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Research paper

Identifying mediators of cognitive behaviour therapy and exposure therapy for social anxiety disorder (SAD) using repeated measures

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ABSTRACT

Background: Process research aims to identify mediators of therapy which can help increase the efficacy and optimization of therapy. The present study examined the role of estimated social cost, perceived social self-efficacy and perceived emotional control as potential mediators in Cognitive Behaviour Therapy (CBT) and Exposure Therapy (EXP) in individuals with social anxiety disorder.

Methods: Fifty adults with a primary diagnosis of social anxiety disorder (SAD) were recruited from a tertiary treatment center and randomly assigned to receive either CBT (N=25) or EXP (N=25).Levels of social anxiety, estimated social cost, perceived social self-efficacy, and perceived emotional control were assessed at the beginning of each session. Multilevel modeling was used to estimate the effects of the above variables on social anxiety and examine differences between the two groups.

Results: Changes in perceived social self-efficacy and estimated social cost predicted changes in social anxiety. Perceived emotional control was not a significant predictor of changes in social anxiety. There were no significant differences between the two groups.

Limitations: The study has a small sample size, and there is a lack of adequate follow-up data. A single therapist delivered both interventions, which could limit external validity.

Conclusions: Perceived social self-efficacy and estimated social cost emerged as mediators of both CBT and EXP. The two interventions had common meditational pathways, and there was an interactive bi-directional relationship between social anxiety and the studied mediators.

1. Introduction

Social anxiety disorder (SAD) is marked by intense anxiety in social situations, fear of negative evaluation, and avoidance of social situations (Sadock and Sadock, 2008). It is one of the most common anxiety disorders amongst youth in India (Shah and Kataria, 2010) and is associated with significant dysfunction and distress (Fresco et al., 2000).

Cognitive Behaviour Therapy (CBT) and Exposure Therapy (EXP) are both empirically supported therapies for SAD (Acarturk et al., 2009; Arch and Craske, 2009; Mayo-Wilson et al., 2014), but outcome studies do not shed light on the mechanism or mediators of these therapies.

Identifying mediators of therapy would aid in making therapy more optimal, efficient and, cost-effective (Kazdin, 2007; Laurenceau et al., 2007; Murphy et al., 2009). It would also aid in validating the distinct models of SAD (Kazdin, 2007), which identify and emphasize different mediating factors and corresponding treatment routes (Clark and Wells, 1995; Heimberg and Becker, 2002; Hofmann, 2007; Rapee and Heimberg, 1997)

Although both the therapies have some standard techniques (Butler et al., 1984; Clark and Wells, 1995), they differ with respect to their putative theoretical mechanisms. CBT is based on the hypothesis of cognitive mediation, which suggests that changes in cognition bring about change in symptoms (Clark, 1986; Garratt et al., 2007). On the other hand, EXP has been hypothesized to work through extinction learning (Abramowitz, 2013) and changes in the fear network due to new experiences (Foa and Kozak, 1986). Another hypothesized mediator is self-efficacy, as described in Bandura's social cognitive theory (Bandura, 1997; Tryon, 2005).

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There is a paucity of studies comparing mediators of CBT and EXP in SAD. Previous studies on mediational pathways comparing CBT and Third-wave therapies such as ACT have suggested distinct mediators for two related therapy modalities for SAD (Forman et al., 2012; Kocovski et al., 2015).

Comparing the outcome of cognitive versus behavioral techniques could aid in empirical support of the underlying theoretical mechanisms. Literature suggests that EXP is effective without the addition of cognitive techniques in the treatment of SAD (Feske and Chambless, 1995; Gil et al., 2001). This would suggest that cognitive techniques may not be required to address cognitive factors (Longmore and Worrell, 2007). However, Taylor (1995) also found that cognitive restructuring with or without exposure techniques is equally effective. A recent network meta-analysis by Mayo-Wilson et al (2014) found the largest effect size for individual CBT, which was higher than that of EXP and social skills training. This indicates that cognitive techniques play an important role in reducing symptoms.

Studies examining changes in cognitions to validate the mechanism underlying CBT have noted changes in variables like negative self-beliefs and post-event processing at the end of therapy (Abbott and Rapee, 2004; Boden et al., 2012; Price and Anderson, 2011). However, since these variables were assessed only at baseline and the end of therapy, they have not been established as occurring before changes in symptoms (Kazdin, 2007). Therefore, in the present study, we repeatedly measured putative mediators and symptom severity during the course of therapy to establish the temporal order of decrease in variables. Assessing multiple mediators may also help capture contrasting or interacting effects and greater control of extraneous variance (Kazdin, 2007).

In the present study, we selected variables with strong empirical links to SAD and those hypothesized to be mediators in either CBT or EXP. Clark and Wells' (1995) model of social anxiety suggests that individuals with social anxiety overestimate the consequences of making mistakes in social situations, also known as social cost, thus increasing their perception of the social situation as a threat. Estimated social cost is the term used for the exaggerated appraisal of threat in the context of social anxiety (Foa and Kozak, 1986; Hofmann, 2007). It is theoretically linked to threat appraisal, the primary cognitive distortion in anxiety disorders (Beck et al., 1986; Clark, 1986; Clark and Wells, 1995; Foa and Kozak, 1986). Although it has been linked to symptom reduction in anxiety disorders (Smits et al., 2012), few studies have examined estimated social cost as a mediator during therapy and therefore established temporal precedence (Hoffart et al., 2009; Smits et al., 2006).

