The Journal of Sex Research

ISSN: 0022-4499 (Print) 1559-8519 (Online) Journal homepage: www.tandfonline.com/journals/hjsr20

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To cite this article: Marieke Dewitte, Marlene Werner, Moniek ter Kuile, Linnea Engman & Ida Flink (2025) A Network Analysis of the Fear Avoidance Model of Genital Pain, The Journal of Sex Research, 62:5, 818-831, DOI: 10.1080/00224499.2024.2352540

To link to this article: https://doi.org/10.1080/00224499.2024.2352540

THE JOURNAL OF SEX RESEARCH
2025, VOL. 62, NO. 5, 818–831
https://doi.org/10.1080/00224499.2024.2352540

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A Network Analysis of the Fear Avoidance Model of Genital Pain

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ABSTRACT

Using a novel data-driven network approach, this study aimed to examine the interconnection between the key elements of the Fear-Avoidance Model of female genital pain – sexual arousal, fear-avoidant cognitions, and motivational coping – and its associated factors to predict the intensity and frequency of genital pain across women over time. Network modeling allowed for a comprehensive evaluation of the Fear-Avoidance model while capturing the dynamic features of genital pain. We estimated a cross-sectional and a temporal, contemporaneous, and between-persons network model on convenience-based data of 543 female students (mean age = 23.7 years, *SD* = 3.6) collected at three time points. Results showed that lubrication, pain catastrophizing, pain avoidance, fear-avoidance beliefs, sexual satisfaction, anxiety, and frequency of coital and non-coital sex predicted pain, with lubrication being the most consistent predictor across estimations. The network of women with recurrent genital pain showed a similar pattern as the network of the total sample, except that pain avoidance and fear-avoidance beliefs rather than pain catastrophizing predicted pain directly, and frequency of coital and non-coital sexual activities played a more prominent role. These results suggest that the main problem of genital pain centers around women not being sufficiently aroused during intercourse and inadequate ways of pain coping, which are critical targets of cognitive-behavioral therapy treatment and should be developed further.

Genital pain is a prevalent health condition that impacts 8% −10% of women across all age groups (Arnold et al., 2007; Harlow & Stewart, 2003; Reed et al., 2008), causing substantial distress in sexual and nonsexual areas of daily life. Due to its multifactorial and biopsychosocial nature, research on genital pain has been examined from various perspectives, although there has been insufficient collaboration and integration among these disciplines (Dewitte, Borg, et al., 2018). Adding to the complexity, genital pain is not a singular diagnosis but comprises various pain syndromes, which hinders the identification of common factors related to etiology, clinical presentation, and coping strategies (Bornstein et al., 2016). Several biopsychosocial factors have been identified, ranging from inflammation, hormonal triggers and genetic factors to personality traits, (sexual)self-concept, depression, anxiety as well as partner responses, relationship processes, and societal expectations about (penetrative) sex (Bergeron et al., 2020; Chisari et al., 2021; Dewitte, Borg, et al., 2018; Rosen & Bergeron, 2019). More research is needed to understand how these different factors work together to generate, maintain, and exacerbate genital pain. In this study, we explored the interconnection and interplay between previously identified cognitive-behavioral factors to predict genital pain.

Theories of Genital Pain

Several explanatory models have been proposed to understand how women get trapped in a self-sustaining circle of pain, some of which move away from single causes to describe the multiple pathways through which biopsychosocial mechanisms contribute to the development and persistence of genital pain (Bergeron et al., 2020; Dewitte, Borg, et al., 2018). The model with the most solid impact on both research and clinical practice is based on the cognitive-behavioral tradition and ascribes a central role to fear of pain in interaction with physiological responses (Spano & Lamont, 1975; ter Kuile & Weijenborg, 2006; ter Kuile et al., 2010). More concretely, it has been assumed that (thoughts of) pain during penetration leads to fearful reactions that inhibit genital arousal, resulting in vaginal dryness and pelvic floor hypertonicity, which in turn lead to a smaller genital hiatus. These physiological reactions might then lead to mechanical friction and increased (fear of) pain during sexual intercourse. The Fear-Avoidance model builds on this cognitive-behavioral tradition and puts forward the central idea that pain generates catastrophic thoughts, fear, muscle tension, and hypervigilance, which in itself can increase the perception of pain. These psychological reactions set the stage for avoidance behaviors that are maintained by decreases in fear and the associated threat of pain (Vlaeyen et al., 2016).

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/00224499.2024.2352540.

Accordingly, fear of pain is assumed to interfere with different cognitive-motivational processes involved in sexual arousal responding, such as hypervigilance to pain and, therefore, less attention to sexual stimuli, as well as more negative appraisals of sexual stimuli and more catastrophic appraisals of pain, resulting in lower levels of subjective sexual arousal and a lower readiness to engage in sexual activity (ter Kuile & Weijenborg, 2006; ter Kuile et al., 2010). Because affected women expect pain rather than sexual reward, they often start to avoid penetrative sex as well as other intimate sexual acts that might progress toward painful intercourse (Ekdahl et al., 2018). Although fear-avoidance mechanisms have proven valid in predicting women's pain experiences during sex, they cannot account for the fact that a large portion of women with pain continue with, rather than avoid, penetrative sex, many of whom because they want to please their partner, avoid conflict or avoid losing the relationship, and keep to the ideal image of being a "normal" woman (Brauer et al., 2014; Elmerstig et al., 2008).

Several components of the Fear-Avoidance model have been supported by empirical evidence, suggesting that substantial overlap exists between pain disorders in terms of fear, negative appraisals of sexual stimuli, catastrophic thoughts about pain, low sexual arousal, and coping strategies to deal with pain (Lahaie et al., 2015; ter Kuile & Weijenborg, 2006; ter Kuile et al., 2010). Yet, the evidence is not nearly as consistent to draw definite conclusions on the role of low arousal and fear-avoidant cognitions, motivation, and behavior.

When it comes to the role of attentional processes and catastrophic beliefs, several studies have failed to demonstrate hypervigilance toward pain-related stimuli and automatic threat appraisals of sexual stimuli in women with genital pain (Brauer et al., 2006; Huijding et al., 2011; Melles et al., 2014). However, some evidence suggests that women with genital pain do selectively attend to pain stimuli, report more negative appraisals of sexual penetration stimuli, and have more catastrophic thoughts than those without pain (Desrochers et al., 2008; Lykins et al., 2011; Payne et al., 2005).

In addition to hypervigilance and catastrophizing, lack of lubrication during sexual activity has also been forwarded as a central mechanism in models of genital pain, because a certain level of sexual arousal during penetration is needed to prevent and overcome pain during intercourse (Lalumière et al., 2022; Melles et al., 2018). However, in an experimental lab study during which subjective and genital arousal were measured while women watched penetrative (and thus threat-provoking) stimuli, no evidence was found that genital arousal was impaired in women with genital pain compared to women without sexual complaints, although women with genital pain consistently reported lower levels of subjective sexual arousal in response to diverse sexual stimuli (Brauer et al., 2006). These findings suggest that the genital response of women with genital pain is intact and that other processes, apart from (pain) threat, play a more prominent role. When it comes to pain coping, research on the motivational determinants of genital pain is limited. It has been suggested that women with genital pain are chronically preoccupied with averting negative outcomes, thereby missing positive opportunities, which causes damage to emotional and relational well-being (Dewitte et al., 2011). It has been shown that women who pursue more sexual avoidance goals (that is, having sex to avoid a negative outcome such as losing the partner) report lower sexual and relationship satisfaction and higher levels of depressive symptoms, whereas the active pursuit of sexual approach goals (e.g., having sex to attain a positive outcome such as sexual pleasure) is associated with higher sexual and relationship satisfaction (Rosen et al., 2017). Note that, in general, women with genital pain do not necessarily report impaired levels of sexual satisfaction, although the pain does limit their sexual life (Engman et al., 2018; Flink et al., 2017; Rosen et al., 2010). Partner responses, partner support, and communication have been found to play an important role in explaining levels of distress and satisfaction in women with genital pain (Bennett-Brown et al., 2022; Blair et al., 2015; Ekholm et al., 2023; Rosen et al., 2010). Furthermore, feelings of love and trust were found to mitigate the influence of pain on relational and sexual outcomes, likely by diminishing the significance of the coital imperative (Blair et al., 2015).

