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J Fam Psychol. Author manuscript; available in PMC 2021 February 01.

Published in final edited form as:

J Fam Psychol. 2020 February ; 34(1): 57–67. doi:10.1037/fam0000569.

Mechanisms of Change in a Brief, Online Relationship Intervention

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Abstract

Internet delivery of couple interventions is becoming increasingly popular; however, little is known about mechanisms of change during these interventions. One online, self-help relationship intervention - the OurRelationship program - has been shown to improve relationship satisfaction (Doss et al., 2016) during the intervention and to maintain gains through 12-months follow-up (Doss, Roddy, Nowlan, Rothman, & Christensen, 2019). This study seeks to understand mechanisms during and following this program using the same sample of 300 couples (600 individuals) randomly assigned to the program or a waitlist control group. Results from the bivariate growth curves revealed that greater increases in relationship satisfaction during the intervention were explained by improvements in negative communication, emotional intimacy, as well as target problem confidence and severity. However, changes in acceptance of targeted relationship problems, positive communication, and self-protective orientation were not related to changes in satisfaction during the intervention. Additionally, in a multivariate model, relationship target problem severity alone remained significant in the presence of other mechanisms. Improvements in positive and negative communication during the intervention and level of negative communication at the end of the intervention predicted maintenance of gains in satisfaction over 12-month follow-up. Results replicate previous findings that communication (Doss et al., 2005) and emotional intimacy (Doss et al., 2005; Hawrilenko, Gray, & Cordova, 2016) are key components in initial decreases in relationship distress. Furthermore, results suggest that improvements in communication may help couples more effectively navigate problems following the intervention – above and beyond its associations with pre-post improvements in satisfaction.

Keywords

mechanism; online; internet; relationship distress; couple therapy

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Dr. Brian Doss is a co-inventor of the intellectual property used in this study and an equity owner in OurRelationship LCC.

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Mechanisms of Change in a Brief, Self-help, Online Relationship Intervention

Relationship distress is common in the United States. Among married couples, nearly one-third are distressed at any given time (Whisman, Beach, & Snyder, 2008), and around one-third of first marriages end within ten years (Copen, Daniels, Vespa, & Mosher, 2012). Relationship difficulties, one of the leading causes of individuals seeking mental health treatment (Foran, Whisman, & Beach, 2015), also negatively impact individual physical health, mortality, and individual mental health (Robles, Slatcher, Trombello, & McGinn, 2014; Schonbrun & Whisman, 2010). Although there are efficacious in-person treatments for relationship distress (e.g., Lebow, Chambers, Christensen, & Johnson, 2012; Shadish & Baldwin, 2005), they are expensive and time-consuming to implement. With online platforms' ability to decrease barriers to treatment (Georgia & Doss, 2013), it is critical to understand whether the mechanisms of change for couple interventions are consistent across delivery modalities.

Although the efficacy of an intervention is the primary step in the course of research, understanding how the intervention is working is a critical follow-up. Understanding the active change mechanisms of an intervention is important for several reasons (Doss, 2004). First, by identifying the active ingredients in an intervention, future iterations of the intervention can be further refined to highlight these mechanisms. Second, interventions can be shortened to concentrate on pieces contributing to the outcomes. Third, treatments can be tailored to specific populations in need (e.g. low-income, rural, racial, ethnic, or sexual minorities) while maintaining the integrity of the intervention. Finally, researchers can combine interventions that function through different mechanisms to possibly boost overall effect sizes of the interventions.

Mechanisms of Change During the Intervention

Investigations into the mechanisms of change of couple interventions have yielded mixed results across methodologies, the studied mechanisms, and the approach to couple treatment. Communication training is a core feature of behavioral couple therapy (BCT) and cognitive behavioral couple therapy. In early studies, gains in relationship satisfaction were unrelated to individual-level (Iverson & Baucom, 1990; Halford, Sanders, & Behrens, 1993) and couple-level (Davidson & Horvath, 1997) improvements in communication. Other studies found improvements in communication and satisfaction were associated for wives but not husbands (Emmelkamp et al., 1988). However, an investigation of mechanisms in the largest study of in-person couple therapy to date revealed that decreases in negative communication as well as increases in positive communication were related to improvements in relationship satisfaction for both husbands and wives in both traditional behavioral couple therapy (TBCT) and IBCT (Doss, Thum, Sevier, Atkins, & Christensen, 2005). Furthermore, in a study of couple therapy in Veteran Affairs (VA) hospitals, improvements in communication in the previous session predicted improvements in relationship satisfaction during the subsequent session (Doss, Mitchell, Georgia, Biesen, & Rowe, 2015).

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Another type of putative mechanism that has been investigated is improvements in targeted behaviors; however, the majority of studies have indicated they do not play a major mediating role. Early in couple therapy, amount of change in target behaviors was related to changes in satisfaction for both IBCT and TBCT (Doss et al., 2005). In the same study, change in acceptance of target behaviors (after controlling for changes in frequency) was associated with changes in satisfaction early, but not late, in therapy (Doss et al., 2005). However, improvements in the frequency of target behaviors were unrelated to treatment gains in an investigation of treatment-as-usual couple therapy (Doss et al., 2015). Similarly, activation - measured as movement towards targeted changes - was not a mechanism of changes in satisfaction during the Marriage Check-up, a brief in-person assessment and feedback relationship intervention (Hawrilenko, Gray, & Cordova, 2016).

A third group of potential mechanisms is improvements in emotions. Increases in emotional closeness served as a mechanism of change for men and women participating in behavioral and integrative couple therapy at VA hospitals (Doss et al., 2015). In a study of Emotion Focused Couple Therapy (EFCT), observed partner supportiveness in session acted as a mediator of change in satisfaction (McKinnon & Greenberg, 2017). Additionally, the occurrence of an emotional softening event during EFCT predicted gains in satisfaction during treatment (Dalgleish, Johnson, Moser, Wiebe, & Tasca, 2015). In the Marriage Check-up, results showed that acceptance (both towards the partner as well as felt from the partner) and intimate safety (feeling safe to be vulnerable in front of the partner) were related to change in relationship satisfaction during the intervention (Hawrilenko et al., 2016).