Self-efficacy has been hypothesized as a factor in anxiety reduction (Bandura, 1997). Perceived social self-efficacy (PSSE) is defined as the belief in the capacity or confidence of the individual to accomplish specific outcomes using social skills in interpersonal and interactional situations (Bandura, 1997). There is empirical support for the relationship between low levels of self-efficacy and increased social anxiety (Iancu et al., 2015). It is hypothesized that it might primarily mediate EXP since mastery experiences aim to increase efficacy expectancies and disconfirm negative self-efficacy beliefs (Bandura, 1984).

While self-efficacy has not been examined in therapy for SAD, it has been a more significant mediator than threat appraisal and arousal levels in EXP for specific phobia and agoraphobia (Williams et al., 19891985, 1984). It is also a mediator in CBT for panic disorder (Bouchard et al., 2007; Fentz et al., 2013; Gallagher et al., 2013). Since it has theoretical links to both models, we included self-efficacy as a potential mediator, linking it to cognitive and behavioral techniques.

Another variable is that of perceived level of control over emotions in social situations. Perceived control over emotions can affect levels of social anxiety (Hofmann, 2007), and it correlates significantly with social anxiety and estimated social cost (Hofmann, 2005). Suppression of emotions and negative beliefs about expressing emotions are associated with social anxiety (Spokas et al., 2009; Turk et al., 2005). Although perceived emotional control is significant in mediating change in therapy for panic disorder (Meuret et al., 2010), it has not been examined as a potential mediator in therapy for SAD. Similar constructs such as cognitive reappraisal self-efficacy (Goldin et al., 2012) and anxiety over loss of control (Vögele et al., 2010) have been identified as significant predictors in CBT and EXP for SAD. Therefore, it was selected as a variable having trans-theoretical links with social anxiety.

The primary research question was to examine differences between mediational pathways of CBT and EXP given their differing theoretical mechanisms, and to examine the impact of estimated social cost, perceived social self-efficacy, and perceived emotional control on the levels of social anxiety during therapy. A secondary question arising from the first is comparing the three variables in terms of their level of impact across the two forms of therapy and the third research question was to examine the impact of the level of social anxiety on the three variables to address the question of temporal precedence.

2. Methodology

2.1. Research design

A randomized controlled design comparing CBT and EXP, with repeated measures assessment during therapy and 3- month follow-up, was adopted.

2.2. Sample

Fifty adults, aged between 18 and 45 years, with a primary diagnosis of SAD as per DSM IV-TR and stabilized on mediation for $\geq$ four weeks were recruited from the outpatient services of a tertiary mental health care center in Southern India. Those with a primary diagnosis of schizophrenia, psychosis, bipolar affective disorder, severe depressive episode with psychotic symptoms, current psychoactive substance dependence other than nicotine, and had received structured psychological intervention for SAD in the previous year were excluded.

2.3. Procedure

The procedure for screening, recruitment, therapy, and assessments is depicted in Fig. 1. The Institute ethics committee reviewed and approved the study, and the study was registered with the clinical trials registry of India (CTRI/2021/03/032435).

Participant flow and allotment are shown in Fig. 1. Baseline assessments were carried out following allotment. Participants were screened on the **Mini-International Neuropsychiatric Interview 6th Edition (MINI;** Sheehan et al., 1998**)** to confirm SAD and assess other comorbid Axis I disorders. The **Structured Clinical Interview for DSM-IV Axis II-Personality Disorders (**SCID-II; First et al., 1997) was used to assess the presence of Axis II disorders**.** Treatment completers were those who completed at least 80% of the intervention program. Attrition in the CBT group was 12% (n=3) and 28% in the EXP group (n=7). However, this difference was not significant (X^2=.289). The number of sessions ranged from 11-14 sessions (CBT (M= 13.1; SD = 1.23); EXP (M = 12.1; SD =1.27).

2.4. Measures

2.4.1. Outcome measures

Social anxiety was assessed at baseline, post-intervention, and at 3-month follow-up using the **Liebowitz Social Anxiety Scale (LSAS)** (Liebowitz, 1987) by an independent, experienced clinician, blind to intervention allocation. Both self-report and clinician-administered versions were employed. The correlation between self-rated LSAS and the clinician-administered LSAS was 0.62 at baseline and 0.88 post-intervention. This 24-item scale assesses fear and avoidance in different social situations and has good psychometric properties (Baker et al., 2002). In the present study, Cronbach's alpha for the fear subscale of LSAS-CA was 0.82 and 0.87 for the avoidance subscale. For the

