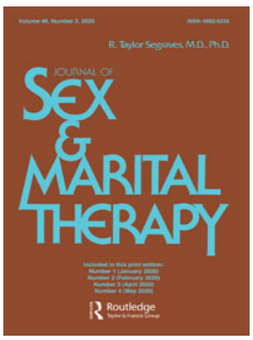

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Development and Validation of a Measure of Responsive Sexual Desire

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ABSTRACT

According to the incentive motivation model, sexual desire does not occur spontaneously but can be triggered by sexual stimuli and stems from one's experience of sexual arousal. Until now, research into responsive sexual desire has been challenged by the lack of measures capturing desire that emerges following sexual arousal. The aim of this study was to validate the 18-item Report of Behavior and Feelings–Desire (RBF-D) scale in a sample of 291 women (M_{age} = 22.41, SD = 5.82) with varying degrees of sexual desire. Items on the RBF-D were selected to reflect 5 aspects of responsive sexual desire: sexual activity with a primary partner, sexual desire for a primary partner, sexual activity with other persons, sexual desire for other persons, and autoerotic activities. A 5-factor solution was confirmed via exploratory structural equation modeling. Internal consistency of 4 out of 5 factors was good. Convergent validity was established via small to medium associations of the RBF-D factors with other measures of sexual desire. Low and nonsignificant correlations with depression and sexual inhibition supported the discriminant validity. The RBF-D is a valid and reliable measure that can be useful in clinical and research settings where assessment of responsive sexual desire and behavior is needed.

Sexual desire and arousal disorders affect up to one third of women (Mitchell et al., 2013; Quinn-Nilas, Milhausen, McKay, & Holzapfel, 2018). Because clinical studies show significant overlap in sexual desire and arousal concerns (Basson et al., 2003; Segraves & Segraves, 1991) and qualitative studies suggest that many women do not differentiate between sexual desire and arousal (Graham, Sanders, Milhausen, & McBride, 2004), the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*; American Psychiatric Association, 2013) expanded the criteria of the former hypoactive sexual desire disorder (HSDD) to include polythetic criteria, allowing for multiple different expressions of low sexual desire under the new category, female sexual interest/arousal disorder (FSIAD). Although there is no universal acceptance of FSIAD in place of HSDD, a recent study showed that 73% of women with HSDD also meet the criteria of the new FSIAD diagnosis (O'Loughlin, Basson, & Brotto, 2018).

Despite their relevance for women's sexual functioning, there is a lack of empirically satisfactory models explaining how women's sexual desire and arousal interact. Contemporary models of sexual response, such as the incentive motivation model (Both, Everaerd, & Laan, 2007; Toates,

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2009), conceptualize desire as emerging from activation of the sexual response system, including physical and psychological sexual arousal, unlike traditional, linear models of sexual response that situate desire as spontaneous and preceding sexual arousal (Kaplan, 1977; Masters & Johnson, 1966). Several studies suggest that the experience of sexual arousal is associated with increases in sexual desire among women without arousal/desire difficulties (see Chivers & Brotto, 2017 for a review). To date, the relationship between sexual arousal and desire remains controversial, in part because of a lack of research on the topic. Thus, a main goal of the current study was to facilitate research on the phenomenon.

Existing measures of responsive sexual desire assess either solitary desire (i.e., desire for self-stimulation or masturbation) or dyadic desire (i.e., desire for sexual activity with a partner) with single items (e.g., "How strong is your desire for sex with a partner?" using a 0-to-9 Likert scale; Dawson & Chivers, 2014a; Timmers, Dawson, & Chivers, 2018). Comprehensive measures of responsive sexual desire have yet to be validated, or have not been used to investigate the relationships among activation of sexual arousal and the experience of sexual desire among women with sexual difficulties. To further investigate the relationship between women's sexual desire and arousal, the aim of this study was to evaluate the psychometric properties of a revised questionnaire intended to assess women's sexual behavior and feelings related to responsive sexual desire.

