



Maladaptive Self-Beliefs During Cognitive Behavioural Therapy for Social Anxiety Disorder: A Test of Temporal Precedence

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Abstract

Given the putative importance of maladaptive self-beliefs in cognitive models of social anxiety, there is growing interest in the construct's influence on social anxiety reduction in treatment. The present study sought to examine whether maladaptive self-beliefs reduce over a 12-week course of cognitive behavioural therapy (CBT) for social anxiety disorder (SAD), and whether change in self-beliefs is an indicator of later change in social anxiety symptom severity within treatment. Participants were 77 individuals with SAD who completed measures of maladaptive self-beliefs every 2 weeks of the treatment protocol and measures of social anxiety each week. Using a dynamic bivariate latent difference score framework, results indicated that maladaptive self-beliefs reduced during CBT for SAD, and that change in maladaptive self-beliefs was a significant predictor of later change in social anxiety symptom severity. Reductions in social anxiety was not a significant predictor of later change in self-beliefs. Findings underscore the importance of maladaptive self-beliefs in the maintenance of social anxiety and in treatment for SAD. Moreover, they permit inferences about the temporal sequence of change processes in therapy and are consistent with CBT therapeutic models suggesting that cognitive change precedes symptom change.

Keywords Self-beliefs · Social anxiety disorder · CBT · Mechanisms of change · Latent difference score

Introduction

Social anxiety disorder (SAD) is a prevalent, complex, and disabling disorder that, if left untreated, runs a chronic course (Crome and Baillie 2015; Stein and Stein 2008; Wong et al. 2014). Individuals with SAD show impairments in financial and employment stability, academic performance, and general mental health (Ruscio et al. 2008). These difficulties are often compounded by a high degree of comorbidity with other mental health diagnoses, such as alcohol abuse and depression (for a review, see Szafranski et al. 2014). Recent meta-analytic evidence suggests that cognitive-behaviour therapy (CBT) is an efficacious treatment for SAD that compares favourably with other psychological and pharmacological interventions (e.g., Mayo-Wilson et al. 2014). Despite the efficacy of CBT for SAD, however, many

patients with the disorder remain symptomatic following treatment intervention (e.g., 59%; Rapee et al. 2009). More research is therefore needed to identify the processes and mechanisms that contribute to symptom change in treatment (Kazdin 2007).

Prominent cognitive-behavioural models of SAD emphasise the importance of maladaptive beliefs relating to the self and others' evaluations in the aetiology and maintenance of the disorder (Clark and Wells 1995; Heimberg et al. 2010; Hofmann 2007; Moscovitch 2009; for a review, see; Gregory et al. 2016; however, see; Nordahl and Wells 2017). For example, Clark and Wells (1995) assert that socially anxious individuals experience excessively high standard beliefs for social performance, conditional beliefs concerning social evaluation, and unconditional beliefs about the self, which maintain social anxiety by inducing perceptions of social danger. A consistent finding in the literature is that individuals with social anxiety report having a negative self-view that is comprised of maladaptive thoughts and beliefs about the self and others (Gregory and Peters 2017b; Hope et al. 2010; Moscovitch et al. 2013; Rapee and Abbott 2006; Rapee and Lim 1992; Stopa and Clark 1993). They also tend to hold negative unconditional beliefs about the self (e.g.,

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“I am boring”; Wong et al. 2017; Wong and Moulds 2009, 2011), and report a wide range of maladaptive schemas, most of which relate to the perception of the self as a failure, socially defective, socially undesirable, and socially isolated (Calvete et al. 2015; Gonzalez-Diez et al. 2015; Pinto-Gouveia et al. 2006).

Given the putative importance of maladaptive beliefs in SAD, there is growing interest in the construct’s influence on social anxiety reduction in treatment. Cognitive models of anxiety imply that symptom reduction should be associated with, and preceded by, the weakening or modification of negative self-schemas (Beck 1967; Clark and Beck 1999). Indeed, “the concept of therapeutic change occurring through mediation or modification of negative cognitive schemas has traditionally underpinned the clinical cognitive model” (Casey et al. 2005, p. 196). The same general principle has been assumed to explain reductions of social anxiety symptoms during treatment, as change in negative self-perception has been argued to be closely associated with treatment progress (Hofmann 2007). As a result, a core component of cognitive treatment is training patients to restructure their negative self-related cognitions (e.g., Rapee et al. 2009). This is often achieved via the systematic collection and rational disputation of evidence for and against maladaptive thoughts and beliefs (e.g., identified through downward arrow techniques), and through the development of action plans to counter them (Rapee et al. 2009).

Despite the prominence of self-related beliefs in cognitive models of social anxiety and treatment for SAD, the field is lacking studies demonstrating whether change in enduring maladaptive beliefs act as mediators or predictors of treatment response. Given that most studies examining within-session change have typically assessed other theorized cognitive constructs and processes in the treatment of SAD (Brozovich et al. 2015; Goldin et al. 2014; Gregory et al. 2015; Mörtberg et al. 2015; Niles et al. 2014; Smits et al. 2006), studying enduring deeper level beliefs theorized in cognitive models (e.g., Clark and Wells 1995) is indicated. For example, a recent study by Goldin et al. (2014) found that weekly cognitive reappraisal success (i.e., an individual’s belief about their own *ability* to reframe their thoughts to regulate their emotions) predicted subsequent decreases in social anxiety symptom severity over a 16-week course of individual CBT for SAD. The inverse relationship was not found to be significant. Such a finding indicates that CBT may alter client’s beliefs as well as actual success in implementing reappraisal to reduce social anxiety during treatment.

