the gradual trends at levels typical of fluctuations in BDI scores over periods of five to seven days. We selected this time period because it represented a rough average of the length of time between sessions during the course of a randomized controlled trial. Simulations were based on simple regression equations. Random numbers generated from a normal distribution were included in the equations in order to produce fluctuations from the trend line. Eight simulations were performed according to a 2 x 4 design. One factor was the shape of the gradual trend (linear or curvilinear); the other factor was the rate of change (with four conditions varying from virtually no change to a strong response to treatment).

*Defining the gradual trend.* The gradual trend was defined in all cases by two points representing a pre-treatment and a post-treatment BDI score. Pre-treatment scores for all conditions were defined as 27.8, which was the average pre-treatment BDI score in

the Tang and DeRubeis (1999b) study.<sup>3</sup> Post-treatment scores for the four conditions were 5.6, 12.4, 19.2, and 26.0. The four conditions were thus equally spaced, with 6.8 points between each condition. A post-treatment score of 5.6 points is a strong response that corresponds to the average post-treatment BDI score for patients experiencing a sudden gain in the Tang and DeRubeis (1999b) study, and a 12.4 point score corresponds to the average post-treatment response for the total sample in the Tang and DeRubeis (1999b) study.<sup>4</sup>

In the linear change conditions, the rate of change was defined as the difference between the pre-treatment and post-treatment scores divided by 19, which was the number of sessions occurring after the initial session. The simulated scores thus were defined to progress from the pre-treatment to the post-treatment score at the same rate of change between each session. The curvilinear conditions were identical to the linear conditions except that the rate of change (the slope of the regression equation) was defined as a multiple of the square root of the session number rather than the actual session number. This transformation is a well-accepted method for defining curvilinear change (Mosteller & Tukey, 1977). The square root transformation results in a greater proportion of the change occurring between the early sessions than between the later sessions.

*Defining the rate of fluctuation in symptoms.* The degree to which the score at any particular session deviates from the gradual trend was defined based on the standard error of measurement of the BDI (Jacobson & Truax, 1991). The standard error of measurement is a measure of the variability in scores expected over a period of five to seven days. It is defined as follows:

$$S_E = s_1 \sqrt{1 - r_{xx}}$$

$S_E$  represents the standard error of measurement,  $s_1$  represents the standard deviation of the measure, and  $r_{xx}$  represents the test-retest reliability of the measure. It is important to note that the term “error of measurement” is to some degree a misnomer in the current case. The value simply represents the expected standard deviation of scores in a normal distribution around the average over a period of time defined by the test-retest reliability, so that 68% of scores separated by the appropriate time period would be within one standard error of the average, 96% would be within two standard errors, and so forth.

The test-retest reliability that we used to calculate the standard error of measurement assesses the degree to which scores vary over periods of 5 to 7 days. Because the standard error represents all causes of fluctuation over the indicated period of time, some of that variability is due to measurement error and some is due to real fluctuations in symptoms.

The test-retest reliability was defined as .67, based on the two test-retest reliabilities of one week or less in clinical samples (.65 and .69; 1 week and 5 days respectively) reviewed by (A. T. Beck, Steer, & Garbin, 1988). The standard deviation of the measure was defined as 9 BDI points. (A. T. Beck, Epstein, Brown, & Steer, 1988) noted standard deviations of 8.1 to 10.4 points for the BDI at various symptom levels, so 9 points captures a central value for the variability in scores across the range of the measure.

*Simulations.* Simulations were performed according to a simple regression equation that incorporated information about the rate of gradual change and the level of

variability around the gradual trend. The equation for the linear change conditions was as follows:

$$BDI_{ij}^{sim} = BDI^{ini} - slope \times session_j + S_E \times x_{ij}$$

$BDI_{ij}^{sim}$  represents the simulated BDI score for patient  $i$  at session  $j$ . *Slope* is the rate of gradual linear change, and  $session_j$  is the session number. Sessions were numbered 0 to 19, so that the intercept of the equation,  $BDI^{ini}$ , would represent the BDI score at the first session. As noted above,  $S_E$  is the standard error of measurement for the BDI.  $x_{ij}$  represents a random number generated from a unit normal distribution. This number multiplied by the standard error of measurement creates a normal distribution of fluctuations around the gradual trend line, with a standard deviation equal to the standard error of measurement. Consequently, this portion of the equation defines the level of deviation in scores on the BDI from the gradual trend line that would be expected over a period of five to seven days.

The curvilinear conditions were defined in the same manner as the linear conditions, with the exception that the session number was replaced by the square root of the session number and the slope was adapted accordingly.

For each of the eight conditions in this study, we simulated 100 samples of data, with each sample including 100 courses of change. By simulating 100 samples of data within each condition, we could define confidence intervals for our results. For any result, the central 90 summary values produced from the 100 samples of data defined the 90% confidence interval for that result. This procedure conforms to the definition of a 90% confidence interval as the central interval within which 90% of the values are expected to occur.

## Results and Discussion

*Sudden Gains in Simulations Designed to Model a Gradual Course of Change*

We calculated sudden gains within each sample following the criteria established by Tang and DeRubeis (1999b) and adopted by subsequent researchers.<sup>2</sup> Results are presented in Table 1. All characteristics of sudden gains that are typically reported by Tang and colleagues (Tang & DeRubeis, 1999b; Tang, et al., 2005; Tang, et al., 2002) are presented in this table.

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Insert Table 1 about here.