Despite the existing body of evidence, many constructs involved in cognitive behavioral and fear-avoidance models of genital pain have been measured in isolation and as part of studies that were not designed primarily to validate theories of genital pain. Given the inconsistent findings in past studies, a systematic and theoretically driven approach to selecting predictors is needed to understand the mechanisms by which cognitive and behavioral factors relate to maintaining the genital pain problem.

Treatment Approaches

Translating these theoretical insights into clinical practice, several cognitive-behavioral therapy (CBT) protocols have been proven effective to reduce pain and restore sexual function by targeting the thoughts, emotions, and behaviors associated with the experience of genital pain (Bergeron et al., 2016; Masheb et al., 2009). The majority of research and treatment has focused on reducing vulnerability factors of chronic pain disability rather than increasing resilience factors. Yet, more recently, third wave CBT protocols have become popular in the genital pain field. These protocols aim to increase adaptive coping by promoting resilience factors such as acceptance, self-efficacy and psychological flexibility and have proven effective in reducing pain, depression and catastrophic thoughts and increasing sexual function and satisfaction (Brotto et al., 2015, 2019; Chisari et al., 2021). Studies have shown that pain acceptance, being a core component of psychological flexibility, is related to less pain and higher sexual satisfaction, and plays a central role in the vulvodynia pain network (Boerner & Rosen, 2015; Chisari et al., 2021).

Although CBT-based models have proven their heuristic and clinical value, treatments of genital pain implement cognitive-behavioral principles without a solid base of empirical evidence, showing that these principles do play a role in the etiology and persistence of genital pain. Evaluating whether these proposed mechanisms hold true is of key importance in order to further develop evidence-based treatments of genital pain. It is remarkable that current guidelines for the management of genital pain generally recommend CBT as a first-line treatment, even though

systematic research into the underlying theoretical model is lacking and the treatment models are lagging behind new insights in psychopathology (Dewitte & Meulders, 2023).

A Potentially Insightful New Perspective

Network theory has gained prominence in psychology as a new way to conceptualize the structure of psychological constructs (such as mental disorders) as well as the mechanisms involved in their emergence (Borsboom, 2008, 2017; Burger, Isvoranu, et al., 2022; Burger, Ralph-Nearman, et al., 2022; McNally, 2021; Robinaugh et al., 2020). Network theory proposes that psychological characteristics arise from direct interactions between a construct's constituents (e.g., symptoms for mental disorders) rather than that constituents co-occur due to a common latent cause (e.g., brain disorder or genetic propensity). Psychological constructs should then not be conceptualized nor studied in terms of a single construct score but at the level of interrelated affective, cognitive, and behavioral constituents or symptoms and (external) predisposing, precipitating, and perpetuating factors (Borsboom, 2008; Fried, 2017, 2020; Lunansky et al., 2021). Also, when symptoms are not merely reflections of a common cause but are the core constituents of a disordered state, we should no longer choose a treatment protocol based on a uniform diagnosis (McNally, 2021). Therapeutic interventions should target symptoms and relations between symptoms and perpetuating factors instead of identifying and treating a single underlying cause.

Notably, which symptoms or relationships one should intervene on might differ between (groups of) individuals[1] (Burger, Ralph-Nearman, et al., 2022). Recently, a network analysis was conducted in a sample of women with (different subtypes of) vulvodynia, focusing specifically on a set of variables that are theoretically relevant from a broader behavioral framework, but less commonly studied in the context of vulvodynia (Chisari et al., 2021). It was found that perceived injustice, psychological flexibility (mainly pain acceptance), and depression were central factors in the network of vulvodynia, while body-exposure and anxiety during intercourse were most central for the provoked subtype. Although it is worthwhile to apply new analytic methods while moving beyond CBT models of genital pain responding, we are not aware of any study to date that has examined the core features of the Fear-Avoidance model from a network perspective. We believe it is an important step to examine the network connections between the core symptoms of genital pain (i.e., fear, catastrophizing, sexual arousal, and motivation), including other relevant variables such as psychological flexibility. We suggest that the network approach might prove insightful to understanding genital pain because it fits with the idea that (1) genital pain is determined by multiple predisposing, precipitating, and perpetuating biopsychosocial factors and that (2) the development and persistence of genital pain involves a cascade of connected symptoms that occur due to causal interactions between symptoms and predisposing, precipitating, and perpetuating factors.

[1]Note that such conclusions should preferably be based on network analyses that model intensive data of an individual, because only such models allow insight into associations that pertain to an individual's intrapersonal symptom relationships rather than temporal relationships based on associations between symptoms shown by the average individual or cross-sectional relationships between symptoms at one moment in time.

The Present Study

In this paper, we present a network analytic approach to genital pain as a novel way to examine the most important predisposing, precipitating, and perpetuating factors previously identified in Fear-Avoidance models of genital pain. We applied network analysis to: (1) reexamine which predisposing, precipitating, and perpetuating factors predict genital pain across individuals and (2) test whether these predisposing, precipitating, and perpetuating factors predict genital pain across time within (the average) individual. Including cognitive-behavioral components of genital pain into one network structure allowed us to reexamine the relative importance of these factors in predicting genital pain. Furthermore, examining how these factors may reciprocally reinforce each other over time allowed for a more comprehensive evaluation of the Fear-Avoidance model that can better capture the dynamical features of genital pain and thus better aligns with the clinical presentation of this condition.

We studied both inter-individual and intra-individual variation and estimated both contemporaneous and temporal connections between variables using an existing dataset that relied on convenience-based data of female students collected at three time points. The benefits of using a convenience sample are that it includes more variation in pain scores than a clinical sample. Given that genital pain is a dimensional construct, it is relevant to consider the total range of variability in pain scores by including data from people with genital pain but also from people without pain who might be progressing toward developing a genital pain disorder. Because cross-sectional network analyses are incapable of capturing the dynamic features of genital pain, we also included a time-panel model across the three time points to model the associations among symptoms that unfold over time.

Our selection of "symptoms" was based on previous theoretical and empirical work that ascribed an important role to arousal and lubrication, pain catastrophizing, pain coping (avoidance and endurance) and pain behavior (reflected in the frequency of sexual and intimate activity) as well as relationship satisfaction and sexual satisfaction, mental health (anxiety and depressive symptoms) and resilience factors such as psychological flexibility. Using a novel network approach, we thus aimed to specify how symptoms and associated factors influence each other to predict the frequency and intensity of genital pain, ultimately validating whether the Fear-Avoidance model holds true for understanding (the progression and persistence of) genital pain.

Method

Recruitment

A total of 1034 women was recruited at two Swedish universities. Female students in 66 classes were invited to stay in the classroom at the end of lectures and were provided oral and written information about the study. Those who agreed to participate provided written informed consent and were

invited to pick up a paper version of the survey from an open box in the classroom. After completing the survey, it was put in a closed envelope in a sealed box when leaving the classroom. The participants could also choose to complete the survey at home and leave it in a sealed box at the research lab. Coffee coupons were provided as incentive. The study was approved by the Regional Ethical Review Board in Uppsala, Sweden (DNr 2014-407).