Of the few studies that have examined within-session change in enduring maladaptive self-beliefs, most have employed a two-wave methodological design and shown that CBT significantly reduces self-beliefs from pre- to post-treatment (Boden et al. 2012; Bögels et al. 2014; Koerner

et al. 2012; Rapee et al. 2009; Wilson and Rapee 2005; Wong et al. 2017), which tends to also be associated with treatment outcome (for a review, see Gregory and Peters 2017a). However, a two-wave design does not allow for an adequate evaluation of mechanisms of action or therapeutic change in treatment (Kazdin and Nock 2003). As a result, most studies leave open the possibility that reductions in self-beliefs are a consequence of treatment gains (i.e., symptom reduction), rather than a contributor to such gains (Teachman et al. 2008).

The possibility that change in maladaptive self-beliefs is an epiphenomenon of social anxiety, and not meaningfully related to symptom reduction, needs to be further addressed. From a clinical perspective, doing so would help improve current understanding of CBT for SAD, and may suggest why therapy occasionally fails and how treatment gains may be improved among partial responders. To establish that a theoretically derived variable serves as a mechanism of change in psychotherapy requires demonstration of a strong association between change in the cognitive and symptom variable, and the demonstration of a temporal relationship between change in cognitions and symptoms that is assessed repeatedly throughout treatment (Kazdin and Nock 2003). To date, most studies have focused on the former of these methodological approaches, with the evaluation of temporality using repeated measures often considered to be the “Achilles heel of treatment studies” (Kazdin and Nock 2003, p. 1121). Indeed, research has yet to include within-session measures of enduring maladaptive beliefs about the self in CBT for SAD and examine temporal precedence with symptoms measures (Gregory and Peters 2017a).

The present study therefore used a repeated measures design to examine whether maladaptive self-beliefs reduce over the course of CBT for SAD, and to understand the temporal sequence of change in self-related beliefs and change in social anxiety over the course of the therapeutic protocol. Our repeated measures approach follows the model used by Teachman et al. (2008), which involved evaluating changes within a treatment group rather than comparing across treatment conditions (see also Barber et al. 2000). Many traditional approaches to mediation models and longitudinal data analysis (e.g., panel models; Cole and Maxwell 2003) focus on interindividual standings across time (i.e., between individuals) rather than on intraindividual variation (i.e., within individuals) and individual differences in this intraindividual variation across time (Selig and Preacher 2009). However, theoretical models of CBT almost universally focus on the importance of idiographic variation when considering hypothesised mechanisms of change (Clark 2001). The present study therefore employed a bivariate latent difference score framework (see McArdle and Hamagami 2001) to investigate within-individual differences in the possible ‘coupling’ of maladaptive self-beliefs and social anxiety;

Table 1 Means and standard deviations for maladaptive self-belief and social anxiety scores

Treatment session	SBSA <i>M</i> (<i>SD</i>)	SP-12 <i>M</i> (<i>SD</i>)
0	84.54 (33.23)	–
1	–	25.04 (10.22)
2	93.02 (30.32)	24.33 (9.60)
3	–	22.01 (9.20)
4	90.52 (31.63)	22.41 (9.88)
5	–	20.73 (9.69)
6	84.11 (27.61)	19.41 (9.10)
7	–	19.07 (9.23)
8	73.33 (27.92)	18.44 (9.43)
9	–	17.30 (8.68)
10	72.01 (27.83)	16.38 (8.09)
11	–	14.83 (8.83)
12	65.08 (28.83)	13.98 (9.01)

SBSA Self-Beliefs Related to Social Anxiety, SP-12 Social Phobia-12, *M* mean, *SD* standard deviation

Treatment sessions: 0=pre-CBT, 1=week 1 of CBT, 2=week 2 of CBT, 3=week 3 of CBT, and so on

specifically, whether change in one univariate process variable predicts later change in the other.

Social anxiety symptoms were measured every week of the 12-week course of CBT for SAD while self-related beliefs were measured at seven time points over the course of the treatment (see Table 1). Self-beliefs were assessed using the Self-Beliefs Related to Social Anxiety Scale (SBSA; Wong and Moulds 2009), which has the advantage of directly mapping onto the three self-belief categories proposed by Clark and Wells (1995): high standard beliefs for social performance, conditional beliefs concerning social evaluation, and unconditional beliefs about the self. While this is a well validated and reliable measure (Wong and Moulds 2009; Wong et al. 2014), this is the first study to use this measure in the context of a full course of treatment for SAD (Gregory and Peters 2017a). Given the aforementioned literature, we expected that both maladaptive self-beliefs and social anxiety would reduce over the course of treatment. We also expected a bidirectional relationship between the two univariate processes, whereby a decrease in maladaptive self-beliefs would both predict, and be predicted by, a decrease in social anxiety symptom severity.

