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It's Not Just "Skin Deep": Social Anxiety and Anxiety Sensitivity in Adults with Psychodermatological Disorders

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IT'S NOT JUST "SKIN DEEP": SOCIAL ANXIETY AND ANXIETY SENSITIVITY IN ADULTS WITH PSYCHODERMALOGICAL DISORDERS

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Abstract

Anxiety contributes to dermatological conditions and, due to the visible nature of skin conditions, social anxiety is particularly salient to dermatology patients. Although many dermatology outpatients report clinically significant social anxiety symptoms, there is little understanding of social anxiety among dermatology patients. Anxiety sensitivity (AS), or the fear of the consequences of anxiety, has been implicated in both social anxiety and dermatological symptoms. To this end, this study aimed to further elucidate the relation of social anxiety and AS among skin disease in two separate samples of individuals with psychodermatological conditions. We hypothesized that AS social, but not physical or cognitive, concerns would emerge as a unique predictor of social anxiety symptoms after accounting for covariates. Study 1 consisted of 164 participants (M_{age} = 31.88; 69.5% female; 83.5% White) with active skin conditions who were recruited through Amazon's Mechanical Turk. Study 2 included 63 patients (M_{age} = 51.49; 70.7% female; 65% White) who were recruited from an outpatient dermatology clinic. In both samples, AS social concerns emerged as a unique factor contributing to social anxiety. The findings suggest heightened concerns about the negative consequences related to their visible skin condition may worsen social anxiety symptoms. Future research should examine the efficacy of brief AS interventions that target fears of social consequences in individuals with psychodermatological disorders.

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Research has shown that psychological disorders are especially common in dermatology patients, with an estimated prevalence ranging from 25% to 40% (Aktan, Ozmen, & Sanli, 1998; Hughes, Barraclough, Hamblin, & White, 1983; Niemeier et al., 2002; Picardi et al., 2000; Rasoulian, Ebrahimi, Zare & Taherifar, 2010; Wessely & Lewis 1989), compared to the 17.6% rate of occurrence observed in the general population (Kessler et al., 2012). The high rate of comorbidity of psychological and dermatological disorders has contributed to the formation of psychodermatology for disease classification, representing the intersection between psychiatry and dermatology. Psychodermatological disorders represent skin conditions affected by psychological stress, meaning that the psychological factors play a modulating role in the etiology, course, and prognosis of these disorders (Buske-Kirschbaum & Hellhammer, 2006; Griesemer, 1978; Jafferaney, 2007, Verhoeven et al., 2009). Psychodermatological disorders include disorders such as acne, atopic dermatitis (eczema), psoriasis, rosacea, urticaria (hives), vitiligo, and seborrheic dermatitis (Koo & Lebwohl, 2001).

Psychodermatological disorders have been classified into three categories: psychophysiologic disorders, primary psychiatric disorders, and secondary psychiatric disorders (Koo & Lee, 2003). Regarding psychophysiologic disorders, the skin disease (e.g., acne, eczema) may be either precipitated or exacerbated by psychological factors such as stress or anxiety, though the disease itself is not directly caused by psychological changes. In primary psychiatric disorders, psychopathology contributes to the

manifestation of skin symptoms. Examples include delusions of parasitosis, trichotillomania, and skin picking from obsessive compulsive disorders. Lastly, secondary psychiatric disorders consist of dermatologic disorders with psychiatric symptoms, such as alopecia aerate and psoriasis. Individuals with secondary psychiatric disorders typically experience anxiety, depression, and other emotional difficulties because of their skin disease.

Although only formally acknowledged in recent years, the bi-directional relationship between the mind and the skin has long been hypothesized (Sneddon, 1949). Indeed, the two are intertwined from the very beginnings of embryological development, with the developing brain and the skin sharing several receptors, neurotransmitters, and hormones (Rasoulian, Ebrahimi, Zare & Taherifar 2010). The immune system, in particular, plays a key regulatory role in the interaction between skin and psyche. Emotional factors (e.g., stress) can precipitate changes in the immune system and produce dermatological symptoms, such as acne breakouts and urticaria flares, by way of histamine release and increased vasodilation (Jeremy, Holland, Roberts, Thomson & Cunliffe, 2003; Misery, 1996; Teshima et al., 1986). This immunomodulated inflammatory response can subsequently affect the symptomatology of dermatological disorders by inflaming the epithelial and endothelial cells of the skin (Buske-Kirschbaum, Gierens, Hollig & Hellhammer, 2002).

Psoriasis can be used to exemplify the interaction between skin and psychological symptoms. For instance, one study found that 39% of psoriasis patients reported a significant stressful event within one month prior to the first episode of the disease (Seville, 1977). Likewise, Gaston and colleagues (1987) examined the relationship

between stress and psoriasis prospectively over the course of twenty weeks. The results indicated a positive correlation between the severity of psoriasis symptoms and the ongoing experience of psychologic distress and adverse life events. Although stress and other psychological factors have been shown to precipitate changes in the skin (Gupta, Gupta & Watteel, 1997; Ganceviciene, Graziene, Fimmel & Zouboulis, 2009; Morren et al., 1994; Tsukahara et al., 2003; Wygledowska-Kania, Bogdanowski & Polska, 1996), there is also evidence that dermatology patients may be more vulnerable to psychological syndromes. Multiple studies have indicated that psychological symptoms are common among dermatology patients (Dalgard et al., 2015; Gascòn et al., 2012; Picardi et al., 2000; Sheehan-Dare et al., 1990; Woodruff et al., 1997). For example, patients with moderate to severe acne vulgaris often report elevated levels of depression, anxiety, and suicidal ideation (Purvis, Robinson, Merry, & Watson 2006; Yazici et al., 2004). Likewise, Ahmed and colleagues (2007) found that patients with vitiligo had significantly higher rates of depression and anxiety than healthy controls. A population-based cohort study conducted by Olivier and colleagues (2010) looked at anxiety, depression, and suicidality in 149,998 psoriasis patients and 766,950 patients without psoriasis. As expected, patients with psoriasis showed an increased risk for all three diagnoses. Collectively, the above studies are indicative of the complex interaction between the mind and skin, and as such, call for further examination of dermatological conditions and co-occurring psychological factors.

