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Patient adherence and treatment outcome with exposure and response prevention for OCD: Which components of adherence matter and who becomes well?

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ABSTRACT

Exposure and response prevention (EX/RP) is an evidence-based treatment for obsessive-compulsive disorder (OCD), yet not all patients achieve wellness with EX/RP. The degree to which patients adhere to EX/RP procedures outside of sessions has been found to predict therapy outcomes, including who achieves post-treatment wellness. We sought to investigate which components of treatment adherence most relate to outcome and to develop adherence benchmarks to identify who does and does not become well to provide clinicians with prognostic tools. Adherence data came from 37 adult patients with DSM-IV OCD who received 17 sessions of EX/RP as part of a randomized controlled trial of augmentation strategies for incomplete response to serotonin reuptake inhibitors (SRIs). Therapists rated between-session patient adherence at each exposure session by quantifying: 1) the quantity of homework exposures attempted; 2) the quality of attempted exposures; and 3) the degree of success with response prevention. Each adherence item significantly correlated with post-treatment OCD severity. Success with response prevention proved particularly strongly linked to therapy outcome. Time course analysis of this item accurately identified, relatively early in treatment, who would achieve post-treatment wellness. These data provide an efficient method for differentiating between those patients who will and will not achieve wellness after EX/RP augmentation of SRIs. Limitations and clinical implications of the current findings are discussed.

Obsessive-compulsive disorder (OCD) affects up to 2% of the population and can be disabling when severe (Ruscio, Stein, Chiu, & Kessler, 2010). Cognitive behavioral therapy (CBT) consisting of exposure and response prevention (EX/RP) is an effective treatment for OCD, and is recommended in practice guidelines (Koran & Simpson, 2013; Koran, Hanna, Hollander, Nestadt, & Simpson, 2007; NICE, 2013). Yet, not all patients achieve minimal symptoms at the end of treatment (e.g., 75–80% of patients respond, yet only 40–52% achieve remission; Farris, McLean, Meter, Simpson, & Foa, 2013; Simpson, Huppert, Petkova, Foa, & Liebowitz, 2006, 2008; Simpson, Foa et al., 2013). Identifying predictors of treatment response can improve patient care by providing markers to identify which individuals are likely to achieve wellness and who might require additional interventions or alternative treatments.

One factor known to affect EX/RP outcome is the degree to which patients adhere to treatment procedures (Abramowitz, Franklin, Zoellner, & DiBernardo, 2002; De Araujo, Ito & Marks, 1996; Tolin, Maltby, Diefenbach, Hannan, & Worhunsky, 2004). Successful EX/RP requires patients to confront their fears (i.e., exposure component) as well as to voluntarily stop their rituals (i.e., response prevention component). During treatment sessions, therapists direct patients in these procedures. Patients are also asked to carry out these procedures between sessions as homework (Foa, Yadin, & Lichner, 2012). To quantify how well patients adhere to between session assignments (hereafter referred to as *patient*

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adherence), Simpson, Maher, et al. (2010) developed the Patient EX/RP Adherence Scale (PEAS). With input from a panel of EX/RP experts, the authors devised the PEAS to tap the components of standard EX/RP homework practice (Kozak & Foa, 1997) thought to be necessary for good outcomes: confronting fears (exposures) and voluntarily stopping rituals (Foa, Steketee, & Milby, 1980). This measure includes three items that therapists rate at the beginning of an exposure session to quantify patient adherence to the previous session's EX/RP assignments: PEAS_A quantifies the number of exposures the patient attempted (as a percentage of those assigned), PEAS_B rates the quality of attempted exposures, and PEAS_C assesses the patient's degree of success with response prevention between sessions. As a global measure of patient adherence, the three PEAS items are averaged at each session and then across all sessions that include EX/RP homework assignments.

Preliminary evidence supports the use of the PEAS as a predictor of EX/RP response. In a small clinical trial of adults with OCD who were randomized to either EX/RP (N = 15) or EX/RP augmented with motivational interviewing (EX/RP + MI; N = 15), higher mean ratings on the PEAS predicted lower post-treatment OCD severity as assessed with the Yale-Brown Obsessive Compulsive Scale (YBOCS; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989, Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989) across the full sample (Simpson et al. 2011). Moreover, mean adherence ratings predicted patient attainment of minimal OCD symptoms (YBOCS≤12). Achieving post-treatment symptoms below this threshold has been associated with good quality of life and a high level of adaptive functioning (Farris et al., 2013). Thus, the PEAS may prove to be a useful tool for prognostic prediction of who is likely to become well after EX/RP and who may need additional treatment.