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We compared characteristics of sudden gains in the simulations to those reported in psychotherapy samples, including the Tang and DeRubeis (1999b) sample (see Table 2). We first examined the frequency of sudden gains events. Tang and DeRubeis reported that 39% of their patients showed a sudden gain. To compare the frequency of sudden gains in the simulated data to the Tang and DeRubeis finding, we examined the frequency of sudden gains in the linear and nonlinear simulations (see Table 1) when the mean post-treatment BDI score was 12.4. These data are most comparable to Tang and DeRubeis because their sample also ended with a mean BDI score of 12.4. In the simulation data, we found that 48% of patients in the linear condition and 50% in the curvilinear condition had sudden gains. The Tang and DeRubeis figure of 39% falls just outside the 90% confidence intervals for these values. It is striking that the data designed to represent a gradual course of change produced rates of sudden gains higher than those seen in Tang and DeRubeis (1999b) and at the high end of the range of the rates seen in

the other published studies (25% to 50% of patients showed sudden gains, as shown in Table 2).

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Insert Table 2 about here

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We next compared the other characteristics of sudden gains in the Tang and DeRubeis (1999b) sample and the other samples in Table 2 to our simulated samples. We used the simulated conditions with a mean post-treatment BDI score of 5.6 for these comparisons, because 5.6 is the mean post-treatment score of patients in the Tang and DeRubeis sample who reported a sudden gain. Tang and DeRubeis (1999b) reported a mean gain magnitude of 11.2 BDI points, and we found essentially the same mean magnitude in both the linear and curvilinear conditions of our simulations. The studies in Table 2 report a mean gain magnitude ranging from 9.3 to 12.0.

The mean percentage of total improvement in the simulated samples was also essentially the same as in Tang and DeRubeis and the other published studies. Tang and DeRubeis (1999b) reported that 51% of total improvement was accounted for by the average sudden gain, and we found that the mean percentage of improvement was 48% for both the linear and curvilinear simulations. The Tang and DeRubeis figure of 51% is well within the 90% confidence intervals for both the linear and curvilinear conditions. The mean percentage of improvement in the other studies reported in Table 2 ranges from 51% to 64%.

In the curvilinear condition of the simulation, which takes into account evidence that improvement is more rapid at the beginning of psychotherapy; the number of the

median pregain session (session 5) was the same as the value in the Tang and DeRubeis study. The number of the median pregain session of the other studies in Table 2 ranges from 4 to 10.

The rate of reversals in the simulated data was much higher (52% in the linear samples and 55% in the curvilinear samples) than in the Tang and DeRubeis (1999b) study (17%) but not very different from rates of reversals in some other studies (e.g., 47% in (Tang, et al., 2002) and 44% in Busch et al., 2006).

In sum, we found that simulations in which the expected fluctuations in BDI scores followed a course of gradual change produced sudden gains with characteristics that are very similar to those in psychotherapy samples except that the simulated data showed more sudden gains events and a higher rate of reversals than in most of the psychotherapy samples.

#### *Relationship between Post-treatment Outcome and a Steep Gradual Course of Change*

We also found (see Table 1) that sudden gains occurred more than three times more often when the gradual trend was steep (and ended in a low post-treatment BDI score (5.6)) than when the trend was flat (and ended in a high post-treatment BDI score (26.0)). Sudden gains occurred in 66% of patients who improved substantially and in 20% of patients who improved very little in the linear simulations; the comparable figures for the curvilinear simulations are 68% and 19%, respectively. These results indicate that there is a strong correlation between the frequency of sudden gains and the post-treatment BDI score, and that this relationship is present even when change is defined to be gradual.

#### *Assumptions and Limitations*

This study relies on simulations to evaluate whether sudden gains would occur even if the course of change were gradual. The gradual change model used in our simulations is intentionally simplistic. The point of our study is to test the hypothesis that even a simplified model produces sudden gains similar to those present in psychotherapy. We kept our model simple and transparent so it is clear that we did not add any characteristics to optimize the chances of producing sudden gains. As a result, we chose a single value for the fluctuations in scores. The value was based on fluctuations in BDI scores typically seen in untreated depressed individuals over a five to seven day period. We chose the five to seven day period because it is a rough average of the number of days between sessions over the course of treatment in the RCTs. We used the level of fluctuation in untreated samples in our model because the rate of fluctuation in these samples provides a single value that is stable over time and is a relatively median value of the level of fluctuation that would be expected during the different stages of treatment. We should note that, in the course of conducting our study, we found similar results regardless of what sample we used to estimate the level of fluctuation, including a cognitive-behavioral therapy sample from an important randomized controlled trial (Elkin et al., 1989) and our own psychotherapy sample.

The fact that we found a higher rate of reversals in our simulations than in the Tang and DeRubeis (1999b) study and some other studies likely reflects a known simplification in our simulation model. In natural psychotherapy, the deviation from the average rate of change is higher early in treatment, and drops to very low levels as treatment progresses. The reason is that many patients become asymptomatic later in treatment, and the level of deviation for the BDI in non-depressed samples is quite low



(Hayes, Laurenceau, Feldman, Strauss, & Cardaciotto, 2007). In our simulations, we made the simpler, more easily interpretable, choice of using a fixed rate of fluctuation around the gradual trend. The rate of fluctuation remained at levels typical of a depressed sample even towards the end of treatment, when most of the sample would no longer be depressed. Our use of a fixed rate of fluctuation likely resulted in more reversals, because more upward jumps in BDI scores necessarily occur if the rate of fluctuation remains relatively high.

We found rates of sudden gains in our simulations that were higher than in the Tang and DeRubeis study, and at the high end of the range of rates reported in the samples in Table 2. Certainly we are less troubled to have found *more* sudden gains in our simulations than in the psychotherapy samples than we would be if we had found *fewer*. The higher level of sudden gains in our sample may be due to the fact that some data are missing in the Tang and DeRubeis psychotherapy sample, whereas all courses of treatment are 20 sessions in the simulated data. Or it may suggest that some feature of change in natural data makes sudden gains less likely to occur than in our simple simulation.