Conceptualizations of women's sexual desire and arousal

According to the classic linear model of sexual response, sexual desire is a prerequisite for sexual arousal. Spontaneous sexual desire motivates people to seek out competent sexual stimulation, which results in arousal and eventually orgasm (Both et al., 2007; Kaplan, 1977). Qualitative studies reveal that many women, especially those with arousal and desire difficulties, do not identify with this "desire then arousal" framework (Brotto, Heiman, & Tolman, 2009; Graham et al., 2004; Jabs & Brotto, 2018), and studies comparing circular and linear sexual response cycles find that women with low desire are likely to reject the linear concept (Ferenidou, Kirana, Fokas, Hatzichristou, & Athanasiadis, 2016; Giraldi, Kristensen, & Sand, 2015; Sand & Fisher, 2007). Consistent with the view that women not only experience sexual desire spontaneously but also readily relate to encounters in which arousal precedes desire, the incentive motivation model (Both et al., 2007; Toates, 2009) proposes that sexual desire is not spontaneous but rather responsive; that is, sexual desire is triggered by sexual stimuli and stems from one's experience of arousal. According to this model, biopsychosocial parameters—such as awareness of genital sexual response, a preferred sexual stimulus, relationship quality, and capacity to respond to sexual stimuli—moderate the relationship between sexual arousal and sexual desire. Until now, however, research has been hampered by the lack of a measure to capture desire that emerges following sexual arousal.

Existing measures of sexual desire

In their review, Dawson and Chivers (2014b) discussed whether sexual desire is best characterized as a trait (i.e., stable) or a state-like (i.e., contextually dependent) construct. Existing evidence suggests that sexual desire, even when assessed using trait measures, shows marked change over the life span (Eplov, Giraldi, Davidsen, Garde, & Kamper-Jørgensen, 2007; Hamilton, Kulseng, Traeen, & Lundin, 2001), including over the course of romantic relationships (Klusmann, 2002) and is influenced by sex hormones (e.g., peri- and postmenopause, pregnancy, and postpartum; Avis et al., 2009; Bullivant et al., 2004; Fischman, Rankin, Soeken, & Lenz, 1986; Pauleta, Pereira, & Graça, 2010; Rupp et al., 2013). As such, one might question whether sexual desire demonstrates the degree of stability expected for a trait.

Stark et al. (2015) used the term *trait sexual motivation* to describe an enduring and stable "driving force behind sexual engagement, pp. 1081" that is mainly influenced by genetic factors and predisposing sociocultural influences (e.g., religiosity). In their view, trait-like sexual desire might interact with sexual cues to determine whether a state of sexual desire is experienced. Thus, measures like the Trait Sexual Motivation Questionnaire (Stark et al., 2015) might not be suitable to assess responsive sexual desire following exposure to incentivized sexual cues. The same criticism can be used against measures assessing *sexual excitation*, which describes how easily one becomes sexually aroused or interested in sexual activity when exposed to sexual stimuli like an attractive partner (Bancroft, Graham, Janssen, & Sanders, 2009). Although sexual excitation is relevant for women's sexual functioning (Velten, 2017; Velten, Scholten, Graham, & Margraf, 2017), recent studies show high temporal stability of this factor as measured with the Sexual Excitation/Sexual Inhibition Inventory for Women (Graham, Sanders, & Milhausen, 2006; Velten, Scholten, Graham, & Margraf, 2016; Velten, Zahler, Scholten, & Margraf, 2019). Thus, although sexual excitation has been described as part the dual control model of sexual response that acknowledges the relevance of both state and trait components, existing questionnaires tap into the trait component of sexual excitation only, and thereby challenge the applicability of sexual excitation in the context of responsive sexual desire.

The most commonly used measures to assess sexual desire in women include the Desire subscale of the Female Sexual Function Index (FSFI; Rosen et al., 2000), the Sexual Interest and Desire Inventory–Female (SIDI-F; Clayton et al., 2006), and the Sexual Desire Inventory (SDI; Spector, Carey, & Steinberg, 1996). The FSFI measures sexual desire with two items asking about the frequency and level of desire over the past 4 weeks (Rosen et al., 2000). A clinical cut-point of 5 or less was found to identify women with clinically low levels of sexual desire (Gerstenberger et al., 2010). The SIDI-F is a 13-item clinician-administered assessment tool validated for use with clinical populations. The item domains assess frequency and intensity of responsive and spontaneous sexual desire and arousal over the past month (Clayton et al., 2006). An adapted self-report version has been used in studies with women with distressing low sexual desire (e.g., Brotto & Basson, 2014; Paterson, Handy, & Brotto, 2017) and was found to have good internal consistency with Cronbach's alpha ranging from .80 to .81. The SDI is a widely used 15-item questionnaire to assess solitary and dyadic sexual desire over the past month (Spector et al., 1996). Although three SDI items refer to the frequency sexual thoughts, and desire for sexual activity alone or with a partner, the remaining items require participants to evaluate how strong their desire is—for example, compared to other people—and how important they deem fulfillment of their desire.

