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Concurrent and prospective associations between negative social-evaluative beliefs, safety behaviours, and symptoms during and following cognitive behavioural group therapy for social anxiety disorder

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A B S T R A C T

Background: Improving the delivery of cognitive-behavioural therapy (CBT) for social anxiety disorder (SAD) requires an in-depth understanding of which cognitive and behavioural mechanisms drive change in social anxiety symptoms (i.e., social interaction anxiety) during and after treatment. The current study explores the dynamic temporal associations between theory-driven cognitive and behavioural mechanisms of symptom change both during and following group CBT.

Methods: A randomized controlled trial of imagery-enhanced CBT ($n = 51$) versus traditional verbal CBT ($n = 54$) for social anxiety was completed in a community mental health clinic setting. This study included data collected from 12-weekly sessions and a 1-month follow-up session. Mixed models were used to assess magnitude of change over the course of treatment. Cross-lagged panel models were fit to the data to examine temporal relationships between mechanisms (social-evaluative beliefs, safety behaviours) and social interaction anxiety symptoms.

Results: Participants in both CBT groups experienced significant improvements across all cognitive, behavioural, and symptom measures, with no significant differences in the magnitude of changes between treatments. During treatment, greater social-evaluative beliefs (fear of negative evaluation, negative self-portrayals) at one time point (T) were predictive of more severe SAD symptoms and safety behaviours at T+1. Social-evaluative beliefs (fear of negative evaluation, probability and cost of social failure) and safety behaviours measured at post-treatment were positively associated with SAD symptoms at the 1-month follow-up.

Conclusions: The current study identifies social-evaluative beliefs that may be important targets for symptom and avoidance reduction during and following CBT. Assessment of these social-evaluative beliefs throughout treatment may be useful for predicting future SAD symptoms and avoidance, and for adapting treatment to promote optimal change for patients.

1. Introduction

Social anxiety disorder (SAD) is characterised by heightened anxiety symptoms in social contexts due to a fear of evaluation, which significantly impacts on social, occupational, and/or other important areas of life functioning (American Psychiatric Association, 2013). People with SAD feel intense anxiety in social-evaluative situations in which they may be the focus of attention. Cognitive behavioural theorists (Clark & Wells, 1995; Heimberg, Brozovich, & Rapee, 2014) propose a range of social-evaluative beliefs as important maintaining factors for social anxiety and avoidance, including threat appraisals (e.g., probability and cost of negative evaluation, fear of negative evaluation) and self-beliefs (e.g., negative self-portrayals, e.g., Moscovitch, 2009), and cognitive behavioural interventions have been designed to target these beliefs (e.g., Rapee, Gaston, & Abbott, 2009). However, while cognitive behavioural therapy (CBT) is an evidence-based treatment for SAD associated with large symptom improvements (Mayo-Wilson et al., 2014), a substantial minority of patients fail to achieve normative functioning (McEvoy, Nathan, Rapee, & Campbell, 2012; Rapee et al., 2009). One way to improve recovery rates is to identify social-evaluative beliefs that are most strongly associated with changes in symptoms and avoidance so that they can be the focus of interventions (Kazdin, 2007).

Several cognitive behavioural models of SAD (Clark & Wells, 1995; Hofmann, 2007; Rapee & Heimberg, 1997; Wong, Gordon, & Heimberg, 2014) suggest that social anxiety and behavioural avoidance are maintained, in part, by exaggerated threat appraisals, which include overestimations of the probability and cost (consequences) of social failure. These beliefs lead to an increase in self-focused attention (e.g.,

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self-monitoring of symptoms of anxiety and social performance) and hypervigilance to social threat at the expense of task-focused attention (e.g., topic of conversation, conversational partner's behaviour). In an attempt to prevent social fears from occurring, people with SAD engage in a range of avoidance (i.e., wholesale avoidance of social contexts) and safety behaviours (i.e., avoidance behaviours used within social contexts to prevent feared outcomes, such as not contributing to conversations to avoid appearing stupid, not disclosing personal information, using alcohol to reduce inhibitions). Safety behaviours are theorised to maintain SAD by (a) preventing disconfirmation of social fears, (b) 'contaminating' social situations by masquerading as poor social skills, and (c) increasing self-focused attention (Wong & Rapee, 2016). Therefore, safety behaviours and avoidance are reciprocally related to social-evaluative beliefs, such that safety behaviours are used in an attempt to prevent social fears but also maintain social fears. Social anxiety is not contained to the social situation itself, as recollections of past social failures guide expectations of further failure in anticipation of upcoming social situations (anticipatory processing) and perceptions of social failure linger well after social situations are escaped (post-event processing). Clark and Wells' (1995) model indicates that these processes are maintained by underlying assumptions (henceforth referred to as 'self-beliefs') relating to excessively high standards for social performance (e.g., "I must never show signs of anxiety"), conditional beliefs about the consequences of social behaviour (e.g., "If I disclose personal information, I will be rejected), and unconditional negative beliefs about the self (e.g., "I am unlikeable").

Consistent with these models, there is evidence that higher perceived probability and cost of social failure predict increases in social anxiety symptoms, with some studies finding that probability (Smits, Rosenfield, McDonald, & Telch, 2006) and others that cost (Hoffart, Borge, Sexton, & Clark, 2009; Hofmann, 2005) of negative social events is a stronger predictor. Other research has demonstrated that early reductions in FNE are associated with rapid symptom reductions during CBT (Auyeung, Hawley, Grimm, McCabe, & Rowa, 2020; Burton, Schmertz, Price, Masuda, & Anderson, 2013; Johnson et al., 2020; Ledley et al., 2009). Research has also shown that increases in self-beliefs outlined in Clark and Wells' (1995) model are associated with subsequent increases in social anxiety symptom severity (Gregory, Wong, Marker, & Peters, 2018).

Moscovitch (2009) proposed an additional set of social beliefs that maintain SAD, whereby negative evaluation is the feared consequence of exposing specific characteristics of the self that are perceived to be deficient relative to the imagined expectations or standards of critical others. According to this model, heterogeneity in social anxiety symptom expression can be accounted for by individual differences in concerns about perceived self-flaws (henceforth called "negative self-portrayal concerns") across four overlapping dimensions, including concerns about social skills and behaviours, concerns about concealing visible signs of anxiety, concerns about physical appearance, and concerns about characterological flaws. Subsequent studies have shown that concerns about social skills and concerns about character loaded onto the same factor, which was labelled concerns about social competence (Moscovitch, Rowa, Paulitzki, Antony, & McCabe, 2015; Moscovitch & Huyder, 2011). From Moscovitch's (2009) perspective, CBT should guide patients to confront the feared stimulus directly via self-exposure whereby they repeatedly reveal aspects of the self that are perceived to be deficient. Directly observing the absence of negative social consequences during these exposures should, in turn, reduce patients' negative self-portrayal concerns.

Consistent with Moscovitch's (2009) model, in cross-sectional data Merrifield, Balk, and Moscovitch (2013) found evidence that the relationship between childhood maltreatment (teasing) and social anxiety symptoms was mediated by negative self-portrayal concerns in a sample of individuals with a principal anxiety disorder. There was no evidence that negative self-portrayal concerns moderated the relationship between recalled teasing and symptoms of social anxiety. In a mixed sample with and without social anxiety disorder, Moscovitch et al. (2013) found that negative self-portrayal concerns were significantly and uniquely associated with social anxiety symptoms and safety behaviours after partialing out depression symptoms. Negative self-portrayal concerns also demonstrated sensitivity to change in a clinical subsample who received CBT (Moscovitch et al., 2015). However, no study to date has investigated whether negative self-portrayal concerns prospectively predict social anxiety symptoms over multiple time points, which limits causal inferences. It is therefore important to examine whether changes in the negative self-portrayal concerns are prospectively associated with changes in social anxiety symptoms.

