Development and Validation of the Social Exercise and Anxiety Measure (SEAM): Assessing Fears, Avoidance, and Importance of Social Exercise

Cheri A. Levinson, Thomas L. Rodebaugh, Andrew R. Menatti & Justin W. Weeks
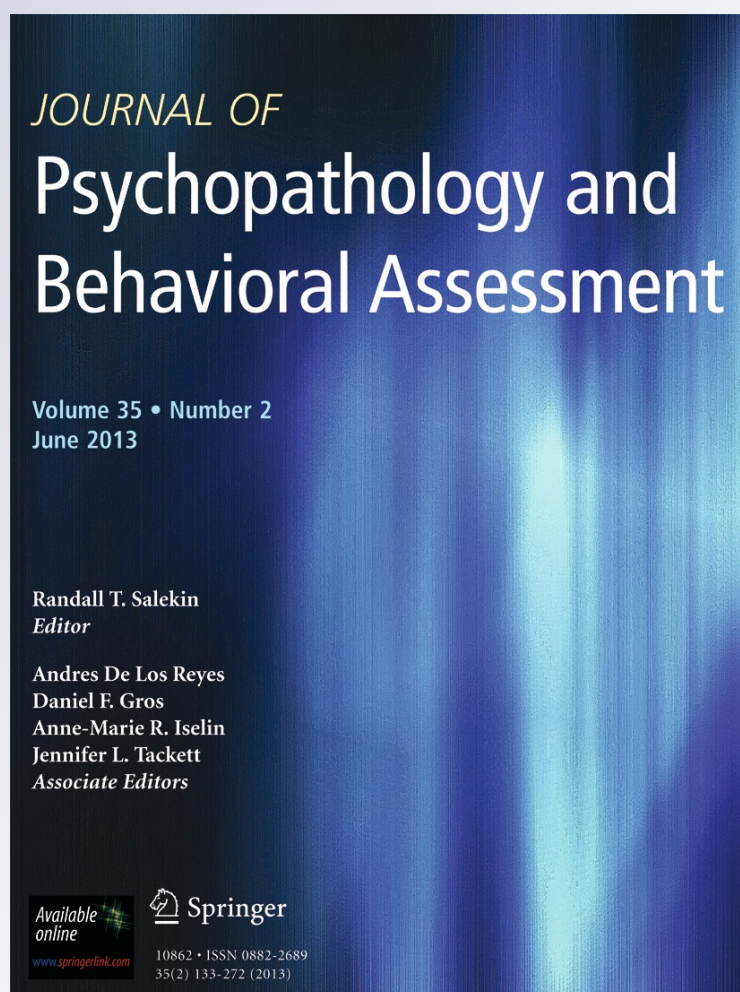
Springer

Springer

Development and Validation of the Social Exercise and Anxiety Measure (SEAM): Assessing Fears, Avoidance, and Importance of Social Exercise

**Cheri A. Levinson · Thomas L. Rodebaugh ·
Andrew R. Menatti · Justin W. Weeks**

Abstract In two studies (N=416; N=118) examining responses from undergraduates, we developed the Social Exercise and Anxiety Measure (SEAM) and tested its factorial, convergent, and divergent validity. Our results demonstrate that the SEAM exhibits an excellent three factor structure consisting of the following subscales: Social Exercise Self-efficacy, Gym Avoidance, and Exercise Importance. In both studies, Social Exercise Self-efficacy correlated negatively, and Gym Avoidance correlated positively with social interaction anxiety, fear of scrutiny, and fear of negative evaluation. Exercise Importance correlated positively with frequency of exercise and frequency of public exercise. Implications for the mental and physical health of individuals with high levels of social anxiety are discussed.

Keywords Social anxiety · Exercise · Self-efficacy · Assessment · Anxiety

Physical activity improves both mental and physical health (Paxton et al. 2010). Indeed, there is evidence that exercise reduces depression (Craft and Landers 1998) and enhances treatment outcomes in post-traumatic stress disorder and panic

C. A. Levinson · T. L. Rodebaugh
Washington University in St. Louis,
St. Louis, MO, USA

A. R. Menatti · J. W. Weeks
Ohio University,
Athens, OH, USA

C. A. Levinson (✉)
Department of Psychology, Washington University in St. Louis,
St. Louis, MO 63130, USA
e-mail: cherialevinson@wustl.edu

disorder patients (Manger and Motta 2005). In a sample of 16,483 undergraduates, Steptoe et al. (1997) found that individuals with higher levels of self-reported physical activity report lower levels of both anxiety and depression after taking into account sex, age, socioeconomic status, and physical illness. Meta-analyses that have tested exercise training as an intervention for depression have consistently shown that exercise training decreases depressive symptoms as compared to control groups (Craft and Landers 1998; Doyne et al. 1983; McDonald and Hogdon 1991; North et al. 1990). Increased exercise has also been shown to reduce anxiety (Long and van Stavel 1995; McDonald and Hogdon 1991; Petruzzello et al. 1991) and there is some research suggesting that this effect is greater in more severely anxious subjects (e.g., Fasting and Gronningsaeter 1986; Salmon 2001; Williams and Lord 1997). Indeed, the U.S. Department of Health and Human Services (2008) concludes that regular physical exercise protects against the onset of anxiety disorders and anxiety symptoms regardless of age, sex, or medical condition. Accordingly, some researchers have proposed that exercise should be included in standard treatment protocols for depression and anxiety disorders (Ströhle 2009) and research is beginning to test if the inclusion of exercise training augments standard treatment for disorders such as post-traumatic stress disorder (Rosenbaum et al. 2011).