Mechanisms of Maintenance Following the Intervention

To our knowledge, no previous studies have examined how improvements in mechanisms during couple therapy impact maintenance of gains following couple therapy with the exception of one small study that found no differences in retrospective reports of therapy experiences between couples who maintained gains or relapsed after treatment (Jacobson, Schmaling, & Holtzworth-Munroe, 1987). However, there have been a series of studies exploring the mechanisms of the long-term effects of relationship education. Across several studies, reductions in negative communication during the intervention were predictive of decreased risk of marital distress in the subsequent 1.5–5.5 years (Schilling, Baucom, Burnett, Allen, & Ragland, 2003; Baucom, Hahlweg, Atkins, Engl, & Thurmaier, 2006; Stanley, Rhoades, Olmos-Gallo, & Markman, 2007). Within relationship education, improvements in self-reported positive communication during the intervention (Barton et al., 2017) but not observed positive communication (Baucom et al., 2006; Schilling et al., 2003; Stanley et al., 2007; Williamson, Altman, Hsueh, & Bradbury, 2016) mediated changes in relationship satisfaction over follow-up. Additionally, improvements in acceptance – but not intimate safety or activation – during the Marriage Check-up intervention predicted maintenance of gains in satisfaction over follow-up (Hawrilenko et al., 2016).

In addition to changes in mechanisms during the intervention, it is also possible that levels of mechanisms at the end of the intervention may predict maintenance of gains. For example, it may be that achieving a certain threshold of the mechanism protects couples

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from relapse, regardless of whether a substantial or minimal amount of change during the intervention was necessary for them to achieve that threshold. Supporting this idea, results of a study of couple therapy at VA medical centers demonstrated that whether or not couples ended treatment in the distressed range of relationship satisfaction was the strongest predictor of maintenance of gains in relationship satisfaction over follow-up (Doss, Hsueh, & Carhart, 2011), with couples still in the distressed range more likely to deteriorate over time. In contrast, reliable change during treatment in the same study were not predictive of deterioration over time.

Current Study

The current study will examine mechanisms of a brief, online intervention for couples – the OurRelationship program. As described by Doss and colleagues (2016), the OurRelationship program is an online adaptation of Integrative Behavioral Couple Therapy (Doss, et al., 2013), a well-validated in-person couple therapy (Christensen et al., 2004; Christensen, Atkins, Baucom, & Yi, 2010). In addition to the online content, couples in the OurRelationship program have four 15-minute videoconference calls with a coach; these tightly-scripted calls help couples apply the material to their relationship and complete the program in a timely fashion.

Previous studies of the OurRelationship program demonstrate that couples in the program, relative to a waitlist control group, improve relationship satisfaction (Cohen's $d = 0.69$), relationship confidence (Cohen's $d = 0.47$), relationship positives (Cohen's $d = 0.15$), as well as reducing relationship negatives (Cohen's $d = 0.57$; Doss et al., 2016) during the intervention. Additionally, couples reported reductions in depressive and anxious symptoms relative to the waitlist control group (Cohen's $ds = 0.50$ and 0.21, respectively) with greater improvements for individuals who started the program with initial difficulties (Doss et al., 2016). These results were found to be generally consistent across racial and ethnic minority groups; however, Hispanic and African American couples were less likely to complete the intervention (Georgia, Roddy, Nowlan, & Doss, 2018). Finally, 12-months later, couples maintained gains in relationship satisfaction, relationship confidence, and relationship negatives, and significantly improved relationship positives (Doss, Roddy, Nowlan, Rothman, & Christensen, 2019). Improvements in depressive and anxious symptoms were also maintained (Doss et al., 2019).

Although the OurRelationship program is effective at improving relationship functioning, its mechanisms are unclear. This study has three specific aims. First, we seek to identify mechanisms of change of the OurRelationship program during the intervention using the same sample as Doss and colleagues (2016). As the OurRelationship program was adapted from IBCT, we hypothesize that the mechanisms of IBCT (communication, change in targeted behaviors, and acceptance; Doss et al., 2005) will be important in creating initial changes. We will also explore whether two additional potential constructs - increases in emotional intimacy or decreases in self-protective orientation – serve as mechanisms for initial improvements in relationship satisfaction. Second, we seek to understand how changes in the mechanisms during the program influence maintenance of gains over 12-month follow-up. We hypothesize that couples who reported greater changes in the

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mechanism during the program will be more likely to maintain their improvements in relationship satisfaction over follow-up. Third, we seek to understand how post-treatment levels of the mechanisms identified during the program influence maintenance of gains over 12-month follow-up. We hypothesize that couples who reported higher levels of the mechanism at post-treatment will be more likely to maintain their changes over follow-up. To address these questions, we will utilize bivariate latent growth models, a structural equation modeling approach that allows us to simultaneously model change in both the mechanism and the outcome while also accounting for the multilevel structure of the data.

Method

Participants

Full sample.—Three-hundred opposite-sex couples (600 individuals) were initially randomized to either the intervention or waitlist. Couples were predominantly married (80%) with children (73%), had been together for nearly ten years (M = 9.72; SD = 8.34), and were in their mid-30s (M = 36.11 years; SD = 9.58 years). Participants tended to be Caucasian, non-Hispanic (67.2%), with 17.2% identifying as African American, 3.3% Asian/Pacific Islander, 0.7% American Indian/Alaskan Native, and 1.4% multiracial or other. Around 10% of individuals identified as Caucasian, Hispanic. Most individuals were fully employed (61.5%) and had at least some college experience (69%), and reported a median household income of $70,500. More information on this sample can be found in Doss et al., 2016.

Follow-up sample.—Of the full sample described above, 151 heterosexual couples (302 individuals) who were initially assigned to the intervention group were contacted for assessments three and 12 months after completion of the intervention. The subsample tended to be married (81%) with children (74.5%), and were in their 30's (M = 37.1 years; SD = 9.3 years). Couples assessed at follow-up had been together for nearly 10 years (M = 9.8; SD = 8.7). Participants' racial and ethnic breakdown was more or less similar to the full sample, with the exception that 76% identified as Caucasian, non-Hispanic and 5% identified as multiracial or other. Most were fully employed (63.3%) and had at least some college experience (69.7%), and reported a median household income of $65,000. More information can be found in Doss et al., 2019.