In summary, there are some common and unique social-evaluative beliefs described in cognitive behavioural models of social anxiety disorder (Wong & Rapee, 2016). Perceived probability and cost of social catastrophes (threat appraisals), FNE, and beliefs about the self are common across the models, although the nature of the theorised self-beliefs differs ('self-beliefs' in Clark & Wells' model; 'self-portrayals' in Moscovitch's model). All models formulate safety and avoidance behaviours as reciprocally related to these social beliefs. Most studies to date have evaluated a small subset of beliefs (e.g., only threat appraisals, or FNE, or self-beliefs) and most have only examined cognitions that are specific to one model. An important advantage to investigating multiple cognitive factors from different models within the same study is that method variance across treatments and sampling procedures are less likely to influence effects. For example, across studies, findings could be influenced by variability in the lengths of treatments, the frequency and number of measurement occasions, whether earlier social anxiety symptoms were controlled (autoregressive effects), statistical methods, and differences in measures. Evaluating the prospective predictive utility of these factors within one study and sample will facilitate more direct comparisons.

A key criticism of CBT is the limited prospective evidence for relationships between cognitive and behavioural factors and changes in SAD symptoms (Longmore & Worrell, 2007), making it difficult to identify which specific cognitive-behavioural factors are important treatment targets. Only a small minority of studies examining cognitive mechanisms of SAD have used longitudinal modelling statistical approaches that assess whether change in one variable temporally precedes changes in another over time, such as traditional cross-lagged panel models (Calamaras, Tully, Tone, Price, & Anderson, 2015; Gregory, Peters, Abbott, Gaston, & Rapee, 2015; Smits et al., 2006). Examining temporal precedence is an important aspect of determining which factors drive improvements in symptoms of SAD, both during and after treatment (Hoffart & Johnson, 2020).

Cognitive behavioural models hypothesise that negative social-evaluative beliefs lead to avoidance and safety behaviours and social anxiety, and that dropping avoidance behaviours within the context of treatment should be associated with reductions in these beliefs and, in turn, social anxiety. The first aim of this study was to examine the effects of group CBT on changes in social anxiety symptoms, use of safety behaviours, threat appraisals (perceived probability and cost), FNE, self-beliefs as described in Clark and Wells' (1995) model (i.e., excessive high standards, conditional beliefs concerning social evaluation, unconditional beliefs about the self), and negative self-portrayal concerns as described in Moscovitch's (2009) model (i.e., related to social competence, physical appearance, and signs of social anxiety). The second aim was to examine the cross-lagged relationships between each of these cognitive maintaining factors, safety behaviours, and social anxiety symptoms. A third aim was to identify whether relationships between social-evaluative beliefs, symptoms, and safety behaviours were similar or different between the active treatment and follow-up (post-treatment to one-month follow-up) phases, given the possibility that different factors might prospectively predict symptoms of social anxiety during treatment (when patients are involved in active treatment) and after treatment (when patients are required to continue applying the treatment principles without regular support from

therapists).

Data for the current study were collected from a randomized controlled trial comparing imagery-enhanced CBT (IE-CBT) to standard verbal-based CBT (VB-CBT, McEvoy, Hyett, Bank et al., 2022; McEvoy, Hyett, Johnson et al., 2022). The primary outcomes of this trial revealed that social interaction anxiety and fear of negative evaluation significantly and similarly reduced in both treatments (McEvoy, Hyett, Bank et al., 2022). This study extends the primary outcomes paper by (a) investigating additional mechanisms including changes in additional socio-evaluative beliefs (probability and cost of negative evaluation; negative self-portrayals; social beliefs about social anxiety) and safety behaviours, (b) data collapsed across treatment conditions where there was no differential treatment effect, and (c) and the prospective relationships between these beliefs, safety behaviours, and social anxiety symptoms. The first hypothesis was that use of safety behaviours and all measured social-evaluative beliefs would decrease significantly during both treatments. Given that the treatments had comparable efficacy in reducing social interaction anxiety and fear of negative evaluation (McEvoy, Hyett, Bank et al., 2022), significant differences between treatments were not expected. The second hypothesis was that variance in social-evaluative beliefs, including threat appraisals, FNE, negative self-beliefs, and negative self-portrayal concerns, would be concurrently and prospectively associated with variance in social interaction anxiety and use of safety behaviours. Further, we expected safety behaviours to be concurrently and prospectively associated with social interaction anxiety. There were no a priori hypotheses relating to whether these relationships would be similar or different during the active treatment and follow-up phases.

2. Method

2.1. Participants and procedure

Mental health professionals (i.e., general practitioner, psychiatrist or psychologist) referred patients for treatment for SAD to a specialist community mental health clinic in Perth, Western Australia. Inclusion criteria were at least 18 years of age, principal diagnosis of SAD, and stable medications for at least one month prior to the start of treatment. A total of 331 people were screened, and clinicians interviewed all potentially eligible patients (n = 204) using the Structured Clinical Interview for DSM-5, Research Version (First, Williams, Karg, & Spitzer, 2015) to assess SAD as a principal diagnosis and evaluate diagnostic exclusion criteria. Referred patients with current and/or past bipolar disorder, psychosis, current substance use disorder, high suicidality, or self-harm risk (i.e., plans and/or intent), or ongoing CBT for SAD outside of the trial, were excluded from the study. Eligible individuals who provided written informed consent for the trial (N = 107, 2 excluded due to invalid responding) were randomly assigned to receive imagery-enhanced (n = 51) group CBT or verbally-based (n = 54) group CBT (see McEvoy et al., 2017; McEvoy, Hyett, Bank et al., 2022). The sample was roughly even in terms of gender (Male = 49.52%), with an average age of 28.6 years (SD = 11.36). The majority of the sample had one (40.95%) or more comorbid diagnoses (46.67%), with current major depressive disorder (39.05%) and generalized anxiety disorder being most common (36.19%). Further sample details have been outlined in McEvoy, Hyett, Bank et al. (2022) and McEvoy, Hyett, Johnson et al. (2022).

Both treatments aligned in their session content and session-by-session focus but differed in the cognitive mode within which the treatment strategies were applied (i.e., a focus on verbally-based or imagery-based modes of processing, see McEvoy, Hyett, & Bank et al., 2022). Patients were asked to complete a range of questionnaires at the end of sessions throughout treatment (see McEvoy et al., 2017). The measures used for the current study were administered at pre-treatment (immediately prior to session 1), week 4, week 8, post-treatment (immediately after session 12), and one-month follow-up. The study protocol was approved by the Human Research Ethics Committee of the Western Australian Department of Health (approval # 04_2016) and Curtin University (HR87_2016).

2.2. Treatments

Patients were randomised to one of two group treatments (IE-CBT or VB-CBT), which both targeted the same theorised maintaining factors: negative automatic cognitions (e.g., probability and cost of evaluation), avoidance of social situations, safety behaviours, negative self-images, self-focussed attention, and negative core beliefs. The protocols differed in the predominant cognitive mode within which the strategies were applied. Specifically, IE-CBT incorporated mental imagery-based techniques throughout all sessions, whereas VB-CBT focused on "thoughts" without mentioning imagery or using imagery-based techniques, except for the video-feedback session which involved challenging beliefs about how they appear when being the focus of attention. For example, when challenging core beliefs IE-CBT used imagery rescripting whereas VB-CBT used more traditional downward arrowing to identify core beliefs and evidence-gathering. Both treatments comprised 12, 2-h weekly group sessions and a 1-month group follow-up session. All groups were facilitated by two clinicians. Please see McEvoy, Bank, Hyett et al. (2022) for more details.