We capitalized on data from a large randomized controlled trial that included a group of patients undergoing manualized EX/RP to conduct three sets of analyses related to patient EX/RP adherence. First, we sought to replicate that the PEAS predicts EX/RP outcome in an independent sample. Based on the data reviewed above, we hypothesized that the PEAS would predict degree of EX/RP response, as well as attainment of post-treatment wellness.

Second, we sought to extend previous findings by examining the predictive ability of individual PEAS items to determine which components of adherence most strongly relate to treatment outcome. Dismantling studies suggest that exposures and response prevention have independent effects and are each key to good EX/RP outcomes (Foa et al., 1980; Foa, Steketee, Grayson, Turner, & Latimer, 1984), so we expected adherence to both components to predict outcome. However, a recent meta-analysis (Mausbach, Moore, Roesch, Cardenas, & Patterson, 2010) of the relationship between homework compliance and CBT outcomes (across disorders and treatments) found relatively weaker effects for compliance ratings based on the percentage of homework completed (as opposed to Likert-based ratings of homework quality). Therefore we specifically hypothesized significant unique predictor effects for PEAS_B and PEAS_C (both of which incorporate ratings of quality), but not PEAS_A (which only involves rating quantity).

Third and finally, we evaluated the ability of the PEAS to forecast outcomes for individual patients through the use of clinically-relevant benchmarks. Specifically, we conducted time course analyses of adherence ratings across treatment to forecast who is likely to become well at the end of treatment and who is not. From this analysis, we evaluated PEAS benchmarks to determine how early in treatment they could make accurate predictions about post-treatment status (i.e., attainment of post-treatment wellness or failure to do so). In so doing, we aimed to provide tools to help treating clinicians identify patients unlikely to achieve post-treatment wellness as early in treatment as possible, so that additional or alternative interventions might be offered.

1. Method

1.1. Participants

Data came from 37 patients with DSM-IV OCD who completed 17 sessions of EX/RP as part of a randomized controlled trial comparing serotonin reuptake inhibitor (SRI) augmentation strategies (Simpson, Foa et al., 2013). Eligible patients were adults with a principal diagnosis of OCD, determined by the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon, & Williams, 1996), who remained symptomatic despite receiving an SRI at a maximally tolerated dose for 12 weeks or more. Exclusion criteria were: 1) diagnosis of bipolar or psychotic disorder; 2) substance abuse or dependence in the past 3 months; 3) clinically significant suicidal ideation; 4) severe depression (≥25 on the 17-item Hamilton Depression Rating Scale [HDRS; Hamilton, 1960]); 5) primary hoarding symptoms; or 6) previous trial of risperidone (≥0.5 mg/day for 8 weeks) or EX/RP (≥8 sessions over 2 months) while taking an SRI.

1.2. Procedures

Full description of study procedures appear elsewhere (Simpson, Foa, et al., 2013). Eligible participants were randomized to EX/RP, risperidone, or pill placebo; only participants who completed EX/RP (n = 37) are included in this report.[1] The study was conducted at two academic outpatient clinics in New York City, New York, and Philadelphia, Pennsylvania. Institutional Review Boards at both sites approved the study protocol, and patients provided written informed consent.

EX/RP sessions were 90 min long and comprised of two introductory sessions followed by 15 exposure sessions, daily homework assignments (self-directed exposures and response prevention), and phone check-ins between each session (Kozak & Foa, 1997). EX/RP was delivered by doctoral-level clinicians (PhD or PsyD), who participated in weekly group supervision phone calls in order to standardize treatment delivery across the two sites. Homework was assigned after the first exposure session; thus, adherence to homework was assessed (as described below) at sessions 4–17.

Independent evaluators blinded to treatment condition were assigned to individual patients across time points and assessed patients' OCD symptoms at baseline (week 0), mid-treatment (week 4) and post-treatment (week 8).