Procedures

Individuals were eligible to participate if they lived in the United States, were between the ages of 21 and 65, married, engaged, or cohabiting for at least six months in an opposite-sex relationship, and reported they were distressed in their relationship (defined as at least one partner scoring one SD below the community mean or both partners scoring half a SD below the community mean). Individuals were excluded from participation if they endorsed clinically-significant intimate partner violence resulting in fear or injury of their partner or at least moderate levels of suicidal ideation within the past three months. Additional exclusionary criteria included: current infidelity, lack of access to broadband internet, concrete plans to divorce or separate, and current participation in couple therapy or intentions to enroll in couple therapy within the next three months.

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Eligible participants completed baseline measures of relationship functioning and were contacted by a member of the program staff to obtain verbal consent and randomize them to condition. All participants were reassessed at four and eight weeks post-enrollment. Couples who were randomly assigned to the intervention group were instructed to create accounts and begin the material. Those who were initially randomized to receive the intervention completed additional assessments at two, five, and seven weeks post-enrollment (in addition to the four- and eight-week assessments completed by couples in all groups). In addition, follow-up assessments were conducted for intervention participants at 3 and 12 months following completion of the program. Participants were paid $10-$25 for each of the research assessments. Couples who were randomly assigned to the waitlist condition were offered the program at two months following randomization and thus did not complete any follow-up assessments.

The OurRelationship program encouraged couples to choose one or two central relationship issues they wished to work on and then guided them in creating an in-depth understanding of how their respective differences, emotional expressiveness, external stressors, and patterns of communication contribute to and maintain their problems. All participants were exposed to identical online content and encouraged to apply what they learned to the specific issue(s) they selected. A more detailed summary of program content can be found in Doss et al., (2016). The program's approximate seven hours of online content were interspersed with four, 15-minute videoconference calls with a staff coach. Coaches were graduate students in a PhD program in Clinical Psychology. Couples also had the opportunity to contact their coach by email. Study procedures were approved by the University of Miami institutional review board. The randomized clinical trial was registered on ClinicalTrials.gov after data were collected ().

Measures

Please see Table 1 for means and standard deviations of all measures. Bivariate correlations for all study measures are available in the supplementary materials.

Relationship satisfaction.—The Couples Satisfaction Index 16-item version (CSI-16; Funk & Rogge, 2007) was used to assess relationship satisfaction across all time points. Scores range from 0 to 81, with higher scores indicating greater satisfaction, and scores lower than 51.5 indicating clinical levels of relationship distress. Within the full sample, 85.6% of participants reported their initial relationship satisfaction as falling within the distressed range. For the present study, Cronbach's alpha was .96.

Communication.—The Communication Patterns Questionnaire—Short Form (CPQ-SF; Christensen & Heavey, 1990) was used to measure participants' perceived frequency of communication patterns during conflict. Questions were grouped into two subscales: positive communication (alpha = 0.76) and negative communication (alpha = 0.72). The positive subscale consisted of 3 items; an example item is "Both members express their feelings to each other". The negative subscale contained 4 items; an example item is "Both members threaten each other with negative consequences".

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Emotional intimacy.—The Emotional Intimacy subscale of the Personal Assessment of Intimacy in Relationships (PAIR; Schaefer & Olson, 1981) was used to measure one's perceived emotional connection with their partner. Individuals were asked to indicate how well each of six statements described their relationship on a 5-point Likert scale ranging from 1 (Does not describe me/my relationship at all) to 5 (Describes me/my relationship very well), with higher scores indicating greater commitment. Sample items include "My partner listens to me when I need someone to talk to," and "My partner can really understand my hurts and joys." Internal consistency for the present study was .96.

Self-protective orientation.—Four high-loading items from a measure of self-goals (Crocker & Canevello, 2008) were used to assess how self-protective participants were of their emotions with their partners over the past week. Sample questions included: "In the past week, how much did you want or try to avoid showing your weaknesses?" and "In the past week, how much did you want or try to avoid showing your partner emotions that made you feel vulnerable?" Questions were measured using a 5-point Likert scale ranging with higher scores indicating more self-protection. Internal consistency for the present sample was 0.85.

Relationship problem severity.—A single-item measure was used to assess the impact of the biggest relationship problem on one's life. Individuals were asked to rate how big of a problem their issue was for them on a 7-point Likert scale ranging from 1 (Not a problem) to 7 (Extreme problem).

Relationship problem confidence.—Relationship problem confidence was assessed with a single-item measure; participants rated how confident they were in handling the conflicts around their biggest relationship problem on a 7-point Likert scale from 1 (not at all confident) to 7 (extremely confident).

Relationship problem acceptance.—Participants were asked to rate their level of acceptance of the frequency with which their biggest relationship problem occurred during the past week. The single-item measure was based on the Frequency and Acceptability of Partner Behavior Inventory (FAPBI; Doss & Christensen, 2006). If the problem did not occur over the past week, individuals were asked to rate how acceptable it was that it had not occurred over the past week. Acceptance was measured using a 10-item Likert scale ranging from 0 (Totally unacceptable) to 9 (Totally acceptable). Consistent with previous analyses using this item (Doss et al., 2005), a residual value for acceptance was calculated (controlling for the frequency of the relationship problem) and the residual value used in all analyses.

Analyses

Missing data.—For the pretreatment to post treatment analyses, data was missing at 7.9% of the time points (8.9% in the intervention condition and 6.0% in the control condition). Missing data was not related to condition ($p = .882$) nor relationship satisfaction ($p > .15$). Please see Doss and colleagues (2016) for more information on missing data during the intervention. For the follow-up assessments, 25% of data at the 3-month follow-up and 21%

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of data at the 12-month follow-up was missing. Missing data at follow-up was not significantly related to relationship status at follow-up, amount of change during the intervention, or demographic factors (e.g. education, ethnicity, or race)[1]. Missing data were handled using Full-Information Maximum Likelihood (FIML) in Mplus. FIML has been demonstrated to yield unbiased estimates of parameters and standard errors under conditions where data are missing at random (MAR; Enders & Bandalos, 2001).

Model building.—Latent growth curve analyses were conducted using Mplus. First, we tested a series of univariate linear growth curves to examine treatment effects on the primary dependent variable (relationship satisfaction), as well as all putative mechanisms. Next, we conducted a series of multilevel, bivariate latent growth curve analyses to test theoretical treatment mechanisms. Specifically, in each model, one mechanism was entered into a bivariate growth curve along with relationship satisfaction, allowing us to test the indirect effect of treatment on changes in relationship satisfaction via changes in the mechanism of interest (see Figure 1). For all models, model fit was evaluated according to the following criteria (Kline, 2015): χ^2 $p > .05$, root mean square error of approximation (RMSEA) < .06, comparative fit index (CFI) > .95, and standardized root mean square residual (SRMR) < .08. Finally, all mechanisms that had a significant indirect effect on relationship satisfaction in the bivaritate models were combined into a multivariate model.

