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Journal of Sex & Marital Therapy

ISSN: 0092-623X (Print) 1521-0715 (Online) Journal homepage: http://www.tandfonline.com/loi/usmt20

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To cite this article: Miriam K. Forbes, Andrew J. Baillie & Carolyn A. Schniering (2016) Should Sexual Problems Be Included in the Internalizing Spectrum? A Comparison of Dimensional and Categorical Models, Journal of Sex & Marital Therapy, 42:1, 70-90, DOI: 10.1080/0092623X.2014.996928

To link to this article: http://dx.doi.org/10.1080/0092623X.2014.996928

Accepted author version posted online: 23 Dec 2014.
Published online: 26 Jan 2015.

JOURNAL OF SEX & MARITAL THERAPY, *42*(1), 70–90, 2016

ISSN: 0092-623X print / 1521-0715 online
DOI: 10.1080/0092623X.2014.996928

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Should Sexual Problems Be Included in the Internalizing Spectrum? A Comparison of Dimensional and Categorical Models

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Preliminary research has suggested that sexual problems should be included in the internalizing spectrum alongside depressive and anxiety disorders. This study aimed to empirically examine and compare an extended internalizing spectrum model with a categorical framework model implied by the current nosological structure. Responses to an online survey from a community sample ($n = 518$) were analyzed to compare the fit of six alternative models of the relationship between sexual problems and depressive and anxiety disorders, separately for men and women. The best model for women ($n = 336$) was a dimensional spectrum model that included sexual arousal, orgasm, and pain difficulties in the internalizing spectrum. The results for men ($n = 182$) were less clear-cut: there were apparent categorical relationships for a small group ($n = 8$), and the spectrum model showed a good fit for 96% of the sample. These findings are consistent with a nosology that maintains discrete disorders and diagnostic chapters while recognizing the relationships between them, as in the new structure of the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders*. As such, this study offers further evidence that there are dimensional relationships between sexual problems and depressive and anxiety disorders, which should be explicitly recognized in diagnostic systems.

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INTRODUCTION

When the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV*) was published, Clark, Watson, and Reynolds (1995) concluded that "it is time to halt the general call for dimensional systems and begin the hard work of developing specific dimensional proposals in targeted domains" (p. 147). This idea gained momentum in the lead up to the fifth edition of the *DSM*. However, none of the attempts at modeling the broad dimensions of psychopathology (e.g., Kendler, 2009; Markon, 2010) have included sexual dysfunctions, and their high rates of co-occurrence with depression and anxiety are not accounted for in the new *DSM* (American Psychiatric Association 2013a) or in the current International Classification of Diseases (ICD; World Health Organization, 2008). The *DSM-IV-TR* (American Psychiatric Association, 2000) had a categorical structure that emphasized the differences between disorders, which distracted research from the development of dimensional theories about the shared processes between them. One of the primary problems with the *DSM-IV-TR* arose from the systematic co-occurrence between disorders (i.e., comorbidity), and this could be accounted for by a shared underlying dimension (Krueger, Markon, Patrick & Iacono, 2005).

It is stated in the *DSM-IV-TR* that "a categorical approach works best when all members of a diagnostic class are homogeneous, when there are class boundaries between classes, and when the different classes are mutually exclusive" (American Psychiatric Association, 2000, p. xxxi). None of these three conditions was satisfied in the *DSM-IV-TR*: There was heterogeneity within and between diagnostic chapters (Widiger & Sankis, 2000; Widiger & Trull, 2007), and chapter boundaries were blurred by new diagnoses included to fill the gaps that were highlighted by the frequency of the "not otherwise specified" diagnosis (e.g., mixed anxiety-depressive disorder; American Psychiatric Association, 2000, p. 484), which impaired clinical utility (Andrews, Anderson, Slade, & Sunderland, 2008). Furthermore, the high rates of comorbidity between diagnostic chapters (see Kessler, Chiu, Demler, & Walters, 2005) suggested that the categories were not mutually exclusive; a categorical taxonomy imposes distinctions that do not exist in nature, and it is incompatible with the nature of psychopathology (Krueger & Piasecki, 2002; Watson, 2005).

Dimensional models can overcome some of these problems and have several advantages over the categorical approach. First, heterogeneity within diagnostic chapters can be eliminated by a dimensional approach that transcends arbitrary categorical distinctions, and organizes disorders according to shared underlying psychopathological processes (or "spectra"). Second, by restructuring the chapters, the confusion at their boundaries would no longer be an issue; a smaller number of spectra that accurately reflect relationships between disorders could be more easily understood and used by clinicians (Acton & Zodda, 2005). Third, patterns of comorbidity can be highlighted as reliable empirical observations—representing the underlying spectra between mental disorders (Vollebergh et al., 2001). This can facilitate the assessment and tracking of subthreshold comorbid conditions that might otherwise not be assessed or noticed (Widiger & Samuel, 2005). In short, the use of a dimensional spectrum model to organize diagnoses according to comorbidity patterns would facilitate differential diagnosis and clinical utility, as well as eliminate many of the problems with a categorical model (Watson, 2005). Diagnostic labels can remain—enabling accurate communication—and research is consequently based on more informative data.

This idea sparked an ongoing debate surrounding the structure of psychopathology, and how to incorporate underlying spectra of psychopathology in a nosological meta-structure (see Kendler, 2009; Krueger, Watson, & Barlow, 2005). As a result of much research and debate, some of the *DSM-5* chapters have been reordered to signal how disorders relate to one another, based on symptom characteristics and underlying vulnerabilities (American Psychiatric Association,, 2013b). The *ICD-11* will also account for the relationship between chapters of diagnoses through multiple parenting (World Health Organization, 2014). These meta-structures will encourage research on how disorders relate to each other within and between diagnostic groupings, as chapters are sorted into broad categories, some of which denote shared features within larger diagnostic groups (American Psychiatric Association, 2013b). A prominent example of this is the depressive and anxiety disorders, which have been established as part of an internalizing spectrum (e.g., Krueger, 1999), and are neighbors in the *DSM-5* (American Psychiatric Association, 2013b) and the *ICD-11 Beta Draft* (World Health Organization, 2013).