Individuals with social anxiety disorder (SAD) have increased rates of physical health impairments, such as cardiovascular disease (CVD) (Acarturk et al. 2008) and there is prolific research documenting lack of exercise as a risk factor for CVD (e.g., Pollock et al. 2000). It may be that individuals with anxiety disorders have specific barriers to the completion of exercise, and these barriers may be particularly pronounced for individuals with SAD, due to the social component of exercise in most settings. Individuals

with SAD fear a multitude of social performance activities such as public speaking, attending parties, and eating in front of others (e.g. Holt et al. 1992), and it is likely that exercising in public may also be a relevant fear. Indeed, research has found that high levels of social anxiety are associated with avoidance of individual sports that may be observed by others (Norton et al. 2000). Given this existing research, it seems plausible that exercise may be especially beneficial for people with SAD due to both physical and mental health impairments inherent to this disorder. Yet, it also seems plausible that the public nature of many exercise settings (i.e. a gymnasium) may constitute a type of social setting that is particularly difficult for individuals high in social anxiety to endure. Thus, it seems necessary to develop a measure that assesses both how comfortable with exercising an individual feels in such a social setting and how likely these settings are to be avoided. It also seems prudent, in designing a measure regarding public exercise, to include at least a brief measure of whether such exercise is important to the individual. Such a subscale could be particularly valuable clinically, because high avoidance and low comfort in the absence of valuing exercise calls for a different intervention than the same profile of avoidance with the presence of valuing exercise.

Such a measure could also draw from self-efficacy theory, which proposes that people's perceptions of their capabilities influence how they behave (Bandura 1977). In regard to health behaviors, research has documented that increases in healthy behaviors, such as weight control and exercise, may be partially dependent on perceived self-efficacy (e.g., Leary 1985). It may be that individuals high in social anxiety perceive that they are incapable of exercising in social situations and that these cognitions impair their ability to adhere to an exercise regimen. For example, it may be that individuals high in social anxiety feel competent exercising in private, but because of fears of how others perceive them during exercise (i.e. their strength, body shape, lack of stamina) they may avoid exercising in public places. This limitation may severely prohibit their ability to exercise, given that many exercise situations are social in nature. Thus, it may be that individuals high in social anxiety have more cognitions regarding others judging them negatively during exercise. However, we are aware of no such measure that assesses this type of self-efficacy. Bandura (2006) suggests that to measure such cognitions, it is necessary to tailor assessments to a particular domain of functioning focusing on the underlying self-efficacy beliefs. Thus, it seemed necessary to develop a measure capable of assessing cognitions specific to beliefs about social exercise self-efficacy.

To the best of our knowledge, there is no well-validated measure of social exercise self-efficacy, avoidance in a gym setting, or exercise importance. Given that individuals in exercise training programs may need to utilize gyms to complete weight training and cardiovascular exercises (Rosenbaum et al.

2011), it seems necessary to be able to assess social discomfort, perceived self-efficacy, and avoidance in such a situation. It also seems useful to test if such a measure can predict social anxiety over and above general sports anxiety. Such a measure would provide an assessment of interpersonal functioning in terms of social exercise and could be used to test how social fears impact exercise behaviors. Further, such a measure could be used to test if individuals with SAD avoid exercise in social settings and to assess social anxiety outcomes during exercise interventions. In the current studies, we developed and psychometrically evaluated the Social Exercise and Anxiety Measure (SEAM), which assesses social exercise self-efficacy, avoidance of the gym, and exercise importance.

We hypothesized that, in Study 1; (a) the SEAM would exhibit a three-factor structure, (b) that social anxiety and sporting anxiety would correlate negatively with social exercise self-efficacy and positively with gym avoidance, (c) and that gym avoidance and social exercise self-efficacy would predict social anxiety over and above the Physical Activity and Sport Anxiety Scale (PASAS; Norton et al. 2004).

Study 1: Methods

Participants

Participants were 416 undergraduates from a public midwestern university who were mostly white (n=367; 90 %) and female (n=297; 72 %), with a mean age of 19.00 years (SD=1.64). Participants were recruited from an introductory psychology class and completed all measures listed below online, although only a subsample of participants (n=236) completed the PASAS. Participants scores on the social interaction anxiety scale ranged from very low to very high (Range: 0 to 63; M=19.62) . A total score of 34 or higher suggests probable social anxiety disorder (Heimberg et al. 1992), suggesting we had a wide range of social anxiety scores and probable diagnoses of social anxiety disorder within our sample.

Measures

The Social Exercise and Anxiety Measure (SEAM) is a 12-item scale divided into three subscales: (a) Social Exercise Self-efficacy (SES; 5 items; e.g., *I am confident that I could exercise with a group of people I do not know*); (b) Gym Avoidance (GA; 4-items; *I don't go to the gym because I feel like people are looking at me*); and (c) Exercise Importance (EI; 3 items; *How important to you is exercising?*). The SES subscale was developed based on the recommendations of Bandura (2006), and therefore utilizes a 0 to 100 scale in keeping with the self-efficacy literature (e.g., Bandura 2006), whereas the GA and EI subscales are

assessed on a 0 to 7 Likert-type scale. The measure is included in Table 1.

The Straightforward Social Interaction Anxiety Scale (S-SIAS; Rodebaugh et al. 2007**)** is a 17-item measure designed to assess social interaction anxiety that uses the straightforward items from the original Social Interaction Anxiety Scale (Mattick and Clarke 1998). Items describe anxiety-related reactions to a variety of social interaction situations. Overall, research on the scale suggests good to excellent reliability, good convergent and divergent validity (see Heimberg and Turk 2002), especially when the three reverse-scored items are omitted, as they are here (e.g., Rodebaugh et al. 2007).

