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Sexual Health

Supplementary Material

Sex film viewing, but not hypersexual concerns, are associated with more sexual arousal in anticipation of an intimate partner experience

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Appendix A

Psychometrics supporting single-item hypersexual behavior problem measure: Item response theory and convergent validity

Study 1: Item response theory

Hypersexual problem are often studied in the lab using sex film models of sexual behaviors. However, difficulties reported around sex and sex films often are not identified by laboratory tests. People report difficulty controlling sexual urges that lead them to view adult films more than they intended, yet those who report the less control of their sexual urges actually exhibit more control during laboratory testing (1,2). Similarly, individuals distressed about their viewing frequency of adult films exhibited sexual cue inhibition, rather than heightened cue reactivity (3–5) inconsistent with the heightened sensitivity observed in drug and process addictions. Some claim their frequent sex film viewing caused erectile problems with a partner or to films portraying common sex acts. Laboratory research (6,7), some cross-sectional questionnaires (e.g., 8), and the only nationally representative data to date (9) found no relationship (or found an inverse relationship where more viewing is associated with fewer erectile problems) between erectile functioning and viewing of sex films. Although sometimes blamed for relationship dissolution, persons who view adult films once a week or more (curvilinear effect) also are less likely to divorce over time (10). Finally, those who report feeling “addicted” to sex films do not report viewing more sex films relative to those who were not distressed (e.g., 11). Minimally, skepticism appears warranted when individuals report difficulty regulating their use of sex films. Regulating actual sexual behaviors is less well-characterized.

Many factors have been proposed to contribute to hypersexual behavior problems (e.g., fantasies interfere with work, sex used to cope with negative emotions), but these were

developed atheoretically. It remains unclear whether all the aspects currently included in conceptualization of hypersexual problems are necessary to characterize the underlying construct. We performed a secondary analysis on a widely-published data set, the Hypersexual Behavior Inventory (HBI) in an attempt to (1) replicate the factor structure and (2) reduce items. We used an item response theoretic approach to determine to identify the items that contribute the most information to this proposed underlying construct. Specifically, a large ($n = 183$) group of men presenting to clinics with hypersexual or non-hypersexual complaints completed a structured clinical interview and questionnaires about their sexual behaviors and feelings, including the HBI. A graded response model analysis identified a single item discriminating ($d = 4.28$) most strongly. Follow-up analyses suggested that the single item was useful for predicting clinical impressions of significant hypersexual problems. Hypersexuality might be better conceptualized as a feeling of repeated failures to decrease distressing sexual behaviors.

Participants

The patients used in this study consisted of 189 men ($n = 175$) and women recruited from three separate outpatient clinics and described in publications (12). Participants were selected based on (a) a primary complaint of hypersexual behavior reported during intake and assessment or a general psychiatric diagnosis (b) willingness to participate in research, as reflected in consent provided at the outset of the treatment process. Participants tended to be caucasian, $n = 163$ (86.2%) middle-aged ($M = 40.9$, $SD = 13.0$), and all were male. Sexual orientation identify included heterosexual, $n = 148$ (78.3%), homosexual, $n = 21$ (10.0%), and bisexual, $n = 12$ (6.3%). Paraphilic disorder was screened, but not present. On the basis of clinical interview participants were classified as meeting criteria for hypersexual disorder as proposed for DSM-5 ($n = 114$). Most of those diagnostic candidates ($N = 59$) reported that the sexual behavior they

struggled with the most involved partners (as opposed to solitary activities such as masturbation or viewing erotic films). The comparison group was comprised of those with another Axis-1 diagnosis. The alternative would have been to recruit additional participants who did not meet criteria for any disorder or those with no diagnosis who also denied distress (e.g., community). Such “super-normal” control groups can introduce other confounds (13). Those high on hypersexual measures also have shown elevated measures of depression (14) and anxiety (15), which makes those with high scores on hypersexual measures more difficult to discriminate from other psychiatric patients. In summary, it is a better, more rigorous test of the HBI to use a psychiatric comparison group rather than a non-diagnostic comparison group.