Method

Participants

Clinical participants were 77 (40 female) adults¹ who took part in a manualised treatment trial for SAD at the Centre for Emotional Health (CEH) Clinic, Macquarie University, Sydney, Australia. Inclusion into the trial required a primary diagnosis of SAD assigned following the Anxiety Disorders Interview Schedule–IV (ADIS–IV; Di Nardo et al. 1994) and a Clinician Severity Rating of 4 or above (i.e., there was at least moderate impairment caused by social phobia). Previous research has indicated strong reliability for diagnosis of SAD and clinical severity ratings using these methods in the CEH clinic ($k = 0.86$; $ICC = 0.85$) (Rapee et al. 2009). Participants were excluded if they had active suicidal ideation, unmanaged substance abuse or dependence, co-morbid psychosis, or a recent change (within a 3 month period) in medication type or dosage. Participants had an average age of 33.51 ($SD = 10.48$, range 18–77 years), and most met criteria for the generalised subtype of SAD (97.4%; reported fear ratings of 4 or above for the majority of social situations listed in the Social Phobia module of the ADIS–IV). Around 40.3% met criteria for an additional anxiety disorder and 29.9% met criteria for a mood disorder. Around 48.1% met criteria for avoidant personality disorder, assessed using the avoidant personality disorder section of the International Personality Disorder Examination (Loranger et al. 1997). Further information revealed that 55.8% held a bachelor degree or higher, and 40.3% were employed full-time (13.0% were unemployed and 27.3% were students).

Measures

Social Phobia-12 (SP-12; Peters et al. 2012). The SP-12, otherwise known as the SIAS-6/SPS-6 scale in the literature, is a short-form measure of social anxiety based on nonparametric item response theory analyses conducted on the items of the Social Interaction Anxiety Scale (SIAS; Mattick and Clark 1998) and the Social Phobia Scale (SPS; Mattick and Clark 1998). The SIAS and SPS are companion questionnaires designed to measure feared social situations involving general social interactions with others (the SIAS) and public scrutiny (the SPS). The scale contains 12-items overall, with six items derived from the SIAS and six items derived from the SPS. Thus, the SP-12 captures both social

¹ These participants were part of an ongoing randomised treatment trial for the treatment of SAD at the CEH, all of whom received 12 weeks group CBT following either three individual preparatory sessions of motivational interviewing or three individual preparatory sessions of supportive counselling. Participants in the present study represent 39% of the participants included in the treatment trial.

interaction and performance-based fears. Items are rated on a 5-point Likert-type scale (0 = *not at all characteristic or true of me* to 4 = *extremely characteristic or true of me*), with total scores ranging from 0 to 48. Higher scores indicate greater symptom severity. Scores on the measure correlate strongly and significantly with the SIAS/SPS in clinical samples at pre-treatment, post-treatment, and 3-month follow-up ($r = .79-.90$), and also correlate strongly and significantly with change scores in the SIAS/SPS following treatment ($r = .81-.91$) (Peters et al. 2012). In the present study, internal consistency for the SP-12 was 0.89.

Self-Beliefs Related to Social Anxiety (SBSA; Wong and Moulds 2009). The SBSA is a 15-item questionnaire designed to measure the strength of beliefs about the self in a social context. It includes three subscales that map directly onto the model proposed by Clark and Wells (1995): excessively high standard beliefs ($n = 4$), conditional beliefs concerning social evaluation ($n = 7$), and unconditional beliefs about the self ($n = 4$). Participants rate the extent they agree with each belief on an 11-point Likert-type scale (0 = *do not agree at all* to 10 = *strongly agree*), with total scores ranging from 0 to 150. Higher scores indicate greater endorsement of maladaptive self-beliefs. Scores on the SBSA have demonstrated excellent internal consistency and have good validity in both clinical and nonclinical samples (Wong and Moulds 2009; Wong et al. 2014). In the present study, internal consistency for the SBSA total scale was 0.92.

Treatment

Participants received CBT delivered in small groups (6–8 participants) over 12 weekly two and a half hour sessions. Primary therapists were clinical psychologists or graduate clinical psychology students with specific expertise in the treatment of SAD. In most cases a graduate psychology student acted as a co-therapist. Treatment was guided by a manual for the therapists and was supported by printed materials and handouts for participants. All therapists received weekly clinical supervision across the treatment protocol.

Details about the group treatment manual have been reported previously (see Rapee et al. 2009). Session 1 covered basic psycho-education and was followed by Session 2, which introduced attentional retraining toward the task at hand. Sessions 3 and 4 included identifying and modifying maladaptive cognitive patterns through hypothesis testing and evidence gathering. Sessions 5 and 6 introduced and encouraged ongoing behavioural experiments and in vivo exposure through exposure hierarchies. Sessions 7 and 8 focused on reduction of safety behaviours and subtle avoidance, as well as realistic appraisal and feedback of social performance. Session 9 provided an opportunity to practise integrating previously introduced skills through in vivo exposure. Sessions 10 and 11 included the examination and

refutation of underlying core beliefs. Session 12 involved relapse prevention and revision.