#### Study 2: Post-treatment Outcome as Predicted by Sudden Gains and Early Treatment

##### Response in a Naturalistic Sample

In this study we examined data from a sample of patients who received CBT and other therapies for depression in a private practice setting. We began by evaluating whether the characteristics of sudden gains in this sample were similar to those seen in other studies of sudden gains. In a series of regression analyses, we then examined

whether the presence of a sudden gain uniquely predicts post-treatment BDI scores when the rate of gradual change over the first few sessions of treatment is taken into account.

## Method

### *Participants*

*Selection criteria.* Patients were selected from a database of patients treated at the San Francisco Bay Area Center for Cognitive Therapy (SFBACCT) or by the second author before the SFBACCT was established. All patients gave written permission for use of anonymized data from their clinical record for research purposes. In order to closely replicate criteria used by Tang and colleagues (Tang & DeRubeis, 1999b; Tang, et al., 2005), we selected patients for study if they (1) were aged 18 or over; (2) received individual (not couple or group) therapy; (3) provided a minimum of 8 scores on the Beck Depression Inventory (BDI) within 20 sessions and within 20 weeks; and (4) had a pre-treatment BDI score greater than 19. The mean number of sessions completed by the patients who met these criteria was 15 (mode = 16).

*Patient characteristics.* The sample that met selection criteria consisted of 88 patients<sup>1</sup>. They were 66% female, had a mean age of 35.6 years ( $SD = 12.2$ ), and had completed an average of 16.3 years of education ( $SD = 2.4$ ). Eighty-seven percent were Caucasian, 5% were Asian, 5% were Hispanic, and 4% were of mixed or other race.

Pre-treatment psychiatric diagnoses were obtained from the clinical record. Diagnoses were made on the basis of a clinical interview by the therapist, who used the most current version of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 1987, 1994, 2000) available at the time the patient was treated. Ninety-six percent of the patients in the sample were diagnosed by

their treating clinicians as having a mood disorder, with 86% carrying a diagnosis of unipolar major depression. The most common comorbid conditions included anxiety disorders (58%) and Axis II disorders (30%).

### *Treatment*

Treatment consisted of CBT, usually provided weekly. Treatment was guided by the extant evidence-based CB protocols, by an individualized case formulation (Persons, 2008), and by the results of weekly symptom monitoring using the BDI. Forty-five percent of patients were treated by the second author, and the remaining patients were treated by 16 different clinicians (13 were Ph.D. psychologists) with one to ten years of experience. Seventy-four percent of patients received adjunct pharmacotherapy, and twenty-nine percent received an adjunct psychosocial treatment (e.g., couple therapy, 12-step group therapy).

### *Measure and Procedure*

Symptoms of depression were assessed with the Beck Depression Inventory (BDI; Beck et al., (1961). The Beck Depression Inventory (BDI) is a widely-used, 21-item self-report measure of the severity of depressive symptoms. (A. T. Beck, Steer, et al., 1988) reported a test-retest reliability over time periods less than one month of .60, good interrater reliability ( $r = .85$ ; (Clark & Watson, 1991), and good convergence with other self-report measures of depressive symptoms (Clark & Watson, 1991).

Patients completed the BDI in the waiting room before their therapy session and presented the measure to their therapist at the beginning of the session. The therapist typically plotted the score with the patient and used the measure to inform the work in the session.

## Results and Discussion

### *Characteristics of Sudden Gains*

We calculated sudden gains as described above. In samples like ours and others (Hardy, et al., 2005; Stiles, et al., 2003), where treatment is not based on a standardized protocol, the period between sessions may vary. In addition, it is possible with all treatment research that patients would have missing data, resulting in longer between-assessment intervals. The evaluation of sudden gains across long intervals would be problematic, because the concept of sudden gains implies large gains over brief periods of time. Consequently, it is important to demonstrate that sudden gains are actually occurring over the brief time periods common in standardized protocols – usually between 3 and 7 days. When we evaluated between-assessment intervals in our sample, we found that the median interval was 7 days. Similarly, the median interval over which sudden gains actually occurred was also 7 days. The result shows that sudden gains in our sample are occurring over appropriate time periods. In order to make certain that gains over extended periods are not biasing results, we report a secondary analysis below that restricts the identification of sudden gains to events that occurred during intervals of 7 days or less.

In our sample, 44 sudden gains occurred in 41 patients. The percentage of patients with at least one sudden gain was 38%<sup>3</sup>, the mean magnitude of the gain was 10.6 BDI points, the median pregain session was 6, the percentage of total improvement accounted for by the gain was 62%, and 29% of sudden gains later reversed (see Table 1). The characteristics reported here are all based on the first sudden gain occurring during a course of psychotherapy. As Table 2 shows, all of these values are very similar to the

results of prior replications of the sudden gains phenomenon. Therefore, we conclude that the sudden gains phenomenon occurs in our sample and that the features of sudden gains in our sample are similar to those of other samples.

To establish that our results were not affected by pharmacotherapy, we reran the analyses including only the 22 patients who did not receive pharmacotherapy during treatment. All 22 of these patients carried a diagnosis of some type of unipolar depression. Results were very similar to the overall sample: Again, 45% of patients had a sudden gain, the median pregain session was 5, the mean magnitude of the gain was 10.9, the gains accounted for an average of 52% of the total gain during treatment, and 21% of sudden gains subsequently reversed.