Model estimation.—Analytic methods modeled random intercepts and slopes while also accounting for dependency in the data (i.e., time points nested within individuals, who were nested within couples). We specified the analysis type as *COMPLEX RANDOM*, where *Complex* computes standard errors accounting for non-independence of observations and *RANDOM* achieves modeling of random intercepts and slopes. Given that the intervention was expected to have couple-level effects, we were not interested in explaining differences in between- versus within-couple effects (similar conceptually to a common fate growth modeling approach; Ledermann & Macho, 2014). Consequently, Mplus's *COMPLEX* analysis type was selected in lieu of *TWOLEVEL* type modeling, as this accounts for dependency without the computational load of modeling within and between level effects separately.

Results

For all growth models assessing change during the treatment period, model fit statistics are reported in supplementary materials, and all parameter estimates are contained in Table 2. Effect sizes were calculated by dividing the product of average weeks elapsed and the slope coefficient at post by the baseline standard deviation of the outcome. Indirect effect sizes were calculated using both the predictor and outcome standard deviations according to guidelines presented by Preacher and Kelley (2011).

[1]Missing data was related to program completion. However, as results were not notably different with and without centered program completion entered as a control variable, an anonymous reviewer suggested omitting it from our final analyses. Results controlling for program completion are available from the authors.

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Univariate Growth Models

Relationship satisfaction.—The best-fitting univariate model for relationship satisfaction included a linear trend as its highest order term and exhibited good fit to the data. Replicating prior analyses of these same data, couples in the treatment group reported greater increases in relationship satisfaction over time than the control group ($b = .304$, $SE = .045$, $p < .001$).

Target problem-focused mechanisms.—Results indicated that compared to the control group, couples in the treatment group exhibited greater increases over time in relationship problem confidence ($b = .221$, $SE = .028$, $p < .001$). Couples in the treatment group also reported a greater decrease in relationship problem severity ($b = -.070$, $SE = .018$, $p < .001$) and residualized acceptance ($b = -.096$, $SE = .036$, $p = .008$) over time.

Communication-focused mechanisms.—Couples in the intervention group endorsed greater increases in positive communication ($b = .123$, $SE = .057$, $p = .031$) and greater decreases in negative communication ($b = -.468$, $SE = .098$, $p < .001$) compared to those in the control condition.

Emotion-focused mechanisms.—Compared to couples in the control group, couples in the intervention group reported a significantly greater increase in emotional intimacy ($b = .238$, $SE = .057$, $p < .001$) and decrease in self-protective orientation ($b = -.125$, $SE = .048$, $p = .009$).

Bivariate Growth Models

Target problem-focused mechanisms.—When the relationship satisfaction and relationship target problem confidence growth curves were combined in the same model, there was a significant association between the slopes of these two variables across the entire sample of couples ($b = 2.231$, $SE = .248$, $p < .001$). Moreover, we observed evidence of an indirect effect of the intervention on changes in relationship satisfaction during treatment via changes in relationship target problem confidence ($b_{IND} = .506$, $SE = .086$, $p < .001$). Notably, when relationship target problem confidence was added into the model with relationship satisfaction, the direct association between treatment and changes in relationship satisfaction became significant in the opposite direction ($b = -.199$, $SE = .049$, $p = .013$), supporting evidence for a total indirect pathway.

Turning to the bivariate model of relationship target problem severity and relationship satisfaction, we observed a significant relation between the slopes of these variables ($b = -1.193$, $SE = .311$, $p < .001$). There was a significant indirect association between the intervention and increases in relationship satisfaction via decreases in relationship target problem severity ($b_{IND} = .084$, $SE = .010$, $p = .010$). In this model, the direct effect of treatment on changes in relationship satisfaction remained significant ($b = .199$, $SE = .049$, $p < .001$), indicating that the indirect effect of treatment via relationship target problem severity was partial in nature.

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In contrast, when the relationship satisfaction and target problem acceptance growth curves were combined into the same model, we found no association between the slopes of target problem acceptance and relationship satisfaction over time ($b = -.074$, $SE = .271$, $p = .784$). As a result, we did not observe an indirect effect of treatment on changes in relationship satisfaction via changes in relationship problem acceptance ($b_{IND} = .007$, $SE = .025$, $p = .789$).

Communication-focused mechanisms.—Across the entire sample, couples who experienced increases in positive communication over time were more likely to report corresponding increases in relationship satisfaction ($b = 1.100$, $SE = .354$, $p = .002$). However, the indirect effect of treatment on changes in relationship satisfaction via changes in positive communication did not reach significance ($b_{IND} = .135$, $SE = .083$, $p = .104$).

In the model combining the growth curves of negative communication and relationship satisfaction, there was a significant association between the slopes of these two variables during treatment ($b = -.473$, $SE = .171$, $p = .006$). Additionally, greater increases in relationship satisfaction in the treatment group were indirectly explained by decreases in negative communication ($b_{IND} = .222$, $SE = .098$, $p = .024$). When the negative communication growth trajectory was added into the model with relationship satisfaction, the direct relationship between treatment and changes relationship satisfaction over time became non-significant ($b = .082$, $SE = .095$, $p = .388$), indicating a complete indirect pathway.

Emotion-focused mechanisms.—Increases in emotional intimacy were linked with increases in relationship satisfaction over the course of treatment ($b = 1.433$, $SE = .274$, $p < .001$). There was an indirect effect of treatment on relationship satisfaction via increases in emotional intimacy ($b_{IND} = .335$, $SE = .111$, $p = .003$), suggesting evidence for the mechanistic action of this intermediary treatment target. Moreover, the effect of the intervention on changes in relationship satisfaction became nonsignificant when the growth trajectory of emotional intimacy was added into the model ($b = -.032$, $SE = .100$, $p = .748$), again supporting evidence of a total indirect effect.

Finally, decreases in self-protective orientation predicted increases in relationship satisfaction over time ($b = -1.509$, $SE = .575$, $p = .009$). We observed a nonsignificant indirect effect of the intervention on increases in relationship satisfaction over time via decreases in self-protective orientation ($b_{IND} = .189$, $SE = .104$, $p = .070$).