2.3. Measures

2.3.1. Social anxiety symptoms

The Social Interaction Anxiety Scale (SIAS) was the pre-registered primary outcome measure for the trial (McEvoy et al., 2017; http://www.anzctr.org.au, ACTRN12616000579493) and was used to assess general social interaction related anxiety (Mattick & Clarke, 1998). The scale consists of 20 items assessing cognitive, affective, and behavioural reactions to interaction situations, such as nervousness when speaking with authority figures, each measured with a 5-point Likert scale (0 = not at all characteristic of me, 4 = extremely characteristic of me). Total scores on the scale represent higher symptoms of social anxiety. Scale scores shown strong psychometric properties in prior research with high internal reliability (Peters, 2000). Internal consistency was good for scale scores in the current study (ω = 0.91).

2.3.2. Safety behaviours

The Subtle Avoidance and Safety Behaviours (SAFE) scale was used to measure safety behaviours (Cuming et al., 2009), such as tendencies to stay silent in social situations and speaking in short sentences. The scale consists of 32 items, each measured on a 5-point Likert scale (0 = Never, 4 = Always). In previous research SAFE scores have demonstrated high internal reliability (αs 0.83-0.91), an ability to discriminate between clinical and non-clinical individuals, and that changes are associated with symptom improvement (Cuming et al., 2009). The scale scores exhibited had good internal consistency in the current study (ω = 0.88).

2.3.3. Probability and cost of social failure

Participants were presented with a standardised hypothetical performance situation that is commonly feared by people with SAD ("You are asked to give a 3-min speech on a topic of your choice. Your speech will be videotaped and watched by two people who will rate various aspects of your performance"), and they were required to describe what they most feared would happen. On 9-point Likert scales developed for this study, participants indicated how likely this outcome would be (i.e., probability; 0 = not at all likely, 8 = extremely likely) and also how bad it would be for them if it occurred (i.e., cost; 0 = not at all bad, 8 = extremely bad). These ratings have been used in previous SAD treatment trials to track changes in threat appraisals, and have been found to prospectively predict social anxiety symptoms (e.g., see Gregory et al., 2015, 2018). The intraclass correlation for probability (ICC = 0.79) and

cost (ICC = 0.73) moderate-high (Koo & Li, 2016), indicating acceptable reliability.

2.3.4. Fear of negative evaluation

The Brief Fear of Negative Evaluation scale – straightforwardly worded (BFNE-S) was used to measure fear or worry about being negatively evaluated (Carleton, Collimore, McCabe, & Antony, 2011). The scale consists of eight items, each measured on 5-point Likert-type scale (0 = Not at all characteristic of me, 4 = Extremely characteristic of me). BFNE-S scores have well-established psychometric properties with high internal reliability (α = 0.95), and factorial and construct validity across clinical and community samples (Carleton, Thibodeau, Osborne, Taylor, & Asmundson, 2014; Rodebaugh et al., 2004; Weeks et al., 2005), and high sensitivity to change (McEvoy, Hyett, Bank et al., 2022). The scale scores had excellent internal reliability in the current study (ω = 0.92).

2.3.5. Negative self-portrayal concerns

The Negative Self-Portrayal Scale (NSPS) was used to measure participants' degree of concern about their own self-attributes that may be exposed for public scrutiny (Moscovitch & Huyder, 2011). The scale consists of 27 items representing concerns about social competence, physical appearance, and signs of anxiety. A total score is derived from summing all items, with a higher score representing a greater overall level of concern about negative self-portrayal. The scale has shown good psychometric properties in prior research, with high internal consistency (α = 0.96) and good test-retest reliability (r = 0.75, Moscovitch & Huyder, 2011). The factors structure of the NSPS has been confirmed within a clinical sample, the measure correlates more strongly with other measures of social anxiety and safety behaviours including the SAFE than with measures of other constructs such as depression, is uniquely associated with social anxiety symptoms after controlling for depression, and is sensitive to change (Moscovitch et al., 2015). The NSPS scale scores had excellent internal consistency in the current study (ω = 0.90).

2.3.6. Self-Beliefs Related to social anxiety

The Self-Beliefs Related to Social Anxiety Scale (SBSA) was used to measure maladaptive self-beliefs in social situations (Wong & Moulds, 2011), and includes the three belief types proposed in the Clark and Wells (1995) model: high standards beliefs, conditional beliefs, and unconditional beliefs. The scale consists of 15 items, each measured with an 11-point Likert scale (0 = do not agree at all, 10 = strongly agree). A total score is derived by summing all items, with a higher score representing stronger overall maladaptive self-beliefs. SBSA scale scores have demonstrated high internal consistency (α = 0.94), test-retest reliability (r = 0.81), factorial validity, convergent and divergent validity, incremental validity and discriminative validity between undergraduate and clinical samples (Wong, Moulds, & Rapee, 2014). The scale had excellent internal consistency in the current study (ω = 0.91).

2.4. Statistical analysis

A mixed-model repeated measures (MMRM) approach was used to test whether there was a significant change in both treatments over time and, for measures where this was not reported in the primary outcomes paper (McEvoy, Hyett, Bank et al., 2022), whether change was significantly different between treatments (Hypothesis 1). MMRM analyses use a residual covariance structure, rather than random intercepts and slopes for each individual, to account for the repeated-measures nature of the data (Mallinckrodt & Lipkovich, 2017). MMRM tests for treatment effects by constructing contrasts of the differences in model-estimated marginal means between the treatment groups at a given time point. This study involves a secondary analysis of data collected as part of an RCT (McEvoy, Hyett, Bank et al., 2022). Although the approach taken in the current study is identical to that detailed in the statistical analysis plan (SAP, i.e., linear mixed models) for the RCT on Open Science Framework (https://osf.io/msq9w/), this study applied this approach to a greater number of the pre-registered variables than could be included in the primary outcomes paper (safety behaviours, cost, probability, negative self-portrayals, self-beliefs). We did not analyse the 6-month follow-up data in this study because there were more missing data and we were concerned about the reliability of parameter estimates at that time point using this form of modelling. Without a waitlist control, we were also more confident that parameter estimates would reflect the treatment effects up to 1 month after treatment relative to 6 months after treatment, where there is more time for factors other than treatment to influence relationships. The additional analyses for this specific study were not pre-registered.

Baseline (pre-treatment)-adjusted means and standard errors were estimated for all measures at each time point collapsed across treatment groups. Contrasts of those means were used to evaluate differences between the treatments and effect sizes (except for SIAS and BFNE-S, which are reported in the primary outcomes paper, McEvoy, Hyett, Bank et al., 2022). Unstandardized effect sizes indexed estimated mean change from pre-treatment. Standardised within-treatment effect sizes were calculated by dividing the unstandardized effects by the pre-treatment standard deviation. Between-treatment effect sizes were computed by subtracting changes in VB-CBT from those in IE-CBT. Missing data were addressed using multiple imputation with predictive mean-matching and 100 imputations (van Buuren & Groothuis-Oudshoorn, 2011). Rubin's rules were used to compute pooled means and proportions, standard errors, confidence intervals, and p-values.

Cross-lagged panel models (CLPM) were used to examine cross-sectional and prospective associations between social-evaluative beliefs, use of safety behaviours, and social interaction anxiety (Hypothesis 2). CLPM demarcates the temporal (prospective) relationships between variables into two categories: auto-regressive and cross-lagged. Auto-regressive relationships quantify how variations in a symptom at a given assessment are related to the status of that same symptom at the next assessment. For example, if an individual experiences an increase in social interaction anxiety (e.g., in response to an unexpected social event) that is captured at a given assessment, how much of that increase in anxiety will remain at their next assessment? Cross-lagged relationships quantify how changes in the status of a symptom at a given assessment are related to the status of a different symptom at the next assessment. For example, given the aforementioned increase in social anxiety at one assessment, how much greater would the individual's use of safety behaviours be at the following assessment than if that increase in anxiety had not occurred? CLPMs also examine the cross-sectional relationships between these variations in symptoms at a given assessment. For example, when individuals experience an increase in anxiety at a given assessment, to what extent does their safety behaviour use at the same assessment (i.e., concurrently) also increase for the same person?