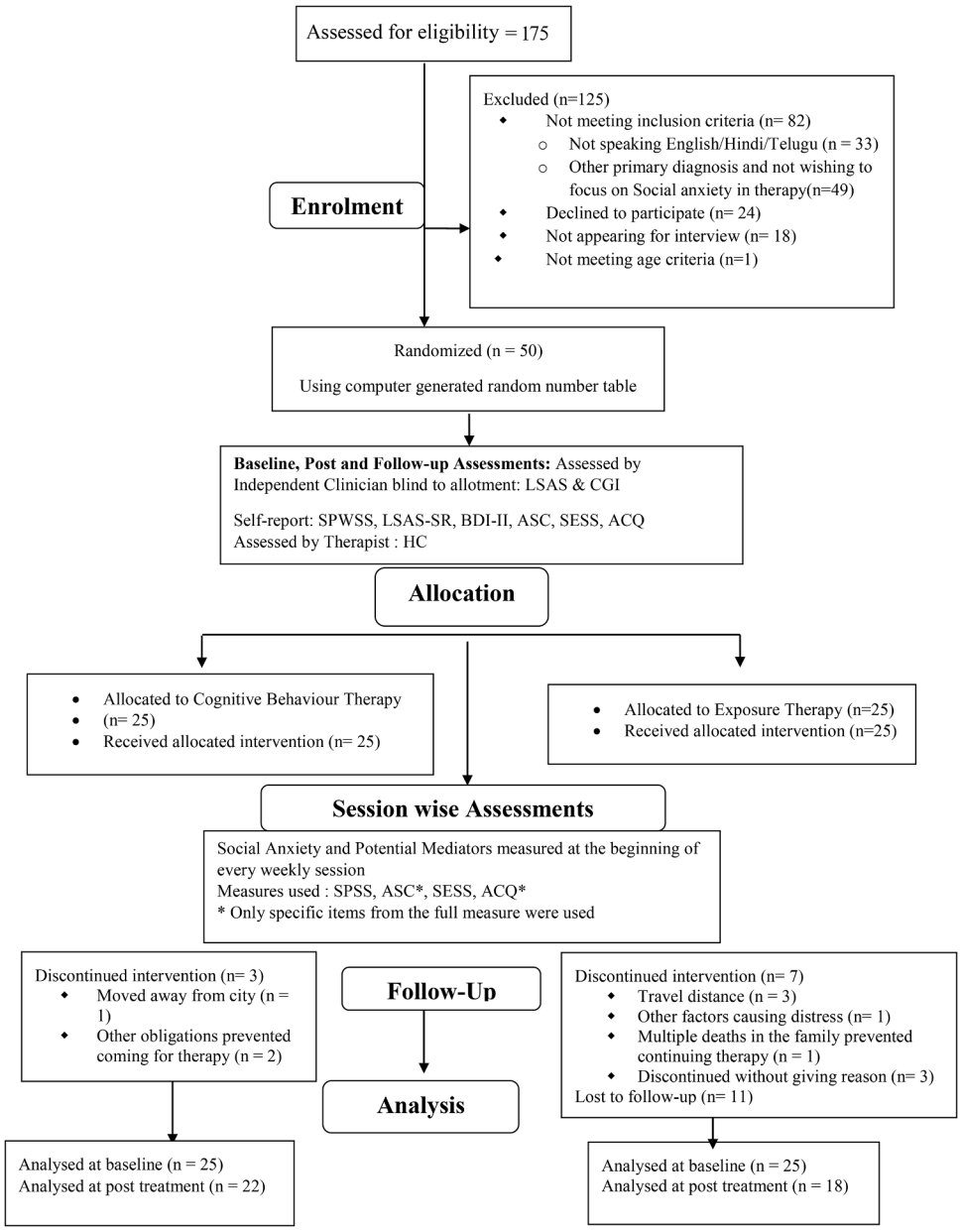

Fig. 1. Flowchart representing sample selection process and participant flow.

self-report, it was 0.86 for the fear subscale and 0.87 for the avoidance subscale.

An independent blind-rater administered the **Clinical Global Impression Scale (CGI**; Guy, 1976**),** consisting of three global scales, and assessed overall symptom severity and improvement. The scale has adequate inter-rater reliability and validity (Zaider et al., 2003).

The **Social Phobia Weekly Summary Scale (SPWS**; Clark et al., 2003) was administered to assess social anxiety on a session-by-session basis and at baseline, post-intervention, and 3-month follow-up. The scale assesses the severity of social anxiety, avoidance of social situations, self-focused attention, anticipatory and post-event processing. It has an excellent internal consistency of 0.81 and has been sensitive to therapy changes (Clark et al., 2003). Cronbach's alpha was 0.77 in the present study.

Beck's Depression Inventory-II (BDI-II; Beck et al., 1996), consisting of 21 items, was used to assess depressive symptoms in participants at baseline, post-intervention, and three-month follow-up. Cronbach's alpha was 0.89 in the present study.

Homework Compliance Scale (Primakoff et al., 1986) was administered by the therapist. A combined score was assigned across both therapy formats, based on the degree and quality of homework compliance throughout therapy.

2.4.2. *Mediators measures*

Estimated *social cost*

Appraisal of Social Concerns Scale (Telch et al., 2004) is a 20 item scale that assesses the degree of concern over Negative Evaluation, Observable symptoms, and Social helplessness. It has good psychometric properties (Telch et al., 2004). Cronbach's alpha was 0.91 in the present study.

Perceived social self-efficacy

Self-efficacy for Social Situations (Gaudiano and Herbert, 2003) is a 9-item measure assessing self-efficacy in social skills, managing thoughts and worries, and managing nervousness. The test has an

excellent internal consistency of 0.81 (Gaudiano and Herbert, 2003). Cronbach's alpha in the current study was 0.82.

