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Shorter communication

Do in-vivo behaviors predict early response in family-based treatment for anorexia nervosa?

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ABSTRACT

The aim of the study is to explore whether identified parental and patient behaviors observed in the first few sessions of family-based treatment (FBT) predict early response (weight gain of 1.8 kg by session four) to treatment. Therapy film recordings from 21 adolescent participants recruited into the FBT arm of a multi-site randomized clinical trial were coded for the presence of behaviors (length of observed behavior divided by length of session recording) in the first, second and fourth sessions. Behaviors that differed between early responders and non-early responders on univariate analysis were entered into discriminant class analyses. Participants with fewer negative verbal behaviors in the first session and were away from table during the meal session less had the greatest rates of early response. Parents who made fewer critical statements and who did not repeatedly present food during the meal session had children who had the greatest rates of early response. In-vivo behaviors in early sessions of FBT may predict early response to FBT. Adaptations to address participant resistance and to decrease the numbers of critical comments made by parents while encouraging their children to eat might improve early response to FBT.

Introduction

Even as the evidence to support behavioral family-based treatment (FBT; Lock, Le Grange, Agras, & Dare, 2001; Lock & Le Grange, 2013) for treatment of anorexia nervosa (AN) in adolescents continues to grow, very little is known about the mechanisms of change.

To date, no mediators of treatment – factors that are present after treatment has started but before treatment changes have occurred – have been identified, though few studies have explored them in FBT (e.g. Le Grange et al., 2012). Identification of mediators would facilitate understanding of the mechanisms through which a treatment achieves its aims. In the absence of formal identification of mediators, two recent observational studies have allowed for a qualitative appraisal of mechanisms of change (Ellison et al., 2012; Robinson, Strahen, Girz, Wilson, & Boachie, 2012). In one study observed parental self-efficacy predicted patient outcomes throughout FBT treatment (Robinson et al., 2012). This finding is not surprising because FBT aims to empower parents to assume responsibility for re-nourishing their child back to health. In addition, a recent study demonstrated that observations of core therapeutic objectives of manualized FBT; parents taking control; externalization of the illness; and not criticizing; predicted weight gain in 59 adolescents with AN (Ellison et al., 2012).

However, not everyone who receives FBT gains sufficient weight or achieves recovery. In the most recent randomized clinical trial, 49% of adolescents were recovered (≥95% ideal body weight [IBW] and EDE-Global score within 1SD of community mean) by one year post-treatment. As is the case with many disorders, among the strongest predictors of long-term outcome in FBT is early response to treatment. Two studies have identified early weight gain as predicting outcome in FBT (Doyle, Le Grange, Loeb, Doyle, & Crosby, 2010; Lock, Couturier, Bryson, & Agras, 2006). Using a signal-detection procedure, Doyle and colleagues identified a cut off point of 2.88% IBW (approximately 1.8 kg weight gain) by session 4 as the best predictor of end of treatment remission with 90% accuracy (Doyle et al., 2010). However, it is not clear what distinguishes those who gain weight early in treatment from those that do not. Hence, in the current study we examine early behaviors of adolescents and their parents in the first several sessions of FBT to

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determine if we can identify specific behaviors that predict early weight gain. Examining how early and non-early responders differ in terms of in-session behavior is a first step toward understanding more about mechanisms of treatment and may inform development of treatment enhancements during this critical early period of FBT to improve response.

Methods

Participants & procedure

Recordings of FBT therapy sessions came from a multi-site randomized treatment trial examining two models of family treatment that recruited a total of 164 adolescent AN patients across 6 sites. Recordings were available from 4 of the 6 sites, leaving 138 adolescents, half of whom ($n = 69$) received FBT. Of these cases, we chose 21 who had complete end of treatment assessments and full and audible recordings for at least two out of the three of the required sessions 1, 2 and 4. A total of 21 patients were included in the analysis of session 1, 2, and 19 who had both sessions 1 and 4 available were included in the analysis that examined change. Participants were not receiving any other type of therapy and were on a stable dose of medication as per inclusion criteria for the study.

