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Sudden gains as a long-term predictor of treatment improvement among children in community mental health organizations

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ABSTRACT

Objective: Sudden gains have been described as rapid, sizeable changes observed between treatment sessions and have been associated with improved treatment outcome in adults. The current study examined weekly sudden gains among children seeking treatment in the community mental health setting.
Method: Participants were 161 children (age $M = 10.58$, $SD = 1.73$; 69.6% male; 47.8% Caucasian) and their parents who were randomized to one of three treatment modalities and were administered weekly and quarterly assessments throughout treatment.
Results: When idiographic (youth- and parent-identified "top problems") and nomothetic measures (standardized checklists) were used to calculate sudden gains (i.e., gain must be large: in absolute terms, relative to prior session, and relative to changes in prior and subsequent sessions), 20–42% of participants experienced at least one sudden gain during treatment. Most sudden gains occurred early in treatment, and session content of relaxation was associated with sudden gain presence. Using a modified Bonferonni correction, sudden gains predicted overall symptom levels at final assessment (i.e., last assessment obtained following post-treatment) even after controlling for pre-treatment symptom levels and magnitude of the overall gain from pre- to post-treatment.
Conclusions: Suddenness of gains may have a direct effect on long-term treatment outcome among children in the community.

A common method of treatment trajectory analysis is examination of sudden gains. Sudden gains are defined as sudden, rapid improvement evidenced between treatment sessions (Tang & DeRubeis, 1999). Early work in this field began in the late 1990s by Tang and DeRubeis (1999), who examined sudden gains during cognitive behavioral therapy for adult depression. They found that nearly half of participants experienced sudden and rapid improvement in symptoms that accounted for most of post-treatment change. These sudden gains occurred early in treatment and were associated with significantly greater improvement at post-treatment and six-month follow-up.

Replication of these findings indicated that sudden gains are a replicable phenomenon across diverse groups of participants and treatment settings. Most studies have examined sudden gains among participants with adult depression who were treated in controlled treatment settings with some form of cognitive therapy (e.g., Tang, Derubeis, Hollon, Amsterdam, & Shelton, 2007). Fewer studies have examined sudden gains among anxiety patients with panic disorder (Clerkin, Teachman, & Smith-Janik, 2008), generalized anxiety disorder (Present et al., 2008), social anxiety disorder (Hofmann, Schulz, Meuret, Moscovitch, & Suvak, 2006), obsessive-compulsive disorder (Aderka et al., 2012), and posttraumatic stress disorder (e.g., Doane, Feeny, & Zoellner, 2010); most of these studies found similar results to those among adults with depression (Aderka, Nickerson, Boe, & Hofmann, 2012). The effect of sudden gains has been tested across diverse treatment modalities including cognitive-behavioral therapy (e.g., Tang & DeRubeis, 1999), group cognitive-behavioral therapy (e.g., Norton, Klenck, & Barrera, 2010), family therapy (e.g., Gaynor et al., 2003), supportive therapy (Gaynor et al., 2003), interpersonal psychotherapy (Kelly, Cyranowski, & Frank, 2007), and couples therapy (Doss, Rowe, Carhart, Madsen, & Georgia, 2011). Further, some studies have

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moved into the community to examine sudden gains across a range of modalities and mental health concerns (e.g., Drymalski & Washburn, 2011).

Advances in understanding the effect of sudden gains on treatment outcome nevertheless are restricted by several important limitations. First, only one study to date has examined the sudden gain effect in treatment for children. Given that Aderka, Appelbaum-Namdar, Shafran, & Gilboa-Schechtman (2011) examined youth between the ages of eight and eighteen, understanding of the sudden gain effect among young children is limited. Further, no studies have examined parent-identified sudden gains. Parents are better informants of their children's externalizing symptoms (Grills & Ollendick, 2002), and thus, parent-identified sudden gains may be a better predictor than child-identified.

Second, although studies have examined the effect of sudden gains on treatments for internalizing problems, to date, we know of no study that has examined the effect of sudden gains on externalizing problems. Cognitive changes are a suggested mechanism of sudden gains in adult depression treatment (e.g., Tang & DeRubeis, 1999). Given that most treatments for externalizing problems utilize parent-based behavioral strategies over cognitive strategies, sudden gains may not be present in such treatments. Still, "break-through" moments in parenting may occur during treatment of externalizing problems.

Third, no studies have examined the effect of sudden gains on treatment outcome beyond the effects of overall treatment improvement. Having any gain during treatment (whether sudden or not) increases the likelihood of having better treatment outcomes (i.e., better overall treatment improvement) than absence of these gains. Those with sudden gains by current definition (e.g., gain must be large: in absolute terms, relative to prior session, and relative to changes in prior and subsequent sessions) have an inherent advantage in demonstrating better overall outcomes than those without such gains. Thus, the sudden gain effect demonstrated in prior studies may be an artifact of the gain itself rather than a result of its suddenness. The question remains, does the *suddenness* of these sudden gains have a unique effect on treatment outcomes? That is, do sudden gains have an effect on treatment outcome beyond the overall magnitude of treatment improvement?

Fourth, the effect of sudden gains on longer-term outcomes is not well understood. Research suggests that sudden gains predicts improvement of depression, as well as anxiety, at 6, 12, and/or 18 months following treatment termination, with results from a meta-analysis demonstrating medium effect sizes (Aderka, Nickerson, et al., 2012). However, other studies suggest that effects are not maintained at follow-up (e.g., Doss, et al., 2011), and that individuals with sudden gains may even demonstrate worse outcomes in the long-term (Vittengl, Clark, & Jarrett, 2005).