Participants

The current study was based on data from three assessment points in a longitudinal study about genital pain in women. Data were collected between 2014 and 2015. Initial inclusion criteria were as follows: (1) being female (biological sex) between 18 and 35 years old and (2) sexually active (i.e., any type of sexual activity including genital contact) during the last month. The 58 women who did not fulfill these inclusion criteria were excluded from the study. In addition, 12 women were excluded due to a lack of informed consent. The remaining sample included 964 participants at baseline. At the 5- and 10-month follow-up, all participants from the baseline measurement were sent postal surveys (identical to the baseline questionnaire), a pre-paid return envelope, and written information about the study to their home address. Nonresponders were sent e-mail reminders after 2 and 4 weeks. After completing the follow-up survey, each respondent received a cinema ticket as an incentive.

After pre-processing, the analyzed total sample comprised 543 women (biological sex; after excluding individuals without a partner, $n = 615$ in a relationship, and listwise deletion $n = 543$ no missing data at T1) who were 23.7 years old on average (SD = 3.6; $18 \leq 23 \leq 35$). The majority (97%) reported being in a relationship with a man, while 2.6% and 0.4% were in relationships with women and partners of another gender, respectively. In addition, the majority of participants reported having no children (88.9%), while 10.9% reported having children and one participant did not provide a response (0.2%).

Measures

Swedish versions of all measures were used, translated using a formal procedure. Several constructs were included in the study survey, of which some were assessed in all participants while others were assessed only in participants who experienced recurring pain during coitus and/or during touch of the vaginal entrance during the last 3 and/or 6 months. To collect demographic and background information, participants were presented with a series of questions on age, having a partner, gender of partner, and having children. Sexual activity was measured as the frequency of sexual activity without coitus, the frequency of sexual activity with coitus, and the frequency of solitary sexual activity. Genital pain was measured with a series of items asking about the intensity of pain during first coitus and having experienced recurrent genital pain during the last 3, and during the last 6 months. In this study, we used the Female Sexual Function Index (FSFI) pain subscale (Rosen et al., 2000) as a pain outcome measure, but we did include the pain frequency item in sensitivity analyses to validate our models. See Table 1 for an overview of included constructs and their respective operationalization and Table 2 for descriptive statistics.

Statistical Analysis

Psychological Network Models

Network models present relations between variables, or "nodes," through graphical representation of associations between these nodes, with each link between nodes referred to as an "edge" (Borsboom et al., 2021; Burger, Isvoranu, et al., 2022; Isvoranu et al., 2022). Networks can include undirected and directed edges which specify the direction of an estimated association. Usually, cross-sectional data are analyzed for undirected associations while repeated (longitudinal or intensive) data can be analyzed for directed associations. Importantly, undirected cross-sectional networks allow insight into the average associations between variables for an average individual, while directed networks based on repeated measurement data allow insight into the temporal relationships between variables for the average individual. Only networks based on intensive experience sampling methods allow insight into potential concurrent and temporal association patterns of a specific individual (Burger, Ralph-Nearman, et al., 2022).

Cross-Sectional Data Analysis – Inter-Individual Differences Network

We modeled the cross-sectional data by means of Spearman correlations in the ggmModSelect estimation algorithm implemented in the *bootnet* package (Epskamp et al., 2018). We aimed to strike a balance between including as many participants as possible while also retaining as many potential inter-individual predictors of genital pain. First, we focused on participants who indicated having a partner, since the constructs relating to relationships were only available for coupled participants. We considered constructs relating to experiences within a (sexual) relationship to be important inter-individual covariates of genital pain (e.g., relationship satisfaction and frequency of intimacy). Second, we excluded those constructs which were conditional on the experience of recurrent genital pain in the modeling of the first network, since these constructs were available only for those participants who indicated having experienced recurrent genital pain in the last three and/or 6 months. We wanted to include women across the full pain spectrum, i.e., those who frequently, infrequently and never experienced pain, in order to be able to predict the experience of pain across all women. Third, we decided to include the FSFI Pain scale as the measure of the construct genital pain because it was available for all participants. The FSFI Pain scale covers both frequency and intensity of genital pain due to sexual activity in the last 4 weeks and the total subscale score represents a combination of the two.

The resulting cross-sectional model for all participants included the following constructs: (1) frequency of sexual activity excluding coitus (2) frequency of sexual activity including coitus (3) frequency of intimacy (4) relationship satisfaction (5) sexual satisfaction (6–10) desire, arousal, lubrication, orgasm, pain (11) pain catastrophizing (12 and 13) psychological inflexibility – pain avoidance and pain fusion

Table 1. Constructs and questionnaires – available in dataset and included in network analysis.

Construct	Questionnaire	Included in Network
Available for all participants		
Background Information	Study developed questions: (1) Age (years) (2) Having a partner (y/n) (3) Gender of partner (women/men/other) (4) Having children (y/n)	Not included
Sexual Activity	Study developed questions: (1) Sexually active (y/n) (2) Frequency sexual activity excl. coitus (1: less than once a month – 5: more than 4 times a week) (3) Frequency sexual activity incl. coitus (1: less than once a month – 5: more than 4 times a week) (4) (Frequency of) Solo sexual activity (y/n and 1: less than once a month – 5: more than 4 times a week)	(1) Frequency sexual activity excl. coitus (2) Frequency sexual activity incl. coitus
Sexual Function	Female Sexual Function Index (FSFI; Rosen et al., 2000): 6-point Likert scales, different anchors: the higher, the better. For ranges see right column.	FSFI (1) Desire (1.2–6) (2) Arousal (0–6) (3) Lubrication (0–6) (4) Orgasm (0–6) (5) Pain (0–6; reverse scored: the higher, the worse) *Main analysis, ordinal pain operationalization (see Figures 1, 2, and 3)*
Sexual Satisfaction	Global Measure of Sexual Satisfaction (GMSEX; Lawrance et al., 2020): 7-point Likert scale; Different anchors: higher scores indicate higher satisfaction; Range 5–35.	GMSEX
Presence Genital Pain	Study developed questions on: (1) Having experienced recurrent genital pain during the last 3 months (y/n) (2) and/or during the last 6 months (y/n)	Having experienced genital pain during the last 6 months *Sensitivity analysis total sample, binary pain operationalization (see supplementary material).*
Coping with General Pain	Psychological Inflexibility in Pain Scale (PIPS; Wicksell et al., 2008) Pain avoidance: "behavioral tendency to withdraw from planned and valued activities and social participation in response to pain or its expectation" (Barke et al., 2015, p. 2) Pain fusion: "entanglement of pain-related thoughts and actual experiences, i.e., the difficulty of distancing oneself from thoughts about the pain and its possible causes" (Barke et al., 2015, p. 2) 7-point Likert scales 1: Never true – 7: Always true; Range: 6–42.	PIPS (1) Pain avoidance (2) Pain fusion
Beliefs regarding General Pain	Pain Catastrophizing Scale (PCS): tendency for thoughts of rumination, magnification and helplessness regarding pain experience (Sullivan et al., 1995): 5-point Likert scale 0: Not at all – 4: All the time; Range: 0–52.	PCS Total
Relationship Satisfaction	Kansas Marital Satisfaction Scale (KMS): brief scale to assess relationship satisfaction (Schumm et al., 1983): 7-point Likert scale 1: Extremely dissatisfied – 7: Extremely satisfied; Range: 3–21.	KMS Total
Frequency of Intimacy	Quality of Dyadic Relationship (QDR; Ahlborg et al., 2009): 6-point Likert scale 1: Never – 6: Always; Range 5–30.	QDR
Depressive symptoms and Anxiety	The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983): 4-point Likert scale 0–3, Different anchors. One subscale for anxiety and one for depressive symptoms, each consisting of 7 items; Range 0–21 on subscale.	HADS (1) Depressive symptoms (2) Anxiety
Life Satisfaction	Satisfaction with Life Scale: global life satisfaction (SWLS; Diener et al., 1985): 7-point Likert scale 1. Strongly disagree – 7: Strongly agree; Range: 5–35.	SWLS
Only available for participants reporting genital pain		
Coping with Pain during Intercourse	CHAMP Sexual Pain Coping Scale (CSPCS; Flink et al., 2015) Tendency for strategies on how to cope with pain during intercourse (Flink et al., 2015): 7-point Likert scales 1: Never true – 7: Always true; Range: 4–28.	CSPCS: (1) Avoidance (2) Endurance (3) Facilitation/Alternative *Included in network on women experiencing pain only (see Figure 2 Panel b and c).*
Beliefs regarding Pain during Intercourse	FABQ-Intercourse (FABQ-I; Flink et al., 2015): 7-point Likert scale 0: Completely disagree – 6: Completely agree; range 0–54.	FABQ-Intercourse *Included in network on women experiencing pain only (see Figure 2 Panel b and c).*
Genital Pain Intensity	Study developed questions: (1) Genital pain intensity during the last 3 months (0: No pain at all – 10: Unbearable pain) (2) Genital pain frequency during the last 3 months (1: All the time – 4: Almost every week but pain-free some weeks; 5: pain free without genital touch) (3) Pain intensity during first coitus (0: No pain at all – 10: Unbearable pain)	Not included
Genital Pain Treatment	Study developed questions: (1) Seeking health care for genital pain (y/n) (2) Frequency of seeking health care for genital pain (Number of times) (3) Coping with genital pain (Different strategies)	Not included
Partner Responses to Pain during Intercourse	Multidimensional Pain Inventory- Significant Other Response Scale (MPI-SORS) of the West Haven-Yale Multidimensional Pain Inventory (Desrosiers et al., 2008; Kerns et al., 1985)	Not included