Measures

Clinical measures

Baseline clinical characteristics were assessed as part of the larger trial from which the sample was derived. The Eating Disorder Examination (EDE) interview (Fairburn & Cooper, 1993) was used to ascertain ED psychopathology. Widely used in eating disorder research and the gold standard instrument, the EDE assesses disordered eating behaviors and cognitions along four dimensions – dietary restraint; eating concern; shape concern and weight concern as well as a global score. The Rosenberg Self Esteem scale (RSE; Rosenberg, 1965) was used to assess self-esteem; and comorbidity was assessed using the Schedule for Affective Disorders and Schizophrenia for School-Aged Children, Present and Lifetime Version (K-SADS-PL; Kaufman et al., 1997).

Behavioral observation

Construction of the coding frames. Members of the research team as well as clinicians expert in the treatment of ED generated a list of candidate behaviors (codes) for inclusion in the coding frames based on previous studies and clinical experience. The team, including coders met to review the codes against sample recordings until a consensus was met and four coding frames were constructed for (a) parent (parents coded together) and (b) identified patient behaviors in the (c) meal session (session 2) and (d) sessions 1 and 4.

Inter-rater-reliability. Six raters coded an initial set of 12 sessions applying the four established coding frames. Observational data for each behavior code were expressed as a percentage of the session (recording length). To establish inter-rater reliability, the data were random ordered into 15 coder-pairs, conducting Spearman's correlation analysis and averaging the results across pairs. This allowed for detection of errors that were consistently made by an individual coder and avoided overestimation of agreement through inflation of the coefficient. We chose .6 as the minimum acceptable agreement level and codes that failed to reach this threshold were removed from the coding frame. A total of 4 out of 21 codes (19%) were removed and 2 were collapsed leaving a total of 16 behavior codes for Sessions 1&4 (agreement range $r = .69–.99$). For the meal session, 10 out of 35 codes (29%) were removed and 2 were collapsed leaving 24 codes for the meal session (agreement range $r = .71–.98$). Behaviors included in the coding frames can be seen in Tables 2 and 3.

Table 1
Mean (standard deviation; SD) baseline psychopathology scores and demographic information by group.

	Early responder?		*t*	*p*	*d*
	Yes ($n = 12$)	No ($n = 9$)			
Age	14.62 (1.30)	15.36 (1.68)	.264	.746	.53
% Ideal body weight	82.08 (3.91)	80.58 (4.19)	.840	.412	.39
Illness duration (months)	6.83 (7.52)	13.33 (10.38)	1.688	.112	.77
EDE[a] Restraint	2.18 (1.66)	1.38 (1.17)	1.239	.230	.57
EDE Eating concern	1.20 (.82)	1.00 (1.40)	.382	.709	.19
EDE Shape concern	2.81 (1.98)	2.13 (1.77)	.824	.420	.39
EDE Weight concern	2.20 (1.51)	1.67 (2.05)	.688	.500	.32
EDE Global	2.10 (1.30)	1.54 (1.49)	.912	.373	.43
Rosenberg self esteem	24.92 (6.11)	23.44 (5.75)	.582	1.472	.26

[a] EDE = Eating Disorder Examination.

Coders: The 6 coders were post-doctoral level clinicians trained and certified in FBT. The first author (AMD) trained all coders in the use of the coding software program and lead weekly consensus meetings with coders from both sites to agree on the operationalization of codes and prevent drift.

Coding procedure. The revised coding frame was applied to the remaining 60 recordings. Coders were blind to participants' outcome. Tapes were viewed individually. All coding was conducted using The Observer XT (Noldus Technology, 2012).

Table 2
Patient behaviors (expressed as Mean (SD: standard deviation) percentage length of the session) for sessions 1, 2 the "family meal" session, and change from 1 to 4.