Fifth, we know of only one study that examined sudden gains with weekly idiographic measures; however, this was in the context of couples therapy (Doss et al., 2011). Idiographic measures are advantageous because they can be individualized to symptoms and potentially more sensitive to treatment progression. Sixth, very few studies have examined sudden gains in the community mental health setting – a necessary area of research for generalizability of this phenomenon to community treatment settings.

Finally, few studies have examined session content preceding sudden gains, and nearly all studies that have done so have examined presence of cognitive content only (e.g., Tang & DeRubeis, 1999). Analysis of session content is a precursor to understanding how to capitalize on these gains. Discovery of session content predicting sudden gains may identify potential mechanisms and treatment-enhancing strategies.

The current study attempts to strengthen understanding of sudden gains using families treated for internalizing and externalizing problems in a multi-site community randomized trial (Weisz et al., 2012). Crucially, this study features idiographic and nomothetic weekly assessments measuring treatment improvement in internalizing and externalizing symptoms according to parent and child reports. Further, analyses uniquely examine the effect of *suddenness* of weekly gains on longer-term outcomes by controlling for magnitude of overall treatment change from pre- to post-assessment.

The current study had several aims to examine: (a) the effect of suddenness of weekly gains on longer-term outcomes among all participants and within internalizing and externalizing domains among independent groups of children with anxiety, depression, and conduct disorder; (b) whether sudden gain effects analyzed independently for each measure (nomothetic, idiographic) and informant (child, parent) would be differentially associated with outcome; (c) whether sudden gains occurring early in treatment predicted improved outcome; and (d) whether certain participant or treatment characteristics (e.g., treatment duration, session content) were associated with sudden gains. Evidence suggests that sudden gains have an effect on adult internalizing problems using nomothetic measures; thus, it was hypothesized that presence of sudden gains—as identified by nomothetic weekly assessment—would be associated with internalizing symptom improvement among children in the community mental health setting. Analyses examining externalizing and internalizing outcomes using an idiographic measure and analyses examining informant differential effects on any outcome were exploratory.

Method

Participants

Participants were 161 children and their caregivers who were treated in a multi-site randomized effectiveness trial (Weisz et al., 2012). As outlined in Weisz et al. (2012), children who had elevated problems in anxiety, depression, or conduct-disruptive disorder and were between the ages of 7–13 participated in the study. Exclusion criteria were having pervasive developmental or psychotic symptoms, primary bipolar disorder, or primary inattention or hyperactivity.

Of the 500 children/families that were screened, 203 were allocated to a treatment group after meeting inclusion criteria, and of these remaining participants, 174 received treatment (e.g., Weisz, et al., 2012). However, given that session dates were a necessary piece of information for analysis of sudden gains, participants were excluded from the current analyses if they were missing information on their session dates. Thus, 161 participants and their caregivers were included in the current analyses.

Participants were approximately 70% male and 50% minority status (see Table 1). Ages ranged from 7 to 13 ($M = 10.58$, $SD = 1.73$). There was nearly equal representation of internalizing and externalizing disorders. Further, the percentage of those with more than one disorder was 80.7.

Design

Data were obtained from a recently completed multi-site randomized effectiveness trial (Weisz et al., 2012) that compared symptom, problem, and diagnostic outcomes across three treatment modalities (modular treatment, standard manual treatment, and usual care). Participating community clinics were recruited across two states – Massachusetts and Hawaii. Eighty-four clinicians were recruited and randomized to one of three treatment

Table 1
Demographic and treatment characteristics for the entire sample and for participants with and without sudden gains.

Characteristic	All	BPC			TPA		
		SG	No SG	Test	SG	No SG	Test
Condition				$\chi^2_{(2)} = 2.44$			$\chi^2_{(2)} = 4.78$
Modular	35.4%	37.9%	34.8%		47.2%	29.6%	
Standard	32.3%	20.7%	34.8%		26.4%	35.2%	
UC	32.3%	41.4%	30.3%		26.4%	35.2%	
% Male	69.6%	69.0%	69.7%	$\chi^2_{(1)} = .01$	73.5%	67.6%	$\chi^2_{(1)} = .60$
Race				$\chi^2_{(4)} = 5.43$			$\chi^2_{(4)} = 2.54$
Afr Am	9.3%	6.9%	9.8%		9.4%	9.3%	
Asian Am	2.5%	34.5%	3.0%		.0%	3.7%	
Caucasian	47.8%	10.3%	50.8%		49.1%	46.3%	
Latin Am	5.6%	44.8%	4.5%		7.5%	4.6%	
Multi	32.9%	96.6%	30.3%		32.1%	33.3%	
City				$\chi^2_{(1)} = 1.01$			$\chi^2_{(1)} = 2.55$
Honolulu	42.9%	34.5%	44.7%		34.0%	47.2%	
Boston	57.1%	65.5%	55.3%		66.0%	52.8%	
Age	$M = 10.58$	$M = 10.88$	$M = 10.53$	$t(159) = -.99$	$M = 10.52$	$M = 10.62$	$t(159) = .36$
	$SD = 1.73$	$SD = 1.86$	$SD = 1.70$		$SD = 1.70$	$SD = 1.75$	
Tx Duration	$M = 286.58$	$M = 365.13$	$M = 266.94$	$t(148) = -3.41^{**}$	$M = 296.25$	$M = 281.45$	$t(148) = -.59$
	$SD = 145.70$	$SD = 219.17$	$SD = 113.71$		$SD = 143.24$	$SD = 147.46$	
Final Ax Duration	$M = 531.16$	$M = 524.00$	$M = 532.61$	$t(129) = .48$	$M = 523.78$	$M = 535.29$	$t(129) = .82$
	$SD = 76.68$	$SD = 66.70$	$SD = 78.74$		$SD = 81.13$	$SD = 74.26$	
Primary Dx				$\chi^2_{(3)} = .27$			$\chi^2_{(3)} = 1.04$
Conduct	38.5%	41.4%	37.9%		37.7%	38.9%	
Anxiety	30.4%	31.0%	30.3%		26.4%	32.4%	
Depression	16.8%	13.8%	17.4%		18.9%	15.7%	
Other	14.3%	13.8%	14.4%		17.0%	13.0%	
% Comorbid	80.7%	96.6%	77.3%	$\chi^2_{(1)} = 5.55^{*}$	79.2%	81.5%	$\chi^2_{(1)} = .01$
Number Dx	$M = 2.94$	$M = 3.36$	$M = 2.85$	$t(150) = -1.70$	$M = 2.96$	$M = 2.93$	$t(150) = -1.1$
	$SD = 1.45$	$SD = 1.16$	$SD = 1.49$		$SD = 1.41$	$SD = 1.47$	