Materials

Hypersexual Behavior Inventory (HBI). The HBI is thought to assess core features of hypersexual dysfunction. These overlap completely with the ICD-11 diagnosis for Compulsive Sexual Behavior (16). The HBI is a 19-item Likert scale with 5 response options per question (1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, and 5 = Very Often). Higher scores (range 19 to 95) reflecting greater hypersexuality. Scale items were designed to cover a proposed DSM-5 classification, including using sex for reducing negative emotions (e.g., “Doing something sexual helps me cope with stress”), unsuccessful attempts to control sexual thoughts, urges, and behaviors (e.g., “Even though I promised myself I would not repeat a sexual behavior, I find myself returning to it over and over again”), and impairment in social, occupational, or other important areas of functioning (e.g., “My sexual activities interfere with aspects of my life such as work or school”).

Hypersexual Disorder-Diagnostic Clinical Interview (HD-DCI).

Given the limitations of clinical judgment (17), a structured clinical interview was created to

improve operationalization of the criteria proposed to the American Psychiatric Association to define a “Hypersexual Disorder” (18). One rater conducted the interview, while the second independently rated criteria from the interview (in person or by later audio recording). Inter-rater reliability was high (Kappa = .93; $p < .001$, 95% CI = .78 to 1.0; intraclass correlation = .95) for a subset of the patients ($n = 50$) in which it was recorded.

Data Analysis

Graded Response Models are used when more than one response is possible and meaningful. (Education tests usually only discriminate correct and incorrect answers, whereas psychological studies usually interpret meaning at each level of the response.) GRM are generally more robust than classical test theory, even when several deviant (minimally related to the construct measured) items are present (19). In GRM, the discrimination parameter shows how good each item is at differentiating between subjects of different trait levels across response options.

In GRM, the probability of responding to each response option on an item is

(1) Category 1: $P_{i1} = 1 - P_{i1}^*(\theta)$

(2) Category 2: $P_{i2} = P_{i1}^*(\theta) - P_{i2}^*(\theta)$

and so on.

Data in this study were modeled in R (v 2.14) using the Latent Trait Models (v .9-7) module (20). The range of endorsement across all 19 items of the HBI for 1 was 5.3 to 22.8% and for 5 was 15.3 to 44.4%. Given that these cannot be easily dichotomized, the Graded Response Model (21) of the Latent Trait Models module was used. GRM assumes trait stability during testing and that respondents are not merely guessing. The latter assumption likely is met because individuals were providing information about themselves with expressed interest in the

outcome of the measure: in other words, participants had both the information and the motivation to not guess. Interpretations have been suggested for the discrimination parameter in IRT: $d < 0.20$, very low discrimination; $0.21 < d < 0.40$, low discrimination; $0.41 < d < 0.80$, moderate discrimination; $0.81 < d < 1$, high discrimination; $d = 1$, very high discrimination (22).

The GRM approach assumes a single underlying construct, and this structure must be demonstrated to support the appropriateness of GRM. To test the latent structure, the R module `nFactors` (23) was used in an exploratory factor analysis including the 19 items of the HBI. Specifically, a parallel analysis of a correlation matrix with 100 replications was conducted. The eigenvalues then were subjected to quantitative scree tests rather than visual discrimination (24). Multiple tests were calculated to allow examination of solution convergence. These included a parallel analysis (25), acceleration, and optimal coordinates. The acceleration criterion was defined as the second derivative of the eigenplot curve, which defined where the scree joint occurred. The optimal coordinates approach uses regression plotted to the eigen points to define the point at which information can no longer be extrapolated. For the proposed GRM approach to be appropriate, a one-factor solution is required.

Finally, Receiver Operating Characteristic (ROC) curves were used to examine the ability of the full and reduced scale versions to accurately classify individuals on diagnostic status. An implementation of ROC in R was used for statistical comparisons of different ROC performance (26).