Social Phobia Scale (SPS; Mattick and Clarke 1998**)** is a 20-item scale designed to assess fear of scrutiny. Items ask about fears of being scrutinized during routine and performance activities such as eating, drinking, or giving a public speech. The SPS has been shown to have high levels of internal consistency, test-retest reliability, and to discriminate between individuals with SAD and other disorders (i.e., agoraphobia, depression; Mattick and Clarke 1998).

The Brief Fear of Negative Evaluation scale (BFNE; Leary 1983**)** is a 12-item measure that assesses fear of negative evaluation, which is a central component of social anxiety. The BFNE correlates strongly and positively with measures of social anxiety, and has excellent psychometric properties when the four reverse scored items are excluded

(hereafter referred to as the Straightforward BFNE [S-BFNE]), as they are here (Rodebaugh et al. 2004).

The Physical Activity and Sport Anxiety Scale (PASAS; Norton et al. 2004**)** is a 16-item measure that assesses social fear and avoidance of sports and physical activities. It can be scored as a total of all 16 items or can be divided into two scales: a sports anxiety and exercise anxiety subscale. This measure has demonstrated good internal consistency, test-retest reliability, convergent and divergent validity (Norton et al. 2004).

Data Analytic Procedure

Because of the 7-point response scale of the SEAM sub-scales assessing gym avoidance and exercise importance, we considered these items to be categorical for the purpose of confirmatory factor analyses, whereas the items with a 0 to 100 response scale were treated as continuous. More specifically, items with more than ten response options cannot be treated as categorical in the Mplus program. We used the Mplus program (version 6.1, Muthén and Muthén 1998–2010) and, more specifically, the robust weighted least squares estimator (referred to as WLSMV in Mplus), which is appropriate for categorical data. Global model fit was evaluated using the: (a) comparative fit index (CFI; Bentler 1990), (b) Tucker-Lewis incremental fit index (TLI; Tucker and Lewis 1973), and (c) root mean square error of approximation (RMSEA; Steiger and Lind 1980).

Table 1 The Social Exercise and Anxiety Measure (SEAM)

Social-Self Efficacy Scale (SES)	Factor loadings	
	Study 1	Study 2
1. That I could work out/ exercise at a public gym where strangers also work out	0.91	0.92
2. That I could work out/ exercise at a private gym where only me and my close friends work out	0.55	0.66
3. That I could work out/exercise with a group of people that I do not know	0.89	0.70
4. That I could work out/exercise in a crowded gym	0.87	0.91
5. That if I went to the gym I would be successful at attaining my workout goals	0.72	0.86
Gym Avoidance scale (GA)		
6. I don't go to the gym because I feel like people are looking at me.	0.95	0.97
7. I don't go to the gym because I don't want to interact with the people at the gym.	0.84	0.84
8. When I go to the gym I think people are judging me.	0.87	0.81
9. I wish that I could go to the gym but I am too afraid of what people will think.	0.94	0.90
Exercise Importance scale (EI)		
10. How important to you is exercising as a social activity?	0.46	0.57
11. How important to you is exercising as an activity to maintain a healthy lifestyle?	0.86	0.99
12. How important are exercising and eating healthy in your daily routine?	0.78	0.76

Directions for the SES: Please rate how confident you are, where 0 is not at all and 100 is completely confident, that you can: I am confident…; Directions for GA: The following items are types of behavior. Please think about how much the behavior is typical of you. Please rate the following items on a 1–7 scale where 1 is not like me at all and 7 is completely like me. Directions for EI: Please think about how much the following behaviors are important to you. Please rate the following items on a 1–7 scale where 1 is not important to me and 7 very important to me

The magnitudes of these indices were evaluated with the aid of recommendations by Hu and Bentler (1999), which are considered appropriate for WLSMV. Essentially, for the CFI and TLI, values of 0.90 and above were considered adequate, whereas values of 0.95 or above were considered very good; for the RMSEA, values of 0.09 and below were considered adequate and 0.05 or less were considered very good. To create an overall measure of social anxiety symptoms for use in multiple regression, we standardized and summed the Social Phobia Scale and S-SIAS (α=.88). We decided to use this method because composite measures provide a more reliable estimate of the construct (Zeller and Carmines 1980). Additionally, a composite measure can simplify the number of analyses conducted; this method has been used in previous social anxiety literature (Clark et al. 2003, 2006).

Validity Analyses

To test convergent validity, we explored the relationship between the SEAM, social anxiety, and sports anxiety. We also tested whether the SEAM subscales were able to predict social anxiety over and above sports and exercise anxiety (i.e. incremental validity).

Initial Development of the Items

After reading the literature on social self-efficacy and avoidance we created a measure consisting of five items to assess social exercise self-efficacy, four items to assess gym avoidance, and three items to assess exercise importance. The first author generated the items, and the second author, who has clinical and research experience with social anxiety, reviewed the items for content. Further, four undergraduate research assistants were consulted on the clarity and content of items. We planned to use iterative measure development if confirmatory factor analysis on the proposed structure indicated it was needed.

Results

Gender Differences

An independent t-test indicated that there were no gender differences on any subscale of the SEAM (all ps>0.254).