Perceived emotional control

The **Anxiety Control Questionnaire (Rapee et al., 1996)** consists of two subscales, Internal Reactions, and External situations, measuring the perceived control over internal reactions like emotions and external events. The questionnaire has good psychometric properties (Rapee et al., 1996). Cronbach's alpha was 0.71 in the current study.

2.4.3. Session-by-session assessment

Assessments for potential mediators and levels of social anxiety were conducted before each session. The Appraisal of Social Concerns Scale (Telch et al., 2004) and Anxiety Control Questionnaire (Rapee et al., 1996) were both shortened to reduce the client's burden. The items were selected to ensure high internal consistency and represented the subscales present in the full measure, as recommended by the author in personal communication (Table 1). There were moderate to high correlations between the full-length version of the scales and the abbreviated measures, indicating that they adequately represent the full scale.

The order of administration of both scales and items was randomized for each session to reduce practice effects. Participants completed the measures in the absence of the investigator to reduce expectancy bias and socially desirable responses. The participants returned completed assessment forms in sealed envelopes, which remained sealed until the end of therapy to avoid biases or changes in therapy. Participants were informed that their responses would remain concealed from the therapist until therapy was completed to reduce expectancy bias.

2.5. Interventions

2.5.1. Cognitive behaviour therapy

Cognitive Behaviour Therapy (CBT) included cognitive restructuring and strategies to modify self-focused attention, negative automatic thoughts, safety behaviors, and long-term factors such as dysfunctional assumptions and beliefs in the latter part of therapy (Wells, 1997).

2.5.2. Exposure therapy (EXP)

EXP was based on the treatment model recommended by Butler (1984) and included repeated exposure to social situations, gradually and systematically, thereby reducing avoidance of social situations. Sessions consisted of preparing a hierarchy of anxiety-provoking situations based on individual presentations, followed by a focus on engaging in exposure exercises with or without assistance from the therapist and reducing avoidance strategies.

2.6. Treatment integrity

A doctoral-level candidate (first author) with supervised training in CBT and EXP for social anxiety delivered both interventions. Adherence to the therapeutic models was ensured by maintaining transcripts of each session and a review by the supervisor. Ten percent of the total number of sessions in each group, selected at random, were rated for adherence to therapy protocols by an independent clinician with over 15 years of experience in practice and supervision of CBT and EXP.

2.7. Statistical analysis

The intervention groups were compared at baseline on the outcome and mediator variables, demographic and clinical characteristics. Level of social anxiety at baseline, post, and follow-up assessment was analyzed in both groups using Repeated Measures ANOVA to ensure significant change to allow for mediational analysis.

Linear Mixed-Effects Models were performed to adjust the effects of the covariates (such as potential mediators) in the longitudinal model with the outcome variables as the dependent measures. Linear Mixed-Effects Model accommodates random effects due to individual participants and time and the fixed effects of the intervention group and process variables (Luke, 2004). The significance level was set at $p<0.05$.

3. Results

3.1. Description of the sample

The final sample (n = 40) comprised of predominantly males (CBT = 84%; EXP = 92%; X^2 =0.758) in their late 20's (mean age in CBT = 27.92 ± 7.13 years and EXP =28.28 ± 7.89 years; p= 0.866). The majority of the sample was single, college-educated, and employed. Both groups were comparable on years of education (X^2=6.15;p=0.104),

Table 1
Contents of the process measures used in each session.

Sl. No.	Measures	Number of items	Items chosen	Factor Loading
1.	Appraisal of Social Concerns (ASC) (Telch et al., 2004)	6 out of the 20 items were selected The scale has three factors: Negative evaluation, observable symptoms and social helplessness (Telch et al., 2004). 2 items were selected per factor in the scale.	Trembling	0.89 on the Observable symptoms subscale
			Appearing Stupid	0.92 on Negative Evaluation subscale
			People laughing at you	0.93 on the Negative Evaluation subscale
			Poor voice quality (cracking, stuttering, squeaking, etc.)	0.80 on the Observable symptoms subscale
			Losing control (screaming, running out, etc.)	0.91 on the Social Helplessness subscale
			Appearing weak	0.64 on the Social Helplessness subscale
2.	Self-Efficacy in Social Situations (SESS)	All 9 items were selected		
3.	Anxiety Control Questionnaire (ACQ) (Rapee et al., 1996)	7 out of 30 items were selected The scale has two factors: Internal Reactions and External Situations 3 items to represent external events subscale. 4 items to represent the internal reactions subscale.	When I am frightened by something, there is generally nothing I can do.	0.60 on the External Situations subscale
			There is little I can do to change frightening events.	0.65 on the External Situations subscale
			There is little I can do to influence people's judgements of me.	0.63 on the External Situations subscale
			I am able to control my level of anxiety.	0.55 on the Internal Reactions subscale
			My emotions seem to have a life of their own.	0.46 on the Internal Reactions subscale

Table 2.
Baseline and Clinical Characteristics of the Sample.

