COMPARING ASSOCIATIONS BETWEEN SEXUAL FUNCTION, SEXUAL DISTRESS AND PSYCHOLOGICAL SYMPTOMS IN WOMEN WITH AND WITHOUT SEXUAL FUNCTION DIFFICULTIES

by

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Comparing Associations Between Sexual Function, Sexual Distress and Psychological Symptoms in Women with and without Sexual Function Difficulties

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Abstract

Anxiety and depressive symptoms, as well as anxiety and depressive disorders, are highly comorbid with sexual dysfunction (i.e., persistent distressing problems with sexual desire, arousal, orgasm, and pain) in women; however, little research has examined this comorbidity at the symptom level, or how it may differ for women with versus without sexual function problems. The present research used network analysis to compare how dimensions of sexual function (i.e., orgasm, satisfaction, lubrication, arousal, desire, pain), sexual distress, and anxiety and depressive symptoms relate to one another in women with (N = 150) and without (N = 575) sexual function problems. For both women with and without sexual function problems, arousal was particularly central. Additionally, somatic symptoms (e.g., tension, cardiovascular symptoms) were central to the networks of anxiety and sexual function symptoms while sadness and anhedonia were central to the networks of depression and sexual function symptoms. We found no differences in the density of symptom networks for women with versus without sexual function problems. In sum, the current study uses network analysis to provide a novel examination of associations between sexual function, sexual distress, and psychological symptoms, as well as how these associations differ in women with and without clinically significant problems with sexual function.
Lay Summary

Anxiety, depression, and difficulties with desire, arousal, orgasm, lubrication, satisfaction, and pain during sex (i.e., sexual function) are connected in women. Although anxiety and depression often coexist with sexual function problems, little research has examined connections between specific symptoms. This study compared two groups of women: 150 participants with clinical levels of sexual function problems and 575 without. We examined connections between different facets of sexual function, sexual distress, and anxiety and depression symptoms. We found that both groups displayed similar symptom networks. The density (connections) of the networks did not differ between groups. Also, the most important symptoms were similar in the two groups, including tension and cardiovascular symptoms, sadness and anhedonia, and arousal. This study sheds light on how sexual function, sexual distress, and psychological symptoms relate to one another for women with and without clinically significant sexual function problems.
Preface

The work in the present document was conducted in the Sexuality and Well–Being laboratory at the University of British Columbia where Dr. Samantha Dawson is the Principal Investigator. This work is based on secondary analyses of an archival dataset. I was responsible for the development of research questions and hypotheses, data analysis, interpretation, and preparation of the final thesis. Dr. Samantha Dawson was the supervisory author of the current project for all components of the study including study design, data analysis, interpretation, and thesis preparation. The data acquisition and original study design is the work of collaborators Drs. Pedro Nobre and Inês Tavares. This project and methods were approved by the University of Porto’s Ethics Board (certificate #2017/04–02). None of the text of this thesis has been taken directly from previously published articles.
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Last but certainly not least, special thanks are owed to my partner, Justin, and my family for their endless support. Thank you for always believing in me.
Chapter 1: Introduction

Psychological difficulties, including anxiety and depression, are some of the most important risk factors for women’s sexual dysfunction (i.e., persistent distressing problems with sexual desire, arousal, orgasm, and pain). Indeed, correlational evidence supports that psychological difficulties both precede and follow problems with desire, arousal, orgasm, and genital pain (e.g., Baldwin, 2001; Cyranowski et al., 2004; Kane et al., 2019; Oliveira & Nobre, 2013; Van Minnen & Kampman, 2000). Up to 40% of women with sexual dysfunction also experience psychological difficulties, with anxiety and depressive symptoms being the most common comorbidities (Clayton et al., 2014; Moyneur et al., 2020; Polland et al., 2019). Despite this comorbidity, little research has focused on understanding the specific symptoms that are most important for maintaining links between psychological difficulties and dimensions of sexual function, and no research to date has evaluated the precise pathways that connect psychological difficulties with dimensions of sexual function and sexual distress. Comparing these associations between women with and without sexual function difficulties might elucidate key factors contributing to the high comorbidity between women’s sexual function problems and psychological difficulties. Assessing these associations would test novel theoretical frameworks like network theory that presuppose that causal relations between symptoms are at least partially responsible for their co-occurrence.

Associations Between Dimensions of Sexual Function and Distress in Women

Female sexual function encompasses desire (i.e., a motivational state defined by interest in sexual behaviour), arousal and lubrication (i.e., a subjective feeling of being “turned on” and a physiological genital response), orgasm, genital pain, as well as satisfaction when engaging in sexual behavior. Sexual distress is essential to diagnoses related to problems with sexual function
Sexual distress involves negative affective and cognitive reactions related to one’s sexuality and sexual function (DeRogatis et al., 2008; Derogatis et al., 2002a). Although sexual distress is generally related to poorer sexual function, the strength of this relationship is not universal across individuals or groups (Hayes et al., 2008). For example, the relationship between sexual function and sexual distress is weaker in older women and women with histories of childhood sexual abuse (Rosen et al., 2009; Stephenson et al., 2012; Stephenson & Meston, 2012). Moreover, women over 50 are over 4 times more likely to experience sexual dysfunction than younger women and age is a significant predictor of distressing problems with sexual function (Safarinejad, 2006; Shifren et al., 2008). Importantly, some dimensions of sexual function are more strongly tied to distress than others. In one study, women with genital pain were most likely to report sexual distress (57%, compared to 31%–33% of those with orgasm, lubrication, and desire concerns; Hayes et al., 2008b). In another studies, women seeking help for problems with sexual function reported orgasm difficulties and low sexual desire as causing the most distress, even in the presence of other sexual function problems (Bancroft, 2003; Hayes et al., 2006; Kadri et al., 2002; Líndal & Stefànsson, 1993; Öberg et al., 2004). In the only existing network study of sexual function, sexual distress was closely related to the desire subscale of a well–validated measure of sexual function—the Female Sexual Function Index (FSFI; Rosen et al., 2000)—but not as closely linked with other dimensions of sexual function (Gunst et al., 2018). Finally, poor sexual function is not always a predictor of sexual distress: A population survey found that sexual distress was better predicted by non–sexual psychological variables (e.g., anxiety and depression symptoms) than by dimensions of sexual function, suggesting one possible path for comorbidity between sexual dysfunction and depression and anxiety (Bancroft, 2003).
Given that some dimensions of sexual function and sexual distress are more strongly linked than others, identifying the importance of certain dimensions over others in upholding problems with sexual function is valuable for better conceptualizations of sexual dysfunction. Indeed, it is possible that some dimensions may be more or less closely connected in people with and without sexual function problems. Identification of these links may also be relevant for guiding future treatment development by targeting the symptoms most relevant to sexual dysfunction, in line with recent research testing network theory in psychopathology (Borsboom & Cramer, 2013).