Confirmatory Factor Analysis

The original, theorized model fit ranged from very good to excellent for a three factor structure (CFI=0.98; TLI=0.98;

RMSEA=0.06).[1] Factor loadings for the original model are reported in Table 1. In addition to the hypothesized three factor structure, we tested an alternative single-factor structure consisting of all scale items. Fit for the single-factor structure was poor (CFI=0.88; TLI=0.85; RMSEA=0.18). Finally, we tested an alternative two-factor structure with items from the social exercise efficacy (SES) subscale as one factor, and the items from the gym avoidance (GA) and exercise importance (EI) subscale as a second, correlated factor. This alternative factor structure was tested because the items on the SES subscale have a different response scale than items from the GA and EI subscales (i.e. 0 to 100 versus 1 to 7), which might lead to a two-factor structure driven by method variance. Fit for the two-factor structure was also poor (CFI=0.87; TLI=0.83; RMSEA=0.19). Chi-square difference tests demonstrated that a two-factor model was significantly better than a one-factor model ($\Delta\chi^2$[1, N=406]=149.51, p<.001) and that a three factor model was significantly better than a two-factor model ($\Delta\chi^2$[2, N=406]=347.94, p<.001).

Zero-Order Correlations

Please see Table 2 for the full inter-correlations between study variables. As hypothesized, social exercise self-efficacy correlated negatively with the three social anxiety scales and sporting anxiety, whereas gym avoidance correlated positively with social anxiety and sporting anxiety. Exercise importance was negatively correlated with social interaction anxiety and sports anxiety. Internal consistency for all subscales was excellent (Please see Table 2).

Multiple Regression Analyses

We tested if social exercise self-efficacy, gym avoidance, and exercise importance predicted social anxiety symptoms over and above the PASAS total score and each of the PASAS subscales. As can be seen in Table 3, in multiple regression, gym avoidance and social exercise self-efficacy significantly predicted social anxiety over and above the PASAS total score. Gym avoidance and social exercise self-efficacy significantly predicted social anxiety over and above the PASAS sports anxiety subscale score. Gym avoidance predicted the social anxiety symptoms over and above

---

[1] We also tested a model that removed item 10 from the exercise importance (EI) subscale because of its reference to exercise as a social activity. Fit for this model was adequate to good (CFI=0.97: TLI=0.97; RMSEA=0.10). Note that, when item 10 is removed from the exercise importance subscale, there are significant correlations between exercise importance and social interaction anxiety (r=−0.19, p=.004) and fear of scrutiny (r=−0.15, p=.024). However, we did not remove item 10 from main analyses because there were no indications that removing it improved psychometric properties of the measure.

Table 2 Zero-order correlations: Social Self-Efficacy Measure, social anxiety, and sporting anxiety in Study 1

	SEAM subscales			Social anxiety			Convergent validity		
	SES	GA	EI	S-SIAS	SPS	S-BFNE	PASAS total	PASAS - Sport anxiety	PASAS-Exercise anxiety
SES	0.87								
GA	−0.67**	0.91							
EI	0.28**	−0.28**	0.74						
S-SIAS	−0.36**	0.46**	−0.12*	0.90					
SPS	−0.37**	0.51**	−0.10	0.78**	0.98				
S-BFNE	−0.28**	0.41**	−0.03	0.63**	0.55**	0.95			
PASAS	−0.44**	0.59**	−0.28**	0.50**	0.51**	0.57**	0.93		
Sport anxiety	−0.37**	0.52**	−0.26**	0.48**	0.49**	0.55**	0.97**	0.91	
Exercise anxiety	−0.51**	0.63**	−0.26**	0.44**	0.48**	0.52**	0.90**	0.77**	0.83

The diagonal is Cronbach's alpha obtained in Study 1

SES Social Exercise Self-Efficacy; *GA* Gym Avoidance; *EI* Exercise Importance; *S-SIAS* Straightforward Social Interaction Anxiety Scale; *SPS* Social Phobia Scale; *S-BFNE* Straightforward Brief Fear of Negative Evaluation Scale; *PASAS* Physical Activity and Sports Anxiety Scale Total Score; *PASAS-Sport Anxiety* Items from the PASAS Sport Anxiety Subscale; *PASAS-Exercise Anxiety* Items from the Exercise Anxiety Subscale

** $p<.01$; * $p<.05$

the PASAS exercise anxiety scale whereas the social exercise self-efficacy subscale approached significance. Exercise

Table 3 Multiple regression analyses testing if the Social Exercise and Anxiety subscales predict social anxiety symptoms over and above the Physical Activity and Sports Anxiety Scale (PASAS) and its subscales from Study 1

Predictors	β	Part r
Regression 1		
Gym avoidance	0.21**	0.20**
Social exercise self-efficacy	−0.12*	−0.13*
Exercise importance	−0.01	0.00
PASAS total score	0.41**	0.26**
Regression 2		
Gym avoidance	0.26**	0.26**
Social exercise self-efficacy	−0.17*	−0.18*
Exercise importance	−0.02	−0.03
PASAS sports anxiety	0.37**	0.35**
Regression 3		
Gym avoidance	0.25**	0.21**
Social exercise self-efficacy	−0.12	−0.12
Exercise importance	−0.03	−0.04
PASAS exercise anxiety	0.31**	0.26**

Social anxiety symptoms is a composite of the social interaction anxiety scale and social phobia scale. Standardized beta and partial correlation coefficients are reported. Regression 1 is the SEAM subscales and PASAS total score predicting social anxiety. Regression 2 is the SEAM subscales and PASAS sports anxiety subscale predicting social anxiety. Regression 3 is the SEAM subscales and PASAS exercise anxiety subscale predicting social anxiety

** $p<.001$; * $p<.05$

importance was not a significant predictor of social anxiety symptoms in any analysis. When gender and the interaction between gender and the subscales of the SEAM were included as predictors, there were no significant changes (the SES and gym avoidance remained significant predictors of social anxiety and there were no significant interactions).