Multivariate Growth Model

Previously significant mechanisms were combined into a multivariate growth model in order to test the relative strength of the mechanisms while controlling for the others. The multivariate growth model had adequate fit [$\chi^2(176) = 575.664$, $p < .001$; CFI = 0.938; RMSEA = 0.062; SRMR = 0.065]. When all four previously-significant indirect effects were added to the model simultaneously, target problem severity uniquely remained significant (b = 0.063, SE = 0.026, $p = 0.017$) in the presence of indirect effects for target problem confidence (b = 0.021, SE = 0.166 $p = .901$), negative communication (b = 0.001, SE = 0.005, $p = .866$), and emotional intimacy (b = −0.084, SE = 0.141, $p = .551$).

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Follow-Up Analyses

Analyses were conducted to determine whether change in putative mechanisms during treatment predicted changes in relationship satisfaction during the follow-up period (above and beyond associations with changes in, and post-treatment levels of, satisfaction tested above). These analyses sought to examine the possibility that the putative mechanisms might have a "delayed" association with satisfaction that was not evident during or at the end of treatment.

Prior to testing bivariate models, we examined a univariate piecewise growth model of relationship satisfaction during follow-up for the treatment group only. This model exhibited good fit to the data, $\chi^2(18) = 36.362$, $p = .006$; RMSEA = .058; CFI = .982; SRMR = .030. As previously reported, results from this model suggested that relationship satisfaction significantly increased during treatment in the intervention group ($b = .460$, $SE = .035$, $p < .001$). In addition, the model indicated that relationship satisfaction did not significantly change during the follow-up period ($b = .007$, $SE = .007$, $p = .336$). However, there was significant variability in change during follow-up ($\sigma^2 = .004$, $SE = .001$, $p < .001$), permitting prediction of this variance.

We next examined multivariate piecewise latent growth models including relationship satisfaction during both treatment and follow-up, and the putative mechanistic variable during treatment. To test associations between early changes in the mechanistic variables and changes in relationship satisfaction during follow-up, each model simultaneously included paths predicting slopes of satisfaction during treatment and the level of satisfaction at the end of treatment. For all growth models assessing change during the follow-up period, model fit statistics are reported in supplementary materials, and parameter estimates are contained in Table 3.

Target problem-focused mechanisms.—We found no significant associations between changes in relationship satisfaction during the follow-up period and either pre-post changes in, or post-treatment levels of, relationship target problem severity, confidence, or acceptance (Table 3).

Communication-focused mechanisms.—For couples in the treatment group, decreases in negative communication during the treatment period significantly predicted greater maintenance of relationship satisfaction during follow-up ($b = -.057$, $SE = .025$, $p = .025$), controlling for the effect of changes in negative communication on changes in relationship satisfaction during the treatment period ($b = -.259$, $SE = .049$, $p < .001$). In addition, couples reporting lower levels of negative communication at treatment termination endorsed greater maintenance of relationship satisfaction in follow-up ($b = -.002$, $SE = .001$, $p = .026$). Relatedly, couples reporting increases in positive communication during the treatment period endorsed significantly greater maintenance of relationship satisfaction during follow-up ($b = .132$, $SE = .052$, $p = .010$), controlling for the effect of changes in positive communication on changes in relationship satisfaction during the treatment period ($b = .120$, $SE = .021$, $p < .001$).

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Emotion-focused mechanisms.—Couples in the treatment group who reported greater decreases in self-protective orientation over the course of treatment endorsed significantly greater levels of relationship satisfaction at treatment termination ($b = -4.311$, $SE = 1.660$, $p = .009$). However, there were no significant associations between changes in relationship satisfaction during the follow-up period and either changes in, or post-treatment levels of, emotional intimacy or self-protective orientation.

Discussion

Mechanisms of Initial Treatment Effects

Similar to previous work on couple therapy (Doss et al., 2005; Doss et al., 2015), negative communication, emotional intimacy, and target problem severity were found to be important mechanisms of immediate change in the online, self-help relationship program. Specifically, we found that greater increases in relationship satisfaction during the intervention were indirectly explained by decreases in negative communication and target problem severity as well as increases in emotional intimacy. Furthermore, the introduction of negative communication and emotional intimacy into their respective models caused the relationship between treatment and the outcome to become non-significant, indicating that the indirect effect fully explained the direct association. Additionally, relationship target problem severity, which has mixed results as to its roll a mechanism of change in previous research (Doss et al., 2005; Doss et al., 2015; Hawrilenko et al., 2016), alone remained significant in the presence of other mechanisms in the multivariate model. Finally, this is the first study to our knowledge to test perceived confidence in addressing the target relationship problem as a mechanism of change. Results here demonstrated a total indirect effect, suggesting it as a potential for further study.

Consistent with the current results, improvements in emotional intimacy have previously been connected to positive treatment outcomes (Dalgleish et al., 2015; Hawrilenko et al., 2016; Doss et al., 2015). The OurRelationship program allows couples to share how emotions, differences, stressors, and patterns of communication contribute to the identified relationship problem. It is likely that through this facilitated sharing, couples experience and increase in intimacy and feelings of closeness with their partner.

Unlike previous research (Doss et al., 2005; Hawrilenko et al., 2016), improvements in acceptance were not a significant mechanism of changes in relationship satisfaction during treatment. In retrospect, there may be two primary reasons for these unexpected findings. First, the OurRelationship program unexpectedly significantly decreased acceptance (after controlling for frequency of behavior change). It has been previously noted that one of the key acceptance-inducing interventions was omitted in the creation of the online intervention (Doss et al., 2013). The OurRelationship program relies solely on unified detachment to create cognitive distance from the problem; in contrast, IBCT also includes a focus on empathic joining. The omission of empathic joining, combined with an increased focus on solving a specific relationship program, could reduce the program's effectiveness in making problems that do not improve more acceptable. Second, the OurRelationship program is structured to help couples work on a target problem which they are encouraged to define as specifically and behaviorally as possible. Broad target problems caused by immutable

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differences between partners (e.g., personality) or external circumstances not under the couples' control are explicitly excluded. Therefore, the target problems on which couples focus are more amendable to change, decreasing the need for acceptance in the program. This hypothesis would seem to be supported by the fact that changes in acceptance were unrelated to changes in satisfaction.