**Associations Between Sexual Function and Psychological Symptoms**

Although past research has not expressly tested network models of sexual dysfunction, consistent with network theories, which conceptualize psychopathology as emerging from mutually–interacting sets of symptoms, population–based surveys find that anxiety is associated with a greater risk of low desire, arousal difficulties, impaired orgasm, lubrication problems, dissatisfaction, and pain during sex (Dunn et al., 1999; Johnson et al., 2004; Laumann & Waite, 2008). Furthermore, sexual dysfunctions are commonly comorbid with anxiety disorders, with over 40% of women with panic disorder or social anxiety reporting sexual dysfunction (Bodinger et al., 2002). Anxiety disorders, as well as their correlates (e.g., pain anxiety, catastrophizing, and hypervigilance), have also been consistently linked to pain during sex (Bodinger et al., 2002; Chisari et al., 2021; Pukall et al., 2002) and women with antecedent anxiety disorders have four to ten times the odds of developing vulvar pain compared to women without a history of anxiety disorders (Dunn et al., 1999; Khandker et al., 2011). Women with anxiety also have greater odds of reporting sexual function problems, including being at three times greater risk of reporting problems with arousal, and twice as likely to have problems with orgasm and lack of satisfaction.
(Dunn et al., 1999). Other research has found that women with anxiety are at greater risk of low desire (Johnson et al., 2004). However, longitudinal evidence for the directionality of these relationships is scarce and findings are inconsistent (Forbes et al., 2016a; Kalmbach et al., 2014, 2015).

Extensive evidence links depression to sexual function problems (Fabre & Smith, 2012; Mezones–Holguin et al., 2011; Trudel et al., 1997). Population–based surveys find that depression is associated with low desire, arousal difficulties, impaired orgasm, lubrication problems, and pain during sex (Dunn et al., 1999; Gracia et al., 2004; Hayes et al., 2008; Kadri et al., 2002). Between 60% and 90% of women with depression report some problems with their sexual function (Casper et al., 1985; Sreelakshmy et al., 2017). Notably, depression is consistently linked with problems with sexual function in all domains, including low desire, low arousal, low orgasm function, dissatisfaction, and higher vulvar pain (Hayes et al., 2008; Kennedy et al., 1999). Women with depression have greater odds of reporting sexual function problems, including being two to five times as likely to report problems with sexual desire, four times as likely to report problems with vulvar pain during sex (Johnson et al., 2004; Schreiner–Engel & Schiavi, 1986), six times as likely to experience problems with arousal, and more than twice as likely to report problems with lubrication (Dunn et al., 1999). Cross–sectional and longitudinal studies of clinical populations also find that depression interferes with orgasm function (Johnson et al., 2004; Kennedy et al., 1999).

The severity of depressive disorders—not only their presence—is linked to sexual function problems. Greater severity of depression is linked to lower sexual desire (Lourenco et al., 2010; Trudel et al., 1997), lower sexual satisfaction, and greater sexual distress (Hayes et al., 2008). Meta–analytic evidence (Atlantis & Sullivan, 2012) supports a bidirectional relationship
between depression and sexual dysfunction. Across six longitudinal studies \((N = 3,285)\) following participants for 2–9 years, individuals with depression had a 50% to 70% increased risk of developing sexual dysfunction. Across six studies \((N = 11,171)\) following participants for 1–10 years, individuals with sexual dysfunction had a 130% to 210% increased risk of developing depression (Atlantis & Sullivan, 2012). The high comorbidity between depression and sexual dysfunction suggests that these disorders are reciprocal and symptoms of one may be caused by the other. Indeed, evidence suggests that the relationships between psychological disorders more broadly and sexual dysfunction are bidirectional. That is, depression and anxiety symptoms may contribute to problems with sexual function and, likewise, sexual dysfunction may contribute to depressive and anxiety symptoms.

In sum, poorer function across all dimensions of sexual function is associated with anxiety and depression, but debate remains over which specific symptoms of anxiety and depression are most relevant for sexual function problems (Witting et al., 2008). Moreover, no research to our knowledge has examined how these symptom level associations might differ between women with and without clinically significant problems with sexual function. Questions remain about which specific symptoms might be central for women with and without sexual function problems, as well as whether associations between these central symptoms differ for those with versus without sexual function problems. Network theory provides one potential avenue for examining these questions.

**Network Analysis in Psychopathology**

Historically, nosologies of psychiatric disease have employed categorical approaches, characterizing psychological disorders as distinct entities that are either present or absent (Dalgleish et al., 2020). However, low response rates to traditional treatments, heterogeneity of
diagnostic categories, and mismatch between biological pathologies and the clusters of symptoms we currently categorize as diagnoses have called into question the utility of traditional psychiatric nosologies (Cuthbert & Insel, 2013). Recent approaches to psychopathology approach psychological symptoms from a transdiagnostic, dimensional perspective (cutting across categorical boundaries) or disregard the boundaries completely (Dalgleish et al., 2020).

The transdiagnostic approach highlights that biological, psychosocial, psychological, and environmental risk and protective mechanisms work to uphold mental health problems, and they do so across traditional diagnostic boundaries. Beyond these factors, a key issue is the role of psychological symptoms themselves. Various components of mental health problems interact with one another over time, and mounting empirical evidence indicates that dimensional psychological symptoms reinforce one another (e.g., experimentally–induced anxiety is associated with sexual arousal; Kane et al., 2019). This observation presents another manner of conceptualizing relationships between symptoms: Network Analysis.

Network Analysis refers to a broad range of modelling approaches for depicting relations between objects (Butts, 2009). Networks are defined as structures containing nodes (i.e., vertices) and edges (i.e., links). Network analysis can be applied to many contexts, many of which we see in daily life. Some networks are tangible and refer to physical space. For example, in transportation networks cities (nodes) are connected to one another by roads (edges). Others are not tangible. For example, in social networks people (nodes) are connected to one another by friendship (edges). In the study of psychopathology, nodes can either be disorders (e.g., depression, anxiety) or symptoms (e.g., sadness, anhedonia, problems concentrating), while edges represent the estimated statistical relationships between the nodes (i.e., correlations). Network analysis thus provides a framework for conceptualizing how psychopathology (and
comorbidity between disorders) emerges. In the traditional measurement of psychological disorders, specific symptoms are understood to be indicators of an underlying disorder. This latent disorder framework presupposes that an underlying disorder causes symptoms. However, recent evidence suggests that psychological disorders are also upheld through symptom interactions, and these interactions might be better examined through a network approach (Borsboom & Cramer, 2013; McNally, 2016).

Cross-sectional networks, which are modelled using partial correlations, present a number of benefits above other tools for modelling relationships between multiple variables (e.g., zero-order correlations or multiple linear regression). Whereas zero-order correlations represent the total association between two variables, including both direct and indirect effects, partial correlations isolate the direct association between two variables, thereby removing the shared variance explained by other variables. Consequently, modelling partial correlations allows us to control for the influence of all other sexual function and psychological symptoms in our models when examining the association between two symptoms of interest. This may help us understand the specific relationship between sexual function and psychological symptoms, especially in the presence of multiple sexual function or psychological problems. Additionally, in contrast to methods like linear regression, examining networks constructed of partial correlations allows us to examine the strength of associations between multiple variables without concerns around multicollinearity and does not require a-priori decisions regarding expected independent and dependent variables, which positions network analysis as an ideal exploratory and hypothesis-generating tool. Moreover, while causality cannot be established with cross-sectional data, partial correlations point to the most important relationships between symptoms: When partial correlations are equal to zero, it suggests variables are independent after controlling for all
other variables in the network. Although such results are subject to measurement error and may be influenced by the omission of potential confounds (e.g., by not modelling an important factor relevant to sexual function), they allow us to direct our focus to the strongest associations between our variables of interest and point to potential causal paths that should be examined in future research.