Anxiety and depression are some of the most pervasive psychiatric disorders among dermatology patients, with estimated prevalence rates of 17% and 20%, respectively (Picardi et al., 2006). In particular, anxiety can have significant implications for skin

diseases. For instance, anxiety disorders are associated with increases in stress responses, and thus lead to heightened cortisol levels and inflammation (Evers, 2010). Importantly, both high cortisol levels and inflammation can directly affect the onset, progression, and resolution of dermatological disorders (Teshima et al., 1986; Wessely & Lewis 1989). The estimated prevalence of anxiety disorders among dermatology patients is on the order of 24 – 35% in outpatient clinics (Picardi et al., 2004; Woodruff, Higgens, Du Vivier & Wesseley, 1997), although moderate to severe anxiety symptoms are discernible in 52 – 77% of dermatology patients (Gascon et al., 2012, Rasoulian et al., 2010). Indeed, 77% of dermatology outpatients reported moderate to severe anxiety symptoms, compared to only 26% reported by healthy controls (Rasoulian et al., 2010). Taken together, anxiety and dermatological disorders appear to be highly comorbid.

Social anxiety disorder (SAD; previously known as social phobia) has been found to be one of the most pervasive anxiety disorders, affecting 7.4% of the U.S population each year (Kessler et al., 2012). According to the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), the first of the diagnostic criteria for SAD is "marked fear or anxiety about one or more social situations in which the individual is exposed to possible scrutiny by others, including social interactions, being observed, and performing in front of others" (American Psychiatric Association [APA], 2013). Individuals with SAD exhibit a hypersensitivity to criticism, negative evaluation, and rejection, stemming from low self-esteem and recurrent feelings of inferiority (APA, 2013; Cox, Fleet & Stein, 2004; Stopa & Clark, 1993). Individuals with SAD often have inaccurate perceptions of themselves, especially in social situations when they allocate important attentional resources to monitoring their actions and the reactions of those

around them (Rapee & Lim, 1992; Stopa & Clark, 1993). Flushing, trembling, stammering, heart palpitations, and sweating are some of the hallmark physical indicators of this disorder (APA, 2013). Despite the significant impairments associated with SAD, only about half of individuals with the disorder ever seek treatment, and typically do so after ten or more years of suffering (Wang et al., 2005).

Several negative outcomes are closely associated with SAD. First, the overall quality of life for those suffering from SAD is often reduced (Schneider, 2006). General impairments, which can range from performance anxiety to complete social isolation, can result in diminished emotional and social functioning (Mennin, McLaughlin & Flanagan, 2009; Stein, Walker & Forde 1996). Individuals with SAD are much less likely to marry than those who do not have the disorder and, for those who do marry, the decreased occupational and interpersonal functioning can cause exceptional tension and strain on the marriage (Salzer & Schallreuter, 2015). Work and school productivity can be significantly impaired as well, as indicated by a threefold higher rate of unemployment among individuals with the disorder (Wittchen & Beloch, 1996). Compared to those without SAD, individuals with SAD report significantly more impairments in work and school performance (Fehm, Beesdo, Jacobi & Fiedler, 2007) and are of lower socioeconomic status than those without the disorder (Schneier et al. 1992). In addition to the various negative outcomes of SAD, the disorder is also associated with a variety of comorbid psychiatric conditions that can worsen disability and prognosis (Lepine & Pelissolo, 1993). SAD is frequently comorbid with major depressive disorder and other anxiety disorders, such as panic disorder, agoraphobia, and obsessive-compulsive disorder (Schneier, Johnson & Hornig, 1992). Relative to skin disease, the negative

outcomes of SAD may be particularly problematic due to the highly visible nature of these conditions.

Dermatological disorders and SAD are highly co-morbid, with approximately 33 – 46% of dermatology outpatients reporting clinically significant social anxiety symptoms (Bez, Yesilova, Kaya & Sir, 2011; Montgomery et al., 2016; Yarpuz, Saadet, Sanli & Ozguven, 2008). Many dermatology patients fear that the prominence of their disease may attract attention (or perceived attention) in social situations (Jowett & Ryan, 1985). Further, social anxiety symptoms may worsen dermatological symptoms, further exposing individuals to visible symptoms which might further amplify fears of scrutiny (Dixon and Witcraft, 2018). Unfortunately, SAD symptoms tend to worsen prognosis in dermatological patients (Salman, Kurt, Topcuoglu & Demircay, 2016; Schneider et al., 2013).

The connection between SAD and dermatological disorders has been examined in several studies. Salman and colleagues (2016) found that vitiligo and acne patients who exhibited social anxiety symptoms experienced greater impairments than those without social anxiety symptoms. Schneider and colleagues (2013) found a similar trend in psoriasis patients, as those with social anxiety symptoms experienced significantly greater psychological distress than those without social anxiety symptoms. Likewise, Lessa and colleagues (2014) found that patients with both hyperhidrosis and social anxiety symptoms experienced greater disability and a more impaired quality of life than those with hyperhidrosis symptoms alone. Despite the fact that social anxiety symptoms are associated with worse wellbeing of individuals with dermatological disorders, the

empirical literature in this area is remarkably limited, and few studies have sought to investigate the mechanisms by which they are related.