Depressive and anxiety disorders also share a strong relationship with sexual dysfunctions, which is indicated by the high rates of comorbidity among the disorders between these diagnostic categories. For example, depression, generalized anxiety disorder, and panic disorder have been found to be associated with sexual desire, arousal and orgasmic disorders for men and women, and with sexual pain disorders for women (e.g., Althof et al., 2005; Balon, 2006; Derogatis, Meyer, & King, 1981; Figueira, Possidente, Marques, & Hayes, 2001; Kendurkar & Kaur, 2008; van Minnen & Kampman, 2000). Social anxiety has been found to have more specific relationships with orgasmic disorders (Figueira et al., 2001) but also with desire and pain disorders (Corretti & Baldi, 2007). In the context of female sexual dysfunction, more research has been conducted focusing on the interrelationships of desire and arousal with depressive and anxiety disorders, so the evidence for these relationships are more robust compared with the studies focusing on orgasm and pain disorders. The evidence for associations with depression is also more robust compared with associations with anxiety, as experimental studies that focus on state anxiety have found mixed results for the effects of anxious arousal for women (e.g., Bradford & Meston, 2006; Elliot & O'Donohue, 1997; Palace & Gorzalka, 1990). For men, most research focuses on erectile dysfunction, but relationships between depression and anxiety and all phases of the sexual response cycle have been found (Laurent & Simons, 2009). A smaller number of studies have found conflicting results for the relationships between sexual desire and depression, with some men reporting increased desire during negative mood states (e.g., Bancroft et al., 2003; Nofzinger et al., 1993). Laurent and Simons (2009) provided an extensive review of the literature on these relationships and found that depressive and anxiety disorders are associated with all sexual dysfunctions for men and women, and across cultures.

Similar cognitive processes between the disorders have also been found. For example, the attributional style that characterizes depression also fosters sexual dysfunction through internal, global and stable attributions about negative sexual experiences (Nobre & Pinto-Gouveia, 2009). Erroneous sexual beliefs and negative self-image are also vulnerability factors for sexual dysfunction (Nobre & Pinto-Gouveia, 2006), as they activate the schemas around negative automatic thoughts and emotions that perpetuate the cycle, and distract from erotic cues (Nobre & Pinto-Gouveia, 2003, 2009). Furthermore, the defining characteristics of internalizing psychopathology (i.e., negative affect and neuroticism) have a role in sexual dysfunction (Laurent & Simons, 2009). Correspondingly, shared treatment response to cognitive-behavioral therapy has been found for

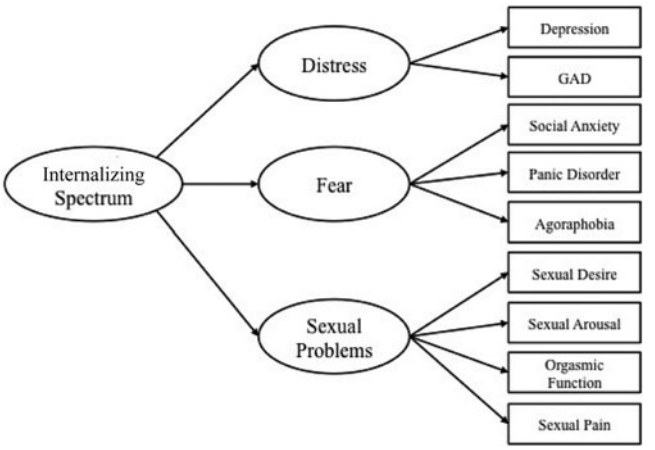

FIGURE 1 A dimensional-spectrum model that fits well for women (Forbes & Schniering, 2013). GAD = generalized anxiety disorder.

depression, anxiety disorders and sexual problems (e.g., Hoyer, Uhmann, Rambow, & Jacobi, 2009), which effects change in the maladaptive cognitions and attributions in sexual dysfunctions (McCabe, 2001; Trudel et al., 2001).

On the basis of their review, Laurent and Simons (2009) suggested that the inclusion of sexual dysfunctions in the internalizing spectrum would be consistent with the evidence to date, as the multifaceted associations between the disorders—combined with the lack of an apparent causal relationship—suggest that sexual problems share an underlying liability with depression and anxiety disorders. Understanding these relationships is crucial to effectively diagnose and treat comorbid disorders, as they have a particularly detrimental effect when combined (Michael & O'Keane, 2000; van Lankveld & Grotjohann, 2000). Nonetheless, sexual dysfunctions have been overlooked in the formulation of a nosological meta-structure. As a result, our current nosology does not adequately account for or highlight the evident relationships between these disorders.

A recent study offered preliminary evidence for the utility of a dimensional spectrum model of the internalizing spectrum that includes sexual problems for women (Forbes & Schniering, 2013; see Figure 1). This type of model understands comorbidity between disorders as a result of common, underlying core psychopathological processes; no longer a nuisance but a signal that supports a conceptualization of *DSM* disorders as indicators of underlying latent factors (Krueger, 1999, p. 921). Although there is heterogeneity across sexual dysfunctions and in theories regarding their underlying pathophysiology, a dimensional spectrum model accounts for their shared symptom characteristics and vulnerabilities through a higher order internalizing spectrum, as well as accounting for the unique aspects of the disorders within the spectrum by maintaining discrete diagnoses (Krueger, Markon, Patrick, & Iacono, 2005). Consequently, a dimensional spectrum model enables us to move forward from a descriptive categorical nosology to an explanation of the relationships between disorders.

This dimensional model provided a superior fit to a model with three independent dimensions, but has not been compared with a true categorical model. To understand the nature of the

relationships between these diagnostic categories, it is imperative to empirically compare dimensional and categorical conceptualizations. This comparison will help determine whether sexual problems are better classified together with depression and anxiety (to recognize the high rates of comorbidity and conceptual associations between them), or conceptualized as distinct categories (as implied in the *DSM-5*). Without comparing the models directly, conclusions regarding the nature of the relationships between these disorders cannot be made. As such, the statistical methods used in this article are integral to effectively addressing this research question, so they are subsequently explained in some detail.

The primary aim of the present study was to empirically examine a dimensional spectrum model and alternative categorical models of the relationships between depression, anxiety, and sexual problems for women. The available data for men are less robust, but preliminary exploratory analyses were conducted as a secondary aim. The continuous variables in this study made latent profile analysis (LPA) and structural equation modeling (SEM) the most appropriate statistical methods for comparing categorical and dimensional spectrum models. Individuals are grouped by symptom profiles in LPA; if the profiles are generally parallel, this suggests the profiles differ by symptom severity, and may indicate an underlying spectrum. A profile model indicating a categorical distinction between the groups of individuals would resemble a strong interaction effect in regression (e.g., a profile with high levels of depression and anxiety and low levels of sexual problems; and a profile with high levels of sexual problems and low levels of depression and anxiety). Structural equation modeling offers the best way to explain patterns using an underlying continuous dimension, or spectrum. Accordingly, a dimensional spectrum conceptualization that includes sexual problems along with depression and anxiety (i.e., an SEM model) will be compared with categorical framework models that may separate these disorders (i.e., LPA models).