Procedure

The procedures received approval from the Macquarie University Human Research Ethics Committee and all participants gave informed consent. Following assessment of suitability, treatment typically began within the following few weeks upon completion of the diagnostic interview. Participants completed the SP-12 every week of the CBT protocol (i.e., from weeks 1 to 12), while the SBSA was completed by participants at pre-treatment, and at weeks 2, 4, 6, 8, 10, and 12 of the weekly CBT treatment. Both measures were given to participants prior to the commencement of the treatment sessions and were completed using paper and pencil.

Results

Missing Data Analysis

The number of participants attending each of the main assessment sessions were: Session 1 = 77, 4 = 71, 6 = 71, 8 = 61, 10 = 59, 12 = 60. To help address the impact of attrition on the results, we conducted an analysis of incomplete data (Little and Rubin 2002). The total data set included 16,819 data points with 2354 (12.28%) containing missing data. Results from Little's MCAR Test confirmed that missing data points were missing completely at random ($\chi^2 = 2837.36$, $df = 7825$, $p = 1.000$, *n.s.*). As part of this analysis, we also examined variables that might predict patterns of missingness with procedures in Mplus (based on Collins et al. 2001; Enders 2010; Graham 2003). Initial levels of social anxiety severity (using the SP-12), depression severity (using the DASS), and baseline self-belief scores (using the SBSA) were not found to be significant predictors of incomplete data. Similarly, no demographic variable (e.g., age, gender, education level, or employment status) was found to be predictive of incomplete data.

Univariate Latent Growth Curve Modelling

Means and standard deviations for the measures of interest are shown in Table 1. Univariate Latent growth curve modelling (LGCM; McArdle 2009) was first used to estimate patterns of univariate change in the SBSA and the SP-12 over the course of treatment² (see McArdle and Nesselrode

² For the current study, time was nested within individuals who were also nested within groups throughout treatment. However, intra-class correlation coefficients (ICCs) calculated using the program HLM 7.01 (Raudenbush et al. 2013) demonstrated that there was little effect of group variance on variable scores (i.e., all ICCs < 0.05). Thus,

Table 2 Univariate latent growth curve criterion information fit indices

Variable	Model	Loglikelihood	df	AIC	BIC	SSBIC
SP-12	1	−1004.78	73	2043.56	2067.94	2014.97
	2	−994.68	69	2031.35	2061.46	1996.04
	3	−998.86	70	2051.73	2090.45	2006.33
SBSA	1	−1186.66	23	2397.32	2380.04	2380.04
	2	−1175.95	19	2383.90	2410.92	2360.85
	3	−1176.95	20	2383.90	2409.23	2362.30

Models: 1 linear model, 2 quadratic model, 3 freely-estimated model

AIC Akaike Information Criteria, BIC Bayesian Information Criteria; SSBIC Sample Size Adjusted Bayesian Information Criteria, df degrees of freedom, SP-12 Social Phobia-12, SBSA Self-Beliefs Related to Social Anxiety

2002, for a more detailed discussion of this type of modelling). LGCM allows for the testing of multiple hypotheses in one model (i.e., change over treatment and predictors of change), while also minimising measurement error in observed variables. Determining the best pattern of univariate change (e.g., linear or some type of non-linear growth) yielded six models in total: linear, quadratic, and freely-estimated models for each of the univariate process variables. Models were compared using the Loglikelihood function, the Akaike Information Criteria (AIC), the Bayesian Information Criteria (BIC), and the Sample Size Adjusted Bayesian Information Criteria (SSBIC), with lower values indicating better model fit (see Table 2).

Fit indices did not indicate substantial improvement when modelling non-linear change (see Table 2), suggesting that modelling linear change was sufficient. Figure 1 displays the path diagrams of the models, which estimate the latent intercept growth factor (initial status), the latent slope growth factor (change over time), and the covariation between intercept and slope factors, with a linear change trajectory. Both the SBSA and SP-12 reduced over the course of treatment. Specifically, estimates of maladaptive self-beliefs, as measured by the SBSA, began on average at 101.81 and reduced by 6.03 units ($SE=0.64$, $p<.001$, 95% CI $[-7.40, -4.64]$, $d=0.94$) over the course of the treatment. Estimates of social anxiety, as measured by the SP-12, began on average at 26.30 and reduced by 0.98 units ($SE=0.10$, $p<.001$, 95% CI $[-1.20, -0.78]$, $d=1.15$) over the course of the

treatment. For both variables, significant variance in the intercept and slope growth factors was indicated (SBSA: initial = 681.65, $p<.001$, slope = 9.67, $p=.004$; SP-12 initial = 89.10, $p<.001$, slope = 0.29, $p=.001$), suggesting that individuals differed in their starting value and rate of change over treatment.