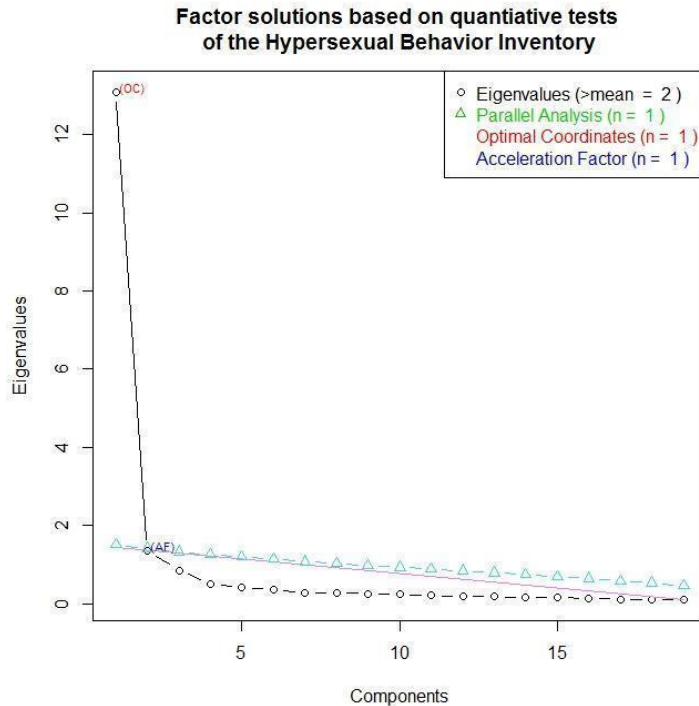
Results

Exploratory factor analysis: Understanding the dimensionality of Hypersexual Behavior

The exploratory factor analysis used maximum-likelihood and varimax rotation (factanal in Stats library in R 4.3). Three quantitative tests of factor fit based on eigenvalues are plotted

(Figure 1). All three tests converged on a one-factor solution. Thus, the GRM analyses appear appropriate for these data and are presented next.

Figure 1.



Graded response model: Selecting short-form items

The GRM was used to evaluate the utility of each of 19 original items on the HBI. Table 1 and Figures 3 and 4 present the descriptive results of this analysis. The discriminability parameter was markedly higher for item 2, which is used in subsequent testing for its ability to predict the Hypersexual Disorder-Diagnostic Clinical Interview outcome and risk behaviors of interest. As can be seen from the criteria curve for item 2 (Figure 3), this was largely due to the high value gained when individuals responded “Never” or “Very often” to the question “Even though I promised myself I would not repeat a sexual behavior, I find myself returning to it over and over again”. In other words, when participants chose one of these extreme responses, it provided a high level of information about how they were likely to respond on the rest of the

questionnaire. The other item portrayed in Figure 3 is provided for contrast. This item had low discriminability. Extreme responses still provided more information about their variance on the rest of the items/construct, but far less than for the highly discriminable item 2. The total IIF across responses options is visually represented in Figure 4. This shows the clear strong predictive utility for item #2.

Table A1.

Questionnaire item	M	SD	d_i	b_1	b_2	b_3	b_4	b_5
1. I use sex to forget about the worries of daily life.	3.49	1.30	2.67	-1.70	-0.95	-0.02	0.88	-1.70
2. Even though I promised myself I would not repeat a sexual behavior, I find myself returning to it over and over again.	3.94	1.24	4.28	-1.78	-1.19	-0.52	0.30	-1.78
3. Doing something sexual helps me feel less lonely.	3.54	1.27	1.92	-2.09	-0.98	-0.22	0.88	-2.09
4. I engage in sexual activities that I know I will later regret.	3.71	1.24	2.52	-1.99	-1.21	-0.20	0.58	-1.99
5. I sacrifice things I really want in life in order to be sexual.	3.29	1.33	2.48	-1.42	-0.72	0.29	0.99	-1.42

6. I turn to sexual activities when I experience unpleasant feelings (e.g. frustration, sadness, anger).	3.69	1.24	3.28	-1.84	-1.07	-0.22	0.64	-1.84
7. My attempts to change my sexual behavior fail.	3.88	1.16	2.80	-2.13	-1.34	-0.55	0.51	-2.13
8. When I feel restless, I turn to sex in order to soothe myself.	3.60	1.29	2.61	-1.70	-1.02	-0.15	0.69	-1.70
9. My sexual thoughts and fantasies distract me from accomplishing important tasks.	3.11	1.35	2.14	-1.40	-0.40	0.43	1.19	-1.40
10. I do things sexually that are against my values and beliefs.	3.60	1.29	2.13	-1.97	-1.16	-0.06	0.66	-1.97
11. Even though my sexual behavior is irresponsible or reckless I find it difficult to stop.	3.72	1.32	3.43	-1.62	-0.98	-0.36	0.52	-1.62