The LPA and SEM models will be compared within each gender using an information-theoretic approach. This approach emphasizes minimizing the amount of information required to express the data and the model—providing efficient and accurate representations of observed data, which are most useful for nosological models—and is appropriate for nonnested model comparisons (Krueger, Markon, Patrick, & Iacono, 2005). It is hypothesized that a model consistent with a dimensional-spectrum conceptualization of the relationships between these variables (i.e., an SEM model) will offer the best representation of the data for women, reflecting the multifaceted relationships between the disorders. Models for men will also be explored, and it is hypothesized that a similar dimensional model will provide the closest fit. The hypothesized SEM models were based on Forbes and Schniering (2013).

METHOD

Participants

The sample in the present study comprised a subset from a larger dataset (Forbes & Schniering, 2013). This article contributes new perspectives based on different research questions and analyses, with a focus on the comparison of dimensional and categorical models. This sample was required to have engaged in penetrative intercourse in the past four weeks, and observed variables also differed from Forbes and Schniering (2013), as subsequently outlined in the Analysis section.

A total of 518 sexually active adults from a convenience sample of the general Australian population were included in the analyses. Participants were required to be 18 years of age to participate in the study, and this was the only exclusion criterion. Participants who had not attempted intercourse in the past four weeks (31% of men with complete responses, $n = 81$; 20% of women with complete responses, $n = 82$) were excluded from analyses because the presence, frequency and severity of sexual problems in penetrative sex could not be assessed. Responses were considered to be incomplete if any item had missing information (16%, $n = 129$), and these responses were excluded for the same reason. Participants who had not attempted intercourse were less likely to be male or in a relationship. Of the included sample, 65% was female ($n = 336$). For the purposes of the study, participants' ages were collected in age brackets; the median age group was 25–34 years ($n = 185$) with an age range from 18 years to over 65. While participants came from a range of sociodemographic backgrounds, a large proportion of participants were younger than 45 years of age (83%, $n = 431$), had no children (75%, $n = 390$), had a university degree (69%, $n = 359$), worked full time (54%, $n = 281$), and/or lived with a partner (48%, $n = 247$). A higher percentage of men were working full time, and a lower percentage lived with a partner or held a university degree, compared with women.

Measures

All participants completed self-report measures that asked about the past four weeks and assessed demographic variables, depression, generalized anxiety disorder, social anxiety, panic disorder and agoraphobia, and sexual problems as follows.

Depression

The depression scale from the 21-item version of the Depression Anxiety Stress Scales (Lovibond & Lovibond, 1995) measures the severity of depressive symptoms on a 4-point Likert scale. Research findings suggest that the depression scale is reliable and has high convergent and discriminant validity (Henry & Crawford, 2005). The norms for the scale (Lovibond & Lovibond, 1995) are presented in Table 1 to show the comparative symptom levels of the present sample.

Generalized Anxiety Disorder

The Brief Measure for Assessing Generalized Anxiety Disorder (Spitzer, Kroenke, Williams, & Lowe, 2006) is a seven-item anxiety scale that measures generalized anxiety disorder symptoms on a 4-point Likert scale. The measure has very good reliability (internal consistency $\alpha = .92$) and strong construct and criterion validity. The norms presented in Table 1 are from Lowe and colleagues (2008).

Social Anxiety

The Social Phobia Inventory (Connor et al., 2000) consists of 17 items and is the only self-report measure of social anxiety that measures a spectrum of fear, avoidance, and physiological symptoms. The degree of distress generated by the symptoms measured on a 5-point scale. It

TABLE 1
Descriptive Statistics for Demographics and Observed Variables for Whole Sample, Women, and Men

Variable (possible range of values)	*Whole sample (n = 518)*	*Women (n = 336)*	*Men (n = 182)*	*Population/control group norms*
Age: Younger than 45 years[a]	431 (83.2%)	285 (84.8%)	146 (80.2%)	—
Relationship: Living together	247 (47.7%)	168 (50.0%)	79 (43.4%)	—
Employment: Full-time work	281 (54.3%)	162 (48.2%)	119 (65.4%)	—
Education: University degree	359 (69.3%)	252 (75.0%)	107 (58.8%)	—
Family: Does not have children	390 (75.3%)	256 (76.2%)	134 (73.6%)	—
Depression (0–42)	7.03 (7.90)	6.99 (7.58)	7.10 (8.48)	6.34 (6.97)
Generalized anxiety disorder (0–21)	4.44 (4.12)	4.68 (4.07)	3.99 (4.20)	2.95 (3.41)
Social phobia (0–68)	11.48 (10.78)	12.30 (10.92)*	9.98 (10.38)*	22.66 (15.02)
Agoraphobic Cognitions Questionnaire (1–5)	1.43 (0.47)	1.49 (0.50)*	1.31 (0.38)*	1.6 (0.46)
Body Sensations Questionnaire (1–5)	1.77 (0.70)	1.82 (0.72)*	1.69 (0.65)*	1.8 (0.59)
Female sexual desire[b] (2–10)	—	6.03 (1.85)[c]	—	6.9 (1.89)
Female subjective arousal[b] (0–20)	—	15.74 (3.65)[c]	—	16.8 (3.62)
Female lubrication[b] (0–20)	—	17.37 (3.25)[c]	—	18.6 (3.17)
Female orgasmic function[b] (0–15)	—	11.41 (3.65)[c]	—	12.7 (3.16)
Female sexual pain[b] (0–15)	—	13.12 (2.62)[c]	—	13.9 (2.79)
Male sexual desire[b] (0–10)	—	—	7.84 (1.58)	7.0 (1.8)
Erectile function[b] (0–30)	—	—	28.41 (2.61)	25.8 (7.6)
Male orgasmic function[b] (0–10)	—	—	9.24 (1.54)	8.8 (2.9)

Note. Values are expressed as means (standard deviations) or *n* (%). Variables shown are scored according to measures' instructions. Variables used in the analyses were scored for all scales so that higher scores denoted greater dysfunction, and scores were then standardized. The female sexual desire scale was excluded from analyses, the subjective arousal and lubrication scores were combined to provide a composite measure of arousal, and the Agoraphobic Cognitions Questionnaire and Body Sensations Questionnaire were also combined to form a composite panic and agoraphobia variable.

[a]Age was collected in age brackets, and the median age group was 25–34 years.

[b]Lower scores denote higher levels of sexual dysfunction.

[c]The mean scaled Female Sexual Function Index domain scores (with a possible range from 0 to 6) are as follows: sexual desire = 3.62, subjective arousal = 4.72, lubrication = 5.21, orgasmic function = 4.56, and sexual pain = 5.25.