#### *Prediction of Post-Treatment BDI Score*

To evaluate the possibility that the rate of early response to treatment could account for the association between the presence of sudden gains and better treatment outcome, we performed a series of multiple regressions predicting post-treatment BDI score. Rate of early response was defined as the rate of change in BDI scores, or the slope of the gradual trend line, through the first six sessions of available data. We examined the first six sessions because six was the average number of data points prior to and including the sudden gain when a patient experienced a sudden gain. The estimate was the slope of a simple regression line through BDI scores, with session number as the independent variable. Regression analyses were performed with PROC GLM in SAS v.9.2. Because slopes were a continuous variable, they were entered as a random effect in regression models. The presence or absence of a sudden gain was coded as a categorical variable and entered as a fixed effect.

Results of the regressions are presented in Table 3. In the baseline model, we found that 14% of the variance in post-treatment BDI scores was accounted for by the pre-treatment BDI score. When the presence of a sudden gain was added to the baseline model, we found that sudden gains were a significant predictor of post-treatment BDI score, accounting for an additional 5% of variance. When the rate of early response to treatment was added to the baseline model, we found that it was a significant and strong predictor of outcome, accounting for an additional 35% of variance over the baseline model. When pre-treatment BDI score, presence of sudden gains, and rate of early response to treatment were included simultaneously in the regression, we found that sudden gains were not a significant predictor of outcome and added only 1% to the variance accounted for by the model that included only rate of early response and pre-treatment BDI score. Thus, the presence of a sudden gain did not account for unique variance in outcome when we included the rate of early response to treatment in the model.

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Insert Table 3 about here

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Some patients in the sample had inter-session intervals of longer than 7 days, so that sudden gains might have occurred over longer periods of time than could appropriately be called sudden. To address this issue, we did a follow-up analysis restricting sudden gains only to events that occurred over 7 days or less. This added restriction resulted in a decrease in the frequency of sudden gains in our sample to 28%. However, it did not affect the prediction of end of treatment outcome. Initial BDI and the

rate of early response both remained strong predictors of end of treatment outcome, ( $F(1, 85) = 33.76, p < .0001$  and  $F(1, 85) = 57.28, p < .0001$  respectively). The presence of a sudden gain continued not to predict end of treatment outcome, ( $F(1, 85) = .01, n.s.$ ).

#### *Assumptions and Limitations*

Although we showed that sudden gains did not add to the power of early gains to predict outcome, it could simply be the calculation of the average change over several sessions, and not the fact that the change occurs at the very beginning of psychotherapy, that accounts for the power of early gradual change to predict outcome. Consistent with this point, (I. M. Aderka, et al., 2012) presented some evidence in their meta-analysis suggesting that expanding the definition of sudden gains to include sudden gains that occur immediately after the first session does not improve the power of sudden gains to predict outcome.

Two features of the regression analyses merit special attention. First, the coding of sudden gains is a dichotomous variable, whereas early response is a continuous variable. A continuous variable has more variance than a dichotomous variable and thus is more likely to be significantly related to the dependent variable than a dichotomous variable. A sudden gain is, by definition, a dichotomous event, and cannot be recoded as a continuous variable; we elected not to transform early change into a dichotomous variable, as this strategy would require us to discard relevant information.

Second, because the median pregain session occurs early in treatment, it is simply not possible to define sudden gains and early change completely independently.

Attempting to do this by excluding all sudden gains events from the calculation of the early rate of change, for example, would produce a severely biased calculation of early

change. The point is made clear in Figure 2. In the sequence with the steeper average slope, excluding the sudden gains in calculating the slope of the first 5 periods would actually reverse the direction of the slope.

The overlap of the constructs of sudden gains and early change, and the fact that one construct is defined dichotomously and one continuously, means that we cannot draw conclusions about the relative importance of the two constructs in predicting outcome. Thus, we do not conclude that one construct is a more important predictor of outcome than the other. We conclude only that sudden gains do not provide any additional ability to predict outcome over and above the predictive power of early change.

### General Discussion

In Study 1, we conducted simulations that showed that sudden gains occurred even when change followed a gradual course. We showed that the ability of the sudden gains phenomenon to predict post-treatment outcome can be accounted for by a steeper overall rate of improvement in treatment (i.e., by the rate of gradual change). We also showed that simulations that defined steep gradual trends (patients had a low post-treatment BDI score) produced about three times as many events meeting sudden gains criteria as simulations with nearly flat gradual trends (patients ended treatment with a high BDI score). In Study 2, we replicated the finding from prior research that sudden gains predict end of treatment outcome. However, we showed that, in our sample, the occurrence of a large gain happening within a single session is not an independent predictor of outcome when early rapid response, a previously identified construct of importance in the treatment of depression (Hayes, Feldman, et al., 2007; Ilardi & Craighead, 1994, 1999), is taken into account.



The studies reported here show that sudden gains can occur even when the course of change in psychotherapy is gradual. We do not show that the course of change in psychotherapy is necessarily gradual; we only show that the presence of sudden gains does not provide conclusive evidence that unique, qualitatively distinct change events are occurring in the pre-gain sessions.

It is important to note that gradual change does not imply that all fluctuations from the gradual rate of change are error. Fluctuations can represent substantive changes. They can represent changes in depressive symptoms related to life events (e.g., a discouraging day at work or an enjoyable phone call with an old friend) or to a particularly effective or ineffective treatment session. However, as long as these effects are normally distributed around a general trend of improvement, change is still gradual. Thus, even if sudden gains are part of a gradual pattern of change, they can still be important events.