Dynamic Bivariate Latent Difference Score Modelling

A dynamic bivariate latent difference score analysis (LDS) with a Markov Chain Monte Carlo (MCMC) estimation was used in Mplus (Muthén and Muthén 2010; Asparouhov and Muthén 2010) to evaluate whether change in maladaptive self-beliefs was an indicator of later change in social anxiety symptom severity over the course of treatment. This type of Bayesian estimation uses prior distributions on all parameters and simulation-based estimation, and is especially suited for small sample sizes and incomplete data. The model was also estimated with full information maximum likelihood estimation (Muthén and Muthén 2008) and results were similar. Due to space limitations, a complete description of LDS models is not possible here; however, interested readers are referred to McArdle and Nesselroade (2002) as the current procedures are based on their methods (for further technical details, see McArdle 1988; McArdle and Hamagami 2001; for a review of LDS, see; Ferrer and McArdle 2010; for other practical examples, see; Teachman et al. 2010). The LDS model is an alternative method for the structural modelling of longitudinal data that integrates features of latent growth curve models and cross-lagged regression models. Ultimately, the LDS allows one to simultaneously model overall change across time and lagged relationships, permitting the estimation of whether change in one process (e.g., self-beliefs) predicts later change in outcome (e.g., social anxiety), while controlling for overall change in both.

Analogously, our focus was on creating a *reliable* parameter estimate for change in each variable as a predictor of the dynamic change in the other variables, rather

Footnote 2 (continued)

accounting for the three-level hierarchical data structure was not considered a necessary endeavour. The RCT also randomly allocated participants to receive two different types of three weekly and individual preparatory sessions prior to group CBT. Results also indicated that there was no significant random component attributable to this allocation in the models (i.e., all ICCs <0.05), and therefore the treatment conditions were collapsed and only the nested effect of individuals remained controlled for. For these analyses, please contact the corresponding author.