Note: $^{*}p < .05$. $^{**}p < .01$. Values in the All column include all study participants ($N = 161$) who were included in the main analyses. Values in the SG columns include only participants with at least one sudden gain. Values in the No SG columns include only participants who did not have a sudden gain throughout treatment. *T*-tests and Chi-Square tests in the Test column tested for differences between participants with and without sudden gains. SG and No SG columns underneath the BPC header include participants who either had or did not have (respectively) sudden gains as identified by the Brief Problem Checklist. SG and No SG columns underneath the TPA header include participants who either had or did not have (respectively) sudden gains as identified by the Top Problems Assessment. SG = presence of at least one sudden gain. No SG = absence of any sudden gains. BPC = as identified by the Brief Problem Checklist. TPA = as identified by the Top Problems Assessment. UC = Usual Care. Afr Am = African American. Asian Am = Asian American. Latin Am = Latin American. Multi = Multi-Ethnic. Tx Duration = Treatment Duration. Final Ax Duration = Duration to Final Assessment. Primary Dx = Primary Disorder. % Comorbid = Percent of sample that had at least one comorbid diagnosis. Number Dx = Number of Disorders.

conditions using blocked randomization stratified by education level. Once recruited, clinicians in the modular treatment group and the standard manual treatment group were trained in their respective treatment modalities. The children in the current study had sought outpatient treatment primarily for anxiety, depression, or disruptive conduct. For more information on methods, see Weisz et al. (2012).

Brief assessments were administered throughout the duration of treatment, with a longer battery of measures given at 3-month intervals over the first 18-months after treatment onset. At each quarterly assessment, a broad measure of internalizing and externalizing symptoms was administered. Weekly measures were given between weekly treatment sessions via a phone call from trained research assistants. Between-session measures were past-week severity ratings of top three problems identified by participant at intake and the Brief Problem Checklist (Chorpita et al., 2010; Weisz et al., 2011).

Outcome and screening measures

Children's Interview for Psychiatric Syndromes – parent and child (ChIPS; Weller, Weller, Fristad, Rooney, & Schecter, 2000)

The ChIPS parent and child versions are structured interviews for children (and parents) 6–18 years of age. With items answered in a yes/no format, it assesses 20 DSM-IV Axis I disorders and psychosocial stressors. It has demonstrated good construct validity with other structured diagnostic interviews and good reliability (i.e., test–retest reliability, interrater reliability). Five meta-analyses (Weller et al., 2000) demonstrated overall sensitivity with clinician diagnoses at .66 for ChIPS and .83 for P-ChIPS and overall specificity at .88 and .78 respectively. In the current study, ChIPS was used as a pre-treatment diagnostic measure.

Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001)

The CBCL is a 118-item parent-report measure that assesses multiple behavioral and internalizing indices. These measures are dimensional with clinical cut-off scores. Subscales are as follows: anxiety/depression, withdrawn/depressed, somatic complaints, attention problems, thought problems, social problems, aggression, and delinquent behavior, as well as competence and DSM-IV subscales. Items are rated on a 0 = *not true* to 2 = *very true* Likert scale with higher scores indicating greater problems. Research demonstrates that the measure has good test–retest reliability, internal consistency, and validity for children ages 6–18 (Achenbach & Rescorla, 2001). Average raw internalizing, externalizing, and total scores were generated at pre- and post-treatment, as well as at final assessment (i.e., last assessment obtained for participant following post-treatment).

Youth Self Report – problem and competence scales (YSR; Achenbach & Rescorla, 2001)

The problem portion of the YSR of the CBCL series is 118-item child-report questionnaire assessing internalizing and externalizing symptoms. These measures share the same dimensional nature and subscales as the CBCL. Research demonstrates that it has good test–retest reliability, internal consistency, and validity for children ages 6–18 (Achenbach & Rescorla, 2001). Average raw internalizing, externalizing, and total scores were generated at pre- and post-treatment, and at final assessment.

Weekly between-session assessments

Top Problems Assessment – parent and child (TPA; Weisz et al., 2011)

The TPA is an idiographic parent- and child-report measure of the severity of problems that parent and child, separately, identified as their most important concerns at the beginning of treatment. Initial assessment was administered following a diagnostic interview and prior to treatment onset. In subsequent administrations (by phone in the study), the assessor listed the top problems (three or fewer), and the reporter (child and parent separately) rated the severity of each problem on a scale of 0–10 with 0 = *not at all* a problem to 10 = *very, very much* of a problem. The TPA has been demonstrated to be clinically relevant, has good test–retest reliability (.69–.91 over an average 8-day period), has strong convergent validity (i.e., significant convergence with full and subscale scores of the Youth Self Report and Child Behavior Checklist), shows good discriminant validity (e.g., non-significant associations with theoretically distinct constructs), and has adequate criterion validity (e.g., scores declined over time with treatment).