In the current study, the auto-regressive and cross-lagged parameter estimates were constrained to be equal over time for the treatment period (i.e., pre-treatment, week 4, week 8, week 12, but not between week 12 and 1-month follow-up). This improves the precision of the auto-regressive and cross-lagged estimates, as it uses all (respective) temporal relationships during the treatment period to inform the estimation of the auto-regressive or cross-lagged parameter. Models were run that relaxed these constraints and revealed that models with fixed parameters provided a similar fit to the data across the Bayes Information Criterion, root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker–Lewis index (TLI) (see Supplementary Table S1). Therefore, the constrained models were retained to preserve power.

Auto-regressive relationships are implicitly standardised, as they represent the relationships between the same variable over time (i.e., if a variable increases by 1-point at one assessment, the proportion of that

increase remaining at the next assessment will always be 1 or less). For cross-lagged effects and cross-sectional relationships, the estimates need to be standardised to be comparable across models. While parameters were constrained to be equal for the treatment phase, there can be slight variations in the standardised estimates as a consequence of different variances at each time point used to standardise parameters. Additionally, the significance (*p*-values) of these parameters will also slightly vary over time due to the different variances resulting in different standard errors. As these differences were negligible, the first autoregressive, cross-lagged, and cross-sectional correlation estimates have been presented in each model. All parameters for each model are provided in Supplementary Table S2.

The CLPMs were estimated in Mplus version 8.4 using maximum likelihood estimation with 1000 bootstrapped samples. The social-evaluative beliefs were analysed in separate CLPMs as the sample size was not large enough to estimate all temporal relationships between all outcomes simultaneously. As a result, separate models were conducted for each belief to assess associations with future SAFE and SIAS scores. Interpretation of model fit is guided by Marsh, Hau, and Wen (2004) and Iacobucci (2010), with no specific weighting applied to one model fit metric. Several metrics were calculated, including chi-square, root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker–Lewis index (TLI). Cut-off criteria typically applied for acceptable model fit are a non-significant chi-square test of the null hypothesis, RMSEA <0.08, CFI >0.90, and TLI >0.90. To account for multiple tests assessing change over time for multiple outcomes and the increased likelihood of detecting statistically significant effects, a Benjamini–Hochberg approach was used to incrementally adjust p-value thresholds for significance (Benjamini & Hochberg, 1995).

In summary, to examine the amount of change in social interaction anxiety, safety behaviours, and social-evaluative beliefs (and whether these differed by treatment group for measures not reported in the primary outcomes paper), mixed-models of the following outcomes were estimated: SIAS, SAFE, cost, probability, FNE, NSPS, and SBSA. To examine the prospective and cross-sectional relationships between variations in social interaction anxiety, safety behaviours, and social-evaluative beliefs, a series of cross-lagged panel models were estimated with the following variables: Model 1 - SAFE & SIAS; Model 2 - cost, SAFE, and SIAS; Model 3 - probability, SAFE, and SIAS; Model 4 - FNE, SAFE, and SIAS; Model 5 - NSPS, SAFE, and SIAS; Model 6 - SBSA, SAFE, and SIAS.

3. Results

3.1. Session attendance, descriptive statistics, and bivariate correlations

As outlined in McEvoy, Hyett, Bank et al. (2022), attendance was similar between the treatments: IE-CBT mean = 9.73/13 sessions (S.D. = 3.96), VB-CBT mean = 9.02 sessions (S.D. = 3.93). The proportions of individuals receiving a 'high' dose of treatment (8+ sessions; McEvoy et al. (2012) were also comparable (73.30% v. 70.00%). Of the 105 retained in the analyses, 72 (69%) provided post-treatment data and 64 (61%) provided one-month follow-up data. Ten randomised participants did not start treatment, 15 attended 1–4 sessions, 16 attended 5–8 sessions, and 34 attended 9–12 sessions. Pre-treatment bivariate correlations were significant between all variables, which are reported along with descriptive statistics in Supplementary Table S3.

3.2. Changes in SAD symptoms, safety behaviours, and social-evaluative beliefs during and after treatment

Both treatments had large and statistically significant within-treatment effect sizes across all symptom, social-evaluative belief, and behaviour measures at Week 12 (≥1.15) and at the 1-month follow-up (≥1.45; see Table 1). There were no significant differences between the treatment groups, and in most cases between-treatment effect sizes were small to negligible (see Supplementary Table S4). The SIAS and BFNE-S results are excluded as they were reported in the primary outcomes paper (McEvoy, Hyett, Bank et al., 2022). The mean scores of all variables over the course of treatment collapsed across treatment groups are displayed in Fig. 1.

Table 1
Changes in SAD symptoms and social-evaluative beliefs from pre-treatment to Week 12 and the one month follow-up.

Outcome	Estimated Means (SE)		Estimated Mean Change from Pre-Treatment		Standardised Effect Size	
	12 Weeks	1-Month	12 Weeks	1-Month	12 Weeks	1-Month
SAFE -						
Imagery	70.63 (2.97)	64.23 (2.69)	−19.99	−26.40	1.15	1.52
Verbal	67.51 (2.61)	61.52 (2.42)	−23.12	−29.11	1.33	1.67
Cost -						
Imagery	2.63 (0.26)	2.60 (0.29)	−3.27	−3.30	2.05	2.07
Verbal	3.03 (0.26)	2.69 (0.31)	−2.87	−3.21	1.80	2.01
Probability -						
Imagery	3.46 (0.28)	3.52 (0.36)	−2.62	−2.55	1.49	1.45
Verbal	3.20 (0.26)	2.96 (0.33)	−2.88	−3.12	1.63	1.77
NSPS -						
Imagery	56.81 (2.69)	55.90 (2.62)	−25.99	−26.89	1.43	1.52
Verbal	55.23 (2.41)	50.93 (2.41)	−27.56	−31.86	1.48	1.76
SBSA -						
Imagery	54.01 (3.83)	45.46 (3.70)	−45.74	−54.30	1.81	2.15
Verbal	56.55 (3.79)	45.78 (3.71)	−43.20	−53.97	1.71	2.14

Note. SIAS = Social Interaction Anxiety Scale. SAFE = Safety behaviours. BFNES = Brief Fear of Negative Evaluation Scale – Straightforwardly Worded. NSPS = Negative Self Portrayal Scale. SBSA = Self-Beliefs Related to Social Anxiety. The pooled multiply-imputed pre-treatment values used to compute the baseline-adjusted means were 90.63 (SAFE), 5.90 (Cost), 6.07 (Probability), 82.79 (NSPS), 99.75 (SBSA). Standard deviations used to compute the standardised-effect sizes were 17.41 (SAFE), 1.60 (Cost), 1.76 (Probability), 18.11 (NSPS), 25.26 (SBSA). SIAS and BFNE-S are reported in the primary outcomes paper (McEvoy, Hyett, Bank, et al., 2022).

3.3. Cross-lagged panel models

3.3.1. Social interaction anxiety

The CLPM with SIAS and SAFE is displayed in Fig. 2A. There was a significant auto-regressive effect for the SIAS during treatment (φ = 0.69, 95% CI = [0.57, 0.82], $p < .001$), indicating that if SIAS scores were one standard deviation above the sample mean, SIAS scores would remain 69% of a standard deviation above the sample mean at the next time point. There was a similar autoregressive association from Week 12 to the one-month follow-up (φ = 0.64 [0.45, 0.84]).

3.3.2. Safety behaviours

During treatment, there were significant autoregressive parameters for SAFE (see Fig. 2A). Further, there was a significant cross-sectional correlation between SAFE and SIAS (r = 0.48 [0.33, 0.64], $p < .001$), indicating that individuals tended to experience change in both SIAS and SAFE at the same time. The cross-lagged association between SAFE and future SIAS during treatment was non-significant (φ = 0.07 [−0.07, 0.22], p = .329). The association between the SIAS and future SAFE during treatment was also non-significant (φ = 0.08 [−0.02, 0.17], p = .128).