Anxiety sensitivity is thought to play a broad role in the development and maintenance of anxiety disorders, including SAD (Naragon-Gainey, 2010; Olatunji & Wolitzky-Taylor, 2009), and may precede the onset of anxiety disorders rather than occurring as a consequence of the anxiety itself (Donnell & McNally, 1989, Reiss & McNally, 1985; Taylor et al., 1992). Anxiety sensitivity (AS) is defined as the propensity to fear the cognitive, physical, and social consequences of anxiety symptoms, such as embarrassment, social rejection, insanity, illness, or even death (Reiss & McNally, 1980; Taylor et al. 2007). AS is posited to be an anxiety amplifier, meaning that anxious individuals often become alarmed about their symptoms, which subsequently intensifies their anxiety (Taylor, Koch & McNally, 1992). For instance, an individual with SAD might notice that s/he becomes flushed during an interview, causing his/her heart rate to increase, which worsens flushing. Additionally, AS also plays a role in social anxiety with co-occurring dermatological symptoms, as the association between social anxiety and impairment due to skin disease has been shown to be mediated by AS (Dixon, Witcraft, & Perry, 2019).

AS is comprised of three, empirically established factors: cognitive concerns, physical concerns, and social concerns (Taylor et al., 2007). Individuals with elevated cognitive concerns generally fear that their anxiety symptoms will lead to some form of mental incapacitation, such as insanity. The physical concerns facet is associated with an increased sensitivity to the physiological cues of anxiety, such as heart palpitations and increased heart rate, with individuals interpreting the physiological symptoms as leading

to catastrophes such as cardiac arrest or stroke. Finally, the social concerns facet is associated with the belief that publicly observable anxiety reactions, such as flushing and trembling, will elicit ridicule and social rejection (Taylor et al., 2007). Deacon and Abramowitz (2006) found that the social facets of AS were particularly elevated among individuals with SAD. Patients with SAD differed markedly from participants with other anxiety disorders in regard to AS, with social phobics fearing anxiety-related sensations due to the potential for negative social evaluation, not concerns about physical or cognitive catastrophes. Given the high rates of co-morbidity between SAD and dermatological disorders and the highly visible nature of skin disease, AS social concerns may be an especially important vulnerability factor for individuals with psychodermatological disorders.

Prior work suggests that the social facets of AS may play a more important regulatory role in the development and maintenance of dermatological disorders than the cognitive and physical concerns facets. For instance, Dixon and colleagues (2016) found that patients with psychodermatological disorders demonstrated significantly elevated AS when compared to patients with nonpsychodermatological disorders, but the social concerns facets of AS had the most robust association with psychodermatological disorders after adjusting for general anxiety symptoms. Additional research has shown that stress is associated with skin disease quality of life among adults with active skin disease at high, but not low, levels of AS social concerns (Dixon, Witcraft, McCowan, & Brodell, 2018).

This preliminary research suggests that the social facets of AS are a unique contributor to the symptoms of psychodermatological disorders, specifically SAD.

However, the underlying mechanisms by which the two are linked have yet to be examined, and additional research is needed to further extrapolate the role of the different facets of AS in dermatological patients. A more in depth understanding of the mechanisms that connect the skin and psyche could result in more efficacious treatment plans and potentially alleviate both psychological and dermatological symptoms. To this end, the aim of this project is to examine associations between AS facets in relation to social anxiety symptoms, specifically among individuals with psychodermatological disorders in two separate samples: 1) an online sample of adults with active skin conditions and 2) a treatment-seeking sample of dermatology patients. We hypothesized that the AS social concerns will demonstrate a stronger association with social anxiety symptoms as compared to the physical and cognitive concerns facets. Additionally, we hypothesized that AS social concerns will account for more variance in social anxiety symptoms than AS cognitive or physical concerns, after accounting for theoretically relevant variables including age (Kessler et al., 2005), sex (Turk et al.,1998), and anxiety (Schneier et al.,1992). We expected that these findings would be observed in the nonclinical sample and replicated in the patient sample.

STUDY 1

Method

Participants and Procedure

Participants were recruited through Amazon's Mechanical Turk using TurkPrime.com, an online crowdsourcing software that compensates "workers" for completing tasks (Litman, Robinson, & Abberbock, 2017). To be eligible for the current study, workers must have been located in the United States, been 18 years or older, and completed a minimum of 100 tasks with at least an 85% approval rating. After providing consent, eligible workers (N =1,129) completed a health screen questionnaire to determine eligibility for the study. Individuals reporting past-year dermatological symptoms (n = 357) were invited to participate in the second portion of the study. After consenting to study procedures, eligible participants completed a series of questionnaires Participants were compensated $3.50 for study procedures. The study protocol was approved by the University of Mississippi's Institutional Review Board.