Brief Problem Checklist – parent and child (BPC; Chorpita et al., 2010)

The BPC is nomothetic measure of internalizing (e.g., anxious/depressed, withdrawn/depressed) and externalizing (e.g., rule-breaking, aggression) symptoms. It is a 12-item parent- and child-report scale, adapted from Achenbach and Rescorla's (2001) CBCL and YSR. The questionnaire is administered orally via interview format (over the phone in the current study). Items are rated on a 3-point Likert scale from 0 to 2 (0 = not true, 1 = somewhat true, 2 = very true) with high sum scores indicating worse internalizing and externalizing symptoms over the past week. The BPC has high internal consistency ($\alpha_{child} = .76$, $\alpha_{parent} = .82$) and good test–retest reliability (.72–.79) over 8 and 30-day periods, as well as good predictive, discriminant, and construct validity (Chorpita et al., 2010).

Session content

Consultation record (Ward et al., 2012)

We used the Consultation Record to identify session content for further investigation of associations between practices performed and subsequent sudden gains. The Consultation Record is a checklist of session content, organized by general procedures (e.g., rewards, relaxation), which is completed by the therapist in consultation with a supervisor following every session. To organize analyses, we grouped most practice content from all four manuals (modular treatment, standard manual treatment for depression, anxiety, and behavior problems) into two categories (cognitive, behavioral) in order to analyze prevalence of types of content preceding sudden gains. For the current analyses, cognitive strategies included fear ladder, cognitive STOP, problem-solving, talent and skills, positive self, cognitive BLUE, cognitive FUN, anticipating problems, coping thoughts, FEAR plan, STEPS, think positive, keep thinking, best fit ACT & THINK, and ACT & THINK in real life. Behavioral strategies included practicing, activity selection, one-on-one time, praise, active ignoring, effective instructions, rewards, time out, daily report card, result and rewards, parent involvement, pay attention, attending to compliance, independent play, compliance training, home point system, and response cost. Remaining modules not grouped into either category were engagement, psychoeducation, relaxation, maintenance, and wrap-up. Self-report, interclass correlation coefficients were established in a previous study, which ranged from .42 to 1.0 (Ward et al., 2012).

Data analytic procedures

Sudden gain (SG) calculation

To obtain between-session scores, averages of each weekly/quarterly score were calculated, such that there were two indices (parent and child report) of each client's past-week average score for every session from pre- to post-treatment. If any session was not attended, average scores for the week prior to and following the missed session were averaged to obtain one score between sessions. Calculating averages across weeks for missed sessions ensured that all calculated gains followed attended treatment sessions, allowing for interpretations about gains in relation to the treatment sessions. Calculating averages is a more conservative approach in that it likely reduces the "suddenness" of our effect. Another alternative solution would have been to examine gains that follow sessions only. This approach is limited in that it would identify some false positive SGs. For example, if a given client missed two consecutive sessions and the gains between sessions were sizeable due to time or external factors, eliminating these two assessments would mask the gain following the next attended session as sudden (Fig. 1). Averaging is a more conservative analysis that accounts for time and external effects, and thus the current study chose this approach.

Using these averages, SGs were identified using standard analytic procedures administered in prior studies (e.g., Tang & DeRubeis, 1999). That is, the gain: (1) must have been large in absolute terms (the value obtained at assessment $N+1$ was reliably greater than the value obtained at N, where N was the most recent assessment preceding the session), (2) must have been large relative to the prior assessment ($N+1$ was 25% greater than N), and (3) must have been significantly larger when averaged across the following three sessions than when averaged across the previous three sessions to rule out the gain as a random fluctuation in treatment.

Each criterion was calculated as follows. Criterion 1 was calculated using the Reliable Change Index (Jacobson & Truax, 1991; Stiles et al., 2003). Criterion 2 was calculated based on original methods of Tang and DeRubeis (1999): the weekly score following $N+1$ had to be at least 25% greater than the weekly score following N. Although criticized for being a subjective method of measurement given its erroneous assumption that intensity scales often are ratio scales (Hardy et al., 2005), prior studies have demonstrated that inclusion or exclusion of this criterion for sudden gains yielded no difference in number of sudden gains (Stiles et al., 2003). Thus, in the current study, criterion 2 was retained for purposes of consistency. Finally, criterion 3 was determined using the descriptive method of comparing $t(4)$ to the critical value of 2.78 (Hardy et al., 2005; Tang et al., 2007). If a t-statistic of $t(4)$ was greater than 2.78, then the gain was determined to meet criterion 3. $t(4)$ was

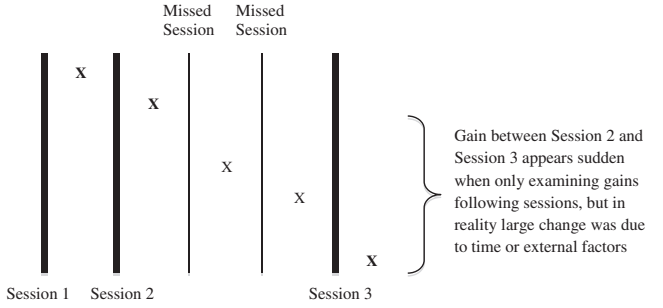

Fig. 1. Hypothetical demonstration of how examination of gains only following treatment sessions rather than calculating averages leads to identification of false positive sudden gains. Vertical axis represents symptom scores, and horizontal axis represents time. "*X*"s represent assessment data points across sessions.

calculated using the following equation $t = (d-\mu)/(s_d/\sqrt{n})$ with d = the difference between the average of gains following N, $N-1$, and $N-2$ and the average of gains following $N+1$, $N+2$, $N+3$ (where N is a given session), s_d = standard deviation of the difference, and n = number of sessions. Original methods using independent t-tests have been argued to be problematic due to autocorrelation over time (Vittengl et al., 2005), but inclusion of criterion 3 was the most stringent in Stiles et al. (2003) and in the current study. Thus, as in prior studies, all three criteria were included.