Finally, although the slopes of positive communication and relationship satisfaction during treatment were related in the present study, the indirect effect failed to reach significance. This result is inconsistent with previous work examining the mechanisms of in-person IBCT (Doss et al., 2005). Additionally, the current study failed to provide support for self-protective orientation as a mechanism of couple interventions; in contrast, a similar construct was previously shown to be a significant mechanism of gains in satisfaction in a brief, in-person couple intervention (Hawrilenko et al., 2016).

When all previously-significant mechanisms were combined into the multivariate model, target problem severity remained the sole predictor of change in relationship satisfaction. As the majority of the program content is focused on the target problem, these results are intuitive. However, we believe the other mechanisms identified in the bivariate models are important to fully understand the mechanisms of the OurRelationship program for three reasons. First, the effect sizes for all significant mechanisms in the bivariate models were within the large range according to Cohen's guidelines. Second, shared variance of changes in negative communication and emotional intimacy was excluded when both were added in the combined model. It may be that the shared improvements in those domains – rather than the independent improvements – drive improvements in satisfaction. Finally, it may be possible that a double mediation pathway can explain this pattern of findings, such that the program creates changes in the intermediary constructs (emotional intimacy, negative communication) and that these changes create subsequent changes in target problem severity. If so, that pattern would indicate that targeting improvements in intimacy and communication would continue to be important as they would be the mechanism through which the OurRelationship program decreases problem severity.

Mechanisms of Maintenance

In contrast to the results for mechanisms of immediate gains, slopes of the mechanisms during treatment did not generally predict maintenance of relationship satisfaction over follow-up (after controlling for immediate associations during the intervention). However, there were two notable exceptions. Specifically, the slopes of positive and negative communication during the intervention were significantly related to maintenance of satisfaction over follow-up.

Post-treatment levels of the mechanisms - with the exception of negative communication- did not generally predict slope of maintenance over follow-up. This general pattern of null findings suggests that there is not a critical level of the mechanisms couples must reach by the end of treatment in order to experience lasting benefits from the brief online intervention. Although findings from treatment-as-usual couple therapy within the VA indicated that post-treatment levels of satisfaction were related to changes in satisfaction over follow-up (Doss

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et al., 2011), that is conceptually distinct from evidence that a certain level of a mechanism is required for maintenance of gains in satisfaction.

So why were post-treatment levels of negative communication – as well as improvements in both positive and negative communication during the intervention – significant predictors of maintenance of satisfaction gains? It may be that improvements in communication help couples better navigate additional problems following the intervention – above and beyond the immediate effects that improvements in communication may have had on pre-post changes in relationship satisfaction. Indeed, reductions in negative communication during preventative interventions have generally been found to enhance long-term effects of those interventions (e.g., Baucom et al., 2006; Stanley et al., 2007; however, see Bodenmann et al., 2008). While the literature on associations of pre-post increases in observed positive communication is more mixed, improvements in self-reported positive communication – like that used here – seem to more consistently predict superior long-term outcomes (Barton et al., 2017; Bodenmann et al., 2008). As a result, especially given that techniques to improve communication have an established history in the relationship intervention field, improvements in communication may be an especially attractive target for intervention. In contrast, the other putative mechanisms examined in this study – which focused on change specific to a targeted relationship problem or emotional intimacy / vulnerability – may have had exclusively immediate effects on improvements in relationship satisfaction.

Limitations & Future Directions

Although there are notable strengths in this work, there are several limitations which must be considered. First, because the mechanisms and outcomes during the intervention period were measured simultaneously, this study does not permit statements of temporal precedence which are considered necessary for determinations of mediation (vs. mechanisms). Second, all measures in this study were self-report measures; more objective measures of these constructs would increase the strength of these results. Third, the control group was not followed through follow-up, precluding between-group comparisons of maintenance.

Continued research in the area of mechanisms of online couple-focused treatment is needed. First, we must consider how to further differentiate mechanisms of treatment versus outcomes of that treatment and consider how results may differ with outcomes other than satisfaction (e.g., relationship stability). One way to overcome this ‘glop problem’ is to measure the mechanisms more frequently during treatment so that changes in mechanisms can be assessed before those changes create improvements in broader relationship functioning. A second approach to further differentiate mechanisms from outcomes is to assess domains of individual functioning rather than relationship functioning. For example, it is possible that individuals change first in domains of emotion regulation, distress tolerance, or negative urgency and that these changes in turn impact relationship functioning. Third, researchers should continue to explore other mechanisms of maintenance following interventions for distressed couples. While communication predicted maintenance in this study, research should continue to explore how experiential communication versus communication skills impact long-term gains. Fourth, research should explore to what extent individual characteristics such as age, years married, same-sex relationships, or presence of

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violence or infidelity might moderate the role of some of these mechanisms. Fifth, given that the average couple is successfully able to maintain their initial gains, it may be that the remaining variability in relationship satisfaction is driven by unexpected life events, changes in individual functioning, or other domains unrelated to those focused on during the program. Therefore, increased focus on couples' individual and dyadic coping abilities may be important mechanisms to explore (Bodenmann et al., 2008; Mitchell et al., 2015). Finally, more work is needed to understand the ideal sequencing of change processes, including double mediation models, as well as which combinations of mechanisms are additive.

Conclusion

This study confirmed several well-known mechanisms of in-person couple therapy as mechanisms of an online self-help program for relationship distress. Specifically, negative communication, emotional intimacy, and target problem severity and confidence were mechanisms of improvements in relationship satisfaction during treatment. When all of the significant mechanisms were included in a single model, target problem severity remained the sole significant mechanism. Furthermore, couples' initial gains in satisfaction were maintained in the year following the intervention to the extent that couples experienced improvements in positive and negative communication during the intervention.

Elucidation of these mechanisms is promising in that it helps us understand how the program is creating its gains. Notably, however, these results are somewhat at odds with the theoretical model of IBCT – the therapy on which the OurRelationship program is built – especially a significant, negative treatment effect on target problem acceptance. It may be that the increased focus on specific, targeted relationship problem amenable to change decreases the need for acceptance and increases the need for behavioral and communication change. Alternately, the program may be operating through additional mechanisms consistent with IBCT's theoretical framework but not included here (e.g. creating a mutual, non-blaming understanding of relationship problems). Thus, while this study advances our knowledge of the mechanisms of web-based interventions, it also highlights the need for further research on these mechanisms and invites investigations on how additional mechanisms could be targeted through different intervention content.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This research was supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health under award R01HD059802. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. We would like to thank Judith N. Biesen, Krystal Cashen, and Shannon McAllister who served as Project Coordinators for this study.