**Defining Central Symptoms**

When assessing various psychological disorders using questionnaires and self-report scales, not all items may have equal weight for assessing outcomes. Specifically, some symptoms may be more important than others for maintaining psychological distress and dysfunction (Fried et al., 2016). In networks of Generalized Anxiety Disorder, excessive worry and inability to control worries have been identified as central symptoms (Beard et al., 2016; Heeren & McNally, 2018). In the case of Major Depressive Disorder, previous research using networks has identified sadness, loss of interest, and loss of energy as central symptoms of depression—findings that align with DSM criteria (Fried et al., 2016). However, little research examines how these individual psychological symptoms may or may not interact with sexual function and sexual distress symptoms, necessary components of sexual dysfunction. While one previous study has explored how anxiety, depression, sexual distress, and sexual function constructs relate to other risk factors (e.g., childhood maltreatment) using network analysis (Gunst et al., 2018), no studies have modelled individual symptom interactions. Examining symptom interactions could identify potential pathways from sexual difficulties to psychological difficulties or vice versa.

Several different centrality measures can be calculated to examine the importance of a node to a network. The most reported centrality measures in psychopathology include strength...
centrality and expected influence (Robinaugh et al., 2016). Strength centrality is defined as the absolute sum of edge weights connecting a node to other nodes and represents how closely linked a node is to the rest of the network, with higher values indicating greater strength. Expected influence is an alternative to traditional centrality indices (e.g., strength) that takes in account the valence of edges (Robinaugh et al., 2016). One–step expected influence is defined as the sum of all edges extending from a given node. Two–step expected influence is defined as the sum of the expected influences of each node connected to the initial node plus the one–step expected influence of the initial node (Robinaugh et al., 2016). Together, these measures provide information on the importance specific symptoms might play in upholding sexual function and psychological difficulties.

**Assessing Comorbidity Through a Network Approach**

Another way network analysis benefits the study of psychopathology is by providing an avenue to explore comorbidity. By modelling how symptoms of different disorders relate to one another, network analysis can explore which symptoms might associate disorders with one another. Network analysis has been applied to the study of comorbid psychopathology, including between major depressive disorder and generalized anxiety disorder (Beard et al., 2016; Park & Kim, 2020). However, no research to our knowledge has examined how sexual dysfunctions relate to other psychopathology using a network approach. Because sexual dysfunctions are highly comorbid with anxiety and depression, explicating the links between disorders and identifying which symptoms might account for comorbidity is highly relevant for identifying potential points of intervention. Specifically, certain sexual dysfunction and psychological symptoms may be linked more strongly than others (e.g., lack of interest in sex may be expected to correlate highly with anhedonia but not as highly with changes in appetite), and so examining
symptoms of interest rather than composite indices may further elucidate the pathways linking psychological disorders to sexual dysfunctions. Specifically, central symptoms in clinical versus nonclinical individuals may differ, and this has indeed been found in past network research examining comorbidity outside the context of sexual dysfunction (Smith et al., 2019). Another way in which the network structure of individuals with and without sexual function problems may differ is in the density of connections. Prior research has found that the density of networks (i.e., strong connections between nodes) is greater in clinical than non–clinical populations and treatment non–responders than those who respond to treatment (Heeren & McNally, 2018; McElroy et al., 2019; Pe et al., 2015; Vanzhula et al., 2019; cf. Hakulinen et al., 2020; Levinson et al., 2018). Network approaches are thus an area ripe for research in the study of sexual function problems.

The Current Study

The present research aimed to compare how associations between anxiety, depressive, and sexual function symptoms differ between women with and without sexual function problems. A secondary goal of this research was to explore symptoms (i.e., central symptoms) that may maintain distressing problems with sexual function and model the pathways (i.e., bridge symptoms) that might connect sexual function (i.e., orgasm, satisfaction, lubrication, arousal, desire, pain) with sexual distress, as well as anxiety and depressive symptoms consistent with network theories of psychopathology.
Chapter 2: Methods

Participants

A cross-sectional sample of Portuguese adults (N = 1492 participants; N = 1045 women) was gathered between October 2018 and January 2021. Data were originally collected as part of a study aimed at validating self-report measures of sexual well-being in the Portuguese population (Tavares et al., 2022). Eligibility criteria for the study required that participants be 18 years of age or older and understand written Portuguese language. Data checks were conducted to detect inattentive respondents; no participants incorrectly answered two or more out of three attention checks, and so no data were excluded. Participants who indicated no sexual activity on any item of the Female Sexual Function Index (FSFI; Rosen et al., 2000) were excluded from the final dataset (n = 246). This decision was made in line with recent recommendations for scoring the FSFI (Meston et al., 2020). Specifically, since scores of 0 on some items of the FSFI indicate lack of sexual activity during the past 4 weeks, they artificially deflate sexual function – a woman can have good sexual function, but by virtue of not engaging in sexual activity in the past 4 weeks, her score will meet cut-off criteria for clinically–significant problems with sexual function. Additionally, data from women who did not complete the Brief Symptoms Inventory (BSI–18; DeRogatis, 2001) were excluded (n = 74). The final sample consisted of 725 adult women. Women were grouped as having clinically significant problems with sexual function based on their sexual function and sexual distress scores, as assessed by the FSFI and the Female Sexual Distress Scale (FSDS; DeRogatis et al., 2002). Previous research has established reliable clinical cut offs for both the FSFI and FSDS. Specifically, as per recommendations regarding scoring, participants scoring below 26.55 on the FSFI and scoring greater or equal to 11 on the FSDS were assigned to the sexual function problems group (n = 150); those with FSFI scores
over or equal to 26.55 or with FSDS scores below 11 were assigned to the no sexual function problems group \((n = 575)\).

**Measures**

**Demographics**

Participants reported on demographic factors including age, gender, education, employment, religion, and relationship status, described in Table 1.

**Sexual Function**

Participants completed the well–validated 19–item Female Sexual Function Index (Rosen, 2000). The FSFI consists of 19 items rated on a 6–point Likert Scale, arranged into six subscales (desire, 2 items; arousal, 4 items; lubrication, 4 items; orgasm, 3 items; satisfaction, 3 items; pain, 3 items). Reliability for the subscales was good (desire \(\alpha = .86\); arousal \(\alpha = .88\); lubrication \(\alpha = .87\); orgasm \(\alpha = .87\); satisfaction \(\alpha = .91\); pain \(\alpha = .87\)). Possible scores ranged from 7.2 to 36, since data from those reporting no sexual activity in the past 4 weeks were excluded. The six subscales representing distinct symptoms of sexual function were input into the networks as these best capture sexual function at the symptom level. Higher scores on each of the subscales indicate better sexual function for that particular symptom.