Table 2. Descriptive statistics of scales included in cross-sectional network analysis.

	Total[a] $n = 543$		Subsample 1[a] $n = 196$			Subsample 2[a] $n = 127$	
	M	SD	M	SD		M	SD
RelSat	18.4	2.9	18.1	2.8	RelSat	18.1	2.8
SexSat	29.5	5.9	27.9	6.2	SexSat	27.7	6.4
FreqIn	27.4	3.9	27.1	3.9	FreqIn	27.3	3.5
FreqSex	2.4	1.1	2.4	1.1	FreqSex	2.4	1.2
FreqCoit	3.2	1.0	3.1	1.1	FreqCoit	3.0	1.0
PainFus	14.4	5.8	15.2	6.6	PainFus	15.2	6.6
PainCat	16.5	10.0	17.7	10.8	FeAvBe	17	9.9
PainAv	17.8	8.0	19.5	9.5	CopAv	9.3	5.3
–	–	–	–	–	CopEnd	13.4	6.3
–	–	–	–	–	CopFac	18.1	5.8
Des	3.8	1.1	3.7	1.2	Des	3.6	1.1
Arous	4.8	1.2	4.5	1.3	Arous	4.5	1.3
Lub	5.3	1.1	4.9	1.3	Lub	4.8	1.3
Org	4.6	1.4	4.5	1.5	Org	4.4	1.6
PainFSFI[b]	1.0	1.4	1.8	1.6	PainFSFI[b]	1.8	1.5
LifSat	25.9	5.2	24.6	5.3	LifSat	24.6	5.4
Anx	8.0	4.0	8.6	4.2	Anx	8.9	4.2
Dep	3.3	2.8	3.7	3.0	Dep	4.0	3.0

[a]Figure 1 represents the total analyzed sample ($n = 543$), Figure 2a represents Subsample 1 including women experiencing genital pain in combination with the original constructs ($n = 196$). Figure 2b,c represent Subsample 2 including women experiencing genital pain in combination with constructs only available for women experiencing pain ($n = 127$). [b] Note that the FSFI Pain scale is reverse scored here compared to the FSFI scoring algorithm. Higher scores reflect more rather than less pain.
FSFI Pain (PainFSFI); FSFI Desire (Des); FSFI Arousal (Arous); FSFI Lubrication (Lub); FSFI Orgasm (Org); PIPS Pain Avoidance (PainAv); PIPS Pain Fusion (PainFus); PCS Total (PainCat); GMSEX (SexSat); KMS Total (RelSat); QDR Total (FreqIn); Frequency sexual activity excl. coitus (FreqSex); Frequency sexual activity incl. coitus (FreqCoit); SWLS (LifSat); HADS Depressive symptoms (Dep); HADS Anxiety (Anx); CSPCS Avoidance (CopAv); CSPCS Endurance (CopEnd); CSPCS Facilitation/Alternative (CopFac); FABQ-I (FeAvBe).

(14) depressive symptoms (15) anxiety (16) life satisfaction. See Table 1 for the respective measures.

We ran several sensitivity analyses for the cross-sectional analyses on the overall sample and included these in the supplementary material. First, we checked whether the associations with genital pain were sensitive to the operationalization of pain (see supplementary material A). Instead of the FSFI pain scale, we included a binary variable indicating whether a participant considered herself as having experienced recurrent pain during coitus and/or during touch of the vaginal entrance in the last 6 months. We chose the last 6 months instead of 3 months because the prevalence of reported pain was higher for 6 than 3 months (35% reported pain in the last 6 months; 30% in the last 3 months), maximizing power and estimation precision for these analyses. Second, we checked whether the relationships with FSFI pain changed when we excluded more general background constructs (i.e., did not control for differences in depressive symptoms, anxiety, and life satisfaction; see supplementary material B). Third, we checked whether our inferences were dependent on the type of estimation procedure (all implemented in the *bootnet* and *psychonetrics* package; Epskamp, 2020b; Epskamp et al., 2018) which differ in their tendency for bias in estimating associations and their possibilities for treating missing data (Isvoranu & Epskamp, 2023): edge estimation via non-regularized model selection (ggmModSelect), edge estimation via model selection and regularization (EBICglasso), edge estimation via regularized regressions (MGM lasso), and via model selection and full information maximum likelihood estimation (*psychonetrics* ggm and FIML estimation; see supplementary material C).

We then focused on women who reported experiencing recurrent genital pain and re-estimated the above network in this group to study predictors of the frequency or intensity of pain in women who experience recurrent genital pain and to see whether the associations found in the total sample would hold in the subsample of women experiencing pain. We also checked whether the associations changed with different construct operationalization by exchanging the general pain coping scales (PCS and PIPS) with genital pain-specific coping scales (FABQ-I and CSPCS: avoidance, respectively) in the network of women with recurrent genital pain. Finally, we added another genital pain-specific coping scale (CSPCS: endurance, facilitation/alternative) to the network of women with recurrent genital pain to check whether controlling for other coping strategies would change the pattern of predictive associations of genital pain.

Panel Data Analysis – Temporal, Contemporaneous, and Between Persons Networks

We estimated the panel data across three time points (T1-T3) by means of dynamic factor model estimation (*dlvm1/panelgvar* function; *psychonetrics* package) in combination with Full Information Maximum Likelihood Estimation (FIML) to allow for missing data. The estimation algorithm models a random intercept but fixed effect cross-lagged panel model as a multilevel GVAR model with effect decomposition into temporal, contemporaneous, and between-persons networks (Epskamp, personal communication, March 12, 2020a). For a more detailed explanation of the estimation paradigm, we refer to Epskamp (2020b). In the Results section, we describe what kind of statistical effects the three networks represent.