Data was collected from 237 participants (67.9% female; M_{age} = 34.18, SD_{age} = 9.574) who consented to the study and reported current dermatological symptoms. Participants were excluded from the current study if they did not report the presence of a current psychodermatological condition. In accordance with the previous literature (Dixon et al., 2016; Jafferany 2007), dermatological conditions were categorized as either "nonpsychodermatological" and "psychodermatological." While "psychodermatology" refers to disorders which may be triggered or exacerbated by psychological factors (e.g., acne, psoriasis, atopic dermatitis), "nonpsychodermatology" refers to skin conditions which are solely precipitated by biological factors (e.g., skin cancer, skin lesions). Participants who reported both nonpsychodermatological and psychodermatological conditions were classified as "psychodermatological" because it was surmised that participants with psychodermatological disorders would report higher levels of AS regardless of co-occurring nonpsychodermatological disorders. Additionally, primary psychiatric disorders and secondary psychiatric disorders were excluded from the final sample, due to the fact that these disorders tend to be psychological in origin (Koo & Lebwohl, 2001). The following psychodermatological disorders were reported and included in the final sample: acne, atopic dermatitis, rosacea, psoriasis, seborrheic dermatitis, perioral dermatitis, hyperhidrosis, hives, dermatitis, ichthyosis, vitiligo, alopecia, and factitial dermatitis. Nonpsychodermatological issues that were excluded from the final sample included skin cancer, moles, scarring, in-grown toenails, keloids, fungal infections, wrinkles, warts, shingles, melasmas, skin tags, birthmarks, hair loss, lesions, rashes, trichotillomania, and body dysmorphic disorder.

Measures

Anxiety Sensitivity Index- 3 (ASI-3). The ASI-3 (Taylor et al., 2007) includes 18 items designed to measure both the frequency and severity of the physical ("when I feel pain in my chest, I worry that I'm going to have a heart attack"), cognitive ("when my thoughts seem to speed up, I worry that I might be going crazy"), and social ("I worry that other people will notice my anxiety") facets of AS. Participants are asked to indicate the extent to which they agree with each statement on a 5-point Likert scale, which ranges from 0 ("very little") to 4 ("very much"). Total scores can range from 0 to 72, with higher scores indicating worse AS. Individuals obtaining a score of 23 or above are classified as having clinically significant levels of AS (Allen et al., 2014). The ASI-3 has demonstrated excellent overall internal consistency (Cronbach's $\alpha = .93$) in both clinical and undergraduate student samples (Wheaton, Deacon, McGrath, Berman, & Abramowitz, 2012). Additionally, the ASI-3 demonstrated good convergent and divergent validity in that the subscales were highly correlated with similar subscales of the original Anxiety Sensitivity Index and evidenced smaller correlations with dissimilar subscales (Taylor et al., 2007). In the current study, the ASI-3 demonstrated excellent internal consistency for the cognitive subscale ($\alpha_{cog} = .93$) and great internal consistency for the social and physical subscales ($\alpha_{soc} = .86$; $\alpha_{phy} = .89$). See Appendix A.

Social Phobia Inventory (SPIN). The SPIN (Connor et al., 2000) is a 17-item, self-report scale from 0 ("not at all") to 4 ("extremely"). Items assess the severity of the physiological symptoms (e.g., distressed by palpitations), avoidance (e.g., avoids speeches), and fear (e.g., fear of talking to strangers) associated with social phobia (social anxiety disorder). The items are summed to produce a total score, which ranges from 0 to 68, with higher scores corresponding to more severe social phobia symptoms. The

recommended clinical cut-off of 19 discriminates between those with and without social phobia (Connor et al., 2000). Regarding psychometric properties, the SPIN has demonstrated excellent internal consistency in both clinical samples (α = .91) and undergraduate samples (α = .94) (Carleton et al., 2010), and adequate test-retest reliability (Connor et al., 2000). Lastly, the SPIN demonstrated excellent internal consistency in the present study (Cronbach's α = .96) See Appendix B.

Depression, Anxiety, & Stress Scales – 21 (DASS-21). The DASS-21 (Lovibond & Lovibond, 1995) is a 21-item self-report questionnaire that assesses depression, anxiety, and stress symptoms. Total scores range from 0 to 84, with higher scores corresponding with more severe symptoms. Lovibond and colleagues (1995) found that the DASS-21 successfully discriminates between depression, anxiety, and stress, despite the fact that these syndromes are still highly correlated with one another. The anxiety subscale (e.g., "I had feelings of shakiness") measures physiological symptoms of anxiety whereas the stress subscale (e.g., "I found it difficult to relax") measures cognitive symptoms of anxiety (Lovibond & Lovibond, 1995). The current study used only the 7-item Anxiety subscale. The DASS-21-Anxiety scale has been found to have excellent overall internal consistency (Cronbach's α = .93) in both clinical and undergraduate samples (Lovibond & Lovibond, 1995; Osman et al., 2012). The DASS-21-Anxiety subscale has evidenced good convergent and discriminant validity when compared to other validated measures of anxiety (Henry & Crawford, 2005). In the present study, the DASS-21-Anxiety demonstrated excellent internal consistency (Cronbach's α = .95). See Appendix C.

Demographics and Dermatological Information Form. Participants reported sociodemographic characteristics, including age, sex, employment status, and education level. In addition, participants responded to a checklist of dermatological conditions experienced in the last four weeks (i.e., currently). See Appendix D.

Results Study 1

Participant Characteristics

Data were cleaned and examined. Per the aforementioned inclusion criteria for psychodermatological disorders, 164 participants were included in the study and 73 participants were excluded. The overall sample was primarily female (69.5%) and was an average age of 31.88 years (*SD* = 8.05). The sociodemographic characteristics in this subsample were similar to those observed in the full sample. The majority of participants were White (83.5%). Other ethnicities represented in the sample included Black/African American (9.1%), Asian/Southeast Asian (6.1%), American Indian (1.2%), and 6.7% Latin. The majority of participants had education beyond high school (87.2%) and most were employed either part time (16.5%) or full time (56.7%).

The most frequently reported psychodermatological disorder was acne (82.3%) followed by atopic dermatitis (32.9%) and dermatitis (15.2%; see Table 1) Additionally, 60.7% of participants reported clinically significant levels of social anxiety symptoms (*M* = 28.33, *SD* = 18.80) and 45.1% reported clinically elevated levels of AS *(M* = 25.52, *SD* = 16.58; see Table 1 for AS subscale scores).