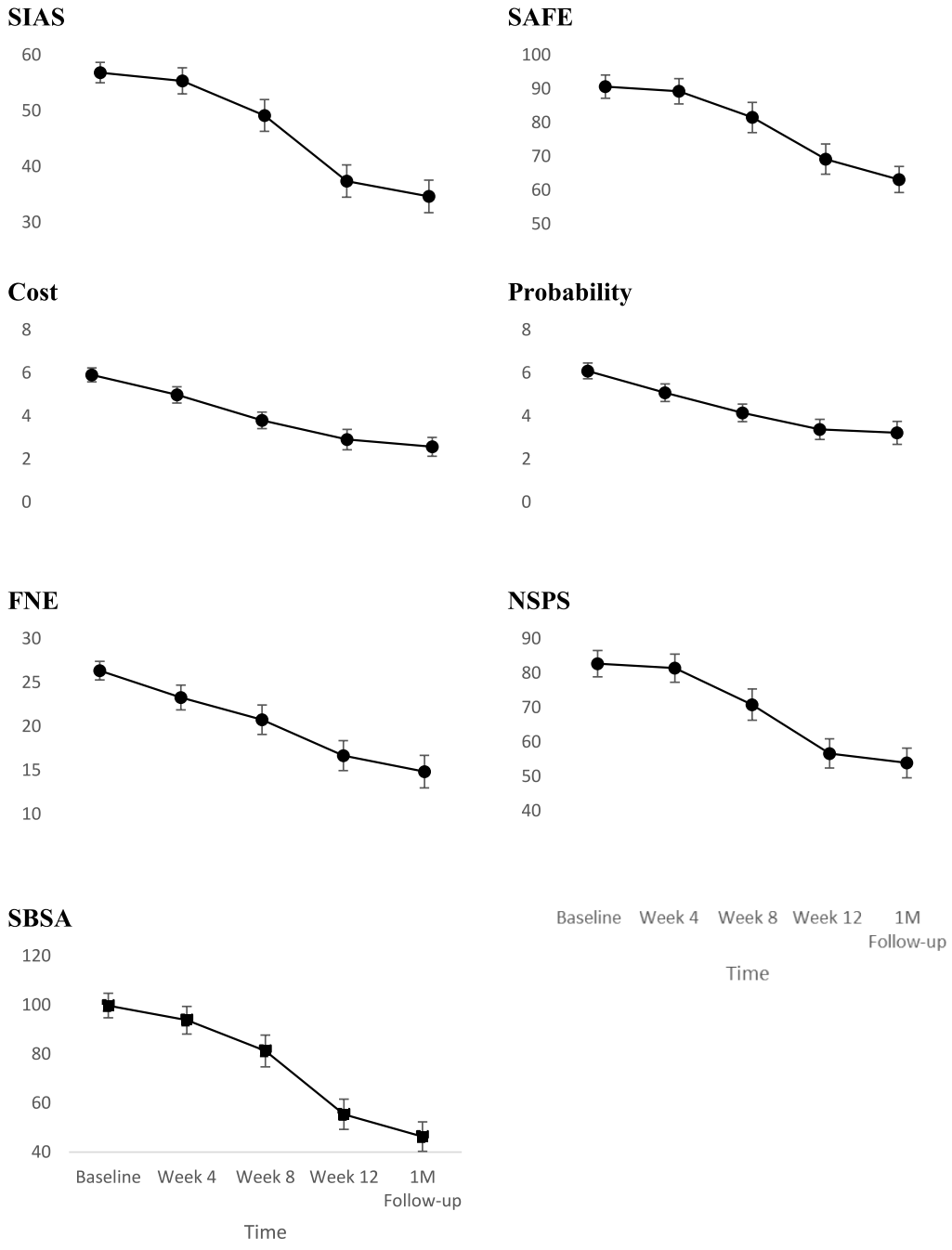

Fig. 1. Mean scores in symptoms of SAD and hypothesized mechanisms of change over the course of treatment. SIAS = Social Interaction Anxiety Scale. SAFE = Safety behaviours. FNE = Fear of Negative Evaluation. NSPS = Negative Self Portrayal Scale. SBSA = Self-Beliefs Related to Social Anxiety. Error bars represent 95% confidence intervals.

During the post-treatment phase, SAFE continued to have a significant auto-regressive relationship. Similarly, the cross-sectional correlation between both variables was consistent at the one month follow-up ($\varphi = 0.48$ [0.30, 0.67], $p < .001$). In contrast to the treatment period, however, there was a significant cross-lagged effect from SAFE at Week 12 to SIAS at the one month follow-up ($\varphi = 0.29$ [0.08, 0.49], $p = .006$), indicating if SAFE scores were standard deviation higher than the sample average at one time point, there was an associated 29% of a standard deviation increase in SIAS above the sample average at the one-month follow-up (when controlling for autoregressive effects). The strength of the reciprocal relationship between the SIAS at Week 12 and SAFE at the one-month follow-up was also larger and statistically significant ($\varphi = 0.28$ [0.03, 0.52], $p < .001$). The model exhibited acceptable fit to the data, (RMSEA = 0.07 [90% CI = 0.04–0.10], CFI = 0.97, TLI = 0.95). While the chi-square test was non-significant, χ^2 (1,72) = 52.05, $p = .014$, the ratio relative to degrees of freedom was below 3 (χ^2/df = 0.72).

3.3.3. *Perceived cost*

The CLPM model with SIAS, perceived cost, and SAFE is displayed in Fig. 2B. During treatment, there was a significant autoregressive parameter for cost ($\varphi = 0.58$ [0.43, 0.72], $p < .001$). In addition, there