We applied the recommended (Epskamp, 2020b) three-step model selection process to retrieve the final model: (1) we modeled the data with the *panelgvar* function to retrieve an initial model (2) pruned relationships by (recursively) removing associations that were not significant (alpha = .05) and refitting the model and (3) subsequently applied a stepwise

model search algorithm which optimizes the BIC (Epskamp, 2020b). We compared the initial model to the selected model by means of the BIC and selected the best fitting model. We also plotted 95% confidence intervals for the model parameters of the first model (before pruning and model search; see supplementary material D) to corroborate the results of the model selection (see supplementary material E) and ran bootstrapped stability analysis to assess how stable the estimated relationships were across random subsamples of the overall sample (75% sampling scheme with replacement; see supplementary material F).

The variable inclusion in the analysis of the temporal relationships followed a theoretically informed approach. We included those constructs in the temporal model which best reflected the components of the cognitive-behavioral model of pain (Thomtén & Linton, 2013). We chose (1) FSFI pain as the representative of genital pain (2) PCS pain catastrophizing as the representative of thoughts about pain (cognition) (3) FSFI lubrication as the representative of genital response; (4) PIPS pain avoidance as the representative of avoiding coitus (motivation); and (5) frequency of coitus as the representative of sexual in/frequency (behavior). Unfortunately, there was no construct available which could represent pelvic muscle tension, making the pain cycle incomplete.

Results

Analyses on Total Sample

Cross-sectionally and among all women, lubrication (FSFI Lubrication; see Figure 1) emerged as one of the strongest and most stable direct predictors of pain (FSFI Pain) across bootstrapped samples (included in 100% of estimations; see first plot in supplementary material G) as well as across sensitivity analyses (binary pain operationalization, differences in included background variables, estimation algorithms; see supplementary material A–C). Among the coping-related variables, general pain catastrophizing (PCS) emerged as a direct predictor of pain (FSFI Pain) in the overall sample. However, this association was only marginally stable across bootstrapped samples (i.e., included in 44% of estimations) and differences in included background variables, and rather unstable across pain operationalizations and estimation algorithms. In sum, these results suggest that women with more frequent/intense pain consistently reported less lubrication than women with no or less frequent/intense pain and that women with more frequent/intense pain reported a somewhat greater tendency for general pain catastrophizing than women with no or less frequent/intense pain.

Sexual satisfaction (GMSEX) and anxiety (HADS Anxiety) also emerged as direct predictors of pain (see Figure 1) in the overall sample. The associations suggest that women who reported more frequent/intense pain also tended to report lower sexual satisfaction and higher anxiety compared to those women who reported less frequent/intense or no pain. However, the associations of sexual satisfaction and anxiety with pain were unstable across bootstrapped subsamples (i.e., only included in 58% and 56% of bootstrapped subsamples in the overall sample, respectively). These associations did not emerge systematically across the other estimation algorithms nor the other pain operationalization (see supplementary material C and A).

Analyses on Women with Recurrent Genital Pain

Among women with recurrent genital pain, lubrication (FSFI Lubrication; see Figure 2) emerged as one of the strongest and most stable direct predictors of pain (FSFI Pain) across bootstrapped samples (included in 64% of estimations; see second to fourth plot in supplementary material G). In contrast to the overall sample, in women experiencing recurrent genital pain (see Figure 2, Panel a–c), general and coitus-related pain avoidance (PIPS Pain Avoidance in Panel a: 48% CSPCS Avoidance in Panel b and c: 48% and 32%) and specific coital pain fear-avoidance beliefs (FABQ-I in Panel b and c: 96% and 97%) emerged as direct predictors, instead of general pain catastrophizing (PCS in Panel a), with coital pain-fear avoidance beliefs showing more stable associations with pain than general pain avoidance.

As was the case in the total sample, the direct association between sexual satisfaction (GMSEX) and pain (FSFI Pain) emerged in the networks of women who reported experiencing recurrent genital pain (see Figure 2, Panel a) before controlling for other types of coping strategies (compare Figure 2, Panel a with Panel b and c). This means that, even within a group of women who reported experiencing recurrent genital pain, the frequency and intensity with which pain is experienced directly predicts differences in sexual (dis)satisfaction. Also, among women who reported experiencing recurrent pain, more frequent/intense pain (FSFI Pain) was associated with more anxiety (HADS Anxiety; see Figure 2 Panel b and c versus a), although this was dependent on which type of coping was controlled for (see Figure 2, Panel b and c for pain-specific coping variables versus Panel a for general pain coping variables). Note that these relationships were rather unstable across bootstrapped subsamples (Satisfaction Panel a: 31% and Anxiety Panel b and c: 39% and 31%; see second to fourth plot in supplementary material G, respectively).

In addition, among women reporting recurrent genital pain, frequency of coital and non-coital sex emerged as rather strong and relatively stable direct predictors of pain, with more pain being directly associated with less frequent coital and more frequent non-coital sex (Figure 2 Panel a–c: 86%/78%/78% for coital sex and 38%/42%/42% for non-coital sex). This suggests that, among these women, those who experienced most pain might opt for non-coital rather than coital sex compared to those women who reported less pain.

Furthermore, direct associations with pain did not change when we included more pain-specific coping variables (CSPCS endurance and facilitation/alternative; see Figure 2 Panel c versus b) and the additional pain-specific coping variables did not show direct associations with pain (FSFI Pain). Finally, it is important to note that pain showed very low to average predictability in all networks, which means that even though some variation in reporting pain could be predicted by the variables included in the networks, the networks omitted