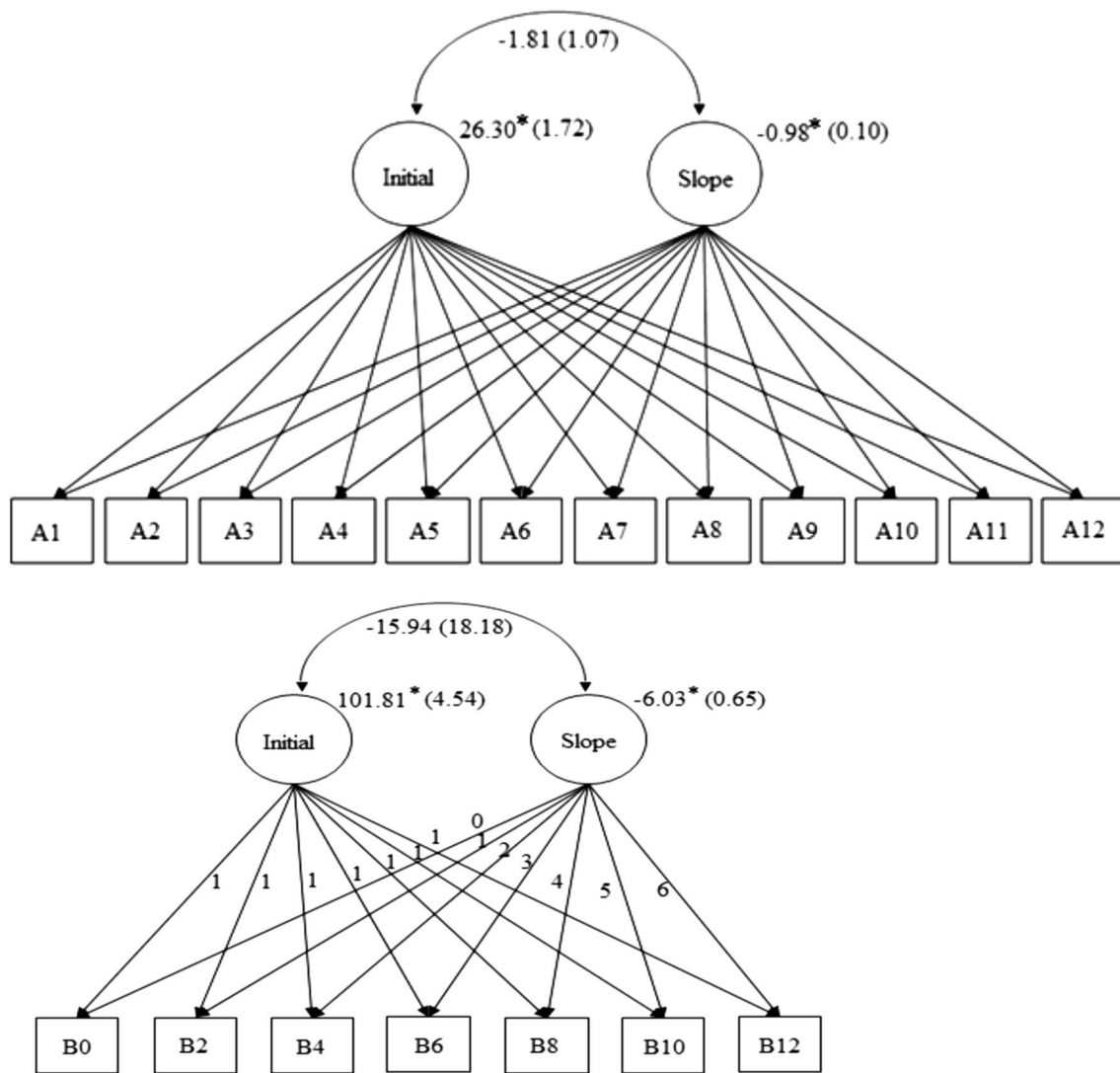


Fig. 1 Univariate latent growth curve modelling for the Social Phobia-12 (SP-12; top) and the Self-Beliefs Related to Social Anxiety (SBSA; bottom). Error terms for the manifest and latent variables are not consistently noted in the Figures to improve readability but were included in all analyses. Initial refers to the initial pre-treatment (for SBSA) or immediately prior to first session of CBT (for SP-12) level

on the variable. Slope refers to the latent growth variable indicating change over time. Factor loadings in each model were set so that linear trajectories were predicted. A=SP-12, B=SBSA. 0=pre-treatment, 1=week 1 of CBT treatment, 2=week 2 of CBT treatment, 3=week 3 of CBT treatment, and so on

than on estimating all possible curvilinear growth parameters. Thus, we only estimate growth parameters for a linear pattern of change in the bivariate latent difference score model to keep the tests highly focused and not raise the risk of Type I error by estimating many parameters with a relatively small sample size. Notably, other curvilinear modelling approaches were also examined, but these models did not provide substantively better estimates of fit than the linear model so are not reported here. All 12 of the SP-12 time points were used in this model for better reliability of change parameters. Figure 2 presents a

simplified diagram of the bivariate latent difference score model. As hypothesized, results indicated that previous change in maladaptive self-beliefs significantly predicted later change in social anxiety symptoms ($\gamma_{\text{SBSA}} = 0.50$, $p < .05$, 95% CI [0.13, 0.89], $d = 0.60$). However, previous change in social anxiety symptoms did not predict later change in maladaptive self-beliefs ($\gamma_{\text{SP-12}} = 0.10$, $p > .05$, 95% CI [0.01, 0.26], $d = 0.32$). Thus, prior change in enduring maladaptive self-beliefs significantly predicts change in social anxiety symptoms, but the reciprocal relationship did not reach significance.