12. I feel like my sexual behavior is taking me in a direction I don't want to go.	3.82	1.30	2.67	-1.69	-1.25	-0.39	0.42	-1.69
13. Doing something sexual helps me cope with stress.	3.73	1.20	2.26	-2.10	-1.35	-0.30	0.67	-2.10
14. My sexual behavior controls my life.	3.22	1.28	2.56	-1.35	-0.68	0.32	1.30	-1.35
15. My sexual cravings and desires feel stronger than my self-discipline.	3.71	1.27	3.47	-1.76	-1.08	-0.22	0.56	-1.76
16. Sex provides a way for me to deal with emotional pain I feel.	3.48	1.27	2.27	-1.69	-1.06	-0.02	0.96	-1.69
17. Sexually, I behave in ways I think are wrong.	3.59	1.26	2.67	-1.73	-1.08	-0.13	0.77	-1.73
18. I use sex as a way to try and help myself deal with my problems.	3.34	1.27	2.79	-1.62	-0.76	0.13	1.08	-1.62

19. My sexual activities

interfere with aspects of my 2.91 1.38 1.78 -1.02 -0.27 0.58 1.56 -1.02
life such as work or school.

Figure A2.

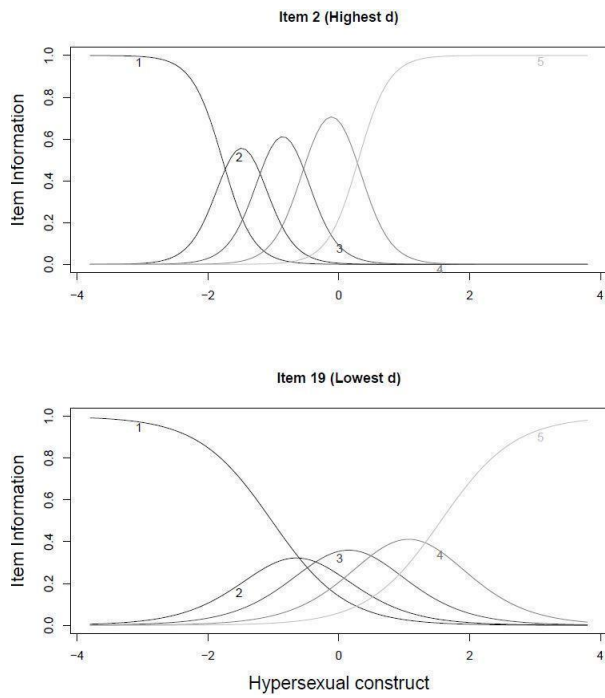
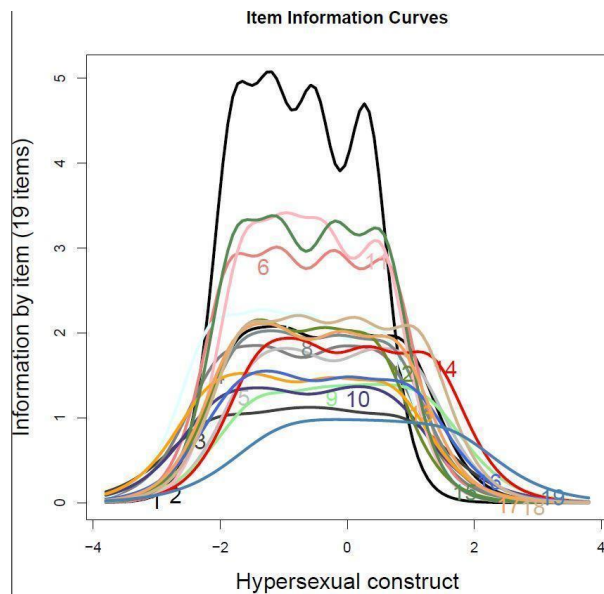


Figure A3.