What do our findings say about the cognitive hypothesis proposed by Tang and DeRubeis? Their cognitive hypothesis proposes that the sudden gain reflects a cognitive change that happened in the pre-gain session, and it is supported by their two studies (Tang & DeRubeis, 1999b; Tang, et al., 2005) showing that more cognitive change happened in the pre-gain session than in a control session. We offer three observations about this cognitive hypothesis. First, two studies of this topic by other investigators have failed to replicate it (Hofmann et al., 2006; Kelly et al., 2005). Second, (Tang & DeRubeis, 1999a) originally presented their research in the context of a critique of the assertion by (Ilardi & Craighead, 1994) that the fact that over 50% of the change in CBT for depression occurs before cognitive interventions are introduced in the therapy

suggests that cognitive change may not be a driving factor in CBT. Study 2 reported here, which shows that sudden gains do not incrementally predict outcome when early change is taken into account, may provide some support for the Ilardi & Craighead (1994; 1999) position.

Third, the finding that more cognitive change occurs in the session preceding a sudden gain than in a control session (Tang & DeRubeis, 1999b; Tang, et al., 2005) does not say anything about whether a sudden gain reflects a relatively large change in a gradual course of change or is a qualitatively distinct change event, as Tang and DeRubeis (1999b) posit. Even if all sessions are on a continuum of effectiveness, as the gradual change model posits, we would expect a more effective session to include more of the active mechanism of change than a less effective session. Because sudden gains are defined as sessions that result in large gains, they would naturally be expected to be more effective than control sessions. In this respect, our demonstration that sudden gains can occur in a gradual course of change is neutral with regard to the cognitive hypothesis proposed by Tang and DeRubeis. More effective sessions might include more cognitive change, as suggested by Tang and DeRubeis, or more non-specific factors, as suggested by (Ilardi & Craighead, 1994, 1999).

The studies of the prediction of post-treatment outcome reported here have implications for the finding that sudden gains predict better long-term outcome (Tang & DeRubeis, 1999b; Tang, et al., 2007). (Haas, Hill, Lambert, & Morrell, 2002) showed that a more rapid early rate of response to treatment is associated with better long-term outcome in a general psychotherapy sample. Because our study showed that sudden gains do not predict better post-treatment outcome when early rate of response to treatment is

taken into account, it is plausible that the early rate of response to treatment could account for the prediction of long-term outcome as well. For this reason, we recommend that future research on the relationship between sudden gains and outcome control for the rate of response to treatment.

### *The Course of Change in Psychotherapy*

Our demonstration that linear and curvilinear gradual change models can produce evidence of the sudden gains phenomenon does not rule out the possibility that many other models could produce the same evidence. In fact, simple linear and curvilinear models like the ones we used in our simulations do not capture the course of change for all patients (Hayes, et al., 2007). In the course of the work we presented here, we conducted hierarchical linear model growth curve analyses on our psychotherapy sample and found that a model including random linear, quadratic, and cubic effects provided a better fit than any simpler model. This model fits a curve to each individual's trajectory of change that bends at two different places. All of the parameters are best fit as random effects, meaning that the curves are different for different individuals. Because this model is so unstructured, it is difficult to interpret. It does show, however, what any clinician already knows: Change occurs at different rates and in different ways for different patients. An accurate understanding of the course of change in psychotherapy will need to account for this heterogeneity.

The study of sudden gains represents an effort to capture one aspect of this heterogeneity. The studies reported here, showing that evidence of sudden gains occur even when change is gradual, point out the limits of our knowledge of what events meeting sudden gains criteria actually indicate about the course of change. However, the nature of

the course of change reflected in a sudden gain is not an “either-or” issue. The question we ask in this paper is not: Is a sudden gain a qualitatively distinct change or part of a gradual course of change? We merely ask: Is it possible that the evidence of sudden gains that has been presented so far in the literature occurs as a result of a gradual pattern of change? Our simulations show that the answer to that question is “Yes, it is possible.” However, we have not shown that *all* sudden gains *are* part of a gradual pattern of change. In fact, it is quite possible that some sudden gains events are part of a gradual pattern of change, whereas other events that meet sudden gains criteria represent a qualitatively distinct change event that is *not* part of a gradual course of change. The main point of the studies we present here is this: The presence of events meeting sudden gains criteria does not provide definitive information about the nature of the course of change within which they occur. More information would be necessary to demonstrate that, at least in some cases, qualitatively distinct changes are occurring at the point of the sudden gain.

Aderka, Nickerson, Boe, and Hofmann (2012) present an interesting example that illustrates the difficulty of interpreting the implications of sudden gains for the course of change. They found that sudden gains in CBT are more predictive of outcome than are sudden gains in non-CB treatments, even though sudden gains are not more frequent in CBT. Aderka’s finding tells us that the course of change in CB and non-CB therapies differs, but it does not tell us what the difference is. Aderka et al. (2012) suggested that the difference might be that an upward spiral follows the sudden gain in CBT but not non-CBT clients. Our result that steeper gradual change results in a much higher rate of sudden gains makes clear that the difference could be due to a very different cause. The

Aderka et al. (2012) finding could result from the following scenario: In CBT, the responders show a steep rate of early change and thus many sudden gains, whereas the non-responders show a flat rate of change and thus few sudden gains. In contrast, in the non-CB clients, the responders and non-responders differ less from one another, and sudden gains are thus divided more equally between them. Such a pattern could lead to the same frequency of sudden gains overall in the CBT patients and the non-CBT patients, but a stronger relationship between outcome and sudden gains in the CBT group. That is, the Aderka et al finding might result from a difference in the distribution of the rates of gradual change between the CBT and non-CBT groups. The point of this discussion is that the simple presence of a sudden gain does not tell us about the course of change within which the sudden gain occurs. More comprehensive analysis of the pattern of change is necessary in order to provide this information.

Recent developments in statistical methods for longitudinal research that take full advantage of all of the available data (see Hayes, et al., 2007) can help us carry out sophisticated examinations of the patterns of change in psychotherapy. These methods are designed to help us distinguish signal from noise, so that we do not over-interpret small or expectable fluctuations in the pattern of symptom change. These methods can help psychotherapy researchers identify distinct patterns of change that occur in certain patients and to understand the implications of those differences for the process of change.