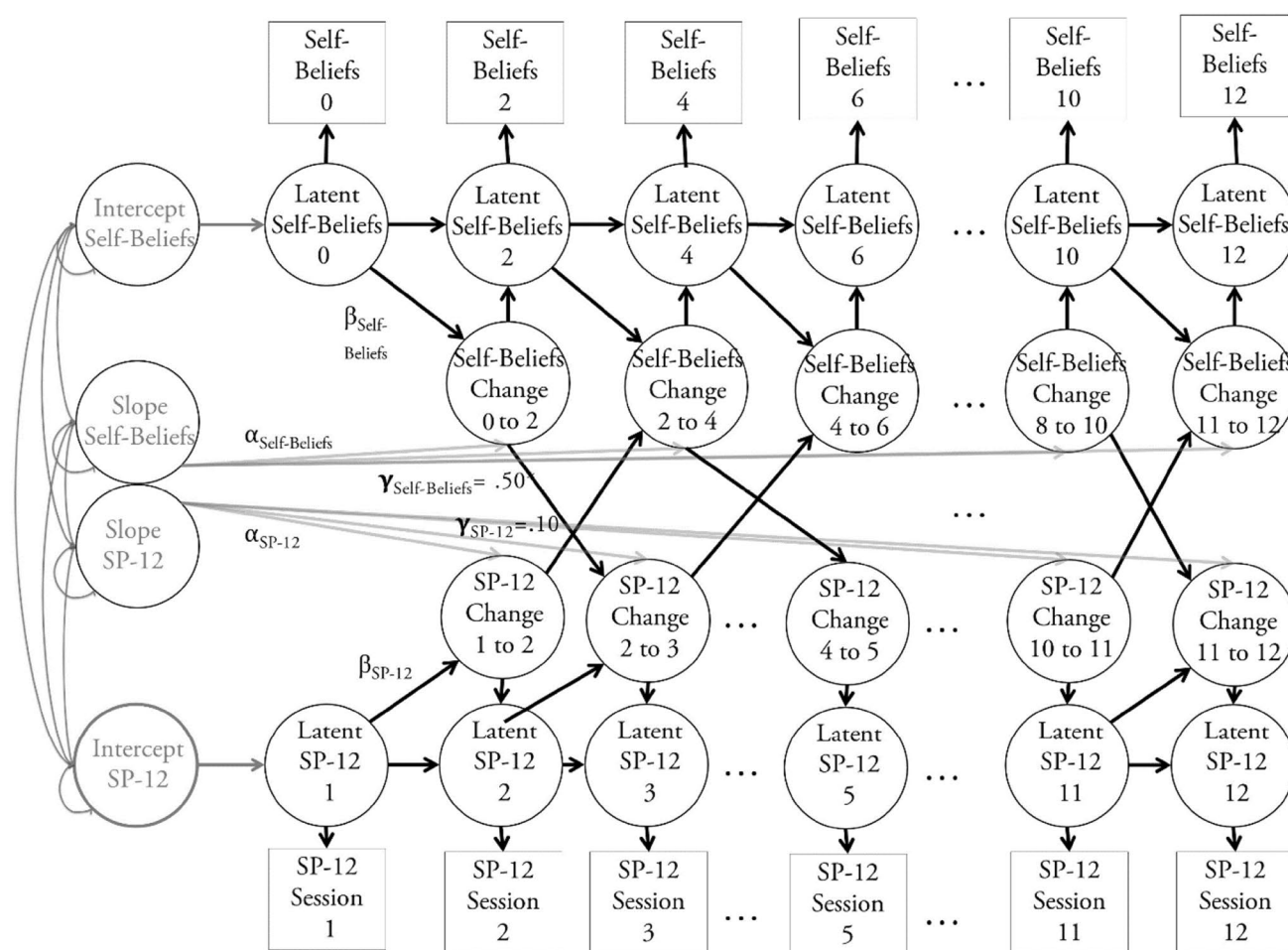


Fig. 2 Dynamic bivariate latent difference score model. Previous change on the SBSA is a significant predictor of later change on the SP-12. However, previous change on the SP-12 is not a significant predictor of later change on the SBSA. Note The role of the latent intercepts and slopes is to describe change in a manner similar to a latent growth curve model. Most arrows have parameters set to one (approach modelled from McArdle and Nesselroade 2002), while the arrows labelled with the α (alpha) parameters are used to estimate

change in each variable over time. The arrows labelled with γ (gamma) predict the temporal relationship between variables (i.e., whether one process predicts later change in the other, reported with standardised beta coefficients). The α and γ parameters were constrained to be equal across time. All 12 SP-12 time points were used in the analyses, but only a subset of the time points are shown here for readability. 0=pre-treatment, 1=week 1 of CBT treatment, 2=week 2 of CBT treatment, 3=week 3 of CBT treatment, and so on

Discussion

To date, research examining whether maladaptive self-beliefs change over treatment and how this change relates to treatment outcome has employed a two wave (e.g., pre- vs. post-treatment; post- vs. follow-up) methodological design (Boden et al. 2012; Bögels et al. 2014; Koerner et al. 2012; Rapee et al. 2009; Wilson and Rapee 2005; Wong et al. 2017). Such an approach does not allow for an adequate evaluation of mechanisms of action or therapeutic change in treatment however, or demonstrate the temporal precedence of change in proposed mechanisms (Kazdin and Nock 2003). As a result, most studies leave open the possibility that reductions in maladaptive self-related beliefs are simply an epiphenomenon of social anxiety, rather than a contributor

to social anxiety amelioration in treatment (Teachman et al. 2008). To our knowledge, this is the first study to include within-session measures of enduring, maladaptive self-beliefs and social anxiety in CBT for SAD, and to examine the temporal sequence of change in the univariate process variables over the course of the therapeutic protocol.

As expected, scores on maladaptive self-beliefs and social anxiety symptom severity reduced over treatment. These findings are in accordance with previous research demonstrating pre- to post-treatment changes in self-related beliefs (Boden et al. 2012; Bögels et al. 2014; Koerner et al. 2012; Rapee et al. 2009; Wilson and Rapee 2005; Wong et al. 2017) and studies demonstrating within-session changes in social anxiety symptoms (e.g., Hedman et al. 2013; Hoffart et al. 2009; Mörtberg et al. 2015; Niles et al. 2014). They

are also in line with studies demonstrating within-session changes in transient thought-like constructs and processes in the treatment of SAD (Brozovich et al. 2015; Gregory et al. 2015; Mörtberg et al. 2015; Niles et al. 2014; Smits et al. 2006). A core component of CBT is restructuring patients' dysfunctional self-related cognitions (Beck 1967; Clark and Beck 1999). Indeed, patients are taught to systematically collect and rationally dispute negative automatic thoughts that contribute to anxiety early in treatment and to challenge maladaptive core-beliefs related to the self (e.g., '*I am worthless*') in later sessions of the therapeutic protocol (Rapee et al. 2009). Moreover, self-related beliefs are thought to be indirectly altered in treatment through attentional training procedures (e.g., task-concentration training; Mulkens et al. 2001), and by teaching patients to reduce their ruminative processing (Wong and Moulds 2009) and minimise safety behaviour use (Wells et al. 1995). Each of these therapeutic techniques were included in the current treatment protocol (see Rapee et al. 2009) and may have contributed to the decline in maladaptive self-beliefs over the course of therapy (Beck and Haigh 2014). However, with the absence of a waitlist control sample and a dismantling methodology (i.e., to test the contribution of various components of treatment on self-belief reduction), this supposition is positioned as a tentative hypothesis that requires further research.