1.3. Measures

Yale Brown Obsessive Compulsive Scale (YBOCS; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989; Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989*).* The YBOCS is the "gold standard" OCD severity measure, a semi-structured clinician-administered interview used to assess symptom severity of obsessions and compulsions in the past week. Each item is rated on a 5-point Likert scale (0 = no symptoms, 4 = extreme). Total scores range from 0 to 40. The YBOCS has good internal consistency, excellent inter-rater reliability, and good test-retest reliability

[1] The original trial comprised 40 OCD patients, but 3 dropped out of EX/RP. Two of these patients dropped out before PEAS data was collected while the third dropped out midway through treatment. The pattern of results in our regression analyses were identical carrying forward this patient's last observation. However, given that our analysis of PEAS over time required complete PEAS data, we report only the completer analyses in the present report.

(Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989; Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989). Internal consistency in the present sample was acceptable (alpha = 0.73).

Clinical Global Impression Scale (CGI; Guy, 1976). As a secondary measure, independent evaluators rated improvement in OCD severity using the CGI, a commonly used instrument for rating clinical impressions of overall illness severity and improvement. This measure uses a single item to assess illness improvement on a 7-point scale, from 1 (very much improved) to 7 (very much worse).

Patient EX/RP Adherence Scale (PEAS; Simpson, Maher, et al., 2010*).* The PEAS is rated by the treating clinician at each therapy session beginning after the first exposure session (i.e., sessions 4–17). The PEAS consists of three items: (a) the quantity of exposures (percentage of assigned HW exposures that were attempted), (b) quality of attempted exposures, and (c) degree of success with response prevention (percentage of urges to ritualize that the patient resisted since the previous therapy session). The therapist rates each item on a 7-point Likert-type scale. For item A, therapists ask patients how many of their assigned exposure practices they completed, which the therapist converts into a percentage, which is rated on a 7 point scale (e.g., 0% = 1; <10% = 2; ~25% = 3, etc). For PEAS_B, therapists ask a semi-structured set of questions to rate how well the patient did the exposures they attempted (with prompts including "how did the _____ exposure go?" and "Were you able to complete the exposure without doing any compulsions during or afterwards?"). The therapist averages ratings across all attempted exposures since the last session and assigns a rating for PEAS_B on a 7-point scale (1-refused-did none of the assigned exposures to 7-excellent: all exposures performed as assigned by the therapist without rituals or safety aids and the patient looked for opportunities to extend the assignment to make it more challenging). For PEAS_C, therapists ask patients to rate the percent of urges to ritualize that the patient successfully resisted since the last visit (not solely during exposure practices). In rating PEAS_C, success with response prevention is also put onto a 7 point scale (e.g., 0% = 1, <10% = 2, ~25% = 3, ~50% = 4, ~75% = 5, ~90% = 6, ~100% = 7). Mean PEAS total scores are calculated by averaging the scores on the three items (PEAS_A, PEAS_B and PEAS_C) for each session and then across sessions. Present sample, mean PEAS ratings had good reliability (alpha = 0.89).

1.4. Statistical methods

To test whether EX/RP adherence predicts outcome, we employed subjects' mean PEAS scores (averaged across items and then across sessions) as the independent variable in two regression models. The first model used linear regression to predict post-treatment YBOCS *scores*. The second used logistic regression to predict post-treatment *wellness* (as indicated by YBOCS ≤12). Both models controlled for baseline YBOCS severity. Overall significance was set at *alpha* < .05.

To investigate which PEAS items most relate to outcomes, these analyses were repeated by simultaneously entering PEAS_A, PEAS_B and PEAS_C as independent variables in lieu of mean PEAS. Because there is some overlap in item content between PEAS_C and the YBOCS items assessing compulsion severity (i.e., items assessing resistance and control over compulsive rituals), these results were followed up with sensitivity analyses predicting post-treatment YBOCS obsession and compulsion severity separately, as well as ordinal regression predicting our secondary outcome measure, post-treatment CGI-improvement.