**Sexual Distress**

The Female Sexual Distress Scale – Revised (FSDS–R; Derogatis et al., 2002) is a 13–item measure of sexual distress, scored on a 5–point Likert scale ranging from 0 (never) to 4 (always). Higher scores indicate higher levels of distress, with scores greater than 11 indicating clinically significant distress. The FSDS–R demonstrates a unidimensional factor structure and so the mean score was used to capture distress in the networks (DeRogatis et al., 2008). Internal consistency was good \((\alpha = .94)\).
Psychological Symptoms

The Brief Symptoms Inventory–18 (Derogatis, 2001) is an 18–item measure of psychological distress, rated using a 5–point Likert–type scale ranging from 0 (not at all) to 4 (extremely). Items from the BSI–18 were selected for inclusion in the network and grouped into parcels based on theoretical similarity and alignment with criteria for Generalized Anxiety Disorder and Major Depressive Disorder as defined in the DSM–5 (American Psychiatric Association, 2013). This decision was made in order to maximize the usefulness of the network approach for capturing associations between distinct symptoms of psychopathology. Notably, past research has used different approaches to measuring and understanding psychopathology, specifically with regard to measure construction and validation. One way to conceptualize measurement is through the reflective/formative framework. Traditional measures of psychopathology, many of which were developed through factor analytic methods, often imply a reflective measurement model. Reflective measurement models assume that underlying latent constructs or dimensions cause observable indicators or symptoms. For example, to measure job satisfaction, one might use items like “I am happy with my job” and “I am satisfied with my job,” which would be expected to correlate highly and could be used interchangeably. Conversely, formative measurement models assume that measured variables define or cause the construct. Using the previous example, job satisfaction might be considered a composite of one’s income, hours worked, and job stability. Network models wherein nodes represent symptoms/criteria presuppose such formative measurement; psychological disorders are understood to be comprised of distinct symptoms that interact with one another to produce psychopathology. Change to one component might change the presence or absence of disease (i.e., depression must have sadness or anhedonia and removing these would change the construct
being measured). In the case of the BSI-18, items like “suddenly scared for no reason,” and “spells of terror or panic,” appear to reflect a latent construct that one might label “panic”. As such, we chose to create composites that grouped like items together in order to more closely capture distinct dimensions of psychological symptoms that we could model in our network. Items for the composites were selected by the first and senior author. The final symptoms included anhedonia (item 2, feeling no interest in things), sadness (item 8, feeling blue; item 11, feeling worthless; and item 13, feeling hopeless), tension (item 6, feeling tense or keyed up; item 15, feeling restless), anxiety/nervousness (item 3, feeling nervous or shaky), panic (item 9, feeling scared for no reason; item 12, spells of terror or panic; item 18, feeling fearful), physiological symptoms (item 13, numbness or tingling; item 16, weakness), and cardiovascular symptoms (item 1, dizziness and faintness; item 4, chest pain; item 7, nausea; item 10, trouble breathing).

**Procedure**

Participants were recruited through social media, print posters, and by referral from sexual health professionals throughout Portugal. Participants who were interested in participating were provided an electronic link to complete an eligibility screener followed by the online survey. No monetary compensation was provided. The procedures were approved by the research ethics board at the University of Porto.

**Analyses and Research Design**

This study used a cross-sectional correlational design. Four networks were fit to the data: 1) A network of sexual function, sexual distress, and anxiety symptoms in women with sexual function problems; 2) a network of sexual function, sexual distress, and anxiety symptoms in women without sexual function problems; 3) a network of sexual function, sexual distress, and
depressive symptoms in women with sexual function problems; and 4) a network of sexual function, sexual distress, and depressive symptoms in women without sexual function problems. We chose to construct separate sets of networks for anxiety and depressive symptoms because we expected different associations between anxiety and sexual function problems as compared to depression and sexual function problems (e.g., anhedonia and low desire might cluster more closely, whereas genital pain and nervousness or tension might cluster more closely). Although depression and anxiety frequently co-occur and some symptoms overlap between the two, they remain distinct disorders. Additionally, because anxiety and depression symptoms were both measured with the BSI-18, entering them into one network might capture shared variance due to measurement rather than construct similarity. Consequently, assessing anxiety and depression separately allows us to focus on the unique mechanisms and specific connections that might underpin comorbidity between sexual function problems and various psychological disorders.

Statistical analyses were conducted using the qgraph package in R to estimate all networks (Epskamp et al., 2012). Skewed, nonnormal data were normalized using the nonparametric nonparanormal transformation (Liu et al., 2009). A graphical LASSO procedure was used to estimate regularized partial correlation networks. When fitting a regularized GGM, the LASSO penalty is controlled by a parameter λ, which is selected using the Extended Bayesian Information Criterion (EBIC; Foygel & Drton, 2010). The EBIC tuning parameter γ was set to 0.5 as per recommendations by Foygel and Drton (2010). To establish that network structures differ between those with and without sexual function problems, the networks were compared using the Network Comparison Test (van Borkulo et al., 2015). Due to the novelty of the proposed work, no parameters were available as a base for sample size calculations. However, past simulation studies suggest that a sample size of 250–350 provides sufficient
power for a network of 20 nodes (Constantin et al., 2021). De-identified data and syntax are available online [https://osf.io/p6tfw/?view_only=0b04262c336345c091ee1433b4ed2744].

**Missing Data**

No best practices have been established for handling missing data in cross-sectional networks. Participants who indicated no sexual activity were removed from the final dataset as per best practice for scoring the FSFI (Meston et al., 2020). Participants with missing data on any of the FSFI items were also excluded from analyses, since full FSFI scores were needed to discriminate between women with and without sexual function problems. For consistency, listwise deletion was used to handle missing data on the BSI–18 and FSDS–R. In total, of all items used for the network analysis, 14.05% were missing. One participant was missing only one item of the FSDS–R and was retained in the final analyses with their missing FSDS–R item score calculated based on the median of the remaining 12 items.
Chapter 3: Results

Sexual Function, Sexual Distress, and Anxiety Symptoms

Networks of sexual function, sexual distress, and anxiety symptoms were constructed in R and graphed using the Fruchterman–Reingold layout. Although networks cannot be interpreted solely through visual means (e.g., centrality of a node in the visualized network does not correspond to its statistical centrality) the visualized networks indicate valence and strength of relationships between nodes. Figure 1 shows connections for women with sexual function problems, compared to those without sexual function problems. The difference in density and connections between networks was formally tested using the Network Comparison Test based on 1000 permutations (van Borkulo et al., 2022).

A global strength invariance test was used to compare women with and without sexual function problems. There were no differences in density of connections between the networks of women with versus without sexual function problems ($S = .03$, $p = .98$; global strength per group $= 4.48_{\text{no problems}}$, $4.46_{\text{problems}}$). An omnibus test of invariance of network structure was used to investigate differences in edges. Results indicated that no edges differed significantly between networks ($M = .18$, $p = .44$) and as such, no post–hoc testing was conducted.