VARIABLES		Cognitive Behaviour Therapy (N = 25)		Exposure Therapy (N=25)		Test Value
Age (in years)				28.28 ±		
Mean		27.92 ±		7.89		t = -.169
Standard Deviation		7.13				p = 0.866
		F	**%**	**F**	**%**	X^2 **(Sig. 2 tailed)**
Sex	**Male**	21	84	23	92	0.758
	Female	4	16	2	8	(0.384)
Education	**Professional/ Postgraduate/ Doctorate**	17	68	14	56	6.15 (0.104)
	6^{th}-12^{th}	5	20	5	20	
	Graduate	3	12	6	24	
Occupation	**Employed**	14	56	16	64	2.28
	Student	8	32	6	24	(0.515)
	Unemployed	3	12	3	12	
Marital Status	**Single**	15	60	18	72	2.27
	Married	10	40	6	24	(0.321)
	Divorced	0	0	1	4	
Age of onset of social anxiety disorder	**Childhood/ Adolescence**	21	84	20	80	0.136 (0.713)
	Young/ Middle adulthood	4	16	5	20	
Medication Status	**Currently stabilized on medications**	12	48	12	48	1.000
	Not on medications	13	52	13	52	
Axis-I Comorbidity	**Present**	15	44	10	40	1.28
	Absent	10	56	15	60	(0.157)
Personality disorders	**Present**	11	44	5	20	3.30
	Absent	14	56	20	80	(0.069)

F – Frequency; *p<.05; **p<.01

occupational status ($X^{2=}$2.28; p=0.515), and marital status(X^2=2.27; p$^=$0.321) (Table 2).

The sample had marked to severe levels of social anxiety based on self-rated (Mean=90.72; SD=19.49 EXP=86.88;SD=22.07; p=0.518) and clinician-rated LSAS score at baseline (Table 3;CBT Mean=81.96; SD=19.43;EXP Mean=75.48; SD=23.31; p=0.291). Forty-four percent of the CBT group and 40% of the EXP group had a comorbid psychiatric disorder, of which Major Depressive Disorder was the most common (CBT = 52%; EXP = 36%).

Within-group analysis indicated a significant difference in both groups in social anxiety and severity of illness from baseline to post-assessment on the SPWSS (F = 160.72, p<0.001), LSAS -CA (F = 98.87, p<0.001), and the CGI (F = 196.71, p<0.001). A large within-group effect size for LSAS and CGI were noted for both arms (CBT=1.68; EXP=2.28 for LSAS and CBT=2.12; EXP=3.12 for CGI). There was no between group difference on SPWSS (F = 1.40, p = 0.245), LSAS- CA (F = 2.37; p = 0.132) and CGI (U = 188.00, p = 0.709; Table 4). There were no significant between-group differences on BDI-II (t=1.95; p=0.06) at baseline and the potential mediators at baseline and post-intervention (Tables 3 & 4). Between-group effect sizes were not significant.

3.2. *Effect of process variables on social anxiety*

Linear Mixed-Effects Models were performed as the data was hierarchical. This method also allows for the calculation of individual effects, effects of the intervention group (CBT and EXP), and effects of time (duration of therapy) (Luke, 2004).

Linear Mixed-Effects Model 1 was fitted with the session-wise measure of social anxiety (SPWSS) as the dependent variable and the session-wise levels of estimated social cost, perceived social self-efficacy, and perceived emotional control as independent variables. Further, the effect of type of intervention and time-lapse on social anxiety was estimated (Table 5).

Results indicate that the dependent variable (social anxiety) changed over time (B = -0.01, p- = 0.024). Decreases in estimated social cost and increases in perceived social self-efficacy and perceived emotional control predicted decreased social anxiety. Perceived social self-efficacy was found to have the greatest relative effect on social anxiety (B=-0.45, p<0.001), followed by estimated social cost (B = 0.23, p <0.001) and then perceived emotional control (B =-0.08, p=0.022). The fitted model was significant and explained 63.4% (95% Confidence Intervals: 59.4%-67.4%) of the variance in the dependent variable. However, there was no significant difference between the two groups (B =0.12, p = 0.89).

3.3. *Effect of social anxiety on process variables*

Linear Mixed-Effects Models 2, 3, and 4 were fitted to understand the influence of session-wise levels of social anxiety on session-wise levels of estimated social cost, perceived social self-efficacy, and perceived emotional control, respectively (Table 6). The linear mixed-effects model helped to establish temporal precedence. Time and intervention were included as independent variables.

Social anxiety has the most significant impact found to be most significant on perceived social self-efficacy, followed by estimated social

Table 3.
Comparisons of the two groups on social anxiety, depression, and severity of illness and potential mediators at baseline.