Bivariate Correlations

Pearson correlations were utilized to test the hypothesis that the AS social concerns would demonstrate a stronger association with social anxiety symptoms than the physical

and cognitive concerns facets. As expected, AS social concerns demonstrated the highest correlation (r = .71) with social anxiety, when compared to the physical (r = .54) and cognitive (r = .56) concerns of AS (all p's < 0.01). See Table 1.

Multiple Linear Regression

A multiple linear regression was computed to test the hypothesis that AS social concerns would account for greater variance in social anxiety symptoms than AS cognitive or physical concerns, over and above theoretically-relevant variables. In Step 1, age, sex, and anxiety were entered as the predictors, and accounted for 34.6% of the variance in social anxiety symptoms, F (3,160) = 29.46, p < .001. In Step 2, the physical, cognitive, and social facets of AS were entered into the model, which accounted for an additional 20.8% of the variance in social anxiety symptoms, ΔF (6, 157) = 24.96, p <.001. Consistent with the hypothesis, AS social concerns, but not physical or cognitive concerns, emerged as a unique predictor of social anxiety. See Table 3.

STUDY 2

Method

Participants and Procedure

Patients seeking outpatient dermatology care were recruited through the University of Mississippi Medical Center (UMMC) Dermatology Clinics. Following patient check-in, UMMC Dermatology Clinic personnel introduced patients to the research study and distributed a questionnaire packet including demographics, ASI-3, DASS-21, and SPIN (see Study 1 for measure information). Written consent was waived by the IRB for this study, and patients were informed in a cover letter that returning a completed measure

packet was indicative of their consent to be a part of the study. In addition, patients were informed that their participation (or lack thereof) would not affect their treatment, and no compensation was provided for their participation. Interested patients returned their anonymous questionnaire packets to clinic personnel. The study protocol was approved by the University of Mississippi's Institutional Review Board.

Inclusion and Exclusion Criteria. To be eligible for the study, the patients had to be 18 years or older and English speaking. This study used the same criteria as Study 1 to identify between participants with psychodermatological disorders. That is, participants who reported non-psychodermatological disorders, such as skin cancer, were excluded from this study.

Measures

Anxiety Sensitivity Index- 3 (ASI-3). See study 1 for the psychometric properties of ASI-3. In Study 2, the internal consistency ranged from great to excellent for all three subscales (α_{soc}= .86; α_{cog} = .93; α_{phy} = .89).

Social Phobia Inventory (SPIN). See Study 1 for the psychometric properties of SPIN. In Study 2, the internal consistency was adequate (α = .76).

Depression, Anxiety, & Stress Scales – 21 (DASS-21). See Study 1 for the psychometric properties of the DASS-21. In Study 2, the internal consistency was great (α = .89).

Demographics Form. This form was utilized to obtain general medical and demographic information. The questionnaire included items assessing age, sex, marital/relationship status, ethnicity, education, total family/household income, and employment status. In addition, patients identified their current dermatological issues or

diagnoses by circling common disorders and/or responding to a free-response item. See Appendix E.

Results

Participant Characteristics

The data were cleaned and participants who did not complete measures pertinent to the current study were excluded from analyses. Using the previously described inclusion criteria, 60 participants were excluded from the current study and the final sample was comprised of 63 participants with psychodermatology disorders. The final sample was primarily female (81%), and was on average 47.94 years old (*SD* = 16.05). Participants identified as White (58.7%), Black/African American (39.7%), and Native American (1.6%). Additionally, most individuals had education beyond high school (73.0%), were employed (52.4%), and married (50.8%). The most common psychodermatological disorder was acne (31.8%), followed by atopic dermatitis (30.1%) and psoriasis (27%). Overall, 27.2% of patients reported social anxiety levels of clinical significance (*M* = 15.65, *SD* = 14.69) and 35.2 % of participants reported clinically significant levels of AS *(M* = 21.03, *SD* = 16.76; see Table 1 for AS subscale scores).

Bivariate Correlations

Pearson correlations revealed that that among psychodermatology patients, the correlation between the social facets of AS social anxiety symptoms was large (*r* = .75) whereas medium-sized correlations were observed between social anxiety symptoms and AS physical (*r* = .49) and cognitive facets (*r* = .56; all *ps* <.01). See Table 1.

Multiple Linear Regression

In Step 1, age, sex, and anxiety were entered as the predictors, and accounted for 34.1% of the variance in social anxiety symptoms F (3,55) = 10.004, p < .001. In Step 2, the physical, cognitive, and social facets of AS were entered into the model, which accounted for an additional 26.6% of the variance in social anxiety symptoms, ΔF (3, 55) = 12.421, p <.001. Supporting the hypothesis, AS social concerns, but not physical or cognitive concerns, emerged as a unique predictor of social anxiety. See Table 4.

Discussion

The current study examined the physical, cognitive, and social facets of AS in relation to social anxiety symptoms in two samples of adults with psychodermatological disorders. In both samples, AS social concerns emerged as a unique factor contributing to social anxiety symptoms, above the theoretically-relevant covariates of age, sex, and trait anxiety. These findings suggest heightened concerns about the negative social

consequences related to their visible skin condition may exacerbate social anxiety symptoms among individuals with psychodermatological disorders.