Centrality

Centrality measures indicate the importance of a node to a network’s structure—that is, how influential a specific symptom is and the extent to which it interacts with other symptoms. Several different centrality measures can be calculated to examine the importance of a node to a network. The most reported centrality measures in psychopathology include strength centrality and expected influence (Robinaugh et al., 2016). Strength centrality is defined as the absolute sum of edge weights connecting a node to other nodes and represents how closely linked a node
is to the rest of the network, with higher values indicating greater strength. Expected influence is an alternative to traditional centrality indices (e.g., strength) that takes into account the valence of edges (Robinaugh et al., 2016). One–step expected influence is defined as the sum of all edges extending from a given node. Two–step expected influence is defined as the sum of the expected influences of each node connected to the initial node plus the one–step expected influence of the initial node (Robinaugh et al., 2016).

For women with sexual function problems, tension, arousal, and cardiovascular symptoms had the greatest strength centrality and one–step expected influence; tension, nervousness, and cardiovascular symptoms had the greatest expected influence. The symptoms with greatest strength centrality for women without sexual function problems were arousal, tension, and panic; tension, arousal, and panic had the greatest one–step expected influence; tension, nervousness, and arousal had the greatest two–step expected influence. Strength centrality and expected influence measures for networks of women with and without sexual function problems (shown in Figure 2) suggest that sexual function dimensions were similarly important in networks of women with and without sexual function problems.

**Centrality Stability.** Centrality stability is a measure of the reliability of the order of node strength established through centrality ratings. Centrality stability is established by dropping individuals from the dataset and constructing the network structure with smaller sample sizes to determine whether the order of node centrality has changed. Maximum drop proportions to maintain a correlation of .7 in at least 95% of samples were calculated using the CS stability coefficient. Centrality differences can be interpreted if the CS–coefficient is above 0.25, and preferably above 0.5 (Epskamp et al., 2018). The CS coefficient in the network of women with sexual function problems was .44. The CS coefficient in the network of women without sexual function problems was .44.
function problems group was .75. These indicate that 44% or 75% of the sample size could be dropped respectively to maintain a correlation of 0.7 (with a 95% CI) with the original network structure in both networks.

**Strength Centrality Difference Test.** Strength centrality difference tests were used to examine whether a statistically significant difference could be identified between nodes’ centrality ranks (e.g., is arousal actually more central than desire?). The most central item in the network of women with sexual function problems was tension, which was significantly more central than other nodes in the network. The most central item in the network of women without sexual function problems was arousal, which was significantly more central than all other nodes in the network. Strength centrality rankings for networks of women with and without sexual function problems can be found in Figure 3.

**Differences Between Edges Within Individual Networks**

In networks, edges represent connections between symptoms (McNally, 2016) and the presence of edges may differ between groups. A bootstrapped edge–weight difference test ($\alpha = 0.05$) was used to examine whether differences between edges were significant within each network. This test compares each edge (i.e., each link, visualized in blue or red in Figures 1 and 5) to test which links between symptoms are the strongest. In the network of women with sexual function problems, the strongest edges with a negative valence (i.e., links between symptoms which are inversely related to one another) were between distress and orgasm, desire and satisfaction, and distress and desire. The strongest edges with a positive valence (i.e., links between symptoms which are positively related to one another) were between tension and nervousness, desire and arousal, and arousal and lubrication. The strongest edges were significantly different from all other edges in the network. In the network of women without
sexual function problems, the strongest edge with a negative valence were between orgasm and distress, pain and cardiovascular symptoms, and between distress and arousal, followed by pain and physiological symptoms. The strongest edges with a positive valence were between tension and nervousness, arousal and desire, and physiological and cardiovascular symptoms. The strongest edges were significantly different from each other and from all other edges in the network, as visualized in Figure 4.

**Sexual Function, Sexual Distress, and Depression Symptoms**

A global strength invariance test was used to compare women with and without sexual function problems. There were no differences in density of connections between the networks of women with versus without sexual function problems ($S = 1.60, p = .09$; global strength per group = 2.98\textsubscript{no problems} 1.38\textsubscript{problems}). An omnibus test of invariance of network structure was used to investigate differences in edges. Results indicated that no edges differed significantly between networks ($M = .25, p = .12$) and as such, no post-hoc testing was conducted.

**Centrality**

The symptoms with greatest strength centrality (i.e., sum of the absolute value of a symptom’s connections) for women with sexual function problems were arousal, sadness, and anhedonia; arousal, sadness, and anhedonia also had the greatest one-step and two-step expected influence (i.e., sum of the values of a symptom’s connections, accounting for negative values of some connections). For women without sexual function problems, arousal, sadness, and sexual distress had greatest strength centrality; arousal, sadness, and lubrication had the greatest one-step and two-step expected influence. Figure 6 shows centrality measures for networks of women with and without sexual function problems.
**Centrality Stability.** Centrality stability was calculated to assess the reliability of the order of node strength established through the centrality ratings. The CS coefficient in the sexual function problems group was .44, whereas the CS coefficient in the network of women without sexual function problems was .75. These indicate that 44% or 75% of the sample size could be dropped to maintain a correlation of 0.7 (95% CI) with the original network structure in the problems network and no problems network, respectively.

**Strength Centrality Difference Test.** The item with greatest strength centrality in the network of women with sexual function problems was arousal. Arousal had greater strength centrality than all nodes except sexual distress, desire, and sadness. Similarly, the most central item in the network of women without sexual function problems was arousal. Arousal was more central than all other nodes in the network. Strength centrality rankings for networks of women with and without sexual function problems can be found in Figure 7.

**Differences Between Edges Within Individual Networks**

A bootstrapped edge–weight difference test ($\alpha = 0.05$) was used to examine differences between edges. In the network of women with sexual function problems, the strongest edges with a negative valence were between sexual distress and orgasm and sexual distress and arousal. The strongest edges with a positive valence were between anhedonia and sadness, and desire and arousal. In the network of women without sexual function problems, the strongest edges with a negative valence were between orgasm and sexual distress, arousal and sexual distress, and pain and anhedonia. The strongest edges with a positive valence were between anhedonia and sadness, arousal and desire, and arousal and lubrication. For both networks, the strongest edges with positive and negative valence were significantly different from each other and from all other edges in the network, as seen in Figure 8.
Chapter 4: Discussion

This research compared associations between anxiety, depressive, and sexual function symptoms between women with and without sexual function problems. We examined how networks differed between women with and without sexual function problems and compared important central symptoms, as well as pathways that might connect sexual function (i.e., orgasm, satisfaction, lubrication, arousal, desire, pain) with sexual distress, as well as anxiety and depressive symptoms in the two groups by drawing on novel network theories of psychopathology and associated analytic methods.

The novel approach used in this study provided a number of benefits. While examining how various psychological and sexual function variables relate to one another through other analytical methods (e.g., multiple regression) might give us information regarding the effect size of such relationships, network analysis with partial correlations provides us with unique information on several counts. First, network analysis with partial correlations allows us to examine associations between symptoms while controlling for all other symptoms in the network. As such, we were able to better isolate the direct associations between various symptoms (e.g., between cardiovascular symptoms and genital pain) while removing the shared variance explained by other variables (e.g., nervousness). Such an approach lends itself to studying complex systems, as is the case in comorbid psychopathology, where many complex relationships link symptoms. Our approach enabled us to examine how unique sexual function and psychological symptoms contributed to other problems in women with and without sexual function problems. Second, by virtue of using partial correlations, network analysis is more robust against violations of multicollinearity, compared to competing alternative analytic approaches like multiple regression. Third, network analysis is useful for exploratory and
hypothesis-generating research. We did not need to establish hypotheses with respect to directionality between symptoms and were able to estimate relationships between variables that might point to potential causal pathways. In sum, this approach was well-suited to a preliminary investigation of symptom-level interactions between facets of sexual function, sexual distress, anxiety, and depression symptoms.