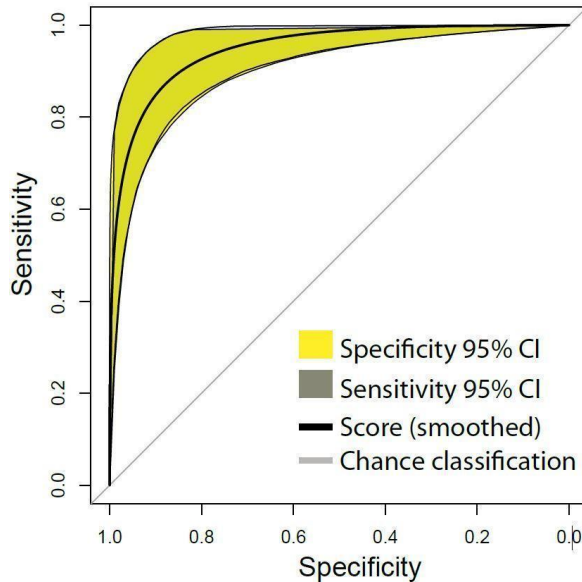
ROC: Predicting structured interview findings

According to the structured interview, 125 participants should be classified as currently hypersexual and 48 as having no history of hypersexuality. Using the full, 19-item scale, a cut-off of 62 resulted in sensitivity = 94% and specificity = 88% with AUC = .93. Recall from the Graded Response Model results (above) that Item 2 was shown to have the highest discriminability. Given its high discriminability, item 2 alone was compared to the total scale score for its ability to correctly classify participants as currently hypersexual or never hypersexual according to the Hypersexual Disorder-Diagnostic Clinical Interview. The area under the curve for the single-item measure (AUC = .91) was significantly less than the area under the curve for the full-scale measure ($Z = -2.67, p = .01$). When using a cut-point of 3.5 on the single-item measure, the sensitivity (75%) and specificity (88%; see Figure 4) also decreased. This means that item 2 alone would likely accurately classify anyone who was not hypersexual accurately.¹

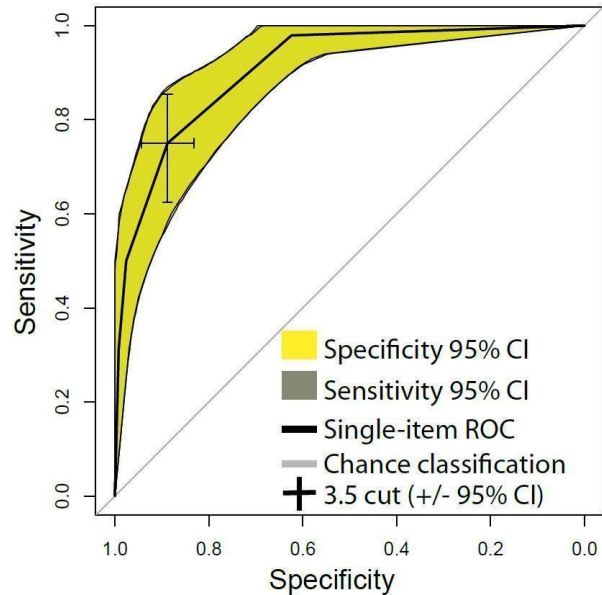
¹ Including the top 3 items (#2, #11, and #15) still resulted in a significant decrease in predictive utility ($Z = -2.3, p = .02$) from the 19-item scale.

Figure A4.

19 item scale



1 item scale



Conclusions

A single item from the HBI (“Even though I promised myself I would not repeat a sexual behavior, I find myself returning to it over and over again.”), identified using a Graded Response Model approach, captured much of the variance in the underlying scale construct. This single item reasonably classified those who were not ultimately diagnosed as having a hypersexual disorder and, to a lesser degree, those who ultimately were classified by a structured clinical interview. The hypersexuality construct hinges primarily on the feeling one is unable to stop one’s own behaviors.