Participants in both studies demonstrated elevated levels of social anxiety, with 60.7% and 27.2% of individuals reporting clinically significant levels of social anxiety in the online and patient samples, respectively. These results are consistent with those of prior studies which have shown high rates of comorbidity between SAD and dermatological disorders (Bez, Yesilova, Kaya & Sir, 2011; Montgomery et al., 2016; Yarpuz, Saadet, Sanli & Ozguven, 2008). Interestingly, participants in Study 1 demonstrated significantly elevated social phobia levels when compared to the participants in Study 2. This disparity could be attributed to a variety of factors, such as differences in demographics and sample size. For instance, the sample in Study 1 (N = 164) was larger than that of Study 2 (N = 62), and a larger sample size minimizes the effects of statistical outliers. Further, participants in Study 1 were on average 16 years younger than those in Study 2, which is consistent with previous research which finds that social anxiety is more prevalent among younger samples (Cairney et al., 2007; Flint et al., 2010; Kessler et al., 2005; Regier et al., 1988). Anxiety disorders, such as SAD, have a peak age of onset in early adulthood and their incidence and prevalence decline later in life (Kessler et al., 2005), and individuals may become more adept at managing their social anxiety with age (Henderson, Form, Korten & Jacomb, 1998). Individuals who report highly visible dermatological symptoms tend to report significantly elevated levels of social anxiety, which could explain the comparably high levels of social anxiety in Study 1 (Montgomery, Norman, Messenger & Thompson, 2016; Salman, Kurt, Topcuoglu & Demicray, 2016). In Study 1, the majority of participants reported acne as

their chief dermatological complaint (82.3%), whereas participants in Study 2 reported notably lower rates of acne (31.8%), and a higher frequency of psoriasis (Study 1: 8.5% vs. Study 2: 27%). Research suggests that SAD may be prevalent in as many as 45.7% of acne patients (Bez, Yesilova, Kaya & Sir, 2011), though SAD prevalence rates appear to be as low as 4% among individuals with disorders such as psoriasis (Golpour et al., 2012). Acne symptoms are typically localized to highly visible areas of the body (e.g., face, upper back, chest), whereas psoriasis and eczema may present to more concealable areas of the body (e.g., Shalita, 2004).

Consistent with expectations, although the three facets of AS were positively correlated with social anxiety symptoms, the social concerns facets demonstrated the strongest association with social anxiety symptoms in both samples. These findings support the premise that individuals with psychodermatological disorders may experience elevated concerns about the social consequences of physiological arousal due to the visible nature of skin disease (e.g., sweating). Further, as these samples, on average, experienced elevated levels of social anxiety symptoms, it stands to reason that they may also experience concerns about the physical and cognitive consequences related to anxiety.

As hypothesized, the social facets of AS emerged as a unique predictor of social anxiety symptoms in both psychodermatological samples. These results are consistent studies implicating the social facets of AS in the etiology and maintenance of SAD (Olthius, Watt & Stewart, 2014). Although previous literature has established age (Kessler et al., 2005), gender (Asher & Aderka; 2018), and anxiety (Schneier et al.,1992) as significant risk factors for SAD, the current study suggests that the social facets of AS

play a more salient role in social anxiety among psychodermatological conditions. Adults with skin disease may fear that their anxiety-related symptoms and the visibility of their dermatological symptoms will result in negative consequences, such as ridicule, social rejection, negative evaluation, and worsened dermatological symptomatology (i.e., acne breakout or psoriasis flare). These fears may result in greater distress and psychosocial impairment, which could further exacerbate skin symptoms.

Although this study replicated and extended current knowledge of the psychodermatology literature, several limitations warrant consideration. First, the methodology of the first study relied on an online crowdsourcing platform. Although attention check questions were used to exclude careless responders and to improve validity (Meade & Craig, 2012), participants could have answered questionnaires dishonestly or carelessly, and dermatological symptoms were not verified by a clinician. These limitations were partially addressed in Study 2, which used an in-person sample of patients presenting to a dermatology clinic and paper-pencil questionnaires. Second, the cross-sectional design of both studies precludes temporal or causal associations. Longitudinal studies are needed to better understand the development of psychodermatological disorders, social anxiety symptoms, and the social facets of AS over time and to identify additional risk factors. Third, social anxiety symptoms were assessed via self-report, rather than clinical interview. Future studies should seek to replicate the findings of Study 1 and Study 2 in a clinical sample of individuals diagnosed with SAD. Additionally, both samples lacked gender diversity, as the majority of participants were female (Study 1 = 69.5%; Study 2 = 81.0%). Although the sample limits the generalizability of the findings, females account for approximately 60% of

dermatology visits (Stern 2004) and have higher lifetime prevalence rates of SAD compared to men (Weinstock, 1999; Xu et al., 2012). Therefore, the results may represent a majority of patients presenting to dermatology clinics with social concerns. Next, high correlations between AS facets in Study 2 indicates potential for multicollinearity, such that one of the facets may be suppressed in accounting for variance in the outcome. Lastly, dermatological disorders in Study 1 and Study 2 were dichotomized as either psychodermatological or nonpsychodermatological and not examined on an individual basis. Subsequent research should target specific psychodermatological and nonpsychodermatological disorders to look for variance, or lack thereof, in social anxiety symptoms and social AS among individuals with different disorders.

Psychological interventions appear to be useful adjuncts to conventional dermatological treatments for individuals with psychodermatological disorders, and improving the specificity of such treatments by targeting the social facets of AS could potentially streamline intervention processes and maximize effectiveness (Hedman-Lagerlof, Bergman, Lindefors & Bradley, 2018; Shenefelt, 2000; Smits, Berry, Tart & Powers, 2008; Woodruff, Higgens, Du Vivier & Wessely, 1997). Interventions such as cognitive-behavioral therapy, which work by altering the dysfunctional thought patterns or actions that are associated with anxiety symptoms, have been shown to effectively reduce AS (Capron & Schmidt, 2016; Kneough & Schmidt, 2012; Olthuis, Watt, MacKinnon & Stewart, 2014). In the future, dermatologists and other clinicians may use assessments of AS social concerns to screen for at risk individuals and provide brief AS interventions targeting social concerns related to their skin and anxiety symptoms.