		Early responder?		*U*	*p*	AUC[a]
		Yes ($n = 12$)	No ($n = 9$)			
Session 1	Positive verbal	.04 (.09)	.05 (.08)	47.00	.506	.435
	Negative verbal	1.12 (2.85)	4.02 (4.22)	18.50	.009	.174
	Neutral verbal	11.11 (8.70)	8.06 (6.37)	43.50	.455	.402
	Negative patient physical	.64 (1.73)	1.42 (2.85)	53.50	.962	.495
	Positive patient physical	.09 (.32)	.02(.05)	53.00	.889	.490
Meal Session	Eating	32.21(16.09)	26.17 (19.40)	42.00	.569	.388
	Takes food	1.17 (2.15)	1.09 (1.28)	46.50	.584	.430
	Non nutritive drinking	1.46 (1.79)	1.03 (1.54)	40.00	.292	.370
	Nutritive drinking	1.13 (1.70)	2.65 (5.03)	54.00	1.00	.500
	Food requests	.03 (.09)	.01 (.02)	53.00	.889	.490
	Positive talking about food	.27 (.52)	.38 (.62)	51.00	.799	.472
	Verbal anger	5.45 (16.12)	4.37 (9.22)	46.00	.572	.425
	Crying	.71 (2.47)	.27 (.79)	47.50	.448	.439
	Physical anger	.09 (.31)	.08 (.23)	53.00	.889	.490
	Away from table	1.06 (2.96)	2.33 (6.91)	41.00	.290	.379
	Moves closer to table/food	.30 (.96)	.74 (2.14)	50.00	.722	.462
	Facilitates meal presentation	.70 (1.10)	.96 (1.98)	48.00	.673	.444
Change Session 1 To 4[b]	Positive verbal	1.64 (2.56)	.95 (2.10)	40.5	.76	.460
	Negative verbal	2.25 (6.18)	.35 (5.14)	28.0	.19	.318
	Neutral verbal	1.22 (17.07)	−3.76 (6.34)	33.0	.36	.375
	Negative patient physical	1.26 (5.03)	.27 (3.65)	42.0	.86	.477
	Positive patient physical	3.85 (12.85)	.09 (.22)	39.0	.65	.443

[a] AUC = Area Under the Curve.
[b] Negative values (in the change variables) denote reduction in behavior.

Table 3
Parental behaviors (expressed as Mean (standard deviation) percentage length of the session) from sessions 1, 2 (the "family meal" session), and change from sessions 1 to 4.

		Early responder?		U	*p*	AUC[a]
		Yes ($n = 12$)	No ($n = 9$)			
Session 1	Neutral statements	33.12 (22.42)	29.75 (10.92)	48.50	.455	.449
	Confidence/ empowerment	1.72 (2.84)	.97 (2.59)	41.50	.355	.384
	Parental alignment	4.23 (12.44)	5.04 (14.43)	54.00	1.00	.500
	Parental divergence	1.31 (4.45)	.06 (.16)	52.00	.836	.481
	Positive physical	4.15 (12.55)	5.19 (14.44)	41.50	.325	.380
Meal Session	Serves food	2.22 (2.10)	4.57 (5.78)	37.00	.226	.342
	Presents food	.40 (1.08)	.63 (.95)	41.00	.306	.379
	Offers food	.59 (1.54)	.47 (.99)	52.00	.871	.481
	Modeling eating	9.52 (17.94)	11.92 (12.22)	35.00	.145	.324
	Puts out plates/ utensils	5.34 (9.92)	5.24 (5.11)	39.00	.286	.361
	Sibling eating	5.23 (9.40)	6.75 (10.99)	45.00	.478	.416
	Physical encouragement	.00 (.07)	.87 (2.29)	36.00	.036	.333
	Parent moves closer	.00 (.01)	.57 (1.15)	39.00	.120	.361
	Verbal encouragement to eat	1.34 (2.14)	1.75 (2.54)	42.50	.412	.393
	Neutral verbal during meal	37.92 (20.74)	30.36 (13.13)	40.00	.320	.370
	Verbal criticism	.08 (.20)	2.14 (3.03)	35.00	.091	.324
	Verbal warmth	.53 (.84)	.69 (.88)	42.00	.385	.388
Change Session 1 To 4[b]	Neutral statements	.92 (20.76)	.91 (16.07)	42.0	.87	.477
	Confidence/ empowerment	4.43 (8.39)	2.51 (5.00)	35.5	.48	.403
	Parental alignment	.98 (14.63)	−4.43 (15.86)	40.0	.74	.455
	Parental divergence	.58 (6.69)	2.19 (5.40)	43.0	.93	.489
	Positive physical	1.18 (16.94)	−3.83 (16.44)	32.5	.34	.369