The presented factor analysis failed to replicate two previous publications. First, Reid and colleagues (27) reported a three-factor solution for the HBI. However, statistical conclusions in that paper were influenced by a stated desire to retain a certain number of items per scale to reflect clinical concerns. Inter-correlations between the HBI subscales also remained very high

between factors. In a second study using a confirmatory approach, a 3-factor solution appeared to fit the data well (28). However, many items loaded strongly on multiple scales, suggesting factor separation might not have been adequately addressed. The current study makes a strong case, using three quantitative characterizations of the factor structure, that hypersexuality as measured by the HBI is unidimensional. This also is consistent with other research suggesting that hypersexuality is best conceptualized as one, continuous dimension (29). Hypersexuality appears better characterized by a single latent construct. When a reduced form is required, a single item appears to be a reasonable assessment of this continuous construct.

Compulsions broadly have been characterized by “significant difficulty inhibiting these behaviors” (30). This also is a core feature proposed for “compulsive” sexual behaviors. One diagnostic proposal (rejected for inclusion in the American Diagnostic and Statistical Manual-5) described a core symptom as “repetitively tried to control or reduce their sexual behaviors but not been able to successfully” (18). More recently, “Compulsive sexual behavior disorder” was added to the International Classification of Disorders (ICD) 11 in the “Impulsivity” disorders section (31). The ICD diagnosis also describes compulsive sexual behaviours as “characterized by a persistent pattern of failure to control intense, repetitive sexual impulses or urges resulting in repetitive sexual behaviour.” This criterion also is present in questionnaires measuring proposed frequent sex pathology. For example, the Compulsive Sexual Behavior Inventory includes the item “How often have you had trouble controlling your sexual urges?” (32), the Sexual Compulsivity Scale includes “I have to struggle to control my sexual thoughts and behaviors” (33), and a clinical “sex addiction” assessment includes “Persistent desire or unsuccessful efforts to stop, reduce or control [sexual behaviors]” (34). Consensus appears to exist regarding this core feature.

This item not only reflects the core of “sexual compulsivity” pathology models, but the core of behavioral compulsivity problems more generally. “Repeated failures to resist impulses, drives, or urges despite longer-term harm” were described as “most clinically useful” criterion for compulsive behavior assessments (35). “Unsuccessful attempts to control amount” of a behavior also carries a very low risk for false positives (36). Put another way, this criterion is relatively stringent, so not likely to be endorsed unless significant distress exists. Given the statistical and theoretical support for this item, it was a reasonable way to quantify sexual compulsivity in the current study.

Study 2: Convergent validity and replication

External validity data already have been published for the full scale, which we do not intend to replicate. However, a psychometric exercise testing whether this single item also suggests some convergent validity may bolster support for the single-item. We examine the relationship of this single item assessing concerns about hypersexual behavior to two items within the current sample: romantic attachment and depressive symptoms.

Romantic attachment difficulties are well-replicated to correlate with measures of hypersexual concerns. For example, men engaging in frequent, distressing sexual behaviors are claimed to have “sex addiction” reflected by anxious and avoidant romantic attachment styles (37). Women distressed by frequent sexual behaviors frequently report attachment ruptures thought to underlie their adult romantic difficulties (38). Some therapists have suggested that increasing secure attachment with one romantic partner is key to treating frequent, distressing sexual behaviors (39). Notably, attachment difficulties are not specific to distress about frequent sexual behaviors. More frequent sex film viewers also report more anxious and avoidant attachment (40). More anxious attachment styles have been associated with earlier age of

intercourse initiation, masturbation, infidelity, and condom use consistency (41). Evidence suggests that attachment styles interact with gender to determine whether the effects of viewing sex films are associated positively or negatively with relationship satisfaction (42). Specifically, among those who are more anxiously attached, pornography use associated with higher relationship satisfaction in men and lower relationship satisfaction in women.

Relatedly, those who are upset about behaviors they feel are hypersexual often report symptoms of depression. A review of 19 samples ($n=3,783$) reported an average correlation of $r = .34$ (range = .11 to .67) between hypersexual concern and depression symptoms (43). Convergent validity support for our single item-measure would be suggested by a similar magnitude relationship between the hypersexual distress item and a measure of depressive symptoms.