Study 1: Conclusions

The Social Exercise and Anxiety Measure exhibited an excellent three-factor structure consisting of social exercise self-efficacy, gym avoidance, and exercise importance subscales. As hypothesized, the social exercise self-efficacy subscale was negatively correlated with all measures of social anxiety and sports anxiety, whereas the gym avoidance subscale was positively correlated with social anxiety and sports anxiety. Both the social exercise self-efficacy and gym avoidance subscales predicted a composite of social anxiety symptoms over and above the three Physical Activity and Sports Anxiety Scale scores, with the exception that social exercise self-efficacy did not predict social anxiety above the exercise anxiety subscale. This latter result suggests that there may be overlap between the social exercise self-efficacy subscale and exercise anxiety subscale, at least in regard to our measure of social anxiety symptoms. Exercise importance was negatively correlated with social interaction anxiety. However, when sports anxiety was included as a simultaneous predictor, exercise importance was no longer a significant predictor of social anxiety. Overall, results suggest that the Social Exercise and Anxiety Measure has good factorial and convergent validity.

Study 2 Hypotheses

In Study 2, we further examined the factorial, convergent, and divergent validity of the Social Exercise and Anxiety Measure in an independent sample. We hypothesized that: (a) the above three-factor structure would demonstrate excellent fit, (b) the social exercise self-efficacy subscale would correlate negatively with social anxiety and positively with frequency of both exercise and public exercise, (c) the gym avoidance scale would correlate positively with social anxiety and negatively with frequency of exercise and frequency of public exercise, (d) exercise importance would correlate positively with frequency of exercise and exercise commitment, and (e) the subscales of the SEAM would not relate significantly to agreeableness and openness (two theoretically unrelated [divergent] personality constructs).

Study 2: Methods

Participants

Participants were 118 students from a private midwestern university (a different university than in Study 1) who were mostly white ($n=84$; 71 %) and female ($n=73$; 62 %), with a mean age of 19.31 years ($SD=1.20$). Participants were enrolled in a psychology class and completed this study for course credit. Participants' scores on the social interaction anxiety scale ranged from very low to very high (Range=1 to 61, $M=24.14$).

Measures

We used the same measures as in Study 1, with the addition of the following measures.

The **Obligatory Exercise Measure (OEQ; Pasman and Thompson** 1988**)** is a 20-item measure that assesses attitudes toward exercise. The OEQ has exhibited good reliability and validity (Pasman and Thompson 1988; Ackard et al. 2002), though it should be noted in the current sample that the exercise commitment subscale did not exhibit good internal consistency. The OEQ can be divided into three subscales: Exercise fixation, exercise frequency, and exercise commitment. The exercise fixation subscale measures immersion and preoccupation with an exercise routine and negative emotionality associated with missing an exercise session. The exercise frequency subscale assesses amount and type of exercise activities. The exercise commitment subscale assesses commitment to an exercise routine. Both exercise commitment and frequency were found to be related to healthy exercise habits, whereas the exercise fixation subscale was found to correlate with measures of disordered eating and negative emotionality (Ackard et al. 2002).

Frequency of Exercise

Participants reported how often they exercised in public during an average week (i.e. an ordered count). Response options ranged from 0 to 9 or more times per week.

The Mini-International Personality Item Pool Inventory (MINI-IPIP; Donnellan et al. 2006**)** is a 20-item short form measure of the five basic factors of personality: Extraversion, neuroticism, agreeableness, conscientiousness, and openness. It is based on the International Personality Item Pool (Goldberg 1999) and has been shown to have consistent and acceptable internal consistencies, similar coverage of personality facets as other Big five measures, and good convergent, divergent, and criterion-related validity with other Big five measures (Donnellan et al. 2006). In the current study, we used the agreeableness and openness factors to assess divergent validity because (a) we could think of no theoretical reason why these two measures should specifically relate to the three SEAM subscales and (b) it would be problematic if participants responded a specific way to the SEAM due to social desirability concerns, which could be indirectly assessed by the agreeableness factor (Graziano and Tobin 2002).

Procedures

Participants completed the same measures used in Study 1, the OEQ, and frequency of exercise measure, amongst a variety of other measures not reported on here. All measures were completed using paper and a pen. Data analytic procedures were identical to those employed in Study 1.

Results

Gender Differences

As in Study 1, an independent t-test indicated that there were no gender differences on any subscale of the SEAM (all $ps>0.222$).

Confirmatory Factor Analysis

As hypothesized, model fit was excellent for the three-factor structure (CFI=1.00, TLI=0.99, RMSEA=0.04) consisting of social exercise self-efficacy, gym avoidance, and exercise importance. Factor loadings for this model are reported in Table 1.