Main analyses

The aims of the current study were to examine: (a) the association of suddenness of gains with long-term treatment outcome (i.e., final assessment) among all participants and within internalizing and externalizing domains; (b) whether sudden gain effects analyzed independently for each measure (nomothetic, idiographic) and informant (child, parent) would be differentially associated with outcome; (c) whether early SGs predicted improved outcome; and (d) whether certain participant or treatment characteristics were associated with SGs.

For the first three aims, hierarchical linear regression analyses were conducted using Mplus version 6.1 in order to utilize Full Maximum Likelihood Estimation for missing data (Enders & Bandalos, 1999). Predictor variables were: (1) pre-treatment scores on the CBCL or YSR depending on informant of dependent variable, (2) magnitude of change from pre- to post-treatment scores on these measures, and (3) presence of any SG. For the first aim, a composite variable was created such that if a child or caregiver identified an SG on either the TPA or BPC, then s/he was identified as having an SG. For the second aim, presence of SGs was calculated separately for each informant (child, caregiver), for each measure (BPC, TPA), and for internalizing and externalizing scales of the BPC. Finally, for the third aim, all of the aforementioned predictor variables were included in separate analyses; however, this sample was limited to those with SGs in the first three months of treatment and who had treatment durations of six months or greater to ensure that early SGs were within the first half. Sixty-three participants with treatment durations of less than six months were excluded. All dichotomous predictors were added as a single step in separate regression analyses.

Dependent variables for main analyses were final assessment scores (i.e., last assessment obtained from a participant following post-treatment). For regression analyses with the composite predictor (first aim), final assessment scores were averaged across informant and measure so that a single dependent variable was generated for each regression analysis. For all other analyses (second and third aims), informant of the predictor variables was matched to informant of the dependent variable. Given that in each model analyses were replicated across three different dependent variables (change in total, internalizing, and externalizing scores), a modified Bonferonni multiple comparisons procedure was conducted (Holland & Copenhaver, 1988) for main analysis testing. Original p-values are reported. If a test did not meet significance per modified alpha level, the p-value is not listed and the test is specified as not significant (*ns*).

For the fourth aim, a logistic regression analysis was conducted to examine which types of session content predicted presence of sudden gains. For this analysis, presence/absence of sudden gains was treated as a dependent variable. Types of session content were coded as separate dichotomous variables with 0 indicating absence of session content in the session preceding the potential gain and 1 indicating partial or full presence of the session content preceding the potential gain. These dichotomous variables were entered as categorical predictors in a single step of the model.

Results

Frequency of sudden gains

There were 2946 treatment sessions analyzed for identification of sudden gains across participants. Reports of sudden gains could come from the child or parent and could refer to unique or the same instances of sudden gains. That is, there can be one or two reports of sudden gains for any one instance of a sudden gain (e.g., both parent and child identify a sudden gain following session ten). On the BPC, 36 (14 child, 22 parent) reports of sudden gains were identified among 32 participants, such that approximately 1% of all sessions were followed by a report of a sudden gain and approximately 20% of all participants reported a sudden gain. Most participants had only one instance of a sudden gain. Two participants had two instances and one participant had three instances throughout the duration of treatment. On the TPA, 64 (16 child, 48 parent) reports of sudden gains were identified among 53 participants. Approximately 2% of all sessions were preceded by a report of a sudden gain and nearly 33% of participants reported a sudden gain at some point during treatment. Seven participants had two instances of sudden gains, whereas all other participants had one instance. Collapsed across informant and measure, 68 participants had at least one instance of a sudden gain throughout treatment.

The average magnitude of the gain was .64 points (3% of the total score) on the BPC and 3.75 (13% of the total score) on the TPA. There were three reversals of sudden gains on the BPC, which were defined as a decrease in at least 50% of improvement from the preceding gain (presence of reversal if $N+1 < 50\%$ of N where N is the gain following a given session). Reversals were defined based on standard analytic procedures of prior sudden gain research (e.g., Tang & DeRubeis, 1999). Four reversals of sudden gains were identified on the TPA.

On both the BPC and TPA, sudden gains were more likely to appear between sessions 2 and 3 than between any other pair of sessions. The median session associated with a sudden gain was Session 5 for the BPC and Session 4 for the TPA. The majority (58.3% BPC, 63.1% TPA) of sudden gains occurred on or before Session 6. Thus, most of the sessions associated with sudden gains occurred early in treatment.

Sudden gains predicting overall outcome

Presence of sudden gains as identified by either parent or child report on the BPC or TPA predicted improvement in overall symptoms at final assessment across both informants after controlling for baseline severity of scores and overall magnitude of change from pre- to post-treatment ($B = -.18$, $SE = .06$, $p = .00$). Presence of sudden gains as identified by either parent or child report on the BPC ($B = -.16$, $SE = .07$, $p = .02$) also predicted improvement; however, this test was no longer significant after applying the modified Bonferroni correction. Presence of parent- or child-identified sudden gains did not predict improvement on the TPA ($B = -4.01$, $SE = 2.29$, *ns*).