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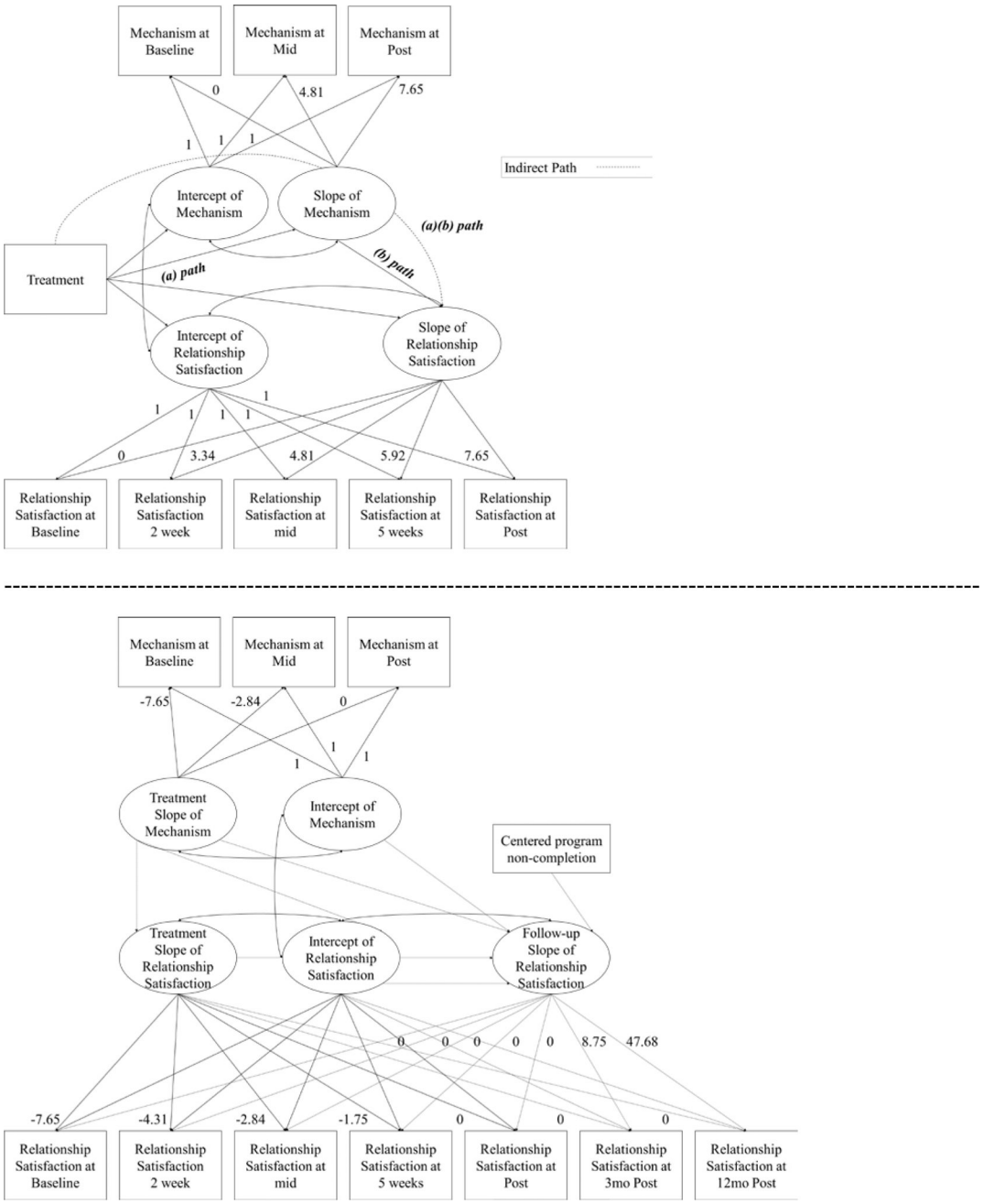

Figure 1:

Example bivariate growth curves

Note: The top model describes the pre to post treatment analyses. The bottom model describes the analyses over follow-up. To simplify the follow-up model, the loadings onto the intercept of relationship satisfaction were omitted; however, all were set to 1.

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Table 1.

Means and Standard Deviations of Outcome and Mechanisms by Gender, Condition, and Assessment Point

	Waitlist control group			*Intervention Group*		
	Screener/Pre	**Mid**	**Post**	**Screener/Pre**	**Mid**	**Post**
Relationship Satisfaction						
Men	9.41 (4.20)	10.41 (4.24)	10.50 (4.81)	9.11 (3.89)	11.29 (4.31)	12.88 (4.18)
Women	7.44 (4.31)	8.70 (4.82)	8.53 (4.84)	7.63 (3.93)	9.97 (4.36)	11.28 (4.66)
Negative Communication						
Men	25.89 (11.24)		22.47 (10.77)	24.14 (9.33)	20.49 (8.83)	18.02 (8.38)
Women	29.32 (11.14)		26.84 (11.27)	28.28 (10.76)	23.58 (9.69)	20.19 (9.73)
Positive Communication						
Men	13.65 (5.15)		13.97 (5.53)	13.60 (4.47)	13.03 (5.23)	15.11 (5.50)
Women	11.93 (5.75)		12.25 (5.73)	12.18 (4.87)	12.23 (4.73)	14.26 (5.36)
Emotional Intimacy						
Men	16.73 (4.45)		17.29 (4.67)	16.29 (4.34)	16.66 (4.23)	19.23 (4.38)
Women	15.21 (4.38)		16.35 (4.86)	13.71 (3.95)	15.59 (3.88)	18.63 (4.21)
Self-protective orientation						
Men	11.15 (4.22)	9.98 (4.17)	10.22 (4.36)	10.53 (4.03)	10.59 (3.65)	8.87 (3.94)
Women	11.65 (4.06)	11.22 (3.91)	10.90 (4.34)	11.09 (4.14)	10.11 (3.62)	8.55 (3.77)
Relationship Problem Acceptance (residualized)						
Men	−0.49 (2.23)	−0.29 (2.71)	0.38 (2.80)	−0.26 (1.89)	−0.11 (2.92)	−0.72 (2.92)
Women	0.44 (1.71)	0.14 (2.51)	0.64 (2.59)	0.30 (1.87)	0.24 (2.58)	−0.31 (2.70)
Relationship Problem Impact						
Men	5.25 (1.38)	4.23 (1.47)	4.35 (1.51)	5.21 (1.24)	4.46 (1.33)	3.60 (1.45)
Women	6.04 (1.01)	4.82 (1.37)	5.21 (1.32)	5.76 (1.16)	4.88 (1.29)	3.93 (1.51)
Relationship Problem Confidence						
Men	4.09 (2.06)	4.45 (1.82)	4.30 (2.06)	4.21 (1.89)	5.36 (1.59)	5.91 (1.09)
Women	3.42 (2.01)	3.63 (2.00)	3.85 (2.05)	3.38 (1.92)	4.97 (1.56)	5.42 (1.49)