Zero-Order Correlations

Please see Table 4 for inter-correlations amongst all study measures. As hypothesized, social self-efficacy correlated positively with exercise frequency as assessed by the OEQ

Table 4 Zero-order correlations: social exercise self-efficacy measure, obligatory exercise, exercise frequency, and social anxiety

	SEAM subscales			Convergent validity				Social anxiety		Divergent validity		
	SES	Gym avoidance	Exercise import	Exercise fixation	Exercise frequency	Exercise commit	Public exercise	S-SIAS	SPS	BFNE	Agr	Open
SES	0.90											
Gym avoidance	−0.64**	0.89										
Exercise import	0.32**	−0.24**	0.77									
Exercise fixation	0.01	0.09	0.50**	0.82								
Exercise frequency	0.22*	−0.15	0.67**	0.42**	0.91							
Exercise commit	0.11	−0.16	0.45**	0.62**	0.43**	0.46						
Public exercise	0.30**	−0.33**	0.49**	0.22*	0.60**	0.38**	X					
S-SIAS	−0.38**	0.46**	−0.10	0.15	−0.10	−0.01	−0.15	0.91				
SPS	−0.42**	0.53**	−0.08	0.09	−0.12	−0.01	−0.18	0.72**	0.93			
S-BFNE	−0.30**	0.43**	−0.07	0.27**	−0.05	0.09	−0.08	0.65**	0.68**	0.89		
Agree	0.05	0.04	−0.11	−0.01	−0.09	−0.03	−0.07	−0.10	−0.05	0.08	0.80	
Open	0.06	−0.04	−0.15	−0.20*	−0.24**	−0.10	−0.19*	−0.12	0.03	0.01	0.22*	0.70

The diagonal is Cronbach's alpha obtained in Study 2. Public exercise has no internal consistency because it is a single item

SES Social Exercise Self-Efficacy; *Exercise Import* Exercise Importance; *Exercise Commit* Exercise Commitment; *S-SIAS* Straightforward Social Interaction Anxiety Scale; *SPS* Social Phobia Scale; *BFNE* Straightforward Brief Fear of Negative Evaluation Scale; *Agr* agreeableness; *Open* openness to experience

** $p<.01$; * $p<.05$

and frequency of public exercise, and negatively with all three measures of social anxiety. Consistent with hypothesis, gym avoidance correlated negatively with frequency of public exercise and positively with all three measures of social anxiety. Gym avoidance was not significantly correlated with exercise frequency. Exercise importance was positively correlated with exercise fixation, exercise frequency, and exercise commitment, and frequency of public exercise. There were no significant relationships between exercise importance and social anxiety. Furthermore, in support of divergent validity, there were no significant relationships between the three subscales of the SEAM and agreeableness and openness.

Divergent and Convergent Validity

As expected, the social exercise self-efficacy subscale was related to all three measures of social anxiety and exercise frequency, the gym avoidance subscale was related to all three measures of social anxiety, and the exercise importance subscale was related to exercise commitment, but no subscale was significantly related to agreeableness or openness (the divergent measures). However, to test if the convergent measures were stronger than divergent measures, as expected, we turned to testing differences between correlated correlations (please see Meng et al. 1992 for a discussion of methods). Meng et al.'s test for correlated correlations is utilized to test if the strength of two correlations from the same sample differ significantly. The SES related equivalently to exercise frequency (the least strongly related convergent measure, $r=0.22$) and the divergent measures (agreeableness: $z=1.25$, $p=.211$; openness: $z=1.11$, $p=.267$). All other convergent relationships with the social exercise self-efficacy subscale were significantly stronger than those between the social exercise self-efficacy subscale and the two divergent relationships (zs>-2.81, ps<.005). All convergent relationships with the gym avoidance subscale were significantly stronger than those between the gym avoidance and the two divergent measures (zs>3.24, p<.001). All convergent relationships with exercise importance differed significantly from those between the exercise importance subscale and the two divergent relationships (zs>4.34, p<.001).

Discussion

Across two independent studies, the Social Exercise and Anxiety Measure (SEAM) exhibited an excellent three factor structure. These results suggest that the SEAM consists of three subscales: Social exercise self-efficacy, gym avoidance, and exercise importance. In Study 1, the social exercise self-efficacy and gym avoidance subscales were able to predict social anxiety over and above sports anxiety and

exercise anxiety, demonstrating that social exercise self-efficacy and gym avoidance have incremental validity.

Further, in Study 2, social exercise self-efficacy and gym avoidance exhibited excellent convergent validity: Both subscales were correlated with the frequency of public exercise (and social exercise self-efficacy was correlated positively with exercise frequency in general). As expected, exercise importance was correlated positively with commitment and fixation on exercise. Additionally, our results suggest that individuals high in social anxiety feel less effective at exercising in public and are likely to avoid working out in a gym. We also found in Study 2 that the subscales of the SEAM had excellent divergent validity with regard to two aspects of personality: Agreeableness and openness. These results suggest that it is not the case that, for example, agreeable individuals report that exercise is important solely because they are high in agreeableness and that it is socially acceptable to exercise.

Interestingly, exercise importance was not consistently correlated with social anxiety. This result suggests that individuals who are high in social anxiety do not find exercise any more or less important than the average individual. Additionally, individuals high in social anxiety did not report exercising less frequently than individuals lower in social anxiety, though they did report lower levels of self-efficacy in social exercise situations. Although it should be noted that the relationship between social anxiety and frequency of *public exercise* approached significance in a negative direction, as would be hypothesized. These results are consistent with the idea that socially anxious individuals may value exercise, but may be less likely to engage in exercise unless they are able to exercise in private. Thus, it may be the social aspect of exercise that leads to avoidance of exercise and potentially may exacerbate negative physical and mental health outcomes. This is consistent with research suggesting that individuals high in social anxiety may avoid individual sports because of the potential to be observed by others (Norton et al. 2000). Social exercise self-efficacy, however, was negatively correlated with both exercise frequency and public exercise. At least for individuals low in social exercise self-efficacy, exercise may not be a frequent habit in daily living.