Indeed, these data are the first to examine symptom–level interactions of sexual function, sexual distress, anxiety, and depressive symptoms in women with and without sexual function problems. We observed no significant differences in density of networks and existing connections when examining anxiety and depressive symptoms in their respective networks. These findings contrast past research comparing clinical and non–clinical populations, which has observed more densely connected symptoms among clinical compared to non–clinical populations. Additionally, we found that the centrality of sexual function, sexual distress, and psychological symptoms differed between women with and without sexual function problems, with psychological symptoms being more central in the networks of women with sexual function problems.

**What Can Network Density Tell Us About Comorbidity and Persistence of Sexual Function Problems?**

Greater density of symptoms has been proposed as a factor that might reflect increased vulnerability for “contagion” of symptoms in the context of comorbidity (Borsboom & Cramer, 2013; Robinaugh et al., 2016). That is, in densely connected networks, elevated levels of one symptom are more likely to lead to changes in associated symptoms, thereby unbalancing the entire system. In the context of the sexual dysfunction, activation of one symptom (e.g., physiological anxiety symptoms) due to an external stressor might be more likely to lead to
increases in related symptoms (e.g., genital pain) for individuals with more densely connected networks.

Notably, the networks of women with and without sexual function problems did not differ significantly with regard to density. These findings indicate that activation of psychological symptoms for women with sexual function problems might not necessarily lead to increased sexual distress or sexual function problems, compared to activation of these symptoms in women without sexual function problems. The lack of differences in density in networks of anxiety symptoms and sexual dysfunction symptoms further supports evidence of a complex relationship between anxiety and sexual function, in which anxiety can both promote and inhibit sexual function (Ashbaugh et al., 2022; Kane et al., 2019). Additionally, these similarities in the two networks suggest that symptom contagion may not play a primary role in comorbidity between sexual dysfunctions and depression and anxiety. Indeed, latent factor and transdiagnostic factor approaches show promise for understanding links between symptoms of sexual function and psychological disorders (Carvalho et al., 2012; Forbes et al., 2016a, 2016b; Forbes & Schniering, 2013; Nobre et al., 2022). Conversely, network density might still be relevant for individuals with true comorbidity (i.e., clinical diagnoses or both sexual dysfunction and anxiety or depression); our data came from a community sample and our groupings were based solely on sexual function, not psychological symptom endorsement.

Despite our null findings regarding network density between those with and without sexual function problems, further research should assess whether network density may still play a predictive clinical role: In a longitudinal study, McElroy et al. (2019) identified network density as a predictor of remission of depression symptoms, with individuals with less densely connected networks more likely to recover relative to those with more densely connected
networks. However, the utility of network density as a differentiating tool has also been called into question (Borsboom et al., 2018). Future research could assess whether network density might provide one method of identifying women at greater risk of developing comorbid or persistent sexual dysfunction and psychological difficulties, or serve as a generalizable indicator of who may benefit from more intensive intervention to address said difficulties.

**What Can Centrality Tell Us About Mechanisms Contributing to Sexual Function Problems?**

The present research provided a novel examination of potential mechanisms explaining comorbidity between anxiety and depressive symptoms and sexual function problems. Specifically, we assessed associations at the symptom, rather than the disorder level. We found that the symptom networks of women with and without sexual function problems differed with respect to the centrality of symptoms. For example, cardiovascular symptoms had greater strength centrality for women with versus without sexual function problems in the anxiety networks, even though the edges between cardiovascular and other symptoms did not differ significantly in the two groups.

Centrality measures are a main component of networks since they quantify the importance of a symptom (i.e., node) to the network. Strength centrality and expected influence are particularly relevant since they measure the likelihood that presence of one symptom will be associated with activation of connected symptoms (McNally, 2016). Consequently, symptoms with high centrality make good potential targets for future treatment development, since they theoretically represent causally important points for the maintenance of disorders, as well as comorbidity (McNally, 2016). Similarly, central symptoms may be ideal intervention targets because effecting change in a central symptom is likely to have the greatest influence on the
overall network (Borsboom & Cramer, 2013). Findings regarding central symptoms in our networks may be clinically relevant because targeting a specific symptom (e.g., genital pain) could potentially lead to the reduction of closely related symptoms (e.g., somatic/cardiovascular dimensions of psychological disorders), even if they are non–sexual, thereby supporting a transdiagnostic approach to treatment. Similarly, the opposite directionality might be supported: Targeting somatic symptoms might potentially help address genital pain for those with comorbid anxiety and sexual dysfunction.

Our anxiety networks showed that for women with sexual function problems, tension, arousal, and cardiovascular symptoms had the greatest strength centrality. It is possible that our findings reflect the importance of somatic symptoms to poor sexual function. These dimensions of psychological distress have been found to play an influential role in sexual dysfunction: Somatic symptoms and tension are common in individuals with genital pain disorders (Lahaie et al., 2010). Moreover, cardiovascular disease frequently co–occurs with sexual dysfunctions and these findings might point to a future direction for transdiagnostic research. Finally, the centrality of arousal aligns with past research; decreased arousal has been proposed as a central mechanism through which sexual function problems lead to distress (Stephenson & Meston, 2015).

In the depression networks, arousal, sexual distress, and orgasm had the greatest strength centrality for women with sexual function problems; whereas, arousal, sadness, and sexual distress had greatest strength centrality for women without sexual function problems. Given that problems with arousal are common in women with depression, this finding points to a possible mechanism through which depression and sexual dysfunction may be related. The centrality of sexual distress in both networks is important to note: Sexual function problems that occur
without associated distress do not meet criteria for sexual dysfunction (American Psychiatric Association, 2013). Higher levels of sexual distress, even if they were subclinical, were associated with greater psychological and sexual function symptoms in those without sexual function problems. It may be that sexual distress acts as a bridge between even mild problems with sexual function and psychological symptoms.

**What Can Edges Tell Us About Psychological Symptoms and Sexual Function Problems?**

Edges (i.e., associations) between symptoms did not show significantly different patterns in the networks of women with and without sexual function problems, indicating that the strength of associations between various symptoms did not differ depending on whether or not a person had clinically significant sexual function problems. Notably, in both our networks, arousal and desire were strongly related. These findings are consistent with the incentive motivation model that propose that desire emerges from arousal (Toates, 2009) and relatedly, that problems with arousal may in turn contribute to difficulties with desire and vice versa. Moreover, the presence of strong edges may point to how symptoms reciprocally reinforce one another to maintain problems with sexual function.