Finally, we conducted a series of analyses to test the ability of PEAS benchmarks to forecast achievement of post-treatment wellness (i.e. YBOCS≤12) throughout treatment. Specifically, we based our prediction on scoring below or above pre-specified cutoffs on cumulative average adherence scores. These were calculated for every session by averaging all the adherence scores for that subject up to that session. Based on our regression results (see below), we employed scores on PEAS_C (adherence to response prevention) for these analyses. Cumulative scores were used as a way to smooth the variability associated with individual sessions (e.g., patients may have a "good week", followed by a "bad week"). In order to maximize interpretability and clinical utility we considered four cutoffs based on the item response anchors corresponding to approximately >90%, >75%, <75% and <50% success with response prevention. Our outcome variable was the post-treatment wellness indicator defined above (YBOCS≤12). For each session, and for each cutoff (i.e., response prevention = ~>90%, >75%, <75% and <50%), we calculated the positive predictive value (i.e., the proportion of subjects who achieved post-treatment wellness, out of all those who were above the predictor cutoff). Graphical displays of the positive predictive values by time and RP cutoff were used to demonstrate how adherence cutoffs could be used to predict post-treatment wellness across treatment.

2. Results

2.1. Sample

Participant age ranged from 18 to 65 (M = 33.78; SD = 12.54). The sample was 51.4% female and 86.5% of participants were non-Hispanic White. Overall mean scores on the YBOCS decreased significantly from baseline (M = 27.03, SD = 3.98) to post-treatment (M = 13.0, SD = 6.09, $t(36) = 12.0$, $p < 0.001$). The mean reduction in YBOCS score was M = 14.03 (SD = 7.11) points (minimum = 1; maximum = 31). Seventeen participants (45.9%) attained post-treatment wellness (YBOCS≤12). Descriptive statistics for PEAS items and mean scores are shown in Table 1. In addition, the three PEAS items were significantly intercorrelated (Table 1). Mean PEAS scores were not significantly related to baseline YBOCS severity, $r = -0.16$, $p > 0.34$.

2.2. Patient adherence predicts EX/RP outcomes

In Step 1 of the regression, baseline YBOCS did not significantly account for variance in post-treatment YBOCS scores ($R^2 = 0.002$, $F = 0.09$; df = 1, 35; $p > 0.77$). In Step 2, mean PEAS scores explained 31% of the variance in post-treatment YBOCS scores, beyond baseline YBOCS ($\Delta R^2 = 0.31$, $F = 14.94$; df = 1, 34; $p < 0.001$). As shown in Table 2, patients with higher mean PEAS (averaged across items and then across sessions) had lower post-treatment YBOCS ($\beta = -0.56$, $p < 0.001$). Baseline YBOCS also did not predict whether a patient achieved wellness (YBOCS≤12). However, mean PEAS significantly predicted wellness: a one unit increase in mean PEAS increased the odds of post-treatment wellness by a factor of 8.8

Table 1
Descriptive statistics for Patient EX/RP Adherence Scale (PEAS).

Measure	*M (SD)*	*Range*	*Correlations (r)*		
			PEAS_A	PEAS_B	PEAS_C
PEAS_total	5.33 (0.89)	3.05–6.73	0.93	0.92	0.89
PEAS_A	5.33 (1.14)	2.71–7.0	–	0.80	0.70
PEAS_B	5.34 (0.82)	3.5–6.58		–	0.75
PEAS_C	5.30 (0.97)	2.93–7.0			–

Note. PEAS total scores calculated by averaging the scores on the three items (PEAS_A, PEAS_B and PEAS_C) for each session and then across treatment.
All correlations significant, $p < 0.001$.

Table 2
Patient adherence and EX/RP outcomes.

Linear regression predicting post-treatment YBOCS score					
Predictor	β	B	95% CI	sr^2	p
Baseline YBOCS	−0.04	−0.06	[−0.51, 0.39]	<0.01	0.79
Mean PEAS	−0.56	−3.83	[−5.84, −1.82]	0.31	<0.001

Logistic regression predicting post-treatment wellness (YBOCS≤12)					
Predictor	*B (SE)*	OR	95% CI	Wald	p
Baseline YBOCS	0.14 (.11)	1.15	[0.92, 1.44]	1.51	0.219
Mean PEAS	2.18 (0.77)	8.80	[1.94, 39.9]	7.95	0.005

Note. YBOCS = Yale-Brown Obsessive Compulsive Scale; PEAS = Patient EX/RP Adherence Scale; CI = confidence interval; sr^2 = squared semipartial correlation, a measure of the unique variance explained by each predictor that is equivalent to the R^2 change in a hierarchical model when each predictor is entered previously.

(95% CI [1.94, 39.9], $p = 0.005$) as shown in Table 2.