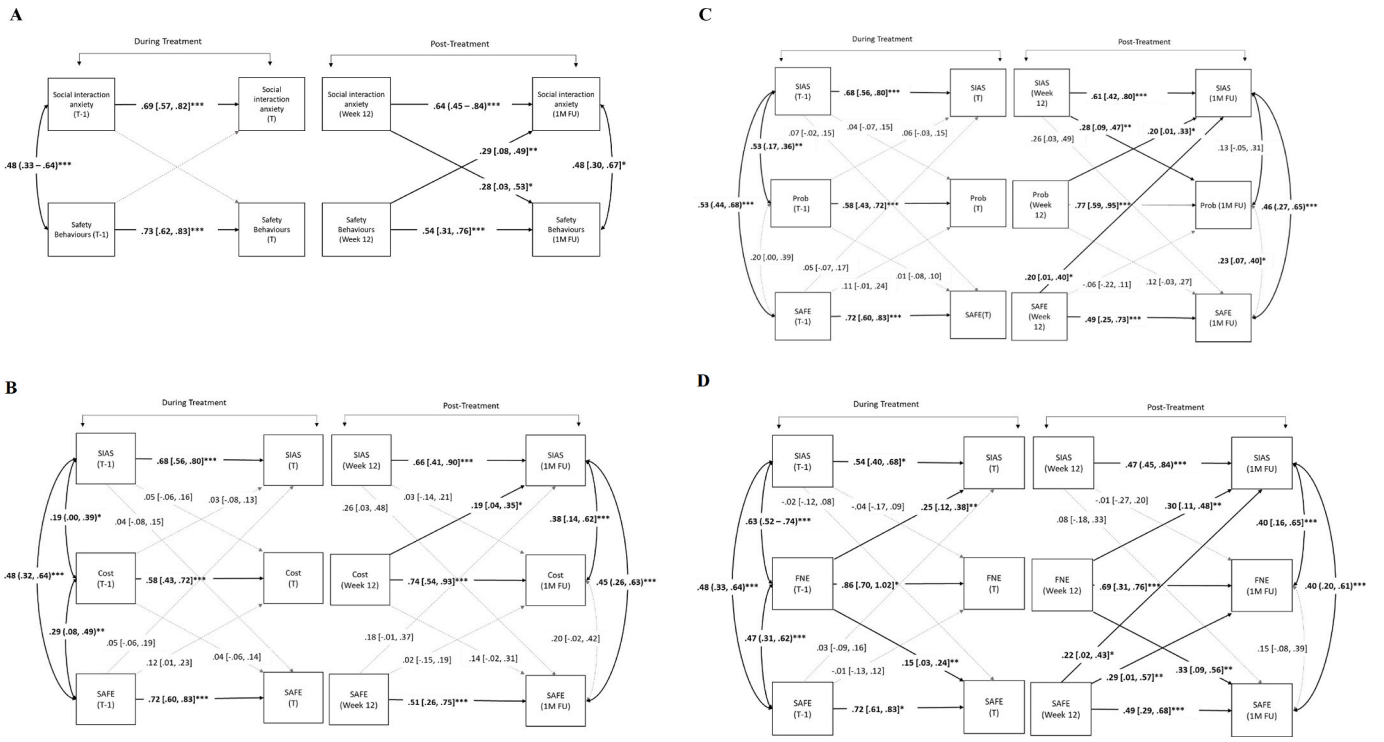

Fig. 2. Autoregressive and cross-lagged parameters from Cross-Lagged Panel Models. T = time, 1M FU = 1-month follow-up. Panel A represents univariate associations between safety behaviours and SIAS scores. Perceived cost (Panel B), perceived probability (Panel C), and fear of negative evaluation (FNE; Panel D) are included in subsequent models. Significant relations are indicated by an asterisk and boldfaced font. Non-significant relationships are represented by grey arrows. Brackets represent 95% credibility intervals. Cross-lagged parameters are standardised.

were significant cross-sectional correlations between all variables. However, there were no significant cross-lagged associations (see Supplementary Table S2 for all parameter estimates).

Following treatment, there were significant autoregressive parameters for each variable. At the one-month follow-up, there were significant cross-sectional correlations between SIAS and both perceived cost and SAFE. The only significant cross-lagged relationship that emerged was between perceived cost assessed at Week 12 and SIAS at the one-month follow-up. The model exhibited acceptable fit to the data, (RMSEA = 0.07 [90% CI = 0.05–0.09], CFI = 0.95, TLI = 0.92). While the chi-square test was statistically non-significant, χ^2 (1,72) = 116.66, $p < .001$, the ratio relative to degrees of freedom was below 3 (χ^2/df = 1.62).

3.3.4. *Perceived probability*

The CLPM model with SIAS, perceived probability, and SAFE is displayed in Fig. 2C. During treatment, there were significant autoregressive parameters for all variables. There were significant cross-sectional correlations between SIAS and both perceived probability and SAFE, but not between probability and SAFE. There were no statistically significant cross-lagged associations between variables.

Following treatment, there were significant auto-regressive parameters for all variables. Further, there were significant cross-sectional correlations between SIAS and both perceived probability and SAFE at the one-month follow-up, but not between probability and SAFE. Both perceived probability and SAFE at post-treatment were associated with SIAS at the one-month follow-up. Further, SIAS at post-treatment was associated with perceived probability at the one-month follow-up, suggesting a reciprocal relationship. The model exhibited acceptable fit to the data, (RMSEA = 0.08 [90% CI = 0.05–0.10], CFI = 0.94, TLI = 0.91). While the chi-square test was non-significant, χ^2 (1,72) = 119.48, $p < .001$, the ratio relative to degrees of freedom was below 3 (χ^2/df = 1.66).

3.3.5. *Fear of Negative Evaluation*

The CLPM model with FNE, SAFE, and SIAS, is displayed in Fig. 2D. During treatment, there were significant autoregressive parameters for all variables. Further, there were significant cross-sectional correlations between all variables. There were also significant cross-lagged associations between FNE and both future SIAS and SAFE.

Following treatment, there were significant autoregressive parameters and there were significant cross-sectional correlations between SIAS and both FNE and SAFE at the one-month follow-up. The correlation between FNE and SAFE was non-significant. There were significant cross-lagged associations between FNE, and both future SIAS and SAFE. Further, SAFE was significantly associated with future SIAS and FNE. The model exhibited acceptable fit to the data, (RMSEA = 0.07 [90% CI = 0.05–0.10], CFI = 0.96, TLI = 0.94). While the chi-square test was non-significant, χ^2 (1,72) = 113.73, $p = .001$, the ratio relative to degrees of freedom was below 3 (χ^2/df = 1.58).

3.3.6. *Negative self-portrayal concerns*

The CLPM model with NSPS, SIAS, and SAFE is presented in Fig. 3A. During treatment, there were significant autoregressive parameters for all variables. Further, there were significant cross-sectional correlations between all variables. There were also significant cross-lagged associations between NSPS and future SIAS and SAFE, but not between SIAS or SAFE and future NSPS.

Following treatment, there were significant autoregressive parameters for all variables, and cross-sectional correlations between all variables. NSPS at Week 12 was not significantly associated with either SIAS or SAFE at the one-month follow-up. On the other hand, SAFE was significantly associated with future SIAS. The model exhibited relatively poor fit to the data for most metrics, RMSEA = 0.11 [90% CI = 0.09–0.14], CFI = 0.92, TLI = 0.88, χ^2 (1,72) = 169.31, $p < .001$, χ^2/df = 2.35.