Measures		Cognitive Behaviour Therapy(N = 25)		Exposure Therapy (N=25)		t-values	Sig (2-tailed)
		Mean	S.D.	Mean	S.D.		
Social Phobia Weekly Summary Scale (SPWSS)		35.48	6.93	33.52	6.89	1.00	0.321
Liebowitz Social Anxiety Scale-Self Rated (LSAS-SR)	**Anxiety**	47.92	9.87	45.52	11.02	0.81	0.421
	Avoidance	42.80	11.74	41.36	12.72	0.42	0.679
	Total Score	90.72	19.49	86.88	22.07	0.65	0.518
Liebowitz Social Anxiety Scale Clinician Administered (LSAS-CA)	**Anxiety**	43.16	9.66	41.36	10.97	0.62	0.541
	Avoidance	38.80	10.97	34.12	13.82	1.32	0.191
	Total	81.96	19.43	75.48	23.31	1.07	0.291
Beck's Depression Inventory –II (BDI)		28.68	11.06	22.76	10.43	1.95	0.057
CGI-Severity		4.55	0.67	4.33	0.69	293	0.673
Appraisal of Social Concerns (ASC)		1199.2	355.90	1025.40	311.48	1.84	0.072
Self-Efficacy for Social Situations (SESS)		30.96	8.87	35.56	8.72	-1.85	0.071
Anxiety Control Questionnaire (ACQ)[a]		58.52	14.14	60.32	15.38	-.43	0.683

*p<.05, **p<.01;[a] Significance level on this variable was calculated using Mann-Whitney U test

Table 4
Between group comparison on social anxiety, depression, severity of illness, mediator variables at post therapy.

Measures		CBT (N=22) Mean	S.D.	EXP (N=18) Mean	S.D.	F-test	Sig (2-tailed)
Social Phobia Weekly Summary Scale (SPWSS)		17.32	10.34	14.89	4.44	1.40	0.245
Liebowitz Social Anxiety Scale-Self Rated (LSAS-SR)	**Anxiety**	25.77	15.37	18.94	11.29	2.81	0.102
	Avoidance	18.73	15.83	13.78	11.41	1.17	0.286
	Total Score	44.50	30.79	32.72	21.88	2.07	0.159
Liebowitz Social Anxiety Scale Clinician Administered (LSAS-CA)	**Anxiety**	23.55	16.31	17.94	9.06	1.69	0.201
	Avoidance	16.00	16.13	10.89	8.59	2.75	0.105
	Total	39.55	32.13	28.83	16.58	2.37	0.132
Beck's Depression Inventory –II (BDI)		13.05	12.86	10.56	9.80	3.02	0.090
CGI- Severity		2.77	0.97	2.44	0.51	1.90	0.176
Appraisal of Social Concerns (ASC)		578.68	477.44	281.11	243.94	7.84	0.008**
Self-Efficacy for Social Situations (SESS)		53.95	15.71	59.50	11.06	5.48	0.025*
Anxiety Control Questionnaire (ACQ)		81.32	21.36	86.11	19.89	1.45	0.236
		Mean	Mean Rank	Mean	Mean Rank	Mann-Whitney U Test	P
CGI-Improvement		2.05	20.95	1.89	19.94	188.00	0.709
Percentage of Improvement		66.59	18.68	74.17	22.72	158.00	0.270

*p<.05, **p<0.01

Table 5.
Linear Mixed Effects Model 1 with session wise measure of social anxiety (SPWSS) as the dependent variable.

Variable	Standardized coefficients (SE.)	t-value	p-value	R^2
Weekly sessions	-0.01(0.09)*	-3.05	0.002	0.634 (95% CI: [0.594- 0.674])
Intervention (EXP)[a]	0.12(0.92)	0.13	0.893	
Estimated Social Cost	0.23(0.002)*	4.89	<0.001	
Perceived Social Self-Efficacy	-0.45(0.031)*	-10.21	<0.001	
Perceived Emotional Control	-0.08(0.05)*	-2.29	0.022	

a- Unstandardized Coefficients; CI: Confidence Intervals, *p<0.05

cost. The impact was least on perceived emotional control in the respective models. The changes in the potential mediators did not differ between the two groups. The role of each of these variables has been described separately in the following sections.

3.3.1. *The role of estimated social cost*

Linear Mixed-Effects Model 2 was fitted, keeping estimated social cost assessed at each session as the dependent variable (Table 6). Social anxiety, perceived social self-efficacy, and perceived emotional control assessed at every session were entered as independent variables. The estimated social cost decreased over time (B =-.0.01, p<0.001). These changes were significantly related to a decrease in social anxiety (B = 0.13, p <0.001) and increases in perceived social self-efficacy (B = -0.22,p<0.001) and perceived emotional control (B = -0.17, p<.001) at every week during therapy. The effect of intervention group was not significant (B = -36.0978, p = 0.11). The model estimated was significant and was found to explain 45.8% (95% Confidence Intervals: 40.6%-51.3%) of the variance in the dependent variable.

Therefore, estimated social cost was related to the changes in social anxiety; however, there is a bidirectional relationship between these two variables, indicating that changes that occur in social anxiety affect the judgemental biases. Estimated social cost had an equal bidirectional relationship with perceived social self-efficacy since the impact of each variable on the other is nearly equal (B = 0.21 & B = 0.25).

3.3.2. *The role of perceived social self-efficacy*

Linear Mixed Effects Model 3 was fitted, keeping perceived social self-efficacy assessed at every session during therapy as the dependent variable (Table 6). It increased over time (B = 0.03, p <0.001) with corresponding decreases in the independent variables of social anxiety (B = -0.33, p <0.001), estimated social cost (B = -0.25, p <0.001) and increases in perceived emotional control (B = 0.20, p value<0.001). The effect of intervention group was not significant (B = -0.42, p = 0.75). The model was significant and accounted for 63.1% (95% Confidence Intervals: 59.1-67.1) of the variance in the dependent variable.