Clinicians could also refer at-risk patients to psychology specialists or therapists for further psychological evaluation and treatment.

In summary, psychodermatology is relatively new area of research, and the literature within this discipline is remarkably limited. This study is one of the few of its kind to examine SAD among individuals with psychodermatological disorders, and the findings regarding the social facets of AS have further elucidated the mechanisms by which the mind and skin are related. Moreover, this study provides a replication, demonstrating that the social facets of AS appear to be a unique contributor to social anxiety symptoms in both clinical and nonclinical samples.

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Table 1. *Psychodermatological disorder*s

	Study 1 (*N* = 164) % (*n)*	Study 2 (*N* = 63) % (*n*)
Acne	82.3 (135)	31.8 (20)
Eczema (Atopic Dermatitis)	32.9 (53)	30.1(19)
Psoriasis	8.5 (14)	27 (17)
Dermatitis	15.2 (25)	3.2 (2)
Seborrheic Dermatitis	11.0 (18)	0.0
Factitial Dermatitis	1.8 (3)	0.0
Rosacea	6.7 (11)	6.4 (4)
Urticaria (hives)	3.0 (5)	0.0
Alopecia Areata	1.2 (2)	4.8 (3)
Vitiligo	0.6 (1)	1.6 (1)
Ichthyosis	0.6 (1)	0.0
Prurigo Nodularis	0.0	1.6 (1)
Hyperhidrosis	3.0 (5)	1.6 (1)

Table 2. *Means, Standard Deviations, and Correlations between Study Variables*

	Study 1 *M* (*SD*)	Study 2 *M* (*SD*)	1.	2.	3.	4.	5.
1. Anxiety	10.69 (9.82)	7.98 (10.76)	-	.57**	.52**	.66**	.59**
2. Social Anxiety	28.32 (7.88)	15.65 (14.69)	.59**	-	.48**	.56**	.747**
3. AS Physical	7.88 (6.42)	7.63 (6.28)	.65**	.54**	-	.79**	.71**
4. AS Cognitive	5.92 (6.57)	5.48 (6.01)	.65**	.55**	.65**	-	.74**
5. AS Social	11.71 (6.30)	7.98 (6.19)	.567**	.71**	.61**	.57**	-

Note. *M* = mean; *SD* = standard deviation. Anxiety= DASS-21 Anxiety; Social Anxiety= Social Phobia Inventory total; AS Physical, AS Cognitive & AS Social = three subscales of the ASI-3. Values below the diagonal of the correlation matrix are from the MTurk sample; values above the diagonal are from the patient sample.

Table 3. *Multiple linear regression of anxiety sensitivity facets in social anxiety symptoms among MTurk workers (N = 164)*

	ΔR^2	*B*	*SE(B)*	*p*
Step 1	**.356**			**<.001**
Age		-.074	.153	.628
Sex		-1.785	2.375	.453
Anxiety		1.129	.125	<.001
Step 2	**.208**			**<001**
Age		-.142	.128	.270
Sex		.020	1.993	.992
Anxiety		.396	.152	.010
AS Physical		.048	.232	.838
AS Cognitive		.327	.221	.140
AS Social		1.519	.212	<.001

Note. AS = Anxiety sensitivity; anxiety= DASS-21 Anxiety; social anxiety = Social Phobia Inventory total; AS Physical, AS Cognitive & AS Social = three subscales of the ASI-3.

Table 4. *Multiple linear regression of anxiety sensitivity facets in social anxiety symptoms among psychodermatology patients (N = 63)*

	ΔR^2	*B*	*SE(B)*	*p*
Step 1	**.341**			**<.001**
Age		0.062	-.068	.548
Sex		.580	.016	.889
Anxiety		.777	.571	<.001
Step 2	**.266**			**<001**
Age		.023	.083	.781
Sex		-1.341	3.312	.687
Anxiety		.316	.161	.054
AS Physical		-.407	.339	.325
AS Cognitive		-.031	.401	.939
AS Social		1.763	.323	<.001

Note. AS = Anxiety sensitivity; anxiety= DASS-21 Anxiety; social anxiety = Social Phobia Inventory total; AS Physical, AS Cognitive & AS Social = three subscales of the ASI-3.

Appendix A

Anxiety Sensitivity Index-3

Please circle the number that best corresponds to how much you agree with each item. If any items concern something that you have never experienced (e.g., fainting in public) answer on the basis of how you think you might feel *if you had* such an experience. Otherwise, answer all items on the basis of your own experience. Be careful to circle only one number for each item and please answer all items.