*Independent samples *t* tests show that women have significantly higher scores than do men on these scales ($p < .05$).

has excellent internal consistency ($\alpha = .94$) and good construct validity. The norms presented in Table 1 are from Connor and colleagues (2000).

Agoraphobia and Panic Disorder

The Agoraphobic Cognitions Questionnaire (ACQ) and the Body Sensations Questionnaire (BSQ; Chambless, Caputo, Bright, & Gallagher, 1984) are among the most widely used measures of agoraphobia and panic disorder. The frequency of thoughts about negative consequences of anxiety—and the amount of concern generated by sensations of autonomic arousal—is measured by the average response across 31 items on 5-point scales. They have good internal consistency (.80 for the ACQ and .87 for the BSQ) and high construct validity. The norms presented in Table 1 are from Chambless and colleagues (1984).

Sexual Problems

Women completed the Female Sexual Function Index (FSFI; Rosen et al., 2000), which is commonly used to measure the six major dimensions of female sexual function (sexual desire, subjective arousal, lubrication, orgasm, sexual satisfaction, and sexual pain). The 19 multiple-choice items are scored with a 5- or 6-point scale. These domains have been found to have a minimum Cronbach's alpha value of .82 (Wiegel, Meston, & Rosen, 2005). The norms presented in Table 1 are from Rosen and colleagues (2000).

Men completed the International Index of Erectile Function (IIEF; Rosen et al., 1997), a 15-item measure widely used to assess five dimensions of male sexual functioning (erectile function, orgasmic function, sexual desire, intercourse satisfaction, and overall satisfaction). Each item is measured on a 5- or 6-point Likert scale. Psychometric studies have suggested that the scales are reliable and valid (i.e., internal consistency ranging from $\alpha = .73$ to $\alpha = .99$; Rosen, Cappelleri, & Gendrano, 2002). As a result of an oversight, one of the overall satisfaction items was not assessed. However, that scale was not included in these analyses, so it will not affect the results of this study. The norms presented in Table 1 are from Rosen and colleagues (1997).

Procedure

The anonymous online survey was advertised extensively through a wide range of community hubs, such as public noticeboards, shopping centers, community and sports clubs, mailing lists of businesses and universities, and online forums. After an initial stage of recruitment, advertising was specifically targeted at underrepresented groups, including participants older than 35 years of age, and men. The study was approved by a human ethics committee and participants were required to provide informed consent before they were able to access the survey. Each Internet protocol address was only permitted to submit one response to the survey to prevent duplicate responses, and reverse-scored items throughout the survey indicated that there were no arbitrary responders.

Analysis

Data were analyzed using PASW 18.0 and MPlus 6.1. These analyses were not a direct comparison of the models for men and women, as different questions were used to assess sexual function for each gender.

The FSFI and IIEF have recently been shown to have psychometric and conceptual flaws, particularly for the measurement of sexual desire (Forbes, Baillie, & Schniering, 2014). For example, the FSFI uses an oversimplified circular definition of *female sexual desire*; relies on two brief and general questions about the level and frequency of desire; uses overly sensitive diagnostic cutoff scores; and the desire subscale is not delineated in the factor structure of the FSFI, which implies it is not being measured adequately. Consequently, the models were tested with and without female sexual desire. Furthermore, female subjective arousal and lubrication were combined to attain a more accurate, composite measure of arousal to reflect the strong relationship between these constructs (Rellini, McCall, Randall, & Meston, 2005). The ACQ and BSQ measures of panic and agoraphobia were also combined to reflect the close relationship

between these disorders. As a result of these decisions, the composite measures of *female sexual arousal* and *panic and agoraphobia*, along with the remaining scales, represented the ten observed variables. The final set of constructs analyzed were as follows: depression (internal consistency for women [α_w] = .88, internal consistency for men [α_m] = .90), generalized anxiety disorder (α_w = .89, α_m = .89), social anxiety (α_w = .92, α_m = .92), panic and agoraphobia (α_w = .94, α_m = .92), as well as the sexual problem variables of female sexual arousal (α_w = .91), female orgasmic function (α_w = .93), female sexual pain (α_w = .89), male sexual desire (α_m = .77), erectile function (α_m = .78), and male orgasmic function (α_m = .65).

Sexual function items were reverse-scored so that higher scores indicated higher levels of sexual problems, in line with all other measures. The scores were standardized, as the scales of the observed variables varied greatly. Scores for some observed variables were skewed to low symptom levels. Consequently, maximum likelihood estimation with robust standard errors (MLR) was used for all analyses.

To decide on which LPA model is the strongest, it is important to use a combination of statistical and substantive model checking. The Vuong-Lo-Mendell-Rubin (VLMR) Likelihood Ratio Test (LRT), Lo-Mendell-Rubin (LMR) LRT (Lo, Mendell, & Rubin, 2001) and the Bootstrapped LRT (BLRT) are tests that provide a *p* value that indicates whether a (k-1) class model can be rejected in favor of a k-class model. These statistical tests are used to determine the best number of symptom profiles to characterize the groups in the data. The first k-class model that has a nonsignificant *p* value ($p > .05$) is rejected in favor of the previous (k-1) class model, which suggests that the (k-1) class model has the best profile enumeration. It is also important to assess the value and utility of the profiles (i.e., how informative the model is) and whether the profile sizes and proportions indicate over-extraction (i.e., are very small; Masyn, Henderson, & Greenbaum, 2010); entropy is a measure of quality of class enumeration with values close to 1 being ideal (Masyn et al., 2010).

For the SEM, model fit should be evaluated by a variety of complementary fit indices (Jackson, Gillaspy, & Purc-Stephenson, 2009). In this study, a mix of global, absolute, and incremental fit indices were used. Because of the high Type II error rate of the chi-square goodness-of-fit statistic (χ^2), other fit indices are often used to ascertain model fit (Hu & Bentler, 1999). The comparative fit index (CFI) and Tucker-Lewis Index (TLI) compare models to an independence model, where all variables are uncorrelated; they are both sensitive to model misspecification, and values greater than .95 suggest an acceptable model fit for both indices (Hu & Bentler, 1999). Absolute fit indices measure how well an *a priori* model reproduces the sample data: the standardized root mean square residual (SRMR) is more sensitive to different types of misspecification than other goodness-of-fit indices, but is biased by sample size; the root mean square error of approximation (RMSEA) is not dependent on sample size and compensates for model complexity (Jackson et al., 2009). Values less than .08 for SRMR and .06 for RMSEA suggest an adequate model fit (Hu & Bentler, 1999).