2.3. Which components of adherence predict EX/RP outcomes?

All three PEAS items were significantly negatively correlated with post-treatment YBOCS scores (with PEAS_A: $r = -0.42$, $p = 0.010$, PEAS_B: $r = -0.48$, $p = 0.003$, PEAS_C: $r = -0.63$, $p < 0.001$). In a stepwise regression which entered baseline YBOCS in Step 1 and all three PEAS items simultaneously in Step 2 of the model, the three PEAS components accounted for 40% of post-treatment YBOCS variance ($\Delta R^2 = 0.40$; $F = 7.01$; df = 3, 32; $p = 0.001$). As Table 3 shows, only PEAS_C emerged as a significant individual predictor, with higher values of PEAS_C associated with lower post-treatment severity.

Results were similar in sensitivity analyses (separately predicting YBOCS obsession and compulsions severity) as shown in Table 3. PEAS_C was also the only significant predictor in an ordinal regression predicting post-treatment CGI-Improvement scores from the three PEAS items (Table 4). Moreover, logistic regression revealed that higher overall mean PEAS_C across all sessions was associated with increased odds of achieving wellness (i.e., YBOCS≤12) (Table 5).

Table 3
Components of patient adherence and EX/RP outcomes.

Predictor	β	B	95% CI	sr^2	p
Predicting post-treatment YBOCS total score					
Baseline YBOCS	−0.05	−0.08	[−0.52, 0.36]	<0.01	0.724
PEAS_A	0.08	0.45	[−2.14, 3.03]	<0.01	0.727
PEAS_B	−0.08	−0.61	[−4.52, 3.29]	<0.01	0.751
PEAS_C	−0.63	−3.95	[−6.66, −1.24]	0.166	0.006
Predicting post-treatment YBOCS Obsessional Severity					
Baseline YBOCS	−0.08	−0.06	[−0.30, 0.18]	<0.01	0.625
PEAS_A	0.18	0.49	[−.92, 1.89]	=0.01	0.486
PEAS_B	−0.13	−0.47	[−2.59, 1.65]	<0.01	0.653
PEAS_C	−0.55	−1.69	[−3.16, −0.23]	0.123	0.025
Predicting post-treatment YBOCS Compulsion Severity					
Baseline YBOCS	−0.02	−0.02	[−0.25, 0.22]	<0.01	0.870
PEAS_A	−0.01	−0.04	[−1.42, 1.35]	<0.01	0.956
PEAS_B	−0.03	−0.14	[−2.23, 1.95]	<0.01	0.892
PEAS_C	−0.64	−2.26	[−3.71, −0.81]	0.239	0.003

Note. YBOCS = Yale-Brown Obsessive Compulsive Scale; PEAS = Patient EX/RP Adherence Scale; PEAS_A = percentage of assigned HW exposures that were attempted, PEAS_B = quality of attempted exposures; PEAS_C = degree of success with response prevention. CI = confidence interval; sr^2 = squared semipartial correlation, a measure of the unique variance explained by each predictor that is equivalent to the R^2 change in a hierarchical model when each predictor is entered previously.

Table 4
Components of patient adherence and CGI-Improvement.

Predictor	*B (SE)*	95% CI	Wald	p
Baseline YBOCS	−0.07 (.09)	[−0.25, 0.11]	0.59	0.444
PEAS_A	0.18 (0.54)	[−0.89, 1.25]	0.11	0.739
PEAS_B	−0.05 (0.84)	[−1.69, 1.6]	0.01	0.957
PEAS_C	−1.69 (0.67)	[−2.99, −0.37]	6.33	0.012

Note. YBOCS = Yale-Brown Obsessive Compulsive Scale; CGI=Clinical Global Impressions Scale; CI = confidence interval.

Table 5
Components of patient adherence and post-treatment wellness.