None of the described measures of sexual desire distinguish, in a systematic way, between sexual desire for primary current partners or other persons. In addition, all measures require women to retrospectively estimate indicators of sexual desire for a given week or day over a 4-week period. As such, these measures may be prone to recall bias (Graham, Catania, Brand, Duong, & Canchola, 2003) and may not capture responsive desire, that is, feelings of sexual motivation that emerge after direct exposure to an effective (or competent) and incentivized sexual stimulus. In addition, because the highest answer categories for many of the SIDI-F items are "daily" or "more than once a week," levels of desire that exceed these anchors cannot be assessed with this instrument. Although several SDI items assess solitary sexual desire, behaviors reflecting sexual motivation beyond masturbation, such as use of erotica (i.e., sexually suggestive material such as books or movies), are not directly assessed.

Responsive sexual desire

Although the concept of responsive sexual desire was only relatively recently coined by Basson (2000), researchers have been assessing sexual desire emerging after exposure to sexual cues since

the early 1970s. Schmidt, Sigusch, and Schafer (1973) were the first to assess responsive desire using an 11-item measure assessing occurrence of coitus, masturbation, orgasm, sexual dreams, sexual fantasies (excluding during coitus/masturbation), talking about sex, arousability, psychosexual stimulation (e.g., use of erotica), going to bars/discotheques, sexual tension, and wish for sexual activity. Women showed increases in coitus, number of orgasms, sexual fantasy, arousability, talking about sex, use of erotica, sexual tension, and desire for sexual activity in the 24 hr after reading a sexual story compared to the 24 hr prior (at baseline) but did not report increases in masturbation, sexual dreams, and going to dance bars.

Both et al. (2004) employed a similar design, assessing occurrence of sexual behaviors following laboratory participation in a sexual response paradigm. Their measure of responsive desire included six items. The first three items asked how often the participant (a) had feelings of sexual desire, (b) had sexual fantasies or daydreams, and (c) searched for sexual incentives. The next three items asked how often the participant (a) masturbated, (b) had sexual intercourse, and (c) had sexual contact without intercourse. Analyses collapsed into desire (first three items averaged) and activity (latter three). In their small samples ($n = 10$) and between-subjects study, women exposed to sexual stimuli showed increases in sexual activity versus women exposed to a sexually neutral stimulus.

Goldey and van Anders (2012) assessed responsive sexual desire following a guided, imagined sexual scenario; an unstructured sexual fantasy; or neutral condition using single items that queried solitary and dyadic desire following exposure to these stimuli. This team also administered items from the SDI as a measure of trait sexual desire. Although included as a trait measure, the Solitary Sexual Desire factor of the SDI showed some sensitivity to sexual stimulation: Desire for solitary sex was higher following the imagined sexual scenario and the neutral stimulus but not the sexual fantasy condition. Self-reported feelings of genital, psychological, and autonomic arousal predicted the single solitary and dyadic sexual desire items included as explicit state-measures of desire, as well as solitary desire measured with the SDI.

In two studies assessing self-reported sexual desire immediately following a sexual stimulus, Dawson and Chivers (2014a) assessed dyadic and solitary desire using the same single items from Goldey and van Anders (2012); these items showed significant increases following exposure to a variety of sexual stimuli of increasing intensities, with a stimulus intensity effect on responsive desire, and significantly greater dyadic desire following preferred sexual stimuli. Timmers et al. (2018) reported small correlations between genital response ($r = .36$) and self-reported sexual arousal ($r = .30$) and solitary desire, medium correlations between self-reported sexual arousal and dyadic desire ($r = .66$), and small correlations between genital response and dyadic sexual desire ($r = .32$) for exclusively opposite-gender attracted women. Taken together, existing measures of sexual motivation either conceptualize desire as a trait (Stark et al., 2015; Velten et al., 2019), assess desire retrospectively with the assumption of relatively stable levels of sexual interest over that period (e.g. FSFI, SDI), or assess desire associated with specific sexual events (Goldey & van Anders, 2012). To our knowledge, no validated measure exists that assesses thoughts and behaviors associated with responsive sexual desire over a specified brief period following exposure to sexual cues.