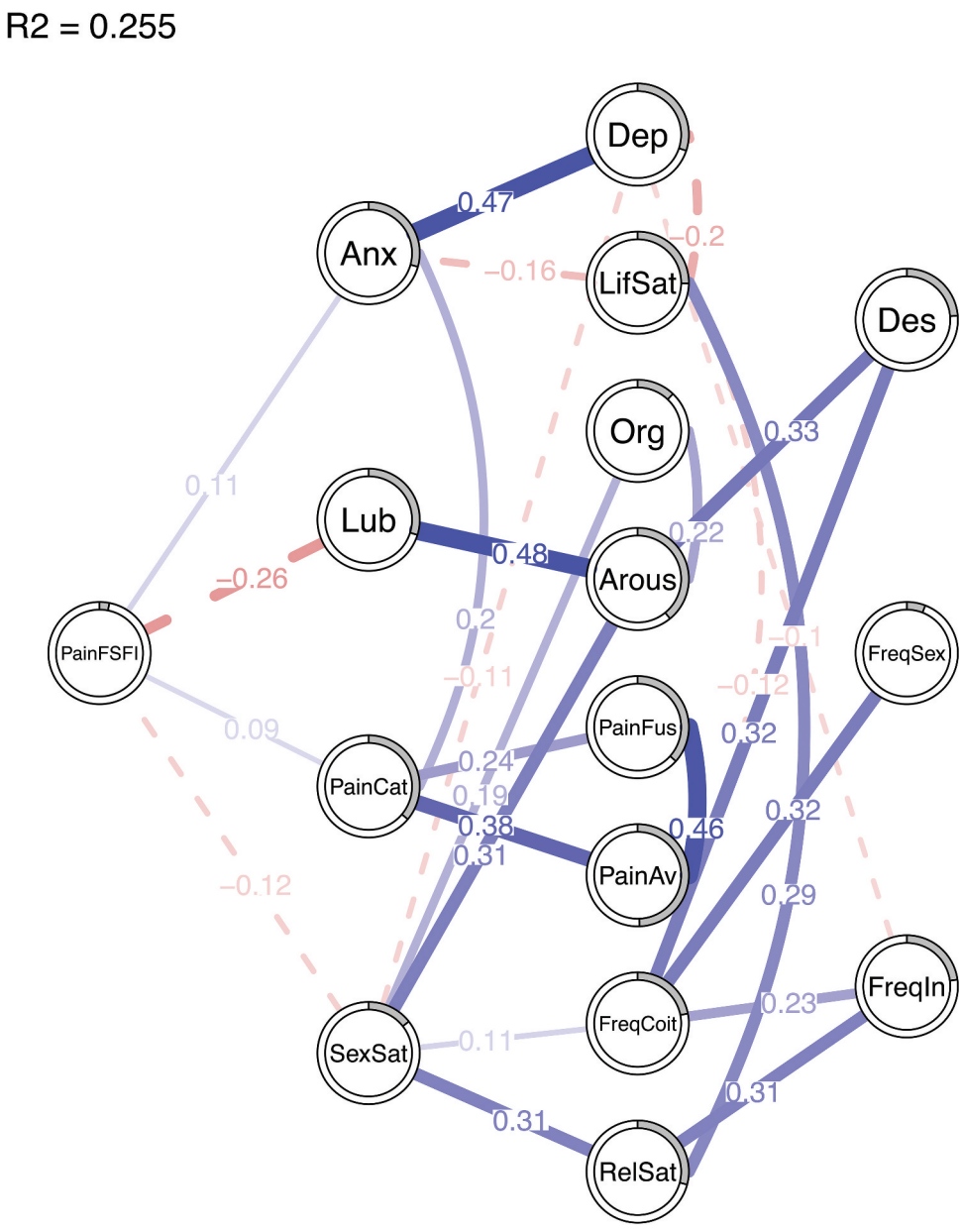

Figure 1. Cross-sectional network based on data from women who do and do not experience recurrent genital pain ($n = 543$). Red (dashed) connections indicate negative associations, blue (full) connections indicate positive associations. The R2 (25.5%) indicates the amount of explained variance in the network across all variables. The rings around the nodes indicate the amount of explained variance of that variable by the variables included in the network. FSFI Pain (PainFSFI); FSFI Desire (Des); FSFI Arousal (Arous); FSFI Lubrication (Lub); FSFI Orgasm (Org); PIPS Pain Avoidance (PainAv); PIPS Pain Fusion (PainFus); PCS Total (PainCat); GMSEX (SexSat); KMS Total (RelSat); QDR Total (FreqIn); Frequency sexual activity excl. coitus (FreqSex); Frequency sexual activity incl. coitus (FreqCoit); SWLS (LifSat); HADS Depressive symptoms (Dep); HADS Anxiety (Anx).

variables which might be able to explain the residual variation in pain.

Panel Data Analysis – Temporal, Contemporaneous, and Between-Persons Networks

Table 3 shows descriptive statistics of the variables included in the panel data analysis. Over time, only general pain catastrophizing (PCS) significantly predicted more pain (FSFI Pain) for the average woman (see Figure 3, Panel a and supplementary material E). Similar to the cross-sectional analyses, general pain catastrophizing emerged as a predictor of pain in the overall analysis but showed instability upon further inspection. Across re-estimations on subsamples, more general pain avoidance (PIPS Pain Avoidance) at T-1 emerged as a temporal predictor of more pain at T, rather than general pain catastrophizing (PCS). However, this association showed large variation across bootstrapped estimations (see supplementary material F).

Lubrication (FSFI Lubrication) emerged as the strongest predictor of pain (FSFI Pain) within potentially shorter time frames than the collected 5 and 10 months, followed by frequency of coitus and general pain avoidance (PIPS Pain Avoidance; see Figure 3, Panel b), because after controlling for the temporal effects, the remaining residuals in pain from each woman's pain over time was associated with residuals in

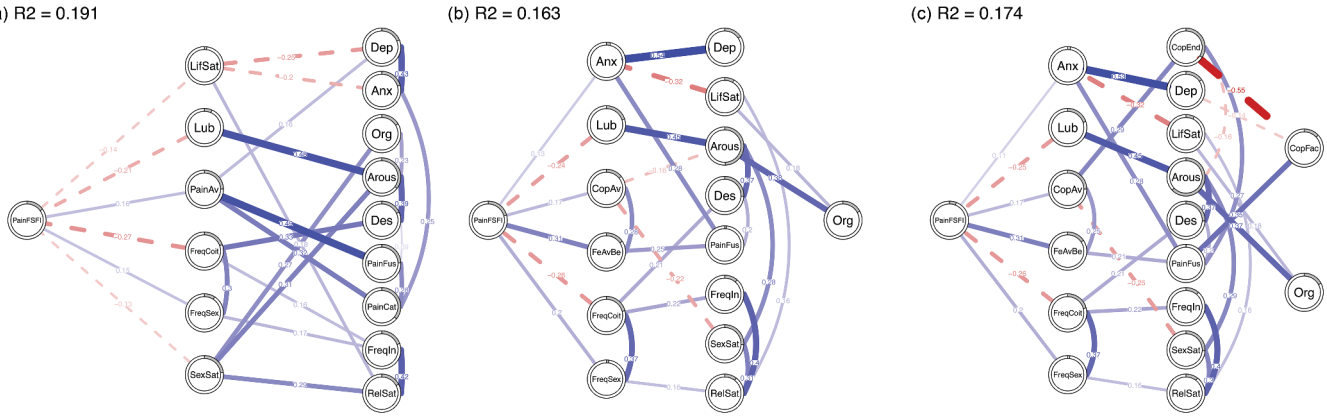

Figure 2. Cross-sectional networks based on data from women who experienced recurrent genital pain ($n = 196$; $n = 127$; $n = 127$ after listwise deletion). FSFI Pain (PainFSFI); FSFI Desire (Des); FSFI Arousal (Arous); FSFI Lubrication (Lub); FSFI Orgasm (Org); PIPS Pain Avoidance (PainAv); PIPS Pain Fusion (PainFus); PCS Total (PainCat); GMSEX (SexSat); KMS Total (RelSat); QDR Total (FreqIn); Frequency sexual activity excl. coitus (FreqSex); Frequency sexual activity incl. coitus (FreqCoit); SWLS (LifSat); HADS Depressive symptoms (Dep); HADS Anxiety (Anx); CSPCS Avoidance (CopAv); CSPCS Endurance (CopEnd); CSPCS Facilitation/Alternative (CopFac); FABQ-I (FeAvBe).

Table 3. Descriptive statistics of scales included in panel data analysis using available and complete data at three time points (panel data analysis uses FIML to deal with missing data).

	T1		T2		T3	
	M	SD	M	SD	M	SD
FreqCoit ($n_{T1-T3} = 543, 329, 298$)	3.2	1.0	2.9	1.1	2.7	1.0
Complete n across $T = 224$	3.2	1.0	2.9	1.1	2.7	1.0
PainCat ($n_{T1-T3} = 543, 327, 300$)	16.5	10.0	16.5	10.3	17.4	10.3
Complete n across $T = 224$	18.1	10.4	17.4	10.5	18	10.3
PainAv ($n_{T1-T3} = 543, 327, 299$)	17.8	8.0	17.8	7.9	17.3	8.2
Complete n across $T = 224$	18.2	7.8	17.8	7.7	17.4	7.9
Lub ($n_{T1-T3} = 543, 328, 302$)	5.3	1.1	5.1	1.4	5.0	1.5
Complete n across $T = 224$	5.3	1.0	5.1	1.5	5.1	1.4
PainFSFI[a] ($n_{T1-T3} = 543, 328, 303$)	1.0	1.4	1.2	1.7	1.4	2.0
Complete n across $T = 224$	1.0	1.5	1.2	1.8	1.4	2.0

[a]Note that the FSFI Pain scale is reverse scored here compared to the FSFI scoring algorithm. Higher scores reflect more rather than less pain.
FSFI Pain (PainFSFI); FSFI Lubrication (Lub); PIPS Pain Avoidance (PainAv); PCS Total (PainCat); Frequency sexual activity incl. coitus (FreqCoit).