**Identifying Next Steps for Network Research of Comorbidities in Sexual Dysfunction**

Beyond traditional nosological systems like the DSM–5 which consider psychopathology to exist as distinct categorical constructs, psychopathology has more recently been conceptualized through a transdiagnostic lens. Transdiagnostic approaches presuppose that latent dimensions traverse traditional boundaries between disorders, thereby accounting for high correlations between various mental disorders and personality traits (Rodriguez–Seijas et al., 2015). Research examining relationships between common mental disorders (e.g., anxiety and depression) and sexual dysfunction has recently found that transdiagnostic factors like worry and
rumination (key factors in emotional distress) also have a direct effect on sexual distress, reinforcing support for a cognitive–emotional approach to sexual dysfunction (Pascoal et al., 2020). Transdiagnostic factors like neuroticism have been linked to poorer sexual function and greater sexual distress, as well as psychological difficulties (Nobre et al., 2022; Paulus et al., 2016; Roelofs et al., 2008). There is also convincing evidence that anxiety, depression, and sexual dysfunction might fall under an internalizing dimension that could explain their co–occurrence (Forbes et al., 2016b; Forbes & Schniering, 2013). Conversely, there is evidence that sexual function is multidimensional and not best conceptualized within a unidimensional factor structure. For example, the FSFI is better explained by 6– and 5–factor models than a one–dimensional sexual function domain (Carvalho et al., 2012). Moreover, the diverse biological and physiological etiologies of sexual dysfunctions and psychological disorders (e.g., the contributing role of neuroproliferative vestibulodynia to Genito–Pelvic Pain and Penetration Disorder compared to other sexual dysfunctions; the co–occurrence of depression with cardiovascular illness and symptoms) suggest that comorbidity between anxiety, depression, and sexual dysfunction may not be wholly explained by a latent internalizing dimension.

The present research allowed an examining of comorbidity at the symptom versus disorder level. The cross–sectional network findings are complementary to other theoretical approaches to characterizing sexual dysfunction and psychopathology. Indeed, findings regarding associations between different dimensions of sexual function and psychological symptoms (e.g., dyspareunia being more closely linked to physiological symptoms than other psychological symptoms) align with suggestions that comorbidity between anxiety, depression, and sexual dysfunction might be related to shared elements between these disorders, above and beyond variability explained by a possible internalizing dimension (Laurent & Simons, 2009). In
sum, these findings point to the potential use of network theory in characterizing sexual
dysfunction and comorbidities between sexual and psychological difficulties. By examining
comorbidity at the symptom versus disorder level, this research elucidated relationships between
dimensions of sexual function and psychological symptoms (e.g., between pain and somatic
symptoms), thereby identifying potential bridges between disorders.

**Limitations and Future Directions**

Despite the large sample size and variability in sexual function in our sample and the use
of a sophisticated analytic technique, the data were cross-sectional. Thus, we are limited in our
ability to examine directionality in the associations between symptoms. Future longitudinal
research is needed to determine whether certain symptoms might be central because they are
causating multiple other symptoms, or because they are being caused by other symptoms. For
example, it is possible that problems with arousal might be interfering with satisfaction, desire,
and causing sexual distress and sadness. However, an equally plausible possibility is that
problems with satisfaction, sexual distress, and feelings of sadness are interfering with arousal.
The network approach posits that disorders emerge as complex, dynamic systems of symptoms
and therefore a key feature of network analysis is the ability to capture directional and reciprocal
relationships between symptoms. However, these causal claims cannot be tested using cross–
sectional data (Huang et al., 2023). Though our study was an important first step to examining
comorbidity at the symptom level, future studies should use intensive sampling methodology to
leverage the benefits of network analysis and assess how sexual function, sexual distress, and
psychological symptoms influence one another over time, thus disentangling causal mechanisms
underpinning symptom centrality. Moreover, the use of cross–sectional data predicates that we
cannot eliminate alternative explanations for comorbidity between sexual dysfunction and
psychological difficulties (e.g., the latent variable model). Future research could compare network and factor models of sexual function, distress, and psychological symptoms to determine the extent to which comorbidity can be conceptualized as emerging from causal symptom interactions, as opposed to being explained by a latent underlying internalizing factor.

Additionally, the current findings may have been influenced by the nature of items included in our networks. In the psychopathology literature, scales are often constructed using a factor analytic approach and are composed of reflective (as opposed to formative) items (Hanafiah, 2020). Reflective measurement models presuppose that an underlying latent construct causes various indicators, and consequently a latent construct can be measured with a set of positively correlated items (e.g., items like “I am happy with my sex life” and “I am satisfied with my sex life”) that tap into a single unidimensional construct. Conversely, network models do not necessarily presuppose the existence of a latent construct and focus instead on how symptoms interact to maintain psychopathology. Because measures like the FSFI and BSI–18 were developed using various methods, including factor analytic approaches (Derogatis et al., 2002a; Rosen, 2000a), the individual items in these scales do not necessarily capture distinct symptoms or criteria, as defined in the DSM–5 or ICD–11 (American Psychiatric Association, 2013; World Health Organization, 2022), but rather are collections of highly correlated items meant to tap into a larger factor or multiple factors. Although we attempted to minimize this limitation by creating composites to capture distinct symptoms/criteria of depression and anxiety, we were limited in the psychological symptoms we could include in our networks based on the items of the BSI–18. Future research should assess psychological difficulties through a standardized clinical interview or a symptom–level measure like the PHQ–9 (Kroenke & Spitzer,
2002) which captures a greater number of depression symptoms (e.g., loss of appetite, trouble sleeping, and concentration difficulties).

Conclusions

The current study provides a novel examination of associations between sexual function, sexual distress, and psychological symptoms, as well as how they differ in women with and without clinically significant problems with sexual function. We demonstrated that women with clinically significant problems with sexual function did not show more densely connected networks of sexual function and psychological symptoms compared to women without clinically significant problems with sexual function. Our research also revealed that the types of symptoms that are most important to sexual function and psychological difficulties did not differ between individuals with and without sexual function problems in our sample; arousal, tension, cardiovascular symptoms, and sadness were among the most important symptoms for women with and without sexual function problems. Beyond adding to our understanding of factors contributing to the high comorbidity between women’s sexual function problems and other psychological difficulties, our null findings may also help inform future longitudinal and experimental study design by pointing to potential avenues for further exploration. Specifically, future research might use temporal networks and clinical samples to explore whether symptom contagion might partially explain comorbidity in women’s sexual function problems. In sum, this research highlights a novel approach to exploring symptom level interactions between sexual function and psychological variables, as well as the different patterns of association that might exist, for individuals with comorbid sexual dysfunction and psychological disorders.
### Tables and Figures

**Table 1**

*Participant Demographics*

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<th>Characteristics</th>
<th>No Problems with Sexual Function</th>
<th>Problems with Sexual Function</th>
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<td>(N) (%)</td>
<td>(N) (%)</td>
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<tr>
<td><strong>Age Mean (SD)</strong></td>
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<td>29.47 (9.93) years</td>
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<td>&lt;12 years</td>
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<td>12 years</td>
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<td>Bachelor’s Degree</td>
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<td>Master’s</td>
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<td><strong>Religious</strong></td>
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<td>Married or Common Law</td>
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<td>Separated or Divorced</td>
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<td><strong>Relationship Length Mean (SD)</strong></td>
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<td>59.9 (90.5) months</td>
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Table 2