Sudden gains predicting internalizing outcome

Among participants treated for either depression and/or anxiety, presence of parent- or child-identified sudden gains on the BPC did not predict final assessment levels of internalizing symptoms across both informants ($B = -.13$, $SE = .09$, *ns*). Among this same group of individuals, presence of sudden gains as identified by child only ($B = -.07$, $SE = .12$, *ns*) or parent only ($B = -.08$, $SE = .07$, *ns*) report on the BPC also did not predict internalizing symptom levels at final assessment.

Sudden gains predicting externalizing outcome

Among participants treated for conduct disorder, presence of parent- or child-identified sudden gains on the BPC did predict externalizing symptom levels at final assessment, even after controlling for pre-treatment symptom levels and magnitude of pre- to post-treatment symptom change ($B = -.31$, $SE = .11$, $p = .00$). Presence of child-identified sudden gains on the BPC ($B = -.23$, $SE = .11$, $p = .03$) also predicted improvement, but after applying the modified Bonferroni correction to this test, it no longer was significant. Parent-identified sudden gains on the BPC ($B = .18$, $SE = .12$, *ns*) did not predict improvement in externalizing symptoms at final assessment.

Early sudden gains predicting internalizing and externalizing outcomes

Presence of early sudden gains as identified by either parent or child report on the BPC or TPA did not predict overall symptom severity at final assessment ($B = -.15$, $SE = .08$, *ns*). Similarly, independent analyses demonstrated that presence of early sudden gains on the BPC ($B = -.13$, $SE = .08$, *ns*) or the TPA ($B = -.08$, $SE = .08$, *ns*) did not predict overall symptom severity at final assessment.

Among participants treated for either depression and/or anxiety, presence of early sudden gains as identified by child report on the BPC did not predict internalizing symptom severity at final assessment ($B = -.05$, $SE = 11$, *ns*). Among children treated for conduct disorder, early sudden gains as identified by parent did not predict improvement in externalizing symptom severity at final assessment ($B = -.19$, $SE = .19$, *ns*). Given that no child treated for conduct problems had an early sudden gain as identified by child report and no child treated for internalizing problems had an early sudden gain as identified by parent report, sudden gain effects were not analyzed.

Participant characteristics and sudden gains

On the BPC, gender, race, age, primary diagnosis and number of diagnoses were not associated with presence of sudden gains when examined with *t*-tests, χ^2 tests, and correlation analyses. However, χ^2 tests demonstrated a significant association between presence of comorbidity and presence of sudden gains (see Table 1), such that those with comorbid diagnoses had a greater likelihood of having a sudden gain. On the TPA, participant characteristics did not predict presence of sudden gains. Significant main effect hierarchical regression analyses on the BPC predicting overall and externalizing outcomes were replicated after controlling for comorbidity.

Treatment characteristics and sudden gains

On the BPC, treatment modality and city were not associated with presence of sudden gains (see Table 1). However, treatment duration was significantly associated with sudden gain presence, such that those with sudden gains had longer treatment duration than those without sudden gains. On the TPA, treatment characteristics were not associated with presence of sudden gains. Significant main effect hierarchical regression analyses on the BPC did not replicate after controlling for treatment duration.

Types of session content

Information on content of sessions was available for only the modular treatment group and the standard manual group. Relaxation was the only type of session content that significantly predicted presence of sudden gains (see Table 2). Sessions with relaxation compared with sessions without relaxation increased the likelihood of having a sudden gain three fold. Although not statistically significant, other session contents that increased the likelihood of a sudden gain occurring were psychoeducation, engagement, and cognitive strategies.

Table 2
Simultaneous Logistic Regression of Session Content Predicting Presence of Sudden Gains.

Session content	*B*	*SE*
Role-play	−.21	.30
In vivo	−.52	.30
Engagement	.16	.53
Psychoeducation	.09	.36
Cognitive/Problem Solving	.41	.30
Behavioral	−.14	.27
Relaxation*	1.07	.41
Maintenance	−.85	.73
Wrap-Up	−.48	.74

Note: $R^2 = .06$ (*$p < .05$).

Discussion

Current study results suggest that the sudden gain effect on improved treatment outcome among adults replicated among this sample of children receiving services in a community mental health setting for a range of problems. That is, presence of sudden gains predicted overall long-term symptom improvement among children with high rates of comorbidity and diverse mental health concerns. Further, these effects remain even after controlling for magnitude of overall symptom change, suggesting that the suddenness of these gains has a direct effect on long-term outcomes.

By definition, sudden gains (gain must be large: in absolute terms, relative to prior session, and relative to changes in prior and subsequent sessions) increase the likelihood of overall symptom change; thus, interpretations on results from prior literature regarding the degree to which suddenness of these gains accounts for the effect on outcome is limited given that magnitude of overall symptom change was not controlled. Addressing this research gap, results of this study suggest that suddenness of weekly gains has a direct effect on long-term outcomes. Greenfield, Gunthert, and Haaga (2011) examined this question using an alternative approach. They compared individuals with sudden gains to those with gradual gains, and they similarly found that those with sudden gains had improved outcomes compared to those with a gradual trajectory of progress.

The current results demonstrate an effect of sudden gains on long-term outcomes, suggesting stability of this effect over time. Prior research has demonstrated conflicting findings, with some studies suggesting effects at follow-up (e.g., Tang et al., 2007) and other studies suggesting absences of long-term effects (e.g., Doss, et al., 2011). Discrepant findings in the literature likely are due to differences in sample and treatment characteristics. Only one other study examined sudden gains among children and adolescents; consistent with the current results, they too found that sudden gains predicted improved outcome at follow-up (Aderka et al., 2011).