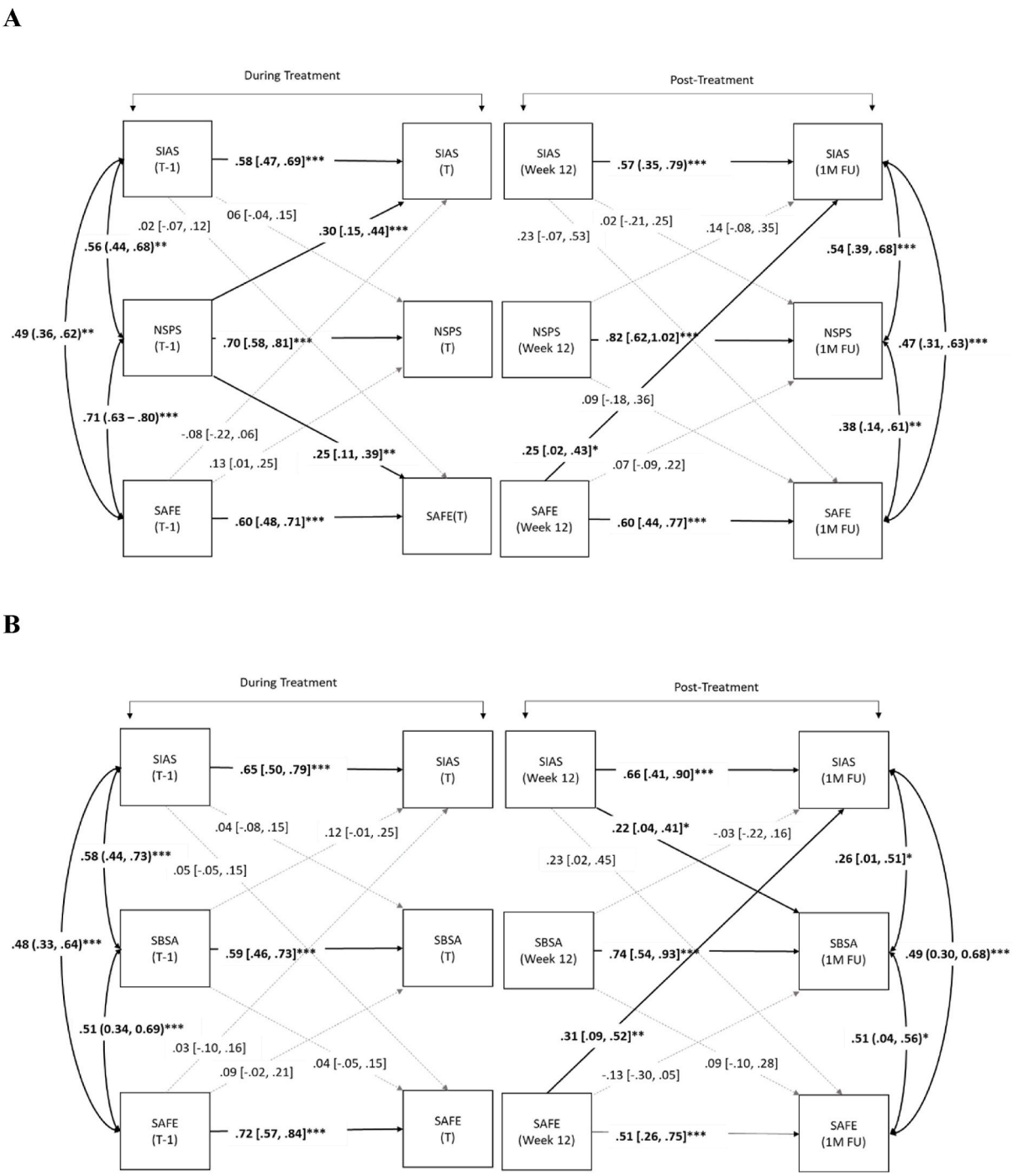

Fig. 3. Autoregressive and cross-lagged parameters from two Cross-Lagged Panel Models assessing associations between cognitive mechanisms (Panel A: Negative Self-Portrayal, Panel B: Self-beliefs Related to Social Anxiety), social interaction anxiety and safety behaviours. T = time, 1M FU = 1-month follow-up. Significant relations are indicated by an asterisk and boldfaced font. Non-significant relationships are represented by grey arrows. Brackets represent 95% credibility intervals. Cross-lagged parameters are standardised.

3.3.7. *Self-Beliefs Related to social anxiety*

The CLPM model with SBSA, SIAS, and SAFE is presented in Fig. 3B. During treatment, there were significant autoregressive parameters for all variables. Further, there were significant cross-sectional correlations between all variables. There were no significant cross-lagged associations between SBSA and future SIAS and SAFE.

Following treatment, there were significant autoregressive parameters for each variable, and significant cross-sectional correlations between all variables. There were significant cross-lagged associations between SIAS at Week 12 and SBSA at the one-month follow-up, indicating change in SIAS was associated with change in future SBSA. Further, SAFE was associated with future SIAS. There were no significant cross-lagged associations between SAFE and SBSA. The model exhibited acceptable fit to the data, RMSEA = 0.07 [90% CI = 0.04–0.09], CFI = 0.96, TLI = 0.95, χ^2 (1,72) = 106.85, p = .005, χ^2/df = 1.48.

3.4. *Post-hoc Monte Carlo simulation*

Power levels and bias were examined through post-hoc Monte Carlo

simulations, where parameter estimates saved from the data analyses were used for population parameter values for data generation and coverage. We found no evidence of bias for SAFE and NSPS. BFNE and Probability exhibited a small degree of parameter estimate bias (i.e., <5% bias), and BFNE, Cost, Probability, and SBSA exhibited slight standard error cut-off bias for significant parameters (i.e., <5% bias). There was no evidence of parameter or standard error bias for non-significant parameters, or power levels under 80% for significant parameters. The specific parameter estimates that exhibited a degree of bias have been presented in detail in Supplementary Table S5. In short, there was evidence of negative bias for the standard errors for statistically significant autoregressive parameters, which means a risk of identifying relationships as more significant than they truly are (evident for SIAS, SBSA, Probability, and Cost). There was also negative bias for the non-significant cross-lagged parameters, which means there was a risk of returning estimates lower than the "true" relationship (Probability at T predicting SAFE at T+1; SAFE at T Predicting BFNE at T+1).

4. Discussion

Understanding how change in social-evaluative beliefs and behavioural mechanisms generate improvements in SAD symptoms is crucial for improving the delivery of CBT. The current study examined change trajectories of theorised maintaining mechanisms of SAD, and how these changes may be concurrently and prospectively associated with symptom change. The first hypothesis was that use of safety behaviours and social-evaluative beliefs (probability, cost, FNE, self-portrayal concerns, self-beliefs) would significantly reduce during treatment. This hypothesis was supported. All measures improved significantly over the course of treatment, for both the imagery and verbal-based CBT protocols, and these changes did not significantly differ by treatment, reflecting the comparable effectiveness reported previously for social interaction anxiety and fear of negative evaluation (McEvoy, Hyett, Bank et al., 2022). While some social-evaluative beliefs may be more generalised and pervasive (e.g., general self-beliefs and self-portrayal concerns) than others (e.g., specific probability and cost beliefs in relation to a speech task), findings from the current study suggest that all the measured variables were successfully modified during CBT.

The second hypothesis that decreases in the social-evaluative beliefs would be concurrently and prospectively associated with decreases in social interaction anxiety and safety behaviours, and safety behaviours would be associated with social interaction anxiety, was partially supported. Significant associations in same-session (i.e., cross-sectional) changes in measures of social-evaluative beliefs, safety behaviour use, and social interaction anxiety were consistently observed during treatment and at post-treatment. Although causality cannot be inferred from these associations, they support cognitive behavioural theories that emphasize the interrelated nature of negative social-evaluative beliefs, safety behaviours, and symptoms of social anxiety in individuals with SAD.

During treatment, only changes in FNE and negative self-portrayal concerns emerged as significant prospective predictors of social anxiety symptom change (SIAS) and use of safety behaviours (SAFE). In contrast, prospective cross-lagged associations were not observed during treatment between the other measures of negative social evaluative beliefs (i.e., probability, cost, self-beliefs) and subsequent safety behaviour use or symptoms of social anxiety, nor were changes in use of safety behaviours a prospective predictor of changes in symptoms. These findings are consistent with CBT models of SAD that incorporate FNE (Clark & Wells, 1995; Rapee & Heimberg, 1997) and negative self-portrayal concerns (Moscovitch, 2009) as key risk factors underlying the persistence of social interaction anxiety. Further, results provide preliminary evidence that treatment-related reductions in social interaction anxiety and safety behaviours are temporally preceded by decreases in fear of negative evaluation and negative self-portrayal concerns. These findings support Moscovitch's (2009) position that reductions in symptoms can be effectively achieved with interventions that ameliorate core fears associated with the imagined consequences of revealing one's perceived self-flaws to critical others. The lack of a prospective cross-lagged associations between self-beliefs (high standards beliefs, conditional beliefs, unconditional beliefs) and social anxiety and safety behaviours was inconsistent with Clark and Wells's (1995) model.

Why were there no other significant prospective associations between candidate predictors, specifically probability, cost, and self-beliefs, and outcomes during treatment? A possible explanation is that the four-week intervals between our assessment points may have been too long to detect dynamic changes in these variables in correspondence with one another over time within the context of treatment. Evidence supporting this idea comes from prior work in which prospective associations have been observed when variables were measured at more frequent intervals. For instance, Gregory et al. (2018) found prospective associations between self-beliefs and social anxiety symptoms when administered biweekly. Other researchers have found that threat appraisals (probability and cost) are prospectively associated with social anxiety over half-weekly periods (Hoffart et al., 2009). Our findings of prospective relationships between FNE, negative self-portrayal concerns, and social interaction anxiety suggests that a four-week period may be adequate to detect relationships between these variables and symptoms, whereas similar relationships between other beliefs and safety behaviours may occur over shorter or longer periods of time.