[a] AUC = Area Under the Curve.
[b] Negative values (in the change variables) denote reduction in behavior.

Data analysis

The sample was divided into early responders ($n = 12$) and non-early responders ($n = 9$) according to achievement of 1.8 kg weight gain by session 4 (Doyle et al., 2010). We chose to use an absolute value rather than percent weight gain because it was a more sensitive predictor when we conducted an ROC in our sample. Since much of the data were non-normally distributed Mann–Whitney U analyses were conducted on each behavior code (percentages of the session) to see if any significant differences in behaviors would be observed between early responders and non-early responders. These were repeated for each of the observed sessions (1, 2, and 4) and for change between sessions 1 and 4. Since the study was underpowered, we examined effect size primarily, in conjunction with statistical significance. Area under the receiver operating characteristic curve (AUC = U[/N1 × N2]) was calculated for each variable and taken as a measure of effect size. Since AUC tests discriminatory power (in this case between early responders [1.8 kg weight gain by session 4] and non-early responders), a value of .5 indicates no discriminatory power (i.e. 50% sensitive and 50% specific) while values of .56 (or −.44), .64 (or −.36) and .71 (or −.31) correspond to Cohen's *d* effect sizes of .2, .5 and .8, respectively. Behaviors where differences were associated with moderate effect sizes were highlighted and entered into a step-wise discriminant class analyses with early response to treatment as the dependent variable. Discriminant class analysis predicts group membership (early responder/non-early responders) and was chosen because it makes no assumptions of normal distribution of predictors. Given the exploratory nature of the study, we used the more liberal probability cut offs of .15 instead of .05 as suggested by (Tabachnick & Fidell, 1996) to ensure that important variables would be entered into the equation.

Results

Participants

Table 1 shows baseline descriptive characteristics and measures of symptom severity for the groups. Overall 9 participants had comorbidity (6 from the early responding group and 3 from the non early responding group) though this difference was non-significant. Participants were mostly Caucasian with 4 non-Caucasian participants (3 from the early responding group and 1 from the non-early responding group); and 16 out of the 21 participant families were intact with 3 non-intact families from the early responding group and 2 from the non-early responders. A total of 3 participants experienced objective binge eating episodes in the past 28 days, 2 from the early responding group and 1 from the non-responding group, and a total of 12 engaged in compensatory behaviors; 8 early responders and 4 non-early responders, though this relationship was not significant (Chi-square$_{(1)} = 1.037$; $p = .309$). A total of 4 participants (2 from each group) were taking medications. There were no statistically significant differences between the groups on age, %IBW, self-esteem or EDE scores, though examination of effect sizes (ES) suggest that early responders were slightly younger (ES = .53) with higher EDE restraint (ES = .57) and global scores (ES = .43) (moderate effect sizes). In addition, early responders had been ill for about half as long (6.88 months) compared to those who failed to respond early (13.33 months) with a large effect size (ES = .77).

Adolescent behaviors

Table 2 shows the percentage of total session length for each patient behavior by group and Mann–Whitney U results. In terms of statistical significance, lower observed Negative verbal behavior during the first session was associated with early response with a large effect size. In addition, effect sizes revealed that more Neutral verbal statements among patients during the first session were associated with early response. During the meal session, more Eating and Non-nutritive drinking (e.g. diet soda, water, etc.) and less moving away from the table, was present among early responders. In terms of behavior change from session 1 to 4, both groups increased negative verbal behavior but early responders had a greater increase. Early responders also showed an increase in neutral verbal while those who failed to respond early had a reduction in neutral verbal.