Thus, changes in this potential mediator resulted in changes in social anxiety; however, changes in social anxiety also resulted in changes in perceived social self-efficacy, albeit to a lesser degree.

3.3.3. *The role of perceived emotional control*

Linear Mixed-Effects Model 4 was fitted, with perceived emotional control assessed at each session as the dependent variable (Table 6). Results indicate that increases in the dependent variable (perceived emotional control) were related with the decreases noted in social

Table 6.
Linear Mixed Effects Model 2, 3 and 4 with session wise measure of potential mediators as dependent variables.

Dependent Variable	Standardized Coefficients(Standard Error)						R^2
	Time	**Intervention (EXP)[a]**	**Social Anxiety**	**Estimated Social Cost**	**Perceived social self-efficacy**	**Perceived Emotional Control**	
Estimated Social Cost (LMM 2)	-0.01 (1.25)*	-36.10 (22.09)	0.13 (0.56)*	-	-0.22 (0.46)*	-0.17 (0.79)*	0.458(95% CI: [0.406 – 0.513])
Perceived self-efficacy in social situations (LMM 3)	0.04 (0.13)*	0.42 (1.33)	-0.33 (0.05)*	-0.25 (0.003)*	-	0.20 (0.07)*	0.631(CI: [0.591 – 0.671])
Perceived Emotional Control (LMM 4)	-0.02 (0.08)	-0.05 (0.79)	-0.09 (0.03)*	-0.29 (0.002)*	0.29 (0.02)*	-	0.434 (CI: [0.382 – 0.491])

LMM – Linear Mixed Effects Model; *p<0.05; CI – Confidence Intervals; a – Unstandardized Coefficients

anxiety (B= -0.08, p= 0.03), estimated social cost (B= -0.29, p<0.001) and increases in perceived social self-efficacy (B= 0.29 p <0.001). However, changes in perceived emotional control were not significant over time (B = -0.02, p = 0.39) and did not differ according to intervention group (B= -0.05, p = 0.94). The model calculated was significant and accounted for 43.4 % (95% Confidence Intervals: 38.2-49.1) of the variance in the dependent variable.

Perceived emotional control did not change over time after controlling for the effects of other variables. Perceived social self-efficacy, estimated social cost, and social anxiety predicted perceived emotional control in that order of magnitude. Perceived emotional control has an equal bidirectional relationship with social anxiety. Both perceived social self-efficacy and estimated social cost impacted perceived emotional control.

In summary, perceived social self-efficacy and estimated social cost influenced each other equally, whereas perceived emotional control had less influence on social anxiety. There was no significant difference between the two interventions in social anxiety and session-by-session changes in process variables (Table 4).

4. Discussion

The present study examined estimated social cost, perceived social self-efficacy, and perceived emotional control as potential mediators of CBT and EXP for SAD. Both CBT and EXP were found to share a common trajectory of change with common mediators in the present study. Perceived social self-efficacy emerged as the most significant mediator, followed by estimated social cost. Social anxiety also predicted changes in each of these variables.

Our first research question was to compare the mediational pathways between the two forms of therapy. The key finding is that both the intervention groups have common mediational pathways and are equally effective in reducing social anxiety. The results partially support the hypothesis regarding cognitive mediation of symptom change (Garratt et al., 2007). Our findings imply that therapeutic techniques that do not explicitly target cognitions can still bring about cognitive changes, as demonstrated by behaviourally based EXP, resulting in changes in cognitive variables.

Findings concerning mediating pathways have yielded mixed results. While some studies report differences in the process of change when comparing CBT with other forms of psychotherapy, such as Acceptance and Commitment Therapy and Mindfulness-based therapy (Forman et al., 2012; Kocovski et al., 2015), others have identified common mediators (Arch et al., 2012).

The overlap between the approach and therapeutic techniques of CBT and EXP could explain the common mediators across the two forms of therapy (Butler et al., 1984; Clark and Wells, 1995). Cognitive factors underlying EXP could include changes in harm expectancies and predictability of anxiety responses. According to avoidance learning theories, these factors impact exposure (Hofmann, 2008; Krypotos et al., 2015; Lovibond, 2004).

Empirical studies also show changes in cognitive factors through behavioral techniques (Calamaras et al., 2015; Hofmann, 2004; Mattick et al., 1989; Newman et al., 1994; Smits et al., 2006). However, the present study addresses the question as to whether cognitive factors temporally precede change in symptoms.

The second research question was to examine the influence of each potential mediator on the level of social anxiety during therapy. Of the three potential mediators examined in the present study, perceived social self-efficacy had the most significant impact on social anxiety, suggesting that self-evaluation significantly impacts cognition, emotions, and behaviors proposed by the social-cognitive theory (Bandura, 1997). Estimated social cost was a significant mediator of change in anxiety levels. These findings are consistent with previous research that estimated social cost has been found to play a significant role in mediating changes in social anxiety during therapy (Hoffart et al., 2009; Smits et al., 2006).

Research on self-efficacy as a potential mediator has been limited and has primarily focused on specific phobias and panic disorder (Fentz et al., 2013; Johnstone and Page, 2004). A related factor called reappraisal self-efficacy is a significant mediator for CBT in social anxiety (Goldin et al., 2012).