The Report of Behaviors and Feelings–Desire

The original Report of Behavior and Feelings scale was developed to identify changes in sexual interest and a partner's mate-retention tactics over the course of a woman's menstrual cycle (Gangestad, Thornhill, & Garver, 2002). The 35-item scale assesses the frequency of solitary sexual and nonsexual behaviors (e.g., flirted with someone, dressed in a sexy outfit) over the past 48 hr. A strength of this questionnaire is the distinction between desire for primary current partners and others. It does not, however, capture the emergence of desire during sexual activity or

desire in response to autoerotic activities or erotica. Thus, we revised the original questionnaire and created the Report of Behaviors and Feelings–Desire (RBF-D) scale to capture aspects of responsive sexual desire not included in the original scale (see the Method section for a description of the RBF-D).

Current study

The aims of this study were to assess the psychometric properties of the RBF-D, an 18-item self-report questionnaire of responsive sexual desire and sexual behaviors, and to validate this measure in a large sample of women with varying levels of sexual desire. Items of the RBF-D were selected to reflect five aspects of responsive sexual desire: (a) sexual activity with a primary sexual partner, (b) desire for sexual activity with a primary sexual partner, (c) sexual activity with other persons, (d) desire for sexual activity with other persons, and (e) autoerotic activities. First, we investigated whether this proposed five-factor solution fit the data at baseline assessment as well as 3 days following an in-laboratory sexual arousal assessment. Second, internal consistency of the five factors was investigated. Third, we investigated the convergent validity of the measure by assessing associations between the five factors, other proximal measures of sexual function (i.e., FSFI Desire, SDI, SIDI-F), and via correlations between factors scores and self-reported dyadic and solitary sexual desire items completed immediately after the sexual stimulus available in a subsample of participants. Discriminant validity was assessed via correlations with distal variables (i.e., depression, sexual inhibition, and socially desirable responding). To establish support for the construct of responsive sexual desire following exposure to a preferred audiovisual sexual stimulus, we compared factor scores at follow-up to those reported during a baseline period among partnered women without symptoms of low sexual arousal or desire.

Method

Participants

Data from 291 women (M_{age} = 22.41, SD = 5.82, range = 18–49) who participated in five research projects from 2014 to 2018 were aggregated for this study. Four studies (Studies 1–4) were conducted at the Sexuality and Gender Laboratory at Queen's University whereas Study 5 took place at the Sexual Health Laboratory at the University of British Columbia. All participants were required to meet the legal age of consent, and to be fluent in English. In all studies except Study 1, participants were required to be cis-women, not be pregnant or breastfeeding, be premenopausal, not have any psychiatric disorder that was interfering with their daily functioning, have experience with vaginal penetration (i.e., tampon use, penetrative intercourse, gynecological exam), not be experiencing pain during sexual activity, and not have a physical condition that would impede participation in psychophysiological assessments (e.g., physical injury). Some studies had additional requirements for participants, such as being younger than 50 years of age; having normal or corrected-to-normal vision; having watched explicit sexual material before; not having a sexually transmitted infection; not trying to conceive; having regular menstrual cycles; not be using neuroleptics, blood pressure medications, vasodilators, or cold/allergy medications regularly; not taking hormonal contraceptives; and not having an endocrine/hormonal disorder. In addition, women in Study 5 were required to have been sexually active with a partner over the last month, and women in Studies 3 and 4 were required to be involved in a sexual relationship. In Studies 2, 3, and 4, only women who indicated being predominantly or exclusively sexually attracted to men were included. Participants were recruited via undergraduate subject pools, flyers at the universities' campuses and the communities, social media (i.e., Facebook, Craigslist, Reddit), and