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## References

- Aderka, I., Appelbaum-Namdar, E., Shafran, N., & Gilboa-Schechtman, E. (2011). Sudden gains in prolonged exposure for children and adolescents with posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology* 79, 441-446.
- Aderka, I., Nickerson, A., Boe, H., & Hoffman, S. (2012). Sudden gains during psychological treatments of anxiety and depression: A meta-analysis. *Journal of Consulting and Clinical Psychology* 80(1), 93-101.
- Aderka, I. M., Nickerson, A., Boe, H., & Hofmann, S. (2012). Sudden gains during psychological treatments of anxiety and depression: A meta-analysis. *Journal of Consulting and Clinical Psychology*, 80(1), 93-101.
- American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders (DSM-III-R)*. (3rd, revised ed.). Washington, DC: American Psychiatric Association.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders (DSM-IV)* (4th ed.). Washington, DC: American Psychiatric Association.
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders (DSM-IV-TR)* (4 ed.). Washington DC: American Psychiatric Association.

- Barkham, M., Rees, A., Stiles, W. B., Shapiro, D. A., Hardy, G. E., & Reynolds, S. (1996). Dose-effect relations in time-limited psychotherapy for depression. *Journal of Consulting and Clinical Psychology, 64*(5), 927-935.
- Beck, A. T., Epstein, N., Brown, G., & Steer, R. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology, 56*, 893-897.
- 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.
- 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.
- Beckham, E. E. (1989). Improvement after evaluation in psychotherapy of depression: Evidence of placebo effect. *Journal of Clinical Psychology, 45*, 945-950.
- Busch, A. M., Kanter, J. W., Landes, S. J., & Kohlenberg, R. J. (2006). Sudden gains and outcome: A broader temporal analysis of cognitive therapy for depression. *Behavior Therapy, 37*, 61-68.
- Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: Evidence and taxonomic implications. *Journal of Abnormal Psychology, 100*, 316-336.
- Elkin, I., Shea, M. T., Watkins, J. T., Imber, S. D., Sotsky, S. M., Collins, J. F., et al. (1989). NIMH treatment of depression collaborative research program: General effectiveness of treatments. *Archives of General Psychiatry, 46*(11), 971-982.



- Fennell, M. J. V., & Teasdale, J. D. (1987). Cognitive therapy for depression: Individual differences and the process of change. *Cognitive Therapy and Research, 11*, 253-271.
- Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: Exposure to corrective information. *Psychological Bulletin, 99*, 20-35.
- Gaynor, S. t., Weersing, V. R., Kolko, D. J., Birmaher, B., Heo, J., & Brent, D. A. (2003). The prevalence and impact of large sudden improvements during adolescent therapy for depression: A comparison across cognitive-behavioral, family, and supportive therapy. *Journal of Consulting and Clinical Psychology, 71*, 386-393.
- Haas, E., Hill, R., Lambert, M. J., & Morrell, B. (2002). Do early responders to psychotherapy maintain treatment gains? *Journal of Consulting and Clinical Psychology, 58*, 1157-1172.
- Hardy, G. E., Cahill, J., Stiles, W. B., Ispan, C., Macaskill, N., & Barkham, M. (2005). Sudden gains in cognitive therapy for depression: A replication and extension. *Journal of Consulting and Clinical Psychology, 73*(1), 59-67.
- 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.
- Hayes, A. M., Laurenceau, J. P., Feldman, G., Strauss, J. L., & Cardaciotto, L. (2007). Change is not always linear: The study of nonlinear and discontinuous patterns of change in psychotherapy. *Clinical Psychology Review, 27*, 715-723.

- Hofmann, S. G., Schulz, S. M., Meuret, A. E., Moscovitch, D. A., & Suvak, M. (2006). Sudden gains during therapy of social phobia. *Journal of Consulting and Clinical Psychology, 74*, 687-697.
- Howard, K. I., Kopta, S. M., Krause, M. S., & Orlinsky, D. E. (1986). The dose-effect relationship in psychotherapy. *American Psychologist, 41*, 159-164.
- Ilardi, S. S., & Craighead, W. E. (1994). The role of nonspecific factors in cognitive-behavior therapy for depression. *Clinical Psychology Science and Practice, 1*, 138-156.
- Ilardi, S. S., & Craighead, W. E. (1999). Rapid early response, cognitive modification, and nonspecific factors in cognitive behavior therapy for depression: A reply to Tang and DeRubeis. *Clinical Psychology: Science and Practice, 6*, 295-299.
- Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology, 59*, 12-19.
- Kelly, M. A. R., Roberts, J. F., & Ciesla, J. A. (2005). Sudden gains in cognitive behavioral treatment for depression: When do they occur and do they matter? *Behaviour Research and Therapy, 43*, 703-714.
- Lambert, M. J., Hansen, N. B., & Finch, A. E. (2001). Patient-focused research: Using patient outcome data to enhance treatment effects. *Journal of Consulting and Clinical Psychology, 69*, 159-172.
- Lutz, W., Martinovich, Z., & Howard, K. I. (1999). Patient profiling: An application of random coefficient regression models to depicting the response of a patient to