Note: All mechanisms were measured either at screener or pretreatment. Relationship satisfaction was measured both at screener and pretreatment. Due to the close timing of measurements, they were averaged and used as baseline in all models, presented here. Relationship problem acceptance was residualized on problem frequency. Residualized scores are reported here and used in all models.

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Table 2.

Results of univariate, bivariate, and multivariate growth curve models of changes in primary study variables

Variable	Univariate Model Results: *b* (*SE*)		Bivariate Model Results: *b* (*SE*)							
			Treatment → mech. slope		Treatment → CSI slope		Mech. slope → CSI slope		Indirect effect of treatment	
	Average slope	Treatment effect on slope	(a)	Cohen's *d*	(c')	Cohen's *d*	(b)	Cohen's *d*	(a*b)	Cohen's *d*
Relationship satisfaction	.437*** (.075)	.304*** (.045)	X	X	X	X	X	X	X	X
Target problem acceptance	0.054* (.024)	−.096** (.036)	−.089* (.037)	−0.346	.291*** (.057)	0.568	−.074 (.271)	−0.144	.007 (.025)	0.007
Target problem confidence	.056* (.025)	.211*** (.028)	.227*** (.028)	0.867	−.199* (.080)	−0.388	2.231*** (.248)	4.355	.506*** (.086)	0.494
Target problem severity	−.137*** (.012)	−.070*** (.018)	−.070*** (.018)	−0.428	.199*** (.049)	0.388	−1.193*** (.311)	−2.329	.084* (.010)	0.082
Emotional intimacy	.499*** (.070)	.238*** (.057)	.234*** (.056)	0.393	−.032 (.100)	−0.062	1.433*** (.274)	2.797	.335** (.111)	0.327
Self-protective orientation	−.110*** (.031)	−.125** (.048)	−.125** (.048)	−0.232	.116 (.107)	0.226	−1.509** (.575)	−2.946	.189† (.104)	0.185
Negative communication	−.347*** (.060)	−.468*** (.098)	−.469*** (.098)	−0.332	.082 (.095)	0.160	−.473** (.171)	−0.923	.222* (.098)	0.217
Positive communication	.030 (.039)	.123* (.057)	.122* (.057)	0.180	.170* (.079)	0.332	1.100** (.354)	2.147	.135 (.083)	0.132
			Multivariate Model Results							
Target problem severity	-	-	−.069*** (.018)	−0.422			−.916** (.284)	−1.880	0.063* (0.026)	0.065
Target problem confidence	-	-	.219*** (.027)	0.837	−.101 (.129)	−0.207	.094 (.756)	0.193	0.021 (0.166)	0.022
Emotional intimacy	-	-	−.050 (.082)	−0.084			1.658*** (.488)	3.402	−0.084 (0.141)	−0.086
Negative communication	-	-	.076 (.132)	0.057			.012 (.059)	0.025	0.001 (0.005)	0.001

Note:

† $p < .10$,

* $p < .05$,

** $p < .01$,

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Mech. = mechanistic variable. CSI = relationship satisfaction. N = 600 individuals.

*** $p < .001$.

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Table 3.

Results of bivariate growth curve models of changes in primary study variables during follow-up period.

Mechanistic Variable	CSI FU Slope	Mech. Slope	Mech. Intercept → CSI FU Slope	Mech. Slope → CSI FU Slope	Mech. Slope → CSI TX Slope	Mech. Slope → CSI Int.	CSI TX Slope → CSI FU Slope	CSI Int. → CSI FU Slope
Target problem acceptance	.005 (.007)	−.035 (.028)	.000 (.006)	−.028 (.050)	−.030 * (.015)	.099 † (.053)	.010 *** (.003)	.015 (.021)
Target problem confidence	.184 (1.168)	.268 *** (.028)	−.037 (.290)	−.200 (1.162)	.041 *** (.009)	.323 † (.169)	.011 (.055)	.008 (.070)
Target problem severity	.024 (.045)	−.386 *** (.034)	−.005 (.007)	.002 (.070)	−1.575 *** (.306)	.042 (.032)	.002 (.003)	−.031 (.027)
Emotional intimacy	−.146 (.285)	.984 *** (.098)	−.001 (.015)	.363 (.308)	.109 *** (.021)	−.575 (.685)	−.686 (.624)	.011 (.007)
Self-protective orientation	.061 (.054)	−.569 *** (.093)	−.006 † (.004)	−.086 (.058)	−0.093 *** (.017)	−4.311 ** (1.660)	−.022 (.077)	−.003 (.002)
Negative communication	.035 (.040)	−1.623 *** (.223)	−.002 * (.001)	−.057 * (.025)	−.259 *** (.049)	−1.146 † (.597)	−.144 (.094)	−.001 (.002)
Positive communication	−.058 (.046)	1.078 *** (.169)	−.003 (.003)	.132 * (.052)	.120 *** (.021)	3.343 † (1.827)	−.103 (.075)	.001 (.002)

Note:

$^{\dagger}p < .10$,

$^{*}p < .05$,

$^{**}p < .01$,

$^{***}p < .001$.

Mech. = mechanistic variable. CSI = relationship satisfaction. TX = Treatment. FU = follow-up. Int. = post-treatment intercept. N = 302 individuals. Additional paths (e.g., mechanism intercept and CSI intercept; CSI treatment slope and CSI intercept) were included in the models; for ease of interpretation, only results for paths most relevant to primary study hypotheses are reported.