To compare LPA and SEM models, maximum likelihood–based indices such as Bayesian information criteria (BIC), Akaike's information criteria (AIC), and sample size–adjusted BIC (ABIC) are used. For these statistical indicators, lower values indicate a better model (Masyn et al., 2010). Coming from an information-theoretic approach, we are looking for stable, robust, and parsimonious models. The BIC has been shown to be more reliable than the other criteria (Nylund, Asparouhov, & Muthén, 2007) and favors parsimonious models, so it was used as our primary criterion to compare LPA and SEM models.

TABLE 2
Fit Indices and Information Criteria for Models for Women

Dimensional model	*LL*	*k*	*BIC*	*ABIC*	*AIC*	*CFI*	*TLI*	*RMSEA*	*SRMR*
Internalizing spectrum	−2975.61	24	6090.83	6014.70	5999.22	.99	.98	.036	.029
Categorical model	*LL*	*k*	*BIC*	*ABIC*	*AIC*	*VLMR*	*LMR*	*BLRT*	*Entropy*
One class	−3333.84	14	6749.12	6704.71	6695.67	—	—	—	—
Two class	−3109.87	22	6347.71	6277.92	6263.73	.025	.027	<.001	.92
Three class	−3014.37	30	6203.25	6108.09	6088.74	.023	.024	<.001	.90
Four class	−2945.74	38	6112.54	5992.00	5967.49	.238	.246	<.001	.91
Five class	−2908.77	46	6085.13	5939.21	5909.54	.525	.530	<.001	.90

Note. LL = log likelihood, k = number of free parameters, BIC = Bayesian information criteria, ABIC = sample size adjusted BIC, AIC = Akaike's information criteria, CFI = comparative fit index, TLI = Tucker-Lewis index, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual, VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio test (LRT) *p* value, LMR = Lo-Mendell-Rubin LRT *p* value, BLRT = Bootstrapped LRT *p* value.

RESULTS

Descriptive Statistics

Descriptive statistics for the sample are presented in Table 1. The sample means for depression, panic disorder and agoraphobia symptoms were similar to population norms. Higher levels of generalized anxiety disorder symptoms and lower levels of social anxiety were present, compared with population norms. Independent samples *t* tests showed that women had higher levels of social anxiety, panic and agoraphobia, compared with men. Women also had higher symptom levels compared with population norms for all sexual problems. In contrast, men had fewer symptoms than population norms on all sexual problems variables, as well as restricted variance.

Latent Profile Analyses and Structural Equation Modeling

Women

To retain sexual desire difficulties in the analyses, models that included desire as part of a female sexual interest and arousal factor were compared with models that excluded desire. Models that included desire were, on average, 60 points higher (worse) on the BIC. When combined with the measurement and theoretical issues with the desire scale, it was judged that the observed variable of desire was not contributing to the models, but detracting from their validity, and this led us to exclude desire from further analyses. The fit indices and information criteria for the models that excluded desire are shown in Table 2.

Dimensional Spectrum Model. The dimensional spectrum model provided an excellent fit to the data (see Table 2) and had a lower BIC than did the strongest categorical framework

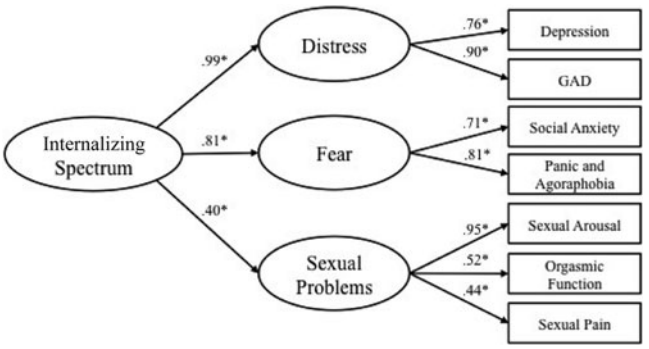

FIGURE 2 Dimensional-spectrum model for women, with standardized regression weights. GAD = generalized anxiety disorder. $^{*}p < .01$.

(three-class) model. The near-perfect fit indices for the dimensional-spectrum model, combined with the superior information criteria and the positive and significant loadings for all variables (see Figure 2) suggest that it offers the best explanation of the relationships in the data for women.

Categorical Framework Models. Table 2 shows the model fit indices for the categorical framework models examined for women. The BIC never reached a minimum, and the BLRT never reached significance, so the VLMR and LMR were used as the primary model indicators. The VLMR and LMR first reached significance for the four-class model, indicating that the three-class model is best. Substantive interpretation for this model shows good class enumeration (entropy = .9), and three interpretable classes (see Figure 3). An asymptomatic class (Class 1)

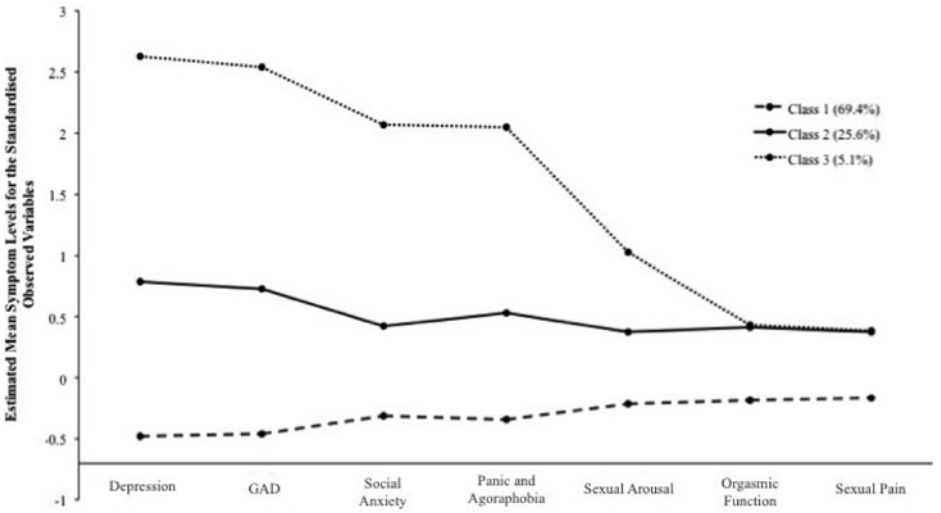

FIGURE 3 Estimated means for the three profiles from the best fitting categorical-framework model for women. GAD = generalized anxiety disorder.