In contrast to the associations between measures observed during treatment, associations between measures of probability, cost, safety behaviours, and FNE at week 12 were prospectively associated with SIAS at the one-month follow-up, and may be particularly important post-treatment predictors of symptom deterioration. During treatment patients are encouraged to challenge fears and core beliefs; however, following treatment external motivations (e.g., therapist influence) are largely be absent, and practice of treatment exercises and skills may largely rely on intrinsic motivation (Heimberg & Becker, 2002; McEvoy, Saulsman, & Rapee, 2018). Patients who exhibit increases in safety behaviours, FNE, and perceived cost and probability at the completion of treatment may therefore be at-risk of poorer outcomes at the one-month follow-up. Moreover, safety behaviours at week 12 were significantly associated with FNE and negative self-portrayals at one month follow up, suggesting that continued exposure without the use of safety behaviours may be essential. Negative self-portrayal concerns and self-beliefs did not prospectively predict social interaction anxiety or safety behaviours during the post-treatment period, although there was evidence of cross-sectional correlations at the one-month follow-up. Therefore, higher levels of safety behaviours, FNE, and threat appraisals (probability and cost) at post-treatment may be particularly important indicators of patients who are at greater risk of symptom deterioration following treatment.

4.1. Clinical implications

Findings from the current study suggest that imagery-enhanced and verbally-based group CBT are associated with significant reductions in social interaction anxiety and theory-driven cognitive and behavioural maintaining factors, including threat appraisals (probability, cost), FNE, negative self-portrayal concerns, self-beliefs, and safety behaviours. Clinicians should carefully monitor changes in each of these factors during treatment along with commensurate reductions in social anxiety symptoms. During treatment, decreases in FNE and negative self-portrayal concerns in particular may signal to clinicians that their interventions are on the right track, whereas increases in scores on these measures should alert clinicians to the need for more intensive targeting of these beliefs. It is also important for clinicians to be aware that optimising decreases in probability, cost, safety behaviours, and FNE at the end of treatment may reduce the risk of deterioration in social interaction anxiety by one-month follow-up. Patients who experience

end-of-treatment increases in their scores on these measures may require more careful monitoring or 'top up' sessions to optimise and maintain treatment gains.

Although this study assessed a variety of cognitive and behavioural factors, in addition to symptoms, it may not be practical to administer such a wide range of repeated measures during therapy in many mental health settings. Clinicians may therefore need to use their case formulation to assess session-by-session change in the cognitive mechanisms they believe are contributing most to a particular client's symptoms, and to imbed repeated measurement of such mechanisms in creative ways during the treatment process. For example, modification of specific threat appraisals may be easily assessed before and after discrete behavioural experiments, whereas more general measures of self-beliefs, negative self-portrayal concerns, or fear of negative evaluation may be tracked at less regular intervals via remote administration of online questionnaires immediately before specific sessions over the course of therapy. If treatment is targeting a particular self-belief, then the administration frequency of that measure may need to increase.

4.2. Limitations and directions for future research

There are several limitations to the current study. First, monthly assessments limited the duration over which dynamic relationships could be investigated. Fluctuations in study variables may occur over shorter or longer periods of time, and different estimates of the same effects across studies may be due to different time intervals (Kuiper & Ryan, 2018). Future research using different intervals between assessments will complement findings from the current study. A second limitation was the sample size, which was generally robust for conducting multiple CLPMs on each type of social-evaluative beliefs separately but insufficient for comparing the effects of all beliefs within a single CLPM. We do however note that there was risk of negative bias in estimates of non-significant parameters and standard errors of significant parameters. Our aim was to investigate changes in a range of theory-driven social-evaluative beliefs within the same cohort who were exposed to many of the same treatment parameters, as a way of controlling method variance that occurs across different studies. However, future studies investigating a smaller number of factors, or with larger samples, will be better placed to investigate more complex relationships between social-evaluative beliefs and social anxiety. For instance, the non-significance of effects in the bivariate SIAS and SAFE model in the current analysis was potentially only due to a lack of power, and future studies could target this association with a larger sample. Conversely, the number of models run in this study may have inflated the Type I error rate, and although adjustments were made to control for this replication of these effects is important. It is noteworthy, however, that the magnitude of non-significant effects tended to be very small, indicating that if replicated and reliable they are unlikely to be clinically meaningful. Interpreting parameter magnitudes and precision around these estimates is likely to be more informative than focusing on statistical significance, and larger samples would yield narrower confidence intervals and higher precision.

Third, the absence of an inert control condition limits the ability to draw firm conclusions regarding the causal effects of CBT on the mechanisms and outcomes. Nonetheless, the pattern of relationships does provide clues about variables that are prospectively associated with changes in social anxiety symptoms during treatment, which could inform RCTs comparing treatments with enhancements designed to target each of the cognitive variables to treatments or control conditions without such enhancements. Fourth, the current study focused on social interaction anxiety as the primary outcome measure for a preregistered RCT (McEvoy et al., 2017; McEvoy, Hyett, Bank et al., 2022); however, it is unclear whether and how our findings would generalize to other important outcomes, such as social performance anxiety or functional impairment, both of which are also emphasized in the current diagnostic criteria for SAD within the DSM-5 (APA, 2013). Fifth, as reported in the primary outcomes paper (McEvoy, Hyett, Bank et al., 2022), the sample was predominantly Anglo-European (90%), so replications with samples from other ethnicities are required. Sixth, although the clinical trial, measures, timing, and statistical plan for the primary outcomes were pre-registered, the specific analyses reported in this study were not and thus they require replication. Lastly, the individual subscales of the NSPS and SBSA measures were not include in separate models in the current study. Associations with SAD symptoms may be different among subscales.

5. Conclusions

The current study investigated concurrent and prospective associations between changes in social-evaluative beliefs, use of safety behaviours, and symptoms of social interaction anxiety during the acute treatment and post-treatment phases of two standardised CBT protocols for SAD. Although there were no differences between treatment protocols, patterns of association between variables depended on the phase examined, with decreases in negative self-portrayal concerns and FNE prospectively associated with decreases in social interaction anxiety during treatment, and probability, cost, safety behaviours, and FNE associated with changes in social interaction anxiety during the post-treatment phase. Reductions in FNE were prospectively associated with reductions in social interaction anxiety during both phases, suggesting that it may be a particularly salient intervention target for ensuring acute and lasting symptom changes in people with SAD. Further research is needed to replicate and extend these findings and to examine their utility for the development and delivery of personalised interventions for SAD based on each patient's unique expression of symptoms.

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Data sharing statement

All trial data will be shared to an open-access repository hosted by Research Data Australia following publication of the primary outcomes (see https://researchdata.ands.org.au).

CRediT authorship contribution statement

Michael J. Kyron: Formal analysis, Writing – original draft, Data curation, All authors contributed to the reviewing and editing of the manuscript. **Andrew Johnson:** Formal analysis, Writing – original draft, Data curation, All authors contributed to the reviewing and editing of the manuscript. **Matthew Hyett:** Conceptualization, Methodology, was the lead trial clinician, data collection for the study, All authors contributed to the reviewing and editing of the manuscript. **David Moscovitch:** Investigation, Funding acquisition, Conceptualization, interpretation of the study findings, All authors contributed to the reviewing and editing of the manuscript. **Quincy Wong:** Conceptualization, interpretation of the study findings, All authors contributed to the reviewing and editing of the manuscript. **Samantha R. Bank:** Conceptualization, Methodology, was the lead trial clinician, data collection for the study, All authors contributed to the reviewing and editing of the manuscript. **David Erceg-Hurn:** Data curation, Formal analysis, Formal analysis, All authors contributed to the reviewing and editing of the manuscript. **Peter M. McEvoy:** Writing – original draft, Conceptualization, Methodology, Funding acquisition, Supervision, All authors contributed to the reviewing and editing of the manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.brat.2023.104253.

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