Although current results demonstrated a sudden gain effect on overall outcomes, specific effects on internalizing and externalizing outcomes were dependent on measure, informant, and outcome. Among children treated in the community, only sudden gains identified by either informant predicted improvement in symptoms when these symptoms were isolated to externalizing problems. However, sudden gains did not significantly predict change in internalizing symptoms, and sudden gains as identified by each

separate informant did not predict improvement in externalizing symptoms.

The current study's findings on internalizing outcomes are inconsistent with those from Aderka et al. (2011), who found that sudden gains among children and adolescents treated for post-traumatic stress disorder with prolonged exposure predicted improved outcome. However, methodological factors may have contributed to these discrepancies. For example, children of the current sample were treated for a diverse range of mental health problems in the community; thus, the range and severity may have diminished the effect in this group. Furthermore, sudden gains may be unrelated to outcome due to potential environmental factors that are more common in the community and thus may limit the longevity of these effects (e.g., family stressors, limited resources). In addition, children in the current study were younger than those in samples of prior studies. The current is the only child sample, not including adolescents, to have been tested for sudden gains. Therefore, the sudden gain effect on internalizing symptom improvement may not be a phenomenon present in such a young age group. Perhaps young children do not have sufficient cognitive insight to detect weekly internalizing changes. Research has demonstrated that age is associated with increased understanding of mental illness (Fox, Buchanan-Barrow, & Barrett, 2010; Nelles & Barlow, 1988). In one study, younger children were less likely to be able to make an internal attribution of their anxiety-related physical symptoms than were older children (Muris, Mayer, Freher, Duncan, & van den Hout, 2010). Thus, these difficulties may have diminished the size of our effect.

No prior studies have examined sudden gains at this level of detail across multiple informants and measures. Given that results differed depending on the informant and the current study is the first to examine sudden gains among children using parent report, future studies should independently examine sudden gain effects with each informant.

Sudden gains – whether calculated nomothetically or ideographically – also predicted improved outcome. One prior study used an idiographic weekly measure to examine sudden gains, and they too found a predictive effect with this measure in treatment for couples therapy (Doss et al., 2011). Given that idiographic measures are individualized for each participant, it would be expected that sudden gains with this type of measure would better associate with outcome. In the current study, sudden gains – as identified by idiographic measure – accounted for only a small magnitude of change. This diminished effect could be the result of type of idiographic measure administered – top three problems that caregiver and child identified at intake. If over the course of therapy other problems overshadowed those mentioned at intake, then original top problems likely would have a decreased effect on outcome. Further, weekly averages across top problems were calculated such that if no improvement was seen on one top problem, then any gains on the others would be diminished and thus less likely to meet sudden gain criteria. Another peculiar result of the current study is the near doubling of the number of sudden gains identified using the idiographic measure compared to the nomothetic measure. This finding suggests that the current idiographic measure had too high sensitivity and too low specificity to detect sudden gains. Future studies would benefit from replicating these effects with other types of idiographic measures among children.

The current study also examined whether sudden gains occurring early in treatment (i.e., early sudden gains) predicted later treatment improvement. It may be that those with early sudden gains have a "head start" over those without sudden gains, given that children would have more time to benefit from resultant changes (e.g., symptom decreases, increased motivation and alliance). Prior studies in the adult literature have found that early sudden gains predicted improved treatment outcome (e.g., Kelly, Roberts, & Ciesla, 2005; Stiles et al., 2003). Contrary to our predictions, however, sudden gain presence early in treatment did not predict greater improvement in internalizing or externalizing scores. Again, discrepant results from prior studies may be due to the nature of the clinical setting, sample age, and range of problems. Differences in defining early sudden gains across studies also may account for the discrepant results. The current study defined sudden gains as within the first three months of treatment when treatment durations were limited to those of six months or greater, whereas Stiles et al. (2003) defined early sudden gains as within the first 16 sessions of treatment. The field would benefit from identifying a standard definition because mechanisms and treatment applications are impossible to identify if the range of "early" differs between studies.

The current study also examined an array of potential associations between treatment and participant characteristics and sudden gains. Although comorbidity was associated with sudden gain presence, this effect was only detected with the nomothetic measure. Perhaps those with sudden gains and comorbidity develop greater treatment confidence, which in turn leads to greater treatment adherence and subsequent improved outcome. However, post-hoc tests determined that comorbidity was not associated with these potential mediating variables nor were these factors associated with outcome.

The only treatment characteristic that predicted sudden gain presence (on the BPC) was longer treatment duration. These findings seem contrary to what one would expect if development of more efficient treatments is the motivation behind this research. However, treatment duration may be a proxy for treatment adherence. Treatment adherence may mediate the effect of sudden gains on outcome, such that presence of sudden gains leads to increased motivation and treatment credibility, which leads to greater treatment adherence, and finally improved outcome. Indeed, the effect of sudden gains as identified by parent or child report no longer predicted significant long-term improvement in externalizing symptoms after controlling for treatment duration. Interestingly enough however, sudden gains still predicted improved long-term *overall* outcome after controlling for treatment duration. Perhaps, sudden gains and treatment duration have a unique relation with *externalizing* outcomes. The current study is the first to examine these relations and thus future research would benefit from further examination of the effect of sudden gains on externalizing problems.