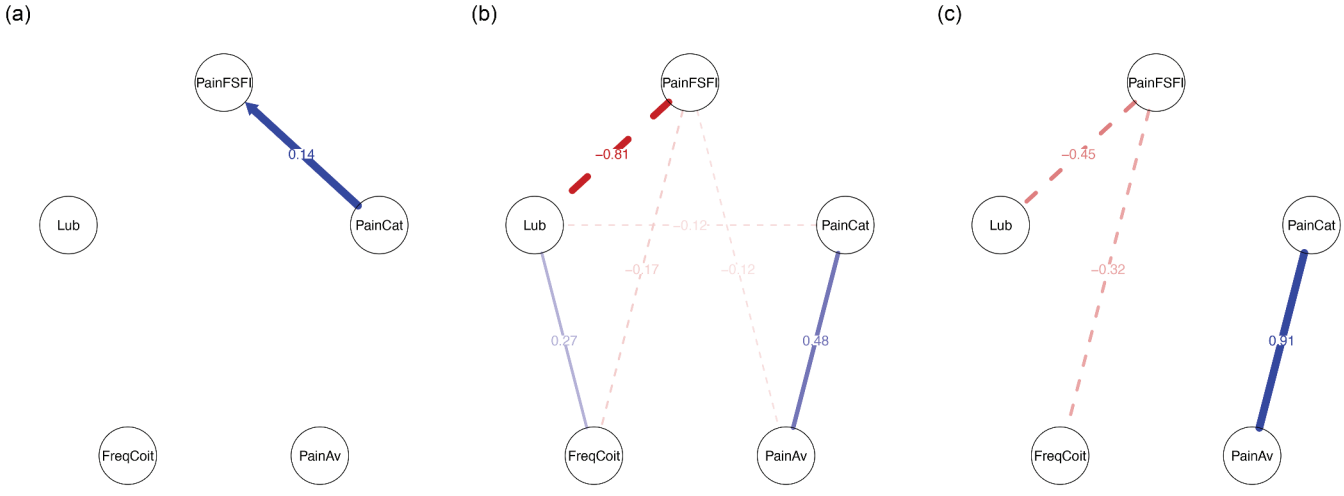

Figure 3. Temporal (panel a), contemporaneous (panel b), and between-persons networks (panel c) based on data from three time points 5 months apart. FSFI Pain (PainFSFI); FSFI Lubrication (Lub); PIPS Pain Avoidance (PainAv); PCS Total (PainCat); Frequency sexual activity incl. coitus (FreqCoit).

lubrication (FSFI Lubrication), coital frequency, and general pain avoidance (PIPS Pain Avoidance). Lubrication (FSFI Lubrication) also showed the strongest association with pain (FSFI Pain) across re-estimations on sub-samples of the contemporaneous model (see supplementary material H). More general pain catastrophizing (PCS) still predicted less lubrication (FSFI Lubrication), but not more pain (FSFI Pain), within shorter time frames and this association appeared across subsamples (see Figure 3, Panel b and supplementary material H). Interestingly, more general pain avoidance (PIPS Pain Avoidance) predicted less (rather than more) pain (FSFI Pain) within shorter time frames and did so across bootstrapped subsamples, which might indicate that women who reported a tendency to avoid pain might have experienced less pain in the short-term through avoiding coital sexual activity (see Figure 3, Panel b and supplementary material H).

The between-persons network (Figure 3, Panel c) indicated that those who, on average, reported more frequent/intense pain (FSFI Pain) across all three time points did not, on average, report more general pain catastrophizing (PCS) or more general pain avoidance (PIPS Pain Avoidance), but did, on average, report less lubrication (FSFI Lubrication) and less frequent coital sex. This implies that the strongest predictor of pain which emerged in the cross-sectional network at one time point, replicates when analyzing the average of measurements across three time points.

Discussion

The present study used a novel data-driven network approach to study the key components of the cognitive-behavioral model of genital pain and explore their interconnections. Our results showed that lubrication, pain catastrophizing, pain avoidance and fear-avoidance beliefs, as well as sexual satisfaction, anxiety, and frequency of coital and non-coital sex predicted pain, with lubrication being the most consistent direct predictor across groups, covariates, and cross-sectional and panel-data networks. The network of women with recurrent genital pain showed a similar pattern as the network of the total sample, except that general and coital pain avoidance and coital fear-avoidance beliefs rather than general pain catastrophizing predicted pain directly. Furthermore, frequency of coital and non-coital sexual activities played a more prominent role in predicting pain in the network of women with recurrent pain compared to the network of all women.

Across all estimated models, self-reported lubrication was the most stable and recurrent predictor of pain, suggesting that women who report pain also report less physical arousal. Although unaroused intercourse has been put forward as a key element in the cascade of genital pain, evidence supporting a lack of genital arousal in women with pain is rather inconsistent, particularly when considering lab-based research (Brauer et al., 2006). Note, however, that our study included a measure of self-reported lubrication, which is markedly different than lab-based measures of genital arousal which, in fact, measure vaginal blood flow and not lubrication. Furthermore, measuring genital arousal while watching a pornographic movie when sitting alone in a laboratory context does not align with the real-life experience of pain during sexual activities with a partner (Dewitte, Schepers, et al., 2018). Based on clinical observations, it has been reported that women often feel as if their vagina "falls dry" when a penis approaches their genital area (ter Kuile & Weijenborg, 2006; ter Kuile et al., 2010). In combination with increased pelvic floor muscle tension, lack of lubrication turns vaginal penetration into an unpleasant and painful experience, which evokes a cascade of pain-related fear and dysfunctional coping responses, ultimately leading to increased and prolonged pain (Lahaie et al., 2015; Spano & Lamont, 1975; ter Kuile et al., 2010). Unfortunately, the current study did not include a measure of pelvic floor muscle tension to actually test whether the combination of pelvic floor hypertonicity and lack of lubrication would act as a critical bridge to trigger downstream activation of other symptoms. This means that we could not test the full pain circle as proposed by cognitive-behavioral models. More research is needed, both survey-based and lab-based, to examine how fear, pelvic floor muscle tension, and sexual arousal operate together to generate and maintain pain (Dewitte & Meulders, 2023).

Together with general pain avoidance, an indicator of psychological inflexibility, general pain catastrophizing was found to predict more pain, suggesting that both factors represent dysfunctional ways to cope with and control pain. Ruminating about pain and pessimistic beliefs about pain-related experiences interfere with one's belief in (and actual) ability to cope with pain (Petrini & Arendt-Nielsen, 2020). Pain catastrophizing can have a negative impact on pain coping behavior but might even serve as a coping strategy in itself to elicit emotional and social support from others, thereby reinforcing the pain and subsequently undermining one's adaptability to cope with the pain (Hadjistavropoulos et al., 2011; Sullivan et al., 2001). Pain catastrophizing and avoidance might work in tandem because catastrophic beliefs about, for instance, vaginal penetration are maintained as long as women avoid sexual opportunities to disconfirm these beliefs (Petrini & Arendt-Nielsen, 2020; Vlaeyen et al., 2016). Hence, when catastrophizing is associated with avoidance behavior, this may lead to an increase in pain over time. The effectiveness of therapy-aided exposure for women with a subtype of genital pain (i.e., lifelong vaginismus) provides support for the interconnection between catastrophic thinking and avoidance of coitus (ter Kuile et al., 2009). This treatment is directed at reducing avoidance by systematically exposing women to the feared stimulus, i.e., vaginal penetration, resulting in clinically relevant reductions in negative penetration beliefs, coital fear, coital pain, and sexual distress (ter Kuile et al., 2015). When catastrophizing is reduced and eventually eliminated, avoidance behavior as a coping strategy is no longer necessary and vice versa.