Zero-order Correlations for Study Variables

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<td>2 Desire</td>
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<td>3 Arousal</td>
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<td>.65***</td>
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<td>4 Lubrication</td>
<td>-.40***</td>
<td>.41***</td>
<td>.65***</td>
<td>–</td>
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<td>5 Satisfaction</td>
<td>-.43***</td>
<td>.24***</td>
<td>.53***</td>
<td>.42***</td>
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<td>6 Orgasm</td>
<td>-.67***</td>
<td>.40***</td>
<td>.60***</td>
<td>.41***</td>
<td>.48***</td>
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<td>7 Pain</td>
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<td>.28***</td>
<td>.41***</td>
<td>.47***</td>
<td>.34***</td>
<td>.25***</td>
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<td>8 Sadness</td>
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<td>-.15***</td>
<td>-.27***</td>
<td>-.18***</td>
<td>-.26***</td>
<td>-.30***</td>
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<td>9 Anhedonia</td>
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<td>-.20***</td>
<td>-.26***</td>
<td>-.20***</td>
<td>-.26***</td>
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<td>10 Tension</td>
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<td>-.21***</td>
<td>-.17***</td>
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<td>.51***</td>
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<td>11 Nervous</td>
<td>.24***</td>
<td>-.06</td>
<td>-.14***</td>
<td>-.14***</td>
<td>-.16***</td>
<td>-.10**</td>
<td>-.19***</td>
<td>.53***</td>
<td>.53***</td>
<td>.76***</td>
<td>–</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Panic</td>
<td>.27***</td>
<td>-.06</td>
<td>-.14***</td>
<td>-.11**</td>
<td>-.13***</td>
<td>-.16***</td>
<td>-.20***</td>
<td>.64***</td>
<td>.43***</td>
<td>.63***</td>
<td>.50***</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>13 Physio</td>
<td>.23***</td>
<td>-.08*</td>
<td>-.12**</td>
<td>-.12***</td>
<td>-.09*</td>
<td>-.14***</td>
<td>-.27***</td>
<td>.42***</td>
<td>.34***</td>
<td>.47***</td>
<td>.33***</td>
<td>.48***</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>14 Cardio</td>
<td>.18***</td>
<td>-.03</td>
<td>-.11**</td>
<td>-.10**</td>
<td>-.10**</td>
<td>-.09*</td>
<td>-.27***</td>
<td>.46***</td>
<td>.40***</td>
<td>.52***</td>
<td>.48***</td>
<td>.61***</td>
<td>.57***</td>
<td>–</td>
</tr>
</tbody>
</table>

*p < .05. **p < .01. ***p < .001
Figure 1

Sexual Function, Sexual Distress, and Anxiety Symptom Networks

Note. Thickness of lines denotes the strength of associations while colour denotes valence. Blue lines denote positive associations and red lines denote negative associations. The network of women with sexual function problems has a greater number of strong associations. Node centrality in the visualized networks does not correspond to statistical centrality as measured through strength centrality rankings.
Figure 2

*Strength and Expected Influence Centrality for the Anxiety Networks*

<table>
<thead>
<tr>
<th>Strength</th>
<th>Expected Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension</td>
<td></td>
</tr>
<tr>
<td>Arousal</td>
<td></td>
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<tr>
<td>Cardio</td>
<td></td>
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<tr>
<td>Nervous</td>
<td></td>
</tr>
<tr>
<td>Panic</td>
<td></td>
</tr>
<tr>
<td>Physio</td>
<td></td>
</tr>
<tr>
<td>Lubrication</td>
<td></td>
</tr>
<tr>
<td>Desire</td>
<td></td>
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<tr>
<td>Satisfaction</td>
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<tr>
<td>Pain</td>
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<tr>
<td>Orgasm</td>
<td></td>
</tr>
<tr>
<td>Distress</td>
<td></td>
</tr>
</tbody>
</table>

Note. Centrality indices are plotted using standardized $z$–scores. The $y$–axis displays the node in the network. The $x$–axis of each graph represents the standardized $z$–score of the centrality metric, with more positive values indicating greater centrality.
Figure 3

*Strength Centrality Difference Rankings for the Anxiety Networks*

*Note:* Bootstrapped difference tests ($\alpha = 0.05$) of node strength in the sexual function, sexual distress, and anxiety symptom networks. Gray boxes indicate nodes that do not differ significantly from each other; black boxes indicate nodes that differ significantly. White boxes in the centrality plot indicate the $z$–score value of node strength. The graph on the left represents node strength differences for the network of women without sexual function problems while the graph on the right represents node strength differences for the network of women with sexual function problems.
Figure 4

Edge Difference Rankings for the Anxiety Networks

Note: Bootstrapped difference tests ($\alpha = 0.05$) of edge strength in the sexual function, sexual distress, and anxiety symptom networks. Gray boxes indicate nodes that do not differ significantly from each other; black boxes indicate nodes that differ significantly. White boxes in the centrality plot indicate the $z$–score value of node strength. The graph on the left represents edge strength differences for the network of women without sexual function problems while the graph on the right represents edge strength differences for the network of women with sexual function problems.
Figure 5

Sexual Function, Sexual Distress, and Depression Symptom Networks

No problems with sexual function

Problems with sexual function

Note. Thickness of lines denotes the strength of associations while colour denotes valence. Blue lines denote positive associations and red lines denote negative associations. The network of women with sexual function problems has a greater number of strong associations. Node centrality in the visualized networks does not correspond to statistical centrality as measured through strength centrality rankings. Although networks cannot be interpreted solely through visual means, and the networks were not significantly
different, there appear to be greater and more dense connections in the network of women with sexual function problems, which should be explored in future studies.
Figure 6

*Strength and Expected Influence Centrality for the Depression Networks*

![Diagram showing centrality indices for depression networks](image)

Note. Centrality indices are plotted using standardized z–scores. The y–axis displays the node in the network. The x–axis of each graph represents the standardized z–score of the centrality metric, with more positive values indicating greater centrality.
Figure 7

Strength Centrality Rankings for the Depression Networks

Note: Bootstrapped difference tests (α = 0.05) of node strength in the sexual function, sexual distress, and depression symptom networks. Gray boxes indicate nodes that do not differ significantly from each other; black boxes indicate nodes that differ significantly. White boxes in the centrality plot indicate the z–score value of node strength while the graph on the right represents node strength differences for the network of women with sexual function problems.
Figure 8

*Edge Difference Rankings for the Depression Networks*

No problems with sexual function

Problems with sexual function

*Note:* Bootstrapped difference tests ($\alpha = 0.05$) of edge strength in the sexual function, sexual distress, and depression symptom networks. Gray boxes indicate nodes that do not differ significantly from each other; black boxes indicate nodes that differ significantly. White boxes in the centrality plot indicate the $z$–score value of node strength. The graph on the left represents edge strength differences for the network of women without sexual function problems while the graph on the right represents edge strength differences for the network of women with sexual function problems.
References