- outpatient psychotherapy. *Journal of Consulting and Clinical Psychology*, 67, 571-577.
- Mosteller, F., & Tukey, J. W. (1977). *Data analysis and regression: A second course in statistics*. Reading, MA: Addison-Wesley.
- Persons, J. B. (2008). *The case formulation approach to cognitive-behavior therapy*. New York: Guilford.
- Persons, J. B., Bostrom, A., & Bertagnolli, A. (1999). Results of randomized controlled trials of cognitive therapy for depression generalize to private practice. *Cognitive Therapy and Research*, 23, 535-548.
- Persons, J. B., Burns, D. D., & Perloff, J. M. (1988). Predictors of dropout and outcome in cognitive therapy for depression in a private practice setting. *Cognitive Therapy and Research*, 12, 557-575.
- Persons, J. B., Roberts, N. A., Zalecki, C. A., & Brechwald, W. A. G. (2006). Naturalistic outcome of case formulation-driven cognitive-behavior therapy for anxious depressed outpatients. *Behaviour Research and Therapy*, 44, 1041-1051.
- Present, J., Crits-Christoph, P., Gibbons, M. B. C., Hearon, B., Ring-Kurtz, S., Worley, M., et al. (2008). Sudden gains in the treatment of generalized anxiety disorder. *Journal of Clinical Psychology*, 64(1), 119-126.
- Renaud, J., Brent, D. A., Baugher, M., Brimaher, B., Kolko, D. J., & Bridge, J. (1998). Rapid response to psychosocial treatment for adolescent depression: A two year follow-up. *Journal of the American Academy of Child & Adolescent Psychiatry*, 37, 1184-1191.

- Santor, D. A., & Segal, Z. V. (2001). Predicting symptom return from rate of symptom reduction in cognitive-behavior therapy for depression. *Cognitive Therapy and Research, 25*, 117-135.
- Stiles, W. B., Leach, C., Barkham, M., Lucock, M., Iveson, S., & Shapiro, D. A. (2003). Early sudden gains in psychotherapy under routine clinical conditions: Practice-based evidence. *Journal of Consulting and Clinical Psychology, 71*, 14-21.
- Tang, T. Z., & DeRubeis, R. J. (1999a). Reconsidering rapid early response in cognitive behavior therapy for depression. *Clinical Psychology: Science and Practice, 6*, 283-288.
- Tang, T. Z., & DeRubeis, R. J. (1999b). Sudden gains and critical sessions in cognitive-behavioral therapy for depression. *Journal of Consulting and Clinical Psychology, 67*(6), 894-904.
- 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.
- Tang, T. Z., DeRubeis, R. J., Hollon, S. D., Amsterdam, J., & Shelton, R. (2007). Sudden gains in cognitive therapy of depression and depressive relapse/recurrence. *Journal of Consulting and Clinical Psychology, 75*, 404-408.
- Tang, T. Z., Luborsky, L., & Andrusyna, T. (2002). Sudden gains in recovering from depression: Are they also found in psychotherapies other than cognitive-behavioral therapy? *Journal of Consulting and Clinical Psychology, 70*, 444-447.

Thompson, M. G., Thompson, L., & Gallagher-Thompson, D. (1995). Linear and nonlinear changes in mood between psychotherapy sessions: Implications for treatment outcome and relapse risk. *Psychotherapy Research, 5*, 327-336.

Vittengl, J. R., Clark, L. A., & Jarrett, R. B. (2005). Validity of sudden gains in acute phase treatment of depression. *Journal of Consulting and Clinical Psychology, 73*(1), 173-182.

## Footnotes

<sup>1</sup>Tang and DeRubeis reported pre-treatment BDI scores of 27.7 for patients who later experienced sudden gains and 27.9 for patients that did not. The score of 27.8 represents the weighted average value between these two groups.

<sup>2</sup>This number was not reported directly in the Tang and DeRubeis (1999) article, but it can be calculated as the weighted mean of the post-treatment scores of the non-sudden gainers and sudden gainers groups.

<sup>3</sup>In Tang et al. (2005) and subsequent papers, Tang and colleagues have used more explicit language to describe the comparison of the three pre-test to three post-test scores, rather than referring to the comparison as a t-test. However, the mathematics of this criterion has remained unchanged.

<sup>4</sup>Pre- and post-treatment BDI scores for some of these subjects were presented in three previously-published articles (Persons, Bostrom, & Bertagnolli, 1999; Persons, Burns, & Perloff, 1988; Persons, Roberts, Zalecki, & Brechwald, 2006).

<sup>5</sup>The percentage of patients with sudden gains includes all patients with events that meet sudden gains criteria, regardless of whether the events subsequently reverse.

## Figure Captions

*Figure 1.* Changes in BDI scores across sessions of psychotherapy for three patients. The trend line represents the best fitting logarithmic curve. Sudden gains are marked in bold.

*Figure 2.* The deviations from both linear trend lines are identical, but the deviations meet sudden gains criteria (marked in bold) only when the trend line represents more rapid gradual change.

*Figure 3.* Three hypothetical gradual change trajectories. Panel D illustrates one of the gradual change trajectories with the expected fluctuation of observed scores from the overall rate of gradual change.

Table 1  
*Characteristics of Sudden Gains in Simulated Data*

End Point	Linear				Curvilinear			
	26.0	19.2	12.4	5.6	26.0	19.2	12.4	5.6
Existence of sudden gains	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
% of patients with sudden gains	20 (13-26)	33(29-41)	48 (40-57)	66 (57-76)	19 (15-26)	35 (25-41)	50 (40-56)	68 (62-72)
Median pregain session	11 (7.5-14)	9 (9-12)	9 (7-11)	9 (7-11)	9 (6-12)	8 (6-10)	6 (5-8)	5 (5-6)
Mean magnitude	11.3 (10.3-12.6)	10.9 (10.5-11.8)	11.0 (10.4-11.7)	11.2 (10.5-12.1)	11.0 (10.2-12.2)	11.0 (10.2-12.1)	11.0 (10.4-11.9)	11.2 (10.6-12.0)
Mean % of total improvement	69 (-112 – 150)	96 (83-118)	69 (62-78)	48 (40-54)	101 (36-157)	100 (71-127)	65 (60-80)	48 (45-53)
% of reversals	81 (69-92)	74 (64-88)	60 (53-72)	52 (44-60)	84 (73-100)	79 (69-88)	69 (61-79)	55(45-64)

*Note.* 90 percent confidence intervals presented in parentheses.