The study findings suggest that estimated social cost and perceived social self-efficacy predict changes in social anxiety. The intervention offered in the CBT group was based on the model proposed by Clark and Wells (1995). Cognitive restructuring techniques in the CBT group targeted negative cognitions and safety behaviors through verbal reattribution, challenging negative automatic thoughts, and behavioral experiments (Bennett-Levy, 2003; Wells, 1997). These behavioral experiments could have induced changes in the perceived consequences of social infractions and perceived self-efficacy in social situations. For example, when an individual ceases to use safety behaviors, it facilitates changes in judgemental biases due to disconfirmation of negative expectations, which also impacts self-efficacy (Garcia-Palacios and Botella, 2003).

The EXP group requires systematic and active participation in social situations, which could lead to a mismatch between expected outcomes and reality, thus reducing the level of perceived threat (Mineka and Zinbarg, 2006; Rachman, 1991). Further, as the number and variety of situations that the participant engaged in increases, there is greater opportunity for mastery experiences. Mastery experiences would further improve self-efficacy (Bandura, 1984).

Perceived emotional control was the least significant factor in mediating social anxiety after accounting for the effect of the other variables. Changes in social anxiety and the other two mediators equally influenced perceived emotional control. Therefore, this could be considered a more distal factor that changes as a function of symptom severity rather than serving primarily as a mediator. Future research could explore related constructs such as emotion regulation and coping techniques.

The final research question was whether changes in social anxiety also impacted the three potential mediators. Each potential mediator has been found to have a bidirectional relationship with social anxiety and with each other. The models examining the impact of potential mediators on social anxiety were found to be less significant than the model which examined the impact of potential mediators on social anxiety. According to cognitive theories, threat appraisal and perceived self-efficacy do not operate in isolation; instead, they maintain a reciprocal feedback loop. This feedback loop is addressed in therapy, such that changes in one variable impact others, eventually reducing social anxiety. (Clark and Wells, 1995; Hofmann, 2007; Rapee and Heimberg, 1997). Thus, re-evaluating the social cost of certain behaviors and re-evaluating their performance and abilities in social situations interact with each other and produce changes in social anxiety.

Previous studies on anxiety disorders and depression have also reported an interactional relationship amongst mediators and symptoms severity during therapy (Fentz et al., 2013; Hoffart et al., 2009; Kocovski et al., 2015; Meuret et al., 2010; Oei et al., 2006). These findings also suggest that targeting any one of the underlying mechanisms in therapy could change the targeted symptoms.

The candidate mediators explained a moderate proportion of the variance in the present study. However, about 36.6% of the variance remained unexplained, indicating that other potential mediators need to be assessed to explain the remaining variance. Variables from other therapeutic modalities, other cognitive factors, and non-specific factors such as therapeutic alliance could also be examined alongside cognitive variables to clarify their role as mediators. Future research can also examine the therapeutic procedures in isolation to understand their role in mediating changes in anxiety.

4.1. Strengths

By comparing two interventions for the potential mediators of change, attempts to control for threats to internal validity such as history, maturation, and statistical regression were made. Further, the variables of interest were assessed at every session to capture nuances of change and establish temporal precedence of these variables to symptom reduction. The methodology adopted ensures mitigation of practice effects and social desirability effects during the assessment of process variables and the biases by the researcher who was delivering the interventions. A range of sessions was used instead of a fixed number of sessions, thereby maximizing external validity. The sample was clinically representative, thus increasing the generalizability of the findings.

4.2. Limitations

Self-report questionnaires were administered before each session to capture potential mediators and symptom severity which could be subject to recall bias or influenced by external events during the week. A single therapist delivered both interventions limiting external validity.

The sample size did not permit analysis such as structural equation modeling. Structural equation modeling would have provided a complete understanding of interrelationships between variables. Follow–up data was not available to analyze the maintenance of these gains and the trajectory of the mediators. Therefore, the present study's findings may be replicated in larger samples and in comparison with other therapeutic modalities, using dismantling studies to identify specific therapeutic techniques that target these mediators.

5. Conclusions

Perceived social self-efficacy and estimated social cost emerged as mediators of social anxiety with CBT and EXP in individuals with SAD. Perceived emotional control emerged as a more distal factor changing as a function of social anxiety than mediating change. Changes in social anxiety also predicted changes in the other potential mediators. Our findings support predictions of cognitive models of social anxiety disorder (Clark and Wells, 1995; Hofmann, 2007) and support avoidance learning theories postulating the role of cognitive processes in EXP.

Finally, it suggests that CBT and EXP are equally effective and share common mediating pathways, implying that behavioral techniques alone would also effect change by working on similar mediators. However, the long-term trajectory of these mediators and the influence of other potential mediators, such as common factors, need further study.

Author statement

All authors contributed to the development of the study and the preparation of the manuscript.

Authors SR, PMS, and SSA contributed to the conceptualization of the study proposal, design and draft and editing of the manuscript. In addition PMS and SSA also contributed to assessment of clients and clinical supervision. Author SR carried out the data collection, under the supervision of PMS and SSA. Author AB assisted SR in the data analysis. All authors have read and approved the manuscript.

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Declaration of Competing Interest

None of the authors had any conflict of interests

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