Note that the association between general pain catastrophizing and pain, emerging in the total sample, appeared to be unstable across women, that is, more dependent on idiosyncrasies of specific subgroups of women. For instance, other types of disadvantageous pain coping predicted more intense and frequent pain in women reporting recurrent genital pain. In the latter group, general pain catastrophizing was not directly related to genital pain, but general and coital pain avoidance and coital fear-avoidance beliefs were. This might

be explained, in part, by methodological reasons because the measurement of fear-avoidance beliefs was specifically directed toward sexual experiences, whereas pain catastrophizing was measured as a general tendency to ruminate about and interpret (any type of) pain in a catastrophic way.

Other direct associations with pain were found for sexual satisfaction and general anxiety, both in the total sample and the subgroup of women reporting recurrent genital pain. Findings on the association between genital pain and sexual satisfaction have yielded mixed findings so far, with some studies showing that women with genital pain report lower levels of sexual satisfaction than a control sample (Smith & Pukall, 2011), and other studies showing that women with genital pain do not necessarily report impaired levels of sexual satisfaction (Aerts et al., 2016; Rosen et al., 2010), although the pain does limit their sexual life. Results suggest that women reporting more pain tend to report less sexual satisfaction, which makes sense given the high levels of distress and negative emotions that are experienced during sex (Nimbi et al., 2020). The fact that relationship satisfaction did not emerge as a directly associated factor in the genital pain network, while sexual satisfaction did, fits with earlier findings that the general climate of the relationship is not necessarily affected by the genital pain experience (Smith & Pukall, 2011). The disabling and distressing impact of genital pain thus seems to be more closely directed to the sexual domain of the relationship.

The association between general anxiety and genital pain can be understood from a transdiagnostic perspective, with general anxiety being critically involved in the etiology and maintenance of a range of disorders, including genital pain (Van den Bergh et al., 2021). Higher levels of anxiety coincide with a higher vulnerability to process threat-related information, resulting in a higher incidence of negative emotions, distress, and dysfunctional coping (Van den Bergh et al., 2021). Accordingly, general anxiety could be regarded as a promising target of intervention to make progress in preventing its consequences and improving treatment effects.

If we were to speculate based on the direction and pattern of all effects estimated in the initial temporal network (i.e., before model selection; see supplementary material D), general pain catastrophizing could act as a predictor, general pain avoidance and pain as a mediator, and frequency of coitus and lubrication as endpoints across the sampling time of 10 months. The observed pain cycle then appears to start with pain catastrophizing and avoidance predicting more pain, which leads to less lubrication and less frequent coitus. The experience of less lubrication then predicts more pain and less frequent coitus within shorter time frames. This suggests that the feedback loops among the sexual experience variables appear to occur on shorter time frames than those between coping vulnerability factors and sexual experiences. In other words, coping seems to act as a predisposing or precipitating factor and affected sexual experiences as a perpetuating factor of the experience of more genital pain. Although this dynamical sequence of interrelations between cognition, behavior, and pain outcomes provides support for the fear-avoidance-based CBT model of genital pain (ter Kuile et al., 2010), it should be noted that these directed effects are speculative, since none other than the association between general pain catastrophizing and pain survived the model pruning and search algorithm. We do repeat that we did not include a measure of pelvic floor hypertonicity, which implies that the pain circle we tested in this study is incomplete based on the available variables.

Based on the direction of temporal associations and pattern of associations in the contemporaneous and between-persons network respectively, we speculate that sexual experiences, pain cognition, and pain coping present connected but independent areas of potential therapeutic intervention. With such therapeutic approaches, we intervene on the pain cycle from different angles at the same time and try to affect predisposing/precipitating and perpetuating factors simultaneously. These results support a cognitive-behavioral approach with a focus on the sexual experience and cognitive-behavioral risk factors, which fits with current therapeutic approaches that have been proven effective (Bergeron et al., 2016). Our results do not indicate how such cognitive-behavioral therapy should be implemented or what exact interventions the treatment should entail. Pain catastrophizing and pain avoidance are predicted by other factors (depressive symptoms, anxiety, life satisfaction). In addition, anxiety predicted pain in some of the analyses, suggesting that direct pain predisposing factors (pain coping) might be changed by intervention on their predisposing factors such as anxiety proneness or neuroticism more generally.

Limitations and Strengths

In this study, we demonstrated the importance of analyzing inter-individual and intra-individual variation in sexual experiences across and within subpopulations (i.e., both in those who do and do not experience the phenomenon of interest), including a wide variety of theoretically defined variables and using a novel network analytic approach. Yet, there are a few limitations to take into account when interpreting the results. First, we did not sufficiently include tests for alternative hypotheses, for example partner reactions or partner-related inadequate coping, which were available only for a very small subsample of the genital pain group. Relational and social variables are important predictors of pain and important points of intervention (Dewitte, Borg, et al., 2018; Rosen & Bergeron, 2019). Our data cannot provide a test of these possibilities. More highly powered research among women with genital pain would need to compare the importance of all different predictors among each other (individual pain coping, sexual satisfaction, partner-related aspects). Furthermore, given that genital pain is a shared stressor among partners and the dyadic interaction between partners impacts on the genital pain experience, it is relevant to explore the networks of both partners facing genital pain (Dewitte, Schepers, et al., 2018; Dewitte et al., 2011; Rosen & Bergeron, 2019). The way in which one partner's symptom network interacts with the other partner's network may lead to the alteration of both partners' networks, making the study of extended networks a highly interesting avenue for future research.

Second, our main analyses were limited to using the FSFI pain subscale as the dimensional operationalization of genital

pain which covers only one aspect of the genital pain experience. While this limits the generalizability of the results, we did ascertain that our main conclusions held for another binary operationalization of genital pain. The fact that the binary operationalization showed different patterns of associations with the pain coping variables indicates the importance of varied and valid construct operationalization depending on the specific research goal (see also Wammen Rathenborg et al., 2019). Also note that we did not measure other, more general, types of (chronic) pain in our sample of women, which might have been relevant to consider in association with general pain predictors such as pain catastrophizing and general pain avoidance. Furthermore, we relied on a convenience sample of women recruited from universities, which limits the generalizability of our results.

Third, future panel data analyses should ascertain that the time-lag between measurements is adequate to capture the dynamics between the sexual experience variables across the temporal lags; with the current dataset we were only able to pick up these potential associations based on the residual variation across three time points (5-months apart).

Fourth, the fact that only one temporal relationship survived the model search and pruning strategy might be caused by the decrease in observed data across the three time points despite using FIML estimation. Future research should try to collect sufficient data across all time points to be able to detect all potential temporal relationships.

Conclusion

We can conclude that self-reported lubrication emerged as the most important predictor of pain across women and within women at shorter periods of time. In addition, various forms of pain coping predicted pain across time within women. These findings support the CBT fear-avoidance model of pain and suggest that the key problem of genital pain centers around women being insufficiently aroused during intercourse and inadequate ways of pain coping. These are critical targets of current CBT treatments and should be developed further, with a particular emphasis on integrating measures of pelvic floor hypertonicity and interpersonal (partner) aspects in the future.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

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