TABLE 3
Fit Indices and Information Criteria for Models for Men

Dimensional model	*LL*	*k*	*BIC*	*ABIC*	*AIC*	*CFI*	*TLI*	*RMSEA*	*SRMR*
Internalizing spectrum	−1603.74	22	3321.96	3252.29	3251.47	.97	.95	.063	.049
Categorical model	*LL*	*k*	*BIC*	*ABIC*	*AIC*	*VLMR*	*LMR*	*BLRT*	*Entropy*
One class	−1781.68	14	3636.21	3591.87	3591.35	—	—	—	—
Two class	−1607.61	22	3329.70	3260.03	3259.22	<.001	<.001	<.001	.98
Three class	−1546.60	30	3249.33	3154.31	3153.21	.167	.174	<.001	.98
Four class	−1502.52	38	3202.80	3082.45	3081.04	.130	.137	<.001	.96
Five class	−1408.67	46	3201	3055	3053	.404	.416	<.001	.95

Note. LL = log likelihood, k = number of free parameters, BIC = Bayesian information criteria, ABIC = sample size adjusted BIC, AIC = Akaike's information criteria, CFI = comparative fit index, TLI = Tucker-Lewis index, RMSEA = root mean square error of approximation, SRMR = standardized root mean square residual, VLMR = Vuong-Lo-Mendell-Rubin likelihood ratio test *p* value (LRT), LMR = Lo-Mendell-Rubin LRT *p* value, BLRT = bootstrapped LRT *p* value.

accounted for 69% of the sample, and a further 26% of the sample had a parallel profile with moderate symptom levels (Class 2). Of the sample, 5% displayed high levels of depression and anxiety symptoms, and moderate sexual problems (Class 3). Thus, the three-class model was chosen as the best LPA on the basis of its strengths, and the significant VLMR and LMR for the four-class model.

Men

Models were tested with and without the IIEF desire scale. The inclusion of desire did not alter model selection or interpretation, so it was included in analyses to retain maximum information in the models. Table 3 shows the model fit indices and information criteria.

Dimensional Spectrum Model. The fit indices for the dimensional model were acceptable (see Table 3). However, there were evident problems: The latent variable covariance matrix was not positive definite, so the nonsignificant negative error variances for erectile function and fear variables were set at .005 to preserve the confirmatory aspect of the model (Anderson & Gerbing, 1988). The sexual problems latent variable also had a fairly small loading onto the internalizing spectrum latent variable (see Figure 4), which suggests this model may not accurately capture the relationships between the observed variables. Sexual desire was a poor indicator for the model and had a small nonsignificant R^2.

Categorical Framework Models. As with the categorical models for women, the BIC never reached a minimum and the BLRT never reached significance. The VLMR and LMR suggested a two-class model, and this model had equal entropy to the three-class model. The two-class model showed a large asymptomatic class (Class 1; 87%) and a smaller class with high mood and anxiety symptoms (Class 2; 13%). The profile patterns and class sizes in this model mirror the two-class model for women (see Figure 5). However, the substantive interpretation of the three-class model provides important information (see Figure 6). This model shows categorical

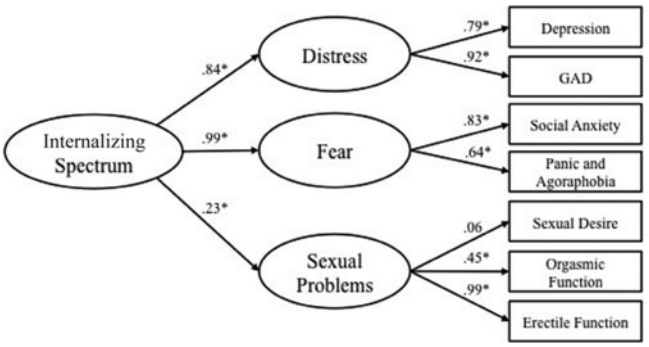

FIGURE 4 Dimensional-Spectrum model for men with standardized regression weights. GAD = generalized anxiety disorder. $^{*}p < .01$.

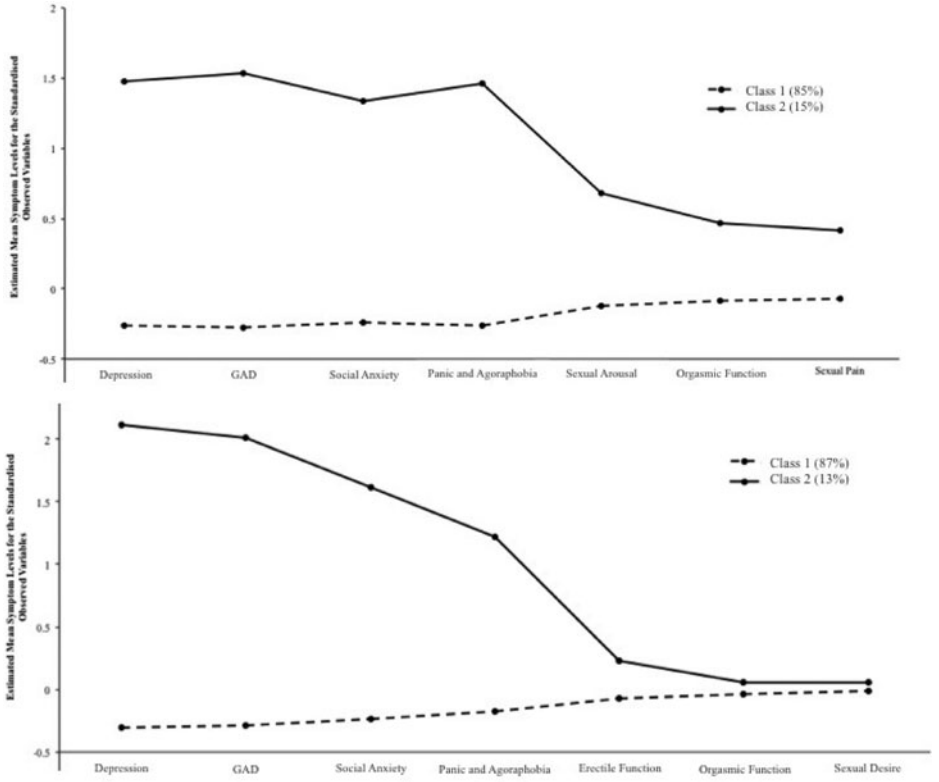

FIGURE 5 Estimated means for the two-class models for women (*above*) and men (*below*). GAD = generalized anxiety disorder.