Importantly, the present study also addressed one of the central tenets in cognitive models of anxiety and CBT: that change in cognitions should precede changes in anxious symptomology (Beck 1967; Clark and Beck 1999). Early variants of CBT held a number of fundamental propositions, many of which have been carried forward today. These include: (1) cognitive activity affects behaviour, which is a restatement of the mediation model presented by Mahoney (1974); (2) cognitive activity may be monitored and altered; and (3) desired behaviour change may be effected through cognitive change (Dobson and Dozois 2010). Consistent with these assumptions, present findings indicate that change in maladaptive self-beliefs are an indicator of later change in social anxiety symptom severity over CBT for SAD.

This finding adds to the body of research providing not only direct support for cognitive mediation in SAD (e.g., Goldin et al. 2013; Hofmann 2004; Smits et al. 2006) but across disorders, including major depressive disorder (Quilty et al. 2008), generalised anxiety disorder (Donegan and Dugas 2012), eating disorders (Wilson et al. 2002), sleep disorders (Schwartz and Carney 2012), and bipolar disorder (Totterdell et al. 2012).

Theoretical adaptations derived from earlier cognitive models (Beck 1967) have tended to shift emphasis from a linear causal model to a more circular model of causality; although, the notion of reciprocal relationships was also mentioned by Beck (1967) and Ellis (1962). This shift has

also been reflected in cognitive models of psychopathology. Although not tested here, negatively valenced self-beliefs have been argued to heighten self-focused attention, increase safety behaviour use, dysregulate emotional regulation, and exaggerate emotional reactivity (e.g., fear and anxiety) (Clark 2001; Spurr and Stopa 2002), which in turn trigger and increase the frequency of dysfunctional self-related cognitions and symptomology (Clark and Wells 1995). Several studies now support the circular model of causality in treatment for SAD (e.g., Sowislo and Orth 2013); however, present findings were not consistent with this temporal pattern. Specifically, while change in maladaptive self-beliefs significantly predicted later change in social anxiety symptoms, the reciprocal effect (i.e., social anxiety predicting later self-belief change) was not found to be significant. It is possible that the relationship between change on the cognitive and symptom measures could still be bidirectional however, with a stronger effect demonstrable when cognitive change is the predictor. In this way, symptom change as the predictor may not reach significance with a relatively small sample size. Thus, present findings should be replicated using a larger sample size before more definitive conclusions can be reached.

While these findings are important in their novelty and in improving understanding of mechanisms underpinning psychological treatment for SAD, several caveats and future research suggestions should be mentioned. First, the primary limitation of the present study was the absence of a randomised, waitlist control condition, which prevents definitive conclusions regarding whether changes in the investigated constructs are truly mechanisms of CBT, are a general treatment effect, or even due to passage of time. However, previous research suggests that individuals with SAD in waitlist control conditions typically do not change on symptom variables (e.g., Clark et al. 2006; Steinert et al. 2016) or on cognitive variables such as self-beliefs (e.g., Boden et al. 2012) over treatment. Furthermore, our repeated measures approach involved evaluating changes *within* a treatment group rather than comparing across treatment conditions; although, we note that these approaches are not mutually exclusive. Second, the sample size was relatively small for the type of modelling approach employed. As a result, multiple versions of the bivariate latent difference score model were run using different time lags and all models produced similar results (consistent with Teachman et al. 2008), potentially increasing reliability of findings. To assist with model convergence, a number of parameters were also constrained to be equal across time, including the γ (gamma) parameters. This meant that while results test the reciprocal causal model, they do not specify at what stage of the treatment protocol change was predictive. The small sample size also meant that testing differences between self-related

belief subscales (Wong and Moulds 2009) was not feasible. Replicating present findings with a larger sample size and a waitlist control condition therefore remains a necessary and warranted future research endeavour. Future research could also include within session measures of depression symptom severity and control for the potential impact of change in depression scores over CBT for SAD. This may be important in the context of maladaptive self-belief change, as global, absolute, and negative self-statements are also typically characteristic of individuals with depression (Wong et al. 2014, 2017). However, one could argue whether it is appropriate to covary out symptoms of depression from social anxiety given the natural covariation between the two conditions (see Miller and Chapman 2001).

Notwithstanding these limitations and future research suggestions, this is the first study to include within-session measurements of maladaptive self-beliefs in CBT for SAD and examine the temporal sequence of change in self-related beliefs and change in social anxiety over the therapeutic protocol. A linear, unidirectional model was supported, with only change in maladaptive self-beliefs being significantly predictive of later social anxiety change. Importantly, self-report measures assessed both social interaction and performance-based social anxiety-related fears (using the SP-12), and mapped directly onto the three self-belief categories proposed by Clark and Wells (1995): high standard beliefs, conditional beliefs, and unconditional beliefs about the self (using the SBSA). From a clinical perspective, present findings underscore the importance of reducing maladaptive self-beliefs in treatment for SAD, and suggest that increased focus on modifying enduring maladaptive self-beliefs should encourage greater reductions in patients' social anxiety symptom severity.

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Compliance with Ethical Standards

Conflict of interest Bree Gregory, Quincy J. J. Wong, Craig D. Marker, Lorna Peters declare that they have no conflict of interest.

Ethical Standards All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Research Involving with Human and Animal Standards No animal studies were carried out by the authors for this article.

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