	Very Little	**A little**	**Some**	**Much**	**Very much**
1. It is important for me not to appear nervous.	0	1	2	3	4
2. When I cannot keep my mind on a task, I worry that I might be going crazy.	0	1	2	3	4
3. It scares me when my heart beats rapidly.	0	1	2	3	4
4. When my stomach is upset, I worry that I might be seriously ill.	0	1	2	3	4
5. It scares me when I am unable to keep my mind on a task.	0	1	2	3	4
6. When I tremble in the presence of others, I fear what people might think of me.	0	1	2	3	4
7. When my chest feels tight, I get scared that I won't be able to breathe properly.	0	1	2	3	4
8. When I feel pain in my chest, I worry that I am going to have a heart attack.	0	1	2	3	4
9. I worry that other people will notice my anxiety.	0	1	2	3	4

10. When I feel "spacey" or spaced out I worry that I may be mentally ill.	0	1	2	3	4
11. It scares me when I blush in front of people.	0	1	2	3	4
12. When I notice my heart skipping a beat, I worry that there is something seriously wrong with me.	0	1	2	3	4
13. When I begin to sweat in a social situation, I fear people will think negatively of me.	0	1	2	3	4
14. When my thoughts seem to speed up, I worry that I might be going crazy.	0	1	2	3	4
15. When my throat feels tight, I worry that I could choke to death.	0	1	2	3	4
16. When I have trouble thinking clearly, I worry that there is something wrong with me.	0	1	2	3	4
17. I think it would be horrible for me to faint in public.	0	1	2	3	4
18. When my mind goes blank, I worry there is something terribly wrong with me.	0	1	2	3	4

Appendix B

Social Phobia Inventory (SPIN)

Directions: Please circle the number that best corresponds to how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any one statement.

	Not at all	**A little bit**	**Some what**	**Very Much**	**Extremely**
1. I am afraid of people in authority.	0	1	2	3	4
2. I am bothered by blushing in front of people.	0	1	2	3	4
3. Parties and social events scare me.	0	1	2	3	4
4. I avoid talking to people I don't know.	0	1	2	3	4
5. Being criticized scares me a lot.	0	1	2	3	4
6. I avoid doing things or speaking to people for fear of embarrassment.	0	1	2	3	4
7. Sweating in front of people causes me distress.	0	1	2	3	4
8. I avoid going to parties.	0	1	2	3	4
9. I avoid activities in which I am the center of attention.	0	1	2	3	4
10. Talking to strangers scares me.	0	1	2	3	4
11. I avoid having to give speeches.	0	1	2	3	4
12. I would do anything to avoid being criticized.	0	1	2	3	4
13. Heart palpitations bother me when I am around people.	0	1	2	3	4
14. I am afraid of doing things when people might be watching.	0	1	2	3	4

15. Being embarrassed or looking stupid are among my worst fears.	0	1	2	3	4
16. I avoid speaking to anyone in authority.	0	1	2	3	4
17. Trembling or shaking in front of others is distressing to me.	0	1	2	3	4

Appendix C

DASS-21
Anxiety Subscale

Choose the number which indicates how much the statement applied to you over the past week.

0 = Did not apply to me at all
1 = Applied to me to some degree, or some of the time
2 = Applied to me to a considerable degree, or a good part of the time
3 = Applied to me very much, or most of the time

_____ 1. I was aware of dryness in my mouth.

_____ 2. I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).

_____ 3. I experienced trembling (e.g., in the hands).

_____ 4. I was worried about situations in which I might panic and make a fool of myself.

_____ 5. I felt I was close to panic.

_____ 6. I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).

_____ 7. I felt scared without any good reason.

Appendix D

Medical Screening Questions

1. In the last 12 months, have you experienced insomnia, difficulties falling asleep, or other sleeping problems (*example*: frequent waking)?		☐ Yes	☐No
2. In the last 12 months, have you experienced, had difficulties with, or seen a medical provider for a dermatology condition or for symptoms related to skin problems (*examples:* rosacea, psoriasis, acne, eczema)?		☐ Yes	☐No
3. In the last 12 months, have you used prescription drugs (e.g., pain pills, Xanax, stimulants) for non-medical purposes (*examples:* to get high, feel better)?		☐ Yes	☐No
4. In the last 12 months, have you experienced perfect health every single day, all day? (*examples:* complete absence of: illness, ailments, headaches/stomachaches)		☐ Yes	☐No
5. *For women,* are you currently pregnant or did you give birth to a child in the last 12 months?	☐ N/A	☐ Yes	☐No

Appendix E

Demographics Form

Age: _____

Sex: ___Female ___ Male

Marital/Relationship Status:

_____ (1) Single (never married, living alone, divorced, widowed, etc.)
_____ (2) Living with a partner as if married
_____ (3) Married BUT separated
_____ (4) Married

Ethnicity / Race:

___ (1) White/Caucasian
___ (2) Black/African American
___ (3) Asian/Southeast Asian
___ (4) Hispanic /Latino
___ (5) Native American

Education (the highest grade or degree you have completed):

___ (1) None
___ (2) 1st to 8th Grade School
___ (3) Some High School
___ (4) High School Graduate School
___ (5) G.E.D. Degree
___ (6) Some College
___ (7) Technical or Business
___ (8) College Graduate
___ (9) Some Graduate
___ (10) Graduate or Professional

Total Family/Household Income (Please check one):

___$0 - 9,999	___$40,000 – 49,999	___$80,000 – 89,999
___$10,000 – 19,999	___$50,000 – 59,999	___$90,000 – 99,999
___$20,000 – 29,999	___$60,000 – 69,999	___$100,000 or more
___$30,000 – 39,999	___$70,000 – 79,999	

Employment Status:

___ (1) unemployed

___ (2) employed part-time (working 1-30 hours a week)

___ (3) employed full-time (working more than 30 hours a week)

___ (4) full-time student

___ (5) home-maker

___ (6) part-time student

___ (7) retired

What are your current dermatological diagnoses? If unsure or no diagnosis, what issues, or concerns are you experiencing? (Please circle all that apply and/or describe current concerns)

_____

_____

_____

_____

Acne	**Birthmarks**	**Eczema**	**Herpes**
Hidradenitis			
Hyperhidrosis (excessive sweating)		**Melasma**	**Psoriasis**
Rosacea			
Scars	**Skin Cancer**	**Sun Damage**	**Vitiligo**
Wrinkles			