Sessions with relaxation were associated with increased likelihood of subsequent sudden gains. Other session contents that more frequently (though nonsignificantly) preceded sudden gains relative to non-sudden gains were engagement, psychoeducation and cognitive strategies. Studies mostly have examined cognitive content preceding sudden gains (e.g., Tang, DeRubeis, Beberman, & Pham, 2005). Only one study conducted formal predictive analyses of diverse session contents on sudden gain presence (Doss et al., 2011). They found that percentage of session time reviewing homework predicted increased likelihood of participants having a sudden gain. Session content analysis has important implications for advancing hypotheses in this area of research. Nevertheless, from the current results, we cannot infer that relaxation led to the presentation of a sudden gain, given that session content was not randomly assigned. For example, procedures occurring more frequently early in treatment could co-occur with sudden gains, simply because sudden gains also tend to occur earlier in treatment.

Descriptively, sudden gains among our child sample generally resemble those gains among adult samples. Approximately 20–42%

of participants in the current study experienced a sudden gain. These percentages are more conservative than most other studies ranging from 40 to 50% but are within the range of 16–50% (Greenfield et al., 2011; Hofmann et al., 2006; Norton et al., 2010; Present et al., 2008). The number of reversals in our study was much lower than that found in the literature suggesting that these gains are more stable. The mode and median of sudden gains occurring early in treatment is consistent with prior studies (e.g., Doane, et al., 2010; Tang et al., 2007).

No prior study has examined sudden gains across multiple informants. Parents of this study were three times as likely as their children to report sudden gains in problem areas that they determined to be most important at treatment start (i.e., TPA). This sizeable discrepancy was specific to the idiographic assessment, in that parents were only twice as likely as their children to report sudden gains with a nomothetic measure, suggesting that clinicians may work harder on parent rather child-identified concerns.

Limitations

The current study has limitations that are worthy of note. First, when analyzing independent models for each measure, informant, and participant diagnosis, sample sizes decreased thus limiting the possibility of finding significant results. Future studies should examine these models with larger samples. Second, participants most often were treated primarily for *either* their internalizing or externalizing symptoms based on problems identified at pre-treatment. Thus, if severity of secondary problem or relative severity of primary and secondary problem changed over the course of therapy, this likely was not captured in our analyses, thus potentially reducing the size of our observed effects.

Third, as a result of identifying four aims – each of which included at least three regression analyses, multiple tests were required. Doing so increased our risk of making a Type I error. To correct for this, we implemented a modified Bonferonni test of multiple comparisons (Holland & Copenhaver, 1988). Fourth, we also were limited in our knowledge of how to analyze change in symptoms among our child sample. No known prior studies have examined sudden gains with externalizing symptoms, and therefore it was unclear whether the type of symptom (internalizing, externalizing) would moderate the relation between sudden gains and outcome. Treatments for externalizing symptoms are more parent-focused. They also are based on behavioral contingencies. Thus, it was unclear whether assessment of externalizing symptoms even could detect weekly changes in the form of sudden gains across treatment and whether these changes would be associated with better outcome. Thus, we conducted multiple analyses in which internalizing and externalizing symptoms were collapsed, as well as analyzed separately. Doing so may have unintentionally diminished or enhanced our sudden gain effects.

Fifth, after controlling for treatment duration, only sudden gains collapsed across informant predicted change in symptoms. Upon closer inspection, most other effects were non-significant, casting doubt on the legitimacy of this phenomenon among children. Additionally, the current study found poor agreement across measure, further suggesting that sudden gains may be purely an adult phenomenon. Of note, however, is that the current study was the first to examine sudden gains using idiographic and nomothetic measures. Thus, the resultant poor agreement may be due to the differing nature of the measures. The reduced number of significant results also may be due to the diminished sample size for analyses examining change in internalizing and externalizing symptoms.

Sixth, weekly measures were administered between sessions over the phone rather than during each session, which resulted in sessions that followed no assessment and assessments that followed missed sessions. In an attempt to ensure that all assessments followed attended sessions, averages of weekly assessment scores were calculated across missed sessions. This method of averaging likely reduced the "suddenness" of our effect. However, given that this was an implementation trial in the community, between session phone calls were preferred to ease clinician responsibility of assessment. Further, averaging across missed sessions versus analysis of gains following attended sessions is a more conservative analysis in that it accounts for time and external effects.

Finally, given that treatment length differed for participants depending on post-treatment diagnostic threshold status, the number of significant findings and size of our effects may be biased. Perhaps treatment duration accounted for these effects; however, when controlling for treatment duration, sudden gains still predicted overall long-term improvement. Further, since everyone completed treatment when symptom levels were below diagnostic threshold, significant sudden gain effects should have been less likely due to decreased variability at outcome. Yet, despite this reduced variability, we found significant sudden gains effects above and beyond the effect of treatment duration.

Conclusions

The current study is novel in that it examined sudden gains among children in the mental health community and its effect on improvement in internalizing and externalizing symptoms even after controlling for overall magnitude of symptom change. We found that presence of sudden gains among this sample predicts improvement in symptoms at post-treatment when collapsing across informant and type of symptomotoloy. However, upon closer inspection, sudden gains were only predictive of externalizing outcome. If those with sudden gains demonstrate sustained improvement following a sudden gain, it may be that treatment durations can be condensed, leading to fewer costs in the community. Further, specific techniques could be implemented subsequent to sudden gain identification in order to maximize treatment improvement and long-term maintenance. Thus, analysis of sudden gains could potentially capitalize on the children's improvement and lead to more efficient treatments. Future studies would benefit from testing ideal timing of treatment termination and specific session content following a sudden gain that would maximize treatment outcome effects.

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