Given the large difference between the groups, the relationship between length of illness and behaviors with large effect sizes was explored. Length of illness was positively significantly correlated with Negative Verbal ($r[21] = .699$; $p < .001$) and Neutral verbal (r [21] = .461; $p = .035$) from session 1; and the length of time spent away from the table in the meal session ($r[22] = .839$; $p < .001$).

A discriminant analysis was performed with achievement of early treatment response as the dependent variable and session 1 behaviors (Negative verbal, Neutral verbal); family meal session behaviors (Eating, Non-nutritive drinking, and Away from table) and change variables (Change in negative verbal and Change in neutral verbal) as predictor variables. Negative verbal ($F[1, 16] = 6.16$; $p = .020$); and Away from table ($F[1, 16] = 6.28$; $p = .010$) were entered and the model was significant (chi-square [2] = 8.75; $p = .01$) indicating that less negative verbal comments in session 1 and less moving away from the table during the meal was associated with early response. The model correctly classified 78.9% of

cases overall – 90% of early responders and 66.7% of non-early responders.

Parental behaviors

Table 2 shows parental behaviors that comprised the coding frames for each session, percentage of session length by group and Mann–Whitney U results. From Session 1, greater parental Confidence/empowerment and lower Positive parental physical behaviors were associated with early response. More Serving food, Presenting food, and Modeling eating was observed in the non-early responding group. Moving closer to the child and Physical encouragement to eat were also associated with failure to respond early and though they were rarely seen in either group Physical encouragement to eat was the only behavior to differ statistically significantly. Physical encouragement to eat was also the only behavior significantly related to length of illness ($r[22] = .716$; $p < .001$).

Lower levels of both verbal criticism and, to a lesser extent verbal warmth were associated with early response. Finally in terms of change variables parents who increased their positive physical behaviors from sessions 1–4 tended to be from the early responding group.

Stepwise discriminant analysis was performed with parental behaviors from session 1 (Confidence/empowerment, Positive physical); the family meal session (Serves food; Presents food; Modeling eating; Puts out plates and utensils; Physical encouragement; Parent moves closer; Verbal encouragement to eat; Negative verbal during meal; Verbal criticism; and Verbal warmth); and change variables (Change in confidence/empowerment, and Change in positive physical) as predictor variables. Two behaviors from the meal session were entered - Verbal criticism ($F[1, 15] = 5.21$; $p = .037$) and Presents food ($F[1, 14] = 7.06$; $p = .008$). The analysis with Verbal criticism and Presents food was significant (chi-square $[1] = 9.76$; $p = .008$), accurately classifying outcome in 81% of cases overall, with accurate predictions of outcome being made for 91.7% of early responders and 66.7% of non-early responders.

Discussion

The study explores adolescent and parental behaviors in relation to early response to FBT. To our knowledge, this is the first study to conduct a frequency analysis of in-vivo behaviors in FBT. Many behaviors that are theoretically linked to components of the FBT model appeared more often in the early responding group, such as parental expressions of confidence and empowerment (session 1), less criticism and more neutral statements by parents during the meal session. This is largely in line with previous studies (e.g. Ellison et al., 2012) and with the therapeutic model. Further while numbers were small and findings are preliminary, other behaviors emerged from the analysis that have not previously been reported and may suggest an interaction between length of illness, specific behaviors and early response to treatment.