To further examine the single-item measure of sexual compulsivity (described above), we used the new data to characterize the relationship between hypersexual distress and attachment difficulties, and hypersexual distress and depressive symptoms. Specifically, the single-item measure of hypersexual distress would be supported if it is positively related to more anxious and avoidant romantic attachment styles and depressive symptoms. Spearman's rho (avoiding distribution assumptions) between these variables is hypothesized to be positive.

Methods

Attachment theory suggests that individuals develop a trait-like pattern of relating to others emotionally as children that extends to adulthood. Attachment style is commonly quantified using two 18-item scales (total 36 items) reflecting anxious attachment and avoidant attachment (Fraley, Waller, & Brennan, 2000). Each item is rated as to "how you feel in emotional relationships" on a Likert scale from 1 (Strongly disagree) to 7 (Strongly agree). Examples include "I often worry that my partner doesn't really love me." and "I find it easy to depend on

romantic partners.” Item order was pseudo-randomized. Scores are calculated by averaging each item, so each scale score ranges from 1 to 7.

Depressive symptoms are quantified as a continuous measure. We used the Quick Inventory of Depressive Symptoms (44). This 16-item scale asks participants to endorse a series of suggested depression symptoms (e.g., “Sleep onset insomnia”) along 4-point scales specific to the item (e.g., “Never takes longer than 30 minutes to fall asleep”, “Takes at least 30 minutes to fall asleep less than half the time”, “Takes at least 30 minutes to fall asleep, more than half the time”, “Takes more than 60 minutes to fall asleep, more than half the time). The symptoms are specific to DSM-IV, grouped into 9 areas of 1) sad mood; 2) concentration; 3) self-criticism; 4) suicidal ideation; 5) interest; 6) energy/fatigue; 7) sleep disturbance (initial, middle, and late insomnia or hypersomnia); 8) decrease/increase in appetite/weight; and 9) psychomotor agitation/retardation. Each item is scored 0 to 3 per domain, resulting in a total scale score ranging from 0 to 27.

These rest of the methods are the same as described in the main body of the current study.

Results

Sexual compulsivity was positively related with measures of both anxious ($\rho = .25, p < .001$) and avoidant ($\rho = .33, p < .001$) attachment (see Figure 3). Sex film viewing was not related to anxious or avoidant attachment (all $\rho < .02$).

Figure A5. Hypersexual concerns item and attachment difficulties.