These results should be considered within the limitations of these studies. We did not use a clinical sample, instead relying upon samples of undergraduates partially due to convenience; thus, further research is needed before utilizing this measure with individuals diagnosed with social anxiety disorder. Additionally, we did not use focus groups or cognitive interviews to develop the items of the SEAM and it has been suggested that these may be important for the development of new measures, especially for assessing the understandability of items (e.g., Brod et al. 2009; Patrick et al. 2011). Further, it is possible, although we think unlikely, that

the two different response options (i.e. 1 to 7 vs. 0 to 100) could cause cognitive burden to participants. Thus, we suggest that use of this measure with populations especially prone to cognitive burden be considered with care.

However, given the substantial rates of health complications within individuals with social anxiety disorder (Acarturk et al. 2008) and the benefits that can be derived from increased exercise (e.g., Long and van Stavel 1995; McDonald and Hogdon 1991), reducing avoidance of exercise may be beneficial for individuals high in social anxiety who are afraid to exercise in public. It may be useful to incorporate exposures into psychotherapy protocols designed to increase social exercise self-efficacy and decrease gym avoidance, especially for individuals who score high on these constructs. The SEAM is an assessment tool that may be used to assess if individuals may benefit from such interventions, and to continue testing the effects of gym avoidance, exercise importance, and social exercise self-efficacy on social anxiety and related disorders. Future research should continue to test the psychometric properties of this measure in additional samples, especially within clinical samples of individuals diagnosed with social anxiety disorder and to explore whether these constructs are unique to social anxiety, or if they generalize to other anxiety disorders, depression, and eating disorders. It may be especially useful to administer this measure to populations who may have difficulty with exercising, such as individuals with eating disorders and obesity. Similarly, it may be useful to test if there are interactions between gender and social exercise self-efficacy in these populations. Finally, future research should test whether exercise training programs increase social exercise self-efficacy and exercise importance in addition to decreasing symptoms of anxiety.

Overall, these studies suggest that the Social Exercise and Anxiety Measure is a psychometrically strong measure of social exercise self-efficacy, gym avoidance, and exercise importance. We hope that both researchers and clinicians will be able to utilize this tool to help increase physical and mental health outcomes and to decrease the suffering associated with social anxiety and related disorders.

References

Acarturk, C., de Graaf, R., van Straten, A., ten Have, M., & Cuijpers, P. (2008). Social phobia and number of social fears, and their association with comorbidity, health-related quality of life and help seeking: a population-based study. *Social Psychiatry and Psychiatric Epidemiology, 43*, 273–279.

Ackard, D. M., Brehm, B. J., & Steffen, J. J. (2002). Exercise and eating disorders in college-aged women: profiling excessive exercisers. *Eating Disorders: The Journal of Treatment & Prevention, 10*, 31–47.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. *Psychological Review, 84*, 191–215.

Bandura, A. (2006). Guide for constructing self-efficacy scales. In self-efficacy beliefs of adolescents. *Information Age Publishing*, 307–337.

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*, 238–246.

Brod, M., Tesler, L. E., & Christensen, T. L. (2009). Qualitative research and content validity: Developing best practices based on science and experience. *Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care & Rehabilitation, 18*, 1263–1278.

Clark, D. M., Ehlers, A., McManus, F., Hackman, A., Fennell, M., Campbell, H., et al. (2003). Cognitive therapy versus fluoxetine in generalized social phobia: A randomized placebo-controlled trial. *Journal of Consulting and Clinical Psychology, 71*, 1058–1067.

Clark, D. M., Ehlers, A., Hackmann, A., McManus, F., Fennell, M., Grey, N., et al. (2006). Cognitive therapy versus exposure and applied relaxation in social phobia: A randomized controlled trial. *Journal of Consulting and Clinical Psychology, 74*, 568–578.

Craft, L. L., & Landers, D. M. (1998). The effect of exercise on clinical depression and depression resulting from mental illness: a meta-analysis. *Journal of Sport & Exercise Psychology, 20*, 339–357.

Donnellan, M. B., Oswald, F. L., Baird, B. M., & Lucas, R. E. (2006). The mini-IPIP scales: tiny-yet-effective measures of the big five factors of personality. *Psychological Assessment, 18*, 192–203.

Doyne, E. J., Chambless, D. L., & Beutler, L. E. (1983). Aerobic exercise as a treatment for depression in women. *Behavior Therapy, 14*, 434–440.

Fasting, K., & Gronningsaeter, H. (1986). Unemployment, trait-anxiety and physical exercise. *Scandinavian Journal of Sports Science, 8*, 99–103.

Goldberg, L. R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. In I. Mervielde, I. Deary, F. DeFruyt, & F. Ostendorf (Eds.), *Personality psychology in Europe (Vol. 7)* (pp. 7–28). Tilburg: Tilburg University Press.

Graziano, W. G., & Tobin, R. M. (2002). Agreeableness: dimension of personality or social desirability artifact? *Journal of Personality, 70*, 695–727.

Heimberg, R. G., Mueller, G. P., Holt, C. S., Hope, D. A., & Liebowitz, M. R. (1992). Assessment of anxiety in social interaction and being observed by others: the social interaction anxiety scale and the social phobia scale. *Behavior Therapy, 23*, 53–73.

Heimberg, R. G., & Turk, C. L. (2002). Assessment of social phobia. In R. G. Heimberg & E. Becker (Eds.), *Cognitive-behavioral group therapy for social phobia: Basic mechanisms and clinical strategies* (pp. 107–126). New York: Guilford Press.

Holt, C. S., Heimberg, R. G., Hope, D. A., & Liebowitz, M. R. (1992). Situational domains of social phobia. *Journal of Anxiety Disorders, 6*, 63–77.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling, 6*, 1–55.

Leary, A. O. (1985). Self-efficacy and health. *Behaviour Research and Therapy, 4*, 437–451.