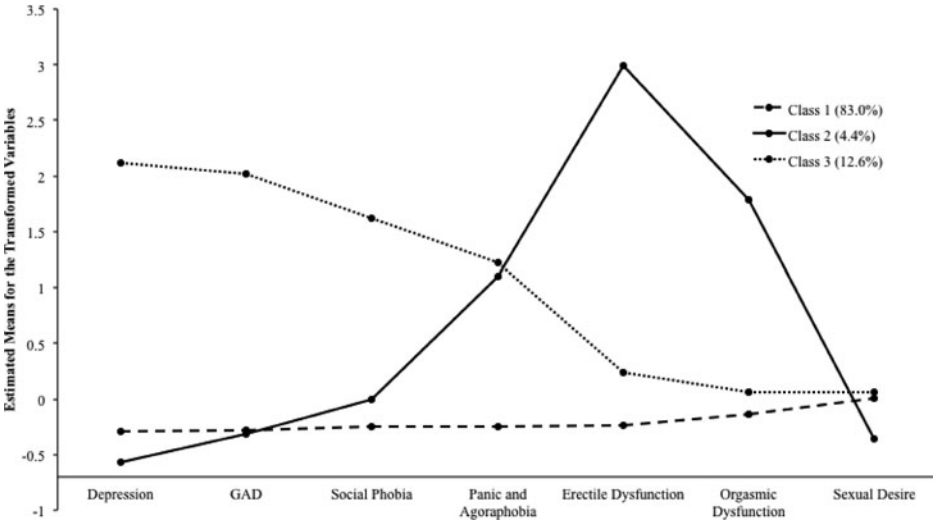

FIGURE 6 Estimated means for the three profiles from the three-class categorical-framework model for men. GAD = generalized anxiety disorder.

distinctions between the symptomatic classes (low mood and high sexual problems except desire in Class 2; high mood and low sexual problems in Class 3), which eludicates the low loadings and correlations in the SEM, and suggests that there are categorical relationships present for a small group of men ($n = 8$).

As a follow-up analysis, the dimensional-spectrum model was reanalyzed without this small group of men, and it provided a strong fit to the data. The fear and erectile function variables still required their error variances to be fixed at .005, but the fit indices were excellent (CFI = 1.000, TLI = 1.012, RMSEA < .001, SRMR = .036), and the factor loadings all increased. The sexual problems loading onto the internalizing spectrum also increased to .38 ($p = .001$).

DISCUSSION

This study is the first of its kind to empirically compare dimensional and categorical conceptualizations of the relationships between depression, anxiety, and sexual arousal, orgasm and pain difficulties for women. For women, the dimensional model provided an excellent fit to the data, and was better than any of the categorical models, as hypothesized. A secondary analysis was conducted on the available data for men; the dimensional model provided a good fit for most of the sample, but the substantive interpretation of the three-class model suggested that a small group of men have categorical distinctions between the disorders. The results are subsequently explored in more detail.

The Results for Women

The dimensional finding for women is particularly significant because the data naturally tend toward finding a categorical model. For example, the female sample had symptom levels

similar to population norms for most measures. Compared to a more diverse group that included a high symptom clinical sample, our community sample may naturally have lower levels of comorbidity because of the lesser severity of the symptoms and floor effects in the observed variables (Kessler et al., 2005). This decreases the chance of finding strong dimensional relationships, and it is likely that the dimensional model would be even stronger in a sample with more varied—and higher—symptom levels. Depression and anxiety symptoms would also be expected to naturally separate from sexual problems because different domains are being measured (i.e., emotional and physiological), and the depression and anxiety symptom questions tend to share similar question stem and response methods, which might further separate these domains from sexual problems. Thus, finding a dimensional-spectrum model to be stronger than the categorical framework profile models implies that it is robust, because it is overcoming boundaries at a measurement level. Likewise, it was not surprising that the regression weight between sexual problems and the higher order internalizing spectrum was lower than for fear or distress. This is most likely because of the greater differentiation of sexual problems from the other factors at a measurement level; the shared symptoms between depressive and anxiety disorders inflate the correlations between the fear and distress factors, which are represented by their loading onto the higher order internalizing spectrum (Laurent & Simons, 2009). Consequently, the comparatively low loading of sexual problems onto the internalizing spectrum does not necessarily denote a weaker underlying relationship. The range of the factor loadings for the observed variables is also consistent with the higher order factor structure, as no two disorders have the same amount of variance accounted for by shared underlying processes (i.e., common variance).

The three-class model was selected as the best LPA. The fact that the profiles were parallel and flat for the majority of the disorders is consistent with the dimensional-spectrum model; it implies that the two largest profiles differed primarily based on symptom severity, and that there were no categorical distinctions between disorder classes. Correspondingly, the fit indices suggested that the internalizing spectrum was the strongest model. This finding is consistent with the literature, and useful in understanding the relationships between the variables in the present data. All of the included female sexual problems were good indicators in the model, which is also consistent with existing research.

Although the exclusion of desire is a limitation of this model, the literature gives an indication of the relationships that we might expect to see in future research: Studies have found a significant overlap between subjective arousal and sexual desire for women, as women find it difficult to differentiate between the two constructs, and the conceptual distinction between the constructs is unclear (for a review, see Brotto, 2010). Given that female sexual arousal was a strong indicator in the present analyses, we can infer that desire might demonstrate similar relationships in future studies. However, it will be important to investigate this hypothesis by using better measurement methods. Taken together, these results suggest that there is a shared underlying factor between depression, anxiety, and sexual problems for women that is not represented in our current nosology.

The Results for Men

The male sample was smaller and showed restriction of range. This poses a number of difficulties for analysis, as the limited range in the variables restricts our ability to see robust relationships between the variables. In contrast with the results for women that clearly showed the spectrum

model to be best, the results for men were not as clear. The fit indices for the spectrum model suggested that it fit well, but overall the model did not adequately conceptualize the relationships between the variables. The sexual desire variable was also a poor indicator for all of the models, which may suggest male sexual desire functions independently of depression, anxiety, and other sexual problems. While many studies have found depression and anxiety to be related to decreased libido (see Laurent & Simons, 2009), a couple of studies have also found the opposite effect for small groups of young men, and men experiencing atypical depression (Bancroft et al. [2003] and Nofzinger et al. [1993], respectively). The finding that desire did not fit into the model could be a result of opposing positive and negative relationships between depression and anxiety and male sexual desire. However, it also seems likely to be related to the poor measurement properties of the IIEF desire domain, which have been explored in detail elsewhere (Forbes et al., 2014).

The two-class model for men mirrored the two-class model for women; it showed a large asymptomatic class, and a class with high mood and anxiety symptoms, but low sexual problems. The strong separation between the disorder classes seems likely to have arisen because of the low and narrow sample of sexual problems. The group with high levels of sexual problems is consequently very small, and is not defined in the two-class model. In contrast, the depression and anxiety variables that distinguished between the profiles had a greater spread of symptom levels, so a symptomatic group based on these variables would be delineated more easily.

While the two-class model was the best model according to the selection rules, the substantive interpretation of the three-class model provided additional important information, as it displayed clear categorical distinctions for a small group of men. Follow-up analyses showed that the dimensional model provided a strong fit to the rest of the sample. It is important to be conscious of the sample limitations in interpreting this data, but taken at face value these results suggest that a dimensional spectrum model fits the data well for 96% of the men in our sample.