The family meal session (session 2 of FBT) offered the most between-group discrepancies. Behaviors that might be considered indicative of parental control or pressure to eat in the meal session – presenting food, serving food, modeling eating, occurred more frequently among those who failed to respond early and in the context of the adolescent's reduced eating, implying that they are less effective. Since offering food occurred at a similar level in both groups, these behaviors may only have been elicited after the child had failed to respond to offers of food and may be reflective of less engaged, more symptomatic adolescents. However, contrary to previous findings that found ED severity to be predictive of outcome (Le Grange, Hoste, Lock, & Bryson, 2011), we failed to find any evidence that some markers of clinical severity including EDE scores, IBW, or level of co-morbidity were elevated among non-early responders. Our results suggest that differences are more likely reflective of *length* of illness rather than the EDE scores, co-morbidity or current weight and are thus consistent with family illness models e.g. (Eisler, 1995, 2005; Le Grange & Eisler, 2009). Family illness models posit that observed behaviors characterized by expressed emotion (critical comments, expressions of hostility, and over-involvement) are the result of a dynamic interactive process associated with coping with a family member who has a chronic illness that unfolds over time and serve to maintain the disorder. This step-wise reorganization may occur quickly in AN because the central symptom occurring at every mealtime is so central to family life (Eisler, 1995). It is possible that differences in behaviors observed in the meal session, while they appear to indicate parental control and are encouraged in the FBT therapeutic approach, are actually evidence of a maintaining mechanism among families who have been dealing with AN for longer (Eisler, 1995). Among these families, repetitive and futile behaviors around food by parents may push the adolescent into a more coherently defensive position that becomes more engrained over time and thus less likely to respond early in treatment. Laboratory experiments suggest that parental pressure to eat such as presenting foods, serving food etc., is associated with eating less among "picky eaters" (Fisher, Mitchell, Smickiklas-Wright, & Birch, 2002; Galloway, Lee, & Birch, 2003). Hence, the parents of adolescents with AN may be inadvertently reinforcing restricted eating.

While early responder adolescents had lower levels of negative statements in the first session, in a seemingly contradictory finding, early responders also had greater increases in negative verbal statements from session 1 to 4. However examining levels in the first session shows that while non-early responders had higher levels of negative verbal statements in session 1 that remained high in session 4, early responders started off with lower levels in session 1 and increased over subsequent sessions, indicating that beginning to talk negatively in the context of treatment – presumably where it can be contained and challenged - was associated with a better outcome. Length of illness was strongly related to negative statements in the first session again indicating a more engrained and immovable illness. While it was not possible to conduct a formal mediator analysis that could empirically test this interaction, the findings of this exploratory study suggest that as participants increasingly engage in FBT, increasing negative statements during early sessions may mediate earlier response among those with shorter illness duration.

The major limitation of the study is that participant numbers are limited and thus it was not possible to conduct mediator analyses of duration of illness. Because we were unable to conduct a meditational analysis it is unclear whether identified changes in behavior were a result of therapy or other changes in the home environment. While the findings nonetheless support a family illness model, they cannot provide information about the complex interplay between illness variables and family systems in the way that a mediator analysis or a prospective design would. However, the sample sizes required to conduct sufficiently powered mediator analyses are such that it is unlikely to be feasible in AN research. Observational analysis of in-vivo behaviors may be a promising way to begin to explore mechanisms of change in the absence of formal mediation designs.

This initial study highlights the potential role of length of illness – one of the most stable prognostic factors (e.g., Dare, Eisler, Russell, Treasure, & Dodge, 2001; Halmi et al., 2005; Le Grange et al., 2012; Russell, Szmukler, Dare, & Eisler, 1987) – in relation to early response and other behaviors that are observable in-vivo. From an intervention-design perspective, given the many differences observed in mealtime behaviors among parents, it seems

reasonable to suggest that an additional family meal might be a useful starting point for an adaptation for non-early responding adolescents. This might be best utilized if the second meal session had a specific goal or focus, so as to avoid repeating the same behavior pattern from the first meal session.

In summary, in-vivo behaviors observed in early sessions appear to predict early response to FBT treatment. Behaviors in the family meal session may be especially potent and could convey the increasing dominance of AN in family life over time. As such, this may be the most useful session around which to design a treatment adaptation for delivery to patients who fail to respond early.

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