Predictor	*B (SE)*	OR	95% CI	Wald	p
Baseline YBOCS	0.19 (.13)	1.21	[0.94, 1.55]	2.13	0.145
PEAS_A	0.07 (.59)	1.07	[0.34, 3.37]	0.01	0.906
PEAS_B	0.50 (1.06)	1.65	[0.21, 13.08]	0.23	0.633
PEAS_C	2.12 (0.87)	8.32	[1.52, 45.59]	5.96	0.015

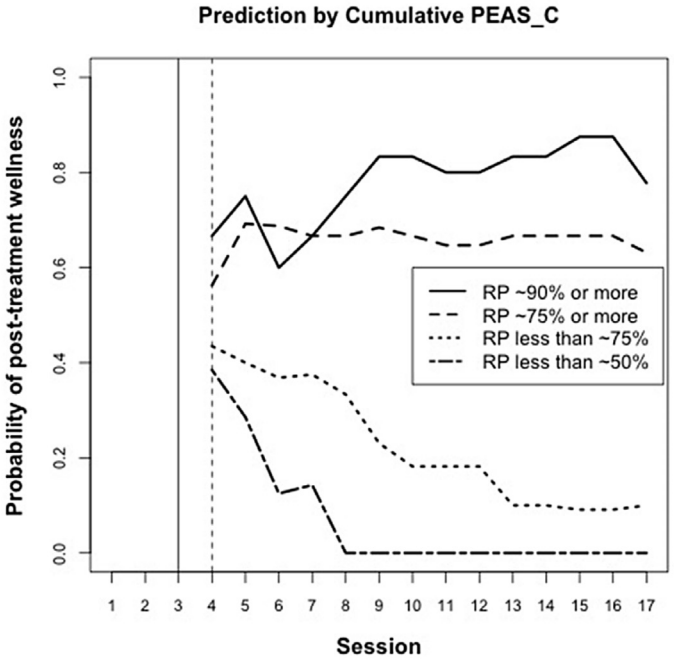
Note. YBOCS = Yale-Brown Obsessive Compulsive Scale; Wellness = Post-treatment YBOCS≤12; CI = confidence interval.

2.4. Adherence benchmarks for predicting wellness throughout treatment

We analyzed PEAS_C data for our benchmark analyses because it predicted significant independent variation in outcomes and because it provides a parsimonious measure of adherence on its own. When averaged across the whole treatment, the mean PEAS_C was 5.3 (SD = 0.97), corresponding to somewhat greater than 75% response prevention. Those with PEAS_C scores above the sample mean were more likely to achieve post-treatment wellness than those below the mean (13 of 18 [72.2%] versus 4 of 19 [21.1%] respectively).

To aid prognostic decision making *during* treatment, we tested the predictive accuracy of *session-by-session* cumulative PEAS_C cutoffs as markers of post-treatment wellness. To do so we calculated the probability of achieving wellness at each session with PEAS data (i.e., beginning at session 4) for four different levels of ritual prevention that are captured by the PEAS_C anchors (specifically approximately >90%, >75%, <75% and <50% response prevention). Fig. 1 plots the probability of achieving post-treatment wellness for each of these cutoffs. As can be seen, response prevention increased across treatment and a mean response prevention of approximately 90% or higher was an excellent marker for achieving post-treatment wellness. Patients who achieved this were more than 80% likely to achieve post-treatment wellness, and this could be forecast as early as the ninth session of EX/RP (i.e., after only 6 sessions of EX/RP homework). On the other hand, mean response prevention of at least 75% was less predictive of post-treatment wellness (averaging just below 70% accuracy at predicting post-treatment wellness throughout treatment).

PEAS_C cutoffs were also able to identify individuals who were unlikely to achieve post-treatment wellness. For example, as shown in Fig. 1, individuals whose cumulative PEAS_C scores indicated that they were able to resist less than half of their compulsions (i.e., worse than 50% response prevention) after five sessions of EX/RP (with EX/RP homework assigned three times) had less than a 20% probability of achieving post-treatment wellness. Later in treatment, individuals who did not achieve cumulative response prevention of 75% or better were also unlikely to achieve wellness: beginning after 10 sessions of EX/RP (8 of which included EX/RP homework), individuals with RP this low had less than an 18% likelihood of becoming well after treatment.



Note. RP=response prevention. The first exposure was conducted at session 3 (solid line), after which between sessions EX/RP homework began. Thus the first data point collected on the PEAS was at session 4 (dashed line).

Fig. 1. Prediction of post-treatment wellness by cumulative PEAS_C.