Leary, M. R. (1983). A brief version of the fear of negative evaluation scale. *Personality and Social Psychology Bulletin, 9*, 371–375.

Long, B. C., & van Stavel, R. (1995). Effects of exercise training on anxiety. A meta-analysis. *Journal of Applied Sport Psychology, 7*, 167–189.

Manger, T. A., & Motta, R. W. (2005). The impact of an exercise program on posttraumatic stress disorder, anxiety, and depression. *International Journal of Emergency Mental Health, 7*, 49–57.

Mattick, R. P., & Clarke, J. C. (1998). Development and validation of measures of social phobia scrutiny fear and social interaction anxiety. *Behaviour Research and Therapy, 36*, 455–470.

McDonald, D. G., & Hogdon, J. A. (1991). *The psychological effects of aerobic fitness training: Research and theory*. Springer-Verlag: New York.

Meng, X., Rosenthal, R., & Rubin, D. B. (1992). Comparing correlated correlation coefficients. *Psychological Bulletin, 111*(1), 172–175. doi:10.1037/0033-2909.111.1.172

Muthén, L. K., & Muthén, B. O. (1998–2011). *Mplus user's guide*. (Sixth Edition ed.). Los Angeles, CA: Muthén & Muthén.

North, T. C., McCullagh, P., & Tran, Z. B. (1990). Effect of exercise on depression. *Exercise and Sport Sciences Reviews, 18*, 379–415.

Norton, P. J., Burns, J. A., Hope, D. A., & Bauer, B. K. (2000). Generalization of social anxiety to sporting and athletic situations: gender, sports involvement, and parental pressure. *Depression and Anxiety, 12*, 193–202.

Norton, P. J., Hope, D. A., & Weeks, J. W. (2004). The physical activity and sport anxiety scale (PASAS): scale development and psychometric analysis. *Anxiety, Stress & Coping: An International Journal, 17*, 363–382.

Patrick, D. L., Burke, L. B., Gwaltney, C. J., Leidy, N. K., Martin, M. L., Molsen, E., et al. (2011). Content validity- establishing and reporting the evidence in newly developed patient-reported outcomes (PRO) instruments for medical product evaluation: ISPOR PRO good research practices task force report: part 2- assessing respondent understanding. *Value in Health, 14*, 978–988.

Paxton, R. J., Motl, R. W., Aylward, A., & Nigg, C. R. (2010). Physical activity and quality of life—the complementary influence of self-efficacy for physical activity and mental health difficulties. *International Journal of Behavioral Medicine, 17*, 255–263.

Pasman, L., & Thompson, J. (1988). Body image and eating disturbance in obligatory runners, obligatory weightlifters, and sedentary individuals. *International Journal of Eating Disorders, 7*, 759–769.

Petruzzello, S. J., Landers, D. M., Hatfield, B. D., Kubitz, K. A., & Salazar, W. (1991). A meta-analysis on theanxiety-reducing effects of acute and chronic exercise: outcomes and mechanisms. *Sports Medicine, 11*, 143–182.

Physical Activity Guidelines Advisory Committee. (2008). *Physical activity guidelines advisory committee report, 2008*. Washington, DC: U.S. Department of Health and Human Services.

Pollock, M. L., Franklin, B. A., Balady, G. J., Chaitman, B. L., Fleg, J. L., Fletcher, B., et al. (2000). Resistance exercise in individuals with and without cardiovascular disease: benefits, rationale, safety, and prescription: an advisory from the committee on exercise, rehabilitation, and prevention, council on clinical cardiology, American heart association. *Position Paper Endorsed by the American College of Sports Medicine, 101*, 828–833.

Rodebaugh, T. L., Woods, C. M., Thissen, D. M., Heimberg, R. G., Chambless, D. L., & Rapee, R. M. (2004). More information from fewer questions: the factor structure and item properties of the original and brief fear of negative evaluation scale. *Psychological Assessment, 16*, 169–181.

Rodebaugh, T. L., Woods, C. M., & Heimberg, R. G. (2007). The reverse of social anxiety is not always the opposite: the reverse-scored items of the social interaction anxiety scale do not belong. *Behavior Therapy, 38*, 192–206.

Rosenbaum, S., Nguyen, D., Lenehan, T., Tiedemann, A., van der Ploeg, H. P., Sherrington, C. (2011). Exercise augmentation compared to usual care for post traumatic stress disorder: a randomised controlled trial (the REAP study: Randomised Exercise Augmentation for PTSD). *BMC Psychiatry*, 1.

Salmon, P. (2001). Effects of physical exercise on anxiety, depression, and sensitivity to stress: a unifying theory. *Clinical Psychology Review, 21*, 33–61.

Steiger, J. H., & Lind, J. C. (1980). Statistically-based tests for the number of factors. *Annual Spring Meeting of the Psychometric Society*. Iowa City, Iowa.

Steptoe, A., Wardle, J., Fuller, R., Holte, A., Justo, J., Sanderman, R., et al. (1997). Leisure-timephysical exercise: prevalence, attitudinal correlates, and behavioral correlates among young Europeans from 21 countries. *Preventive Medicine, 26*, 845–854.

Ströhle, A. (2009). Physical activity, exercise, depression and anxiety disorders. *Journal of Neural Transmission, 116*, 777–784.

Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika, 38*, 1–10.

Williams, P., & Lord, S. R. (1997). Effects of group exercise on cognitive functioning and mood in older women. *Australian and New Zealand Journal of Public Health, 21*, 45–52.

Zeller, R. A., & Carmines, E. G. (1980). Measurement in the Social Sciences: The link between theory and data. New York: Cambridge University Press.