The dimensional spectrum model is similar to that tested in Forbes and Schniering (2013), but the results for the spectrum model in this study are different for a number of reasons. This was a sample of participants who had engaged in penetrative sexual intercourse in the past four weeks, so these analyses were conducted on a slightly different sample from Forbes and Schniering, which required any form of sexual activity (e.g., masturbation or oral sex) in the past four weeks. This study also used different observed variables. For example, panic and agoraphobia were combined; as were the subjective and physiological female sexual arousal measures, which gave us a better picture of female sexual arousal; and sexual desire was ultimately removed from analyses for women because of flawed measurement. The main point of difference for this study was the combination of LPA and SEM, which enabled the empirical evaluation of dimensional and categorical relationships between these disorders. Because of these differences, there are interesting new results.

Limitations

Before exploring the implications of this study, it is important to recognize its limitations. The use of a convenience sample from the general community will have affected the results in a number of ways. Our sample tended toward healthy sexual function, as participants were required to have attempted intercourse in the past four weeks, and the sample was also young and well educated (Laumann, Paik, & Rosen, 1999). Consequently, the relationships found here will be weaker than if a

clinical sample were included, as discussed earlier. In particular, it seems likely that a more diverse sample and better measurement for men would give better information on appropriate models. Although we cannot rule out a biased sample, the female sample appears more robust than the male sample given its larger size, higher symptom means, and larger variance. Because of the samples used, the results presented here have limited generalizability to clinical and sexually inactive populations. The inclusion criterion of penetrative sex in the past four weeks may also have affected the results, as this sexual behavior may not be in the repertoire of people who are lesbian, HIV positive, elderly, or who simply do not include penetrative sex as part of their sexual activity. These groups may consequently be underrepresented in the present study, and the present results may not generalize to explain these relationships for people who do not engage in penetrative sex regularly. Furthermore, distress associated with sexual problems was not measured, so these findings cannot necessarily be applied to sexual dysfunctions. However, this study offers preliminary comparative analyses of dimensional and categorical models of the relationships between depression anxiety and sexual problems, and so offers an important step toward broader and more accurate nosological models. It became clear after we collected this data that the FSFI and IIEF measures of sexual function have marked limitations. While the removal of the sexual desire observed variable for women detracted from the coverage of the models tested, the temporary inclusion of the FSFI desire domain detracted from the models. The inclusion of desire in the models for men appears to have not contributed anything, as it was a poor indicator. The present dataset offers the best measurement of the variables of interest; none of the large-scale epidemiological datasets include sexual problems variables in sufficient depth to examine these models (e.g., Australian Bureau of Statistics, 2007; Smith, Pitts, Shelley, Richters, & Ferris, 2007), so this data set was used despite its shortcomings. Despite the limitations of this study, new and noteworthy results were found.

Implications

The results suggest that there are strong dimensional relationships between depression, anxiety, subjective and physiological arousal, orgasmic function and sexual pain for women. Neither a dimensional-spectrum nor a categorical framework model was superior to the exclusion of the other for men. It is interesting to note that when four percent of men were excluded from analyses, the dimensional model provided strong fit for the remaining 96%. Because of the narrow and low-symptom male sample, implications are primarily drawn from the results for women.

The implications of the present study are mainly structural; understanding the nature of the relationships between these disorders is key to having valid nosological systems, and it is vital for our nosology to explicitly recognize known relationships between diagnostic categories to aid effective diagnosis and treatment. Because of the recent inclusion of spectra in *DSM-5*, there is ongoing debate about the spectra of psychopathology and a valuable opportunity for change for *ICD-11*. This study provides empirical evidence that internalizing psychopathology may be a liability for sexual dysfunctions, which is consistent with the evidence in the literature to date. Specifically, this study contributes to the literature by showing that the inclusion of a broad range of sexual problems in a model of the internalizing spectrum provides a more accurate representation of the pattern of interrelationships than the current conceptualization of psychopathology classification that implies sexual dysfunctions are categorically distinct from depressive and anxiety disorders. A secondary implication of these results is that models of the development

and maintenance of sexual problems would be more accurate if emotional and psychosocial factors were considered (e.g., Basson, 2003, 2005)—potentially for women *and* men.

More broadly, some possible future clinical implications are of note. Comorbidity between depression and anxiety is related to increased chronicity, poorer treatment outcomes and greater psychopathology. When sexual dysfunctions are also present, quality of life is further reduced, long-term outcomes are worse, and patients are more likely to drop out of treatment (Michael & O'Keane, 2000; van Lankveld & Grotjohann, 2000). Implementing a conceptualization of the internalizing spectrum that includes sexual problems could pre-empt these detrimental effects of mixed disorder presentation by highlighting likely patterns of co-occurrence, facilitating early recognition and encouraging treatment of diagnosed and sub-threshold comorbid conditions in combination. It is also possible that a transdiagnostic treatment program that targets shared underlying psychopathological processes could be effective for concurrent treatment (e.g., "The Unified Protocol"; Boisseau, Farchione, Fairholme, Ellard, & Barlow, 2010). Transdiagnostic programs are gaining momentum with the advancement toward a dimensional model of psychopathology, and have been used effectively to target common elements of internalizing disorders in populations with comorbid symptom presentation (e.g., Ehrenreich, Buzzella, & Barlow, 2007). Further research will be needed to understand if any shared underlying mechanisms between these disorders offer good targets for treatment, but the first step is to determine an accurate description of the nature of the structural relationships between disorders. The potential for these treatments to target underlying spectra of psychopathology adds to the list of reasons for the identification of a comprehensive and integrated dimensional model of psychopathology on the basis of higher order factors being a clear priority for future research.

Conclusions

This study offers an important step toward identifying the nature of the latent structure between a variety of sexual problems, and depressive and anxiety disorders. Because of the stronger female sample, the case for dimensional relationships between these disorders is stronger than the mixed results found in the male sample. It is not yet clear, however, whether the same model will be appropriate for men and women. Further research is also needed to ascertain whether the small group of men with categorical distinctions was an idiosyncrasy of this sample or a signpost of relationships in the broader population, and also to test these models in sexually inactive and higher symptom populations. This study adds to the growing body of evidence suggesting that sexual problems should be integrated into the internalizing spectrum, and that the *DSM* and *ICD* should explicitly recognize these known relationships between sexual dysfunctions and depressive and anxiety disorders. However, regardless of whether the relationships are recognized in our nosology, research on these disorders in conjunction with one another will provide a greater depth of understanding about the role of underlying psychopathological processes in the disorders' etiology, course and treatment response.

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