3. Discussion

We examined the relationship between patient adherence to EX/RP procedures and treatment outcome in a sample of OCD patients receiving manualized EX/RP as part of a randomized controlled trial. As hypothesized, we found a strong relationship between EX/RP outcome and mean patient adherence as measured by the PEAS, replicating a previous report (Simpson et al., 2011) in an independent sample. Expanding on that prior report, we found all three PEAS items correlated with outcome, but only success with response prevention (PEAS_C) predicted unique outcome variance. Time course analyses showed success with response prevention increased as treatment progressed, and differentiated patients who ultimately achieved post-treatment wellness from those who did not. Analysis of cumulative success with response prevention yielded clinically relevant benchmarks capable of identifying individuals likely to achieve post-treatment wellness, as well those unlikely to do so (e.g., 90% cumulative response prevention predicted likely achievement of post-treatment wellness, and less than 50% cumulative response prevention predicted failure to achieve wellness).

Our replication that the PEAS predicts EX/RP outcome further validates this measure as a clinically useful tool and is noteworthy given that the extant OCD literature on predictors of response to CBT catalogues many inconsistent findings (Keeley, Storch, Merlo, & Geffken, 2008; Knopp, Knowles, Bee, Lovell, & Bower, 2013). As one example of a predictor with a mixed literature, some (Franklin, Abramowitz, Kozak, Levitt, & Foa, 2000; Keijsers, Hoogduin, & Schaap, 1994; Mataix-Cols, Marks, Greist, Kobak, & Baer, 2002) but not all (Foa et al., 1983; Maher et al., 2010; Rufer, Fricke, Moritz, Kloss, & Hand, 2006) findings suggest that greater baseline OCD severity predicts worse EX/RP outcome. As was previously reported on in this sample (Wheaton, Rosenfield, Foa, & Simpson, 2015), baseline OCD severity did not relate to EX/RP outcome. This finding suggests that severe OCD does not in itself preclude an individual from benefitting from EX/RP, and that therapists should instead monitor patient adherence regardless of initial severity to determine who will likely respond well and who may need alternative treatment.

This study extends prior findings by analyzing the relationships between individual PEAS items and EX/RP outcome. Although all three PEAS items (assessing - quantity of homework exposures attempted [PEAS_A], quality of attempted exposure practices [PEAS_B], and success with response prevention between sessions [PEAS_C]) were significantly correlated with outcome (post-treatment YBOCS), only the response prevention item (PEAS_C) accounted for independent variance in our regression analyses. Importantly, item content overlaps somewhat between PEAS_C and the two YBOCS items assessing patients' ability to resist and control compulsions. However, sensitivity analyses suggested that item overlap did not account for the strong relationship between success with response prevention and treatment outcome. Specifically, PEAS_C independently predicted obsessional severity post-treatment, in addition to compulsion severity, as well as global improvement as rated on the CGI. These results suggest that adherence to response prevention robustly predicts EX/RP outcomes. Of course, in our study all patients engaged in both exposures and response prevention, making it impossible to disentangle the effects of each component in isolation. Thus, our results should not be interpreted to mean that response prevention is more important than exposure practice. Rather, our findings suggest that assessing success with response prevention serves as a strong marker of EX/RP outcome.

This finding has clinical implications, as this one item assessing

success with response prevention (PEAS_C) could provide clinicians with a powerful prognostic tool for forecasting therapy outcome. For example, achieving 90% or better response prevention was linked to achievement of minimal symptoms (YBOCS ≤12), a marker of overall wellness (Farris et al., 2013). Some patients were able to achieve this degree of control of their compulsions approximately midway through treatment, and these individuals were highly likely to achieve post-treatment wellness. Our data would suggest to therapists that good outcomes are likely for these patients.

PEAS_C also proved capable of identifying individuals unlikely to achieve post-treatment wellness, relatively early in treatment. Since our data are cross-sectional and cannot determine causality, future studies will need to determine whether adjunctive or alternative treatments can help these individuals. For example, motivational interviewing (MI) strategies have been used to enhance patient EX/RP adherence, albeit with mixed results to date (Simpson et al., 2008; Simpson, Maher, et al., 2010; Simpson, Zuckoff, et al., 2010; Zuckoff, Balan, & Simpson, 2014). Another approach to improve patient adherence could involve devising interventions to directly bolster the ability to resist compulsions. For example, preliminary data suggest that computerized response inhibition training (in conjunction with OCD-stimuli) could be used to enhance response prevention to improve therapy outcomes (Kalanthroff, Steinman, & Simpson, 2016).