Table 2

*Comparison of Sudden Gains Studies*

Study*	Tang & DeRubeis 1999b	Tang et al., 2002	Gaynor et al., 2003			Tang et al., 2005		Vittengl et al., 2005				Busch et al., 2006	SFBACCT
Treatment	CT (n = 61)	SET (n = 35)	CT (n = 32)	SBFT (n = 27)	NST (n = 28)	AT (n = 44)	CT (n = 50)	A-CT <sup>a</sup> (n = 138)	A-CT <sup>b</sup> (n = 33)	MED <sup>b</sup> (n = 32)	PBO <sup>b</sup> (n = 24)	CT/FECT (n = 38)	CBT (n=88)
Existence of sudden gains	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
% of patients with sudden gains	39	43	50	26	39	46	43	46	33	47	25	42	47
Median pregain session number	5	5	--	--	--	5	8	----- 4 across all conditions -----				10	6
Mean magnitude	11.2	10.6	10.8	10.7	12.0	11.5	10.2	10.2	9.7	10.1	11.2	9.3	10.8
Mean % of total improvement	51	64	--	--	--	59	59	----- 59 across conditions -----				51	60
% of reversals	17	47	19	57	9	29	40	21	9	13	33	44	26

Note. SFBACCT = San Francisco Bay Area Center for Cognitive Therapy sample

<sup>a</sup>Recurrent depression sample, <sup>b</sup>Atypical depression sample

\*Only studies using the BDI were included.

Table 3. Prediction of Post-Treatment BDI Score

	Model 1: Baseline		Model 2a: Sudden Gain		Model 2b: Early Response		Model 3: Full	
	$F(1, 87) = 28.67, p < .0001$		$F(2, 86) = 9.90, p < .0001$		$F(2, 86) = 40.95, p < .0001$		$F(3, 85) = 28.29, p < .0001$	
	$R^2 = .14$		$R^2 = .19$		$R^2 = .49$		$R^2 = .50$	
	$F$	$p$	$F$	$p$	$F$	$p$	$F$	$p$
Pre-treatment BDI	13.71	.0004	15.28	<.0001	34.39	<.0001	35.13	<.0001
Early response					59.04	<.0001	53.09	<.0001
Sudden gain			5.39	.02			2.01	<i>n.s.</i>

*Note.* Where applicable, all  $F$ 's are based on Type III sums of squares.

Figure 1

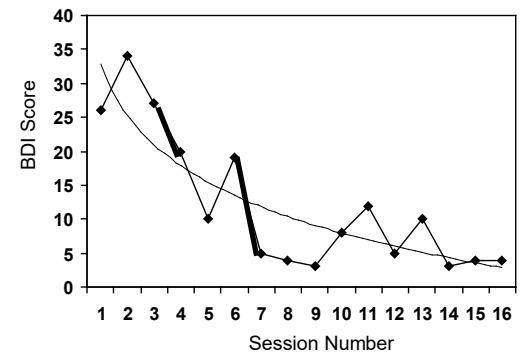
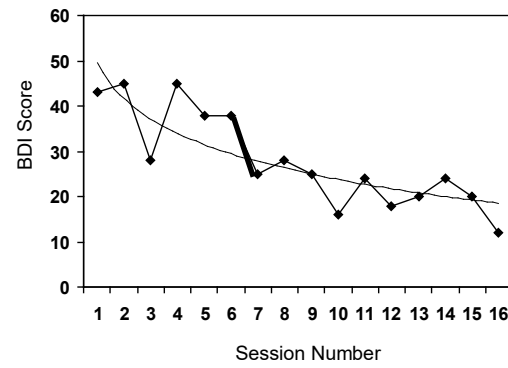
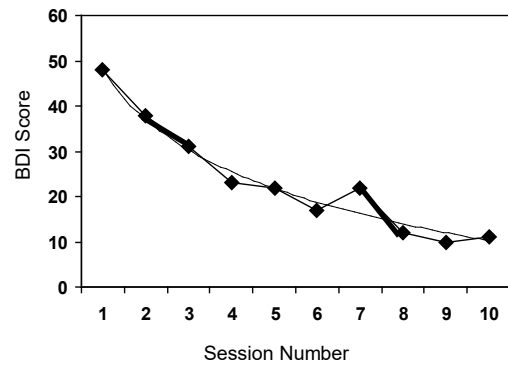


Figure 2

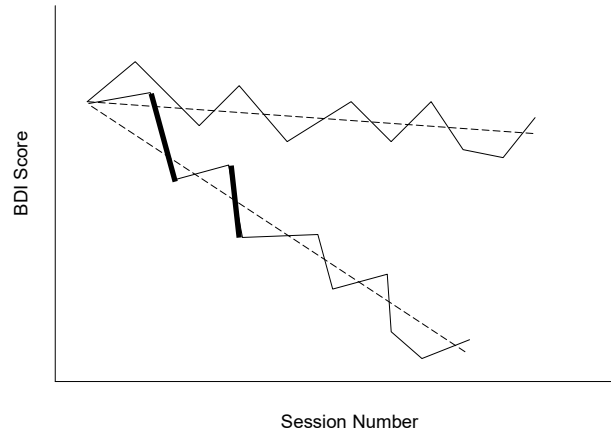


Figure 3