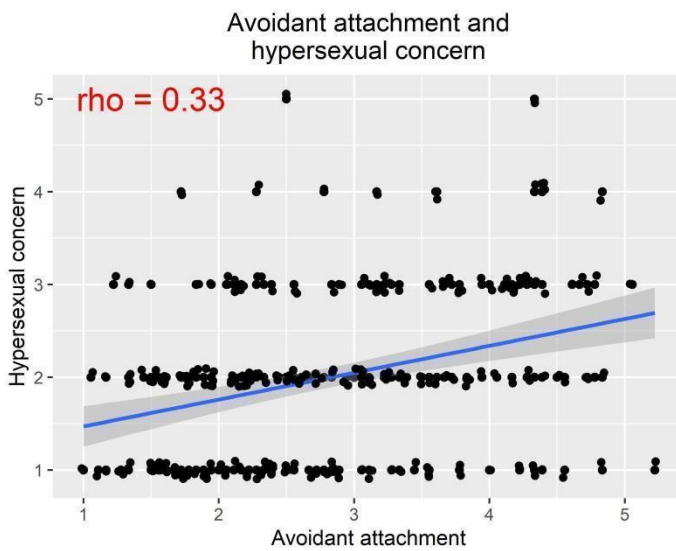
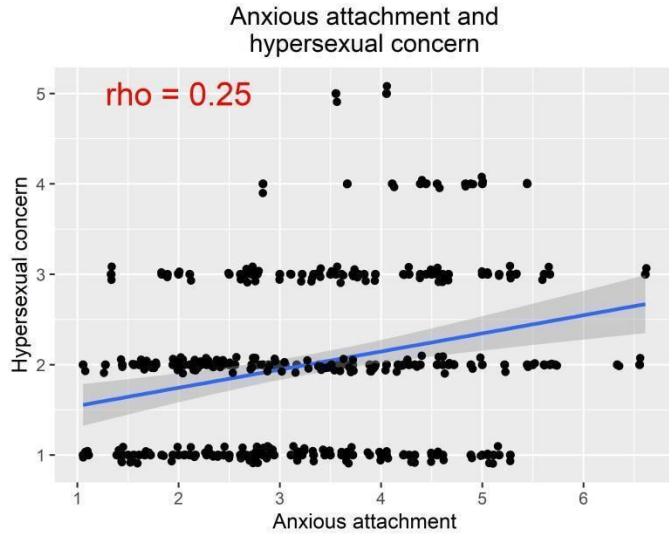
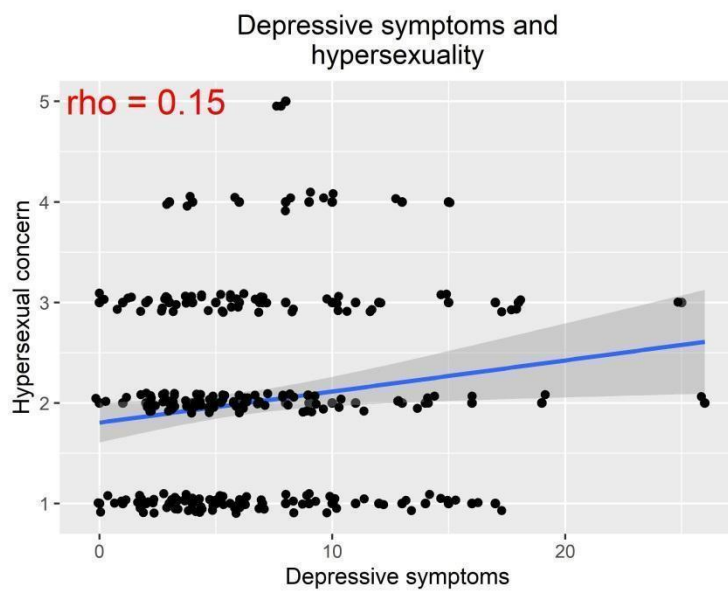
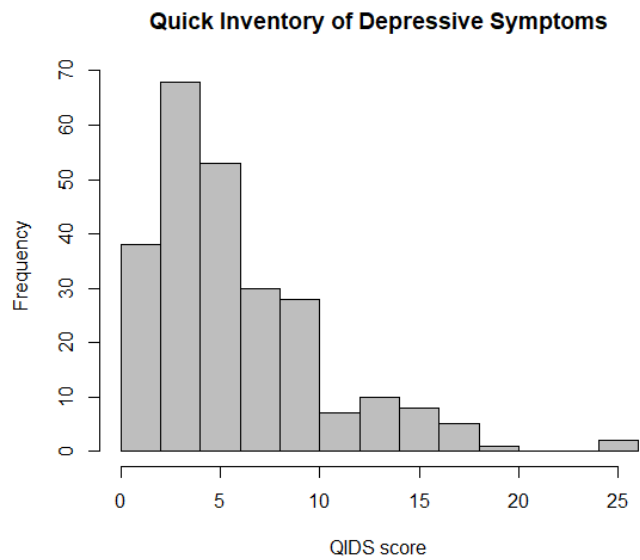


Figure A6. Hypersexual concern item and depression concern.

This sample was characterized by relatively low rates of depressive symptoms, skewed positively (1.4).



The relationship between concerns about hypersexual behaviors and depressive symptoms was small ($\rho = .15$, $p = .02$).

Conclusions

Our question regarding feeling out-of-control sexually replicated previous studies, in that it was positively associated with both attachment difficulties (anxious and avoidant) and depressive

symptoms. Our sample had relatively low depressive symptoms, which might have contributed to the lower relationship with depressive symptoms compared to a treatment-seeking sample.

Appendix B

Orgasmic Meditation partner positions during stroking.



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