That PEAS_B (assessing quality of HW exposures) did not emerge as a significant individual predictor of outcome was unanticipated, given that dismantling studies have shown that both exposures and response prevention are important (Foa et al., 1980, 1984). One possible explanation is that the exact wording used in the PEAS to evaluate exposure practices may not precisely conform to the factors that make exposures effective. Specifically, the current PEAS_B item evaluates successful exposures based on patients' ability to complete the exercise for a sufficient amount of time without giving into compulsions or safety behaviors. However, evaluating other aspects of exposures, such as violating expectancies, learning something new, and practicing in a new context (as emphasized by Abramowitz & Arch, 2014; Craske et al., 2008; 2014) might reveal a stronger relationship between homework exposure quality and treatment outcome. Thus the PEAS might be refined to explicitly evaluate these aspects of exposure quality (i.e., formally evaluating the degree to which patients' expectancies are violated during an exposure).

Strengths of the present study include standardized delivery of EX/RP with highly trained therapists and independent evaluations of therapy outcomes. In addition, we assessed adherence using a validated instrument that was rated by therapists on a session-by-session basis, which improves upon alternative methods of assessing adherence (i.e., self-report measures, retrospective measurement at post-treatment).

However, our study also had limitations. First, this is a secondary analysis of data drawn from only one arm of a larger treatment study, and thus is subject to replication in an independent sample, in a study designed and powered for the specific aim of testing the association between adherence and outcome. Second, our assessment of adherence involved therapists rating the PEAS based on patients' self-reports, which may be subject to reporting biases (i.e., demand characteristics and social desirability) on the part of both the patient and therapist. In particular, PEAS_C involves having patients reflect back on their ability to resist compulsions during the entire period of elapsed time since the last session, which could be challenging. Guidelines for administering the PEAS (Simpson, Maher, et al., 2010) suggest that therapists review self-monitoring of rituals forms (completed on a daily basis by patients) to help make accurate estimates for this item.

Third, all of the patients in our study were taking SRI medications. Thus additional study is needed to determine if our results generalize to non-medicated patients, and to investigate whether medication may influence adherence. Similarly, most of our participants were non-Hispanic White and so future work in more diverse samples is warranted. Fourth, because treatment response was so common in our sample, we were unable to differentiate responders from non-responders (as opposed to differentiating patients who got well from those who did not get well). Similarly, the low dropout rate in the present study precluded us from investigating whether the PEAS could be used to predict dropout.

It is important to note that we cannot make causal determinations about the adherence-outcome relationship given that there was no experimental manipulation of adherence. While it could be the case that higher levels of adherence lead to better outcomes, it could also be that patients who notice improvements in their symptoms might find the treatment more credible and thus begin to adhere to EX/RP procedures to a greater degree. Thus adherence and outcome might influence one another in a reciprocal fashion, perhaps also involving patients' treatment expectations and how credible they find EX/RP to be. Future studies might employ session-by-session ratings of OCD severity (e.g., using the adapted version of the Florida Obsessive-Compulsive Inventory [FOCI] as recommended in the DSM-5; APA, 2013) in order to investigate whether changes in symptoms precede or follow changes in adherence. Time lag analysis with such data might elucidate the longitudinal and reciprocal influences by which adherence and outcome influence each other.

In summary, patient EX/RP adherence measured by the PEAS strongly predicted treatment outcome. The PEAS measure and administration and scoring instructions are publicly available for clinical use (published as appendix in Simpson, Maher, et al., 2010). The PEAS item assessing success with response prevention proved particularly strongly linked to therapy outcome. This single item could provide clinicians with an efficient tool for identifying who is and is not likely to become well with EX/RP and it would be relatively easy for clinicians to calculate cumulative PEAS_C throughout treatment. Future study is needed to examine the relationship between adherence and outcome in other practice settings (e.g., private practice and intensive outpatient programs) with modalities of EX/RP delivery other than the twice weekly format used in the present study (e.g., once weekly, intensive outpatient, inpatient). As previously hypothesized (Simpson, Maher, et al., 2010), between-session adherence might prove an even stronger predictor of outcome when therapy is less frequent. In addition, whether increasing adherence leads causally to better therapy outcomes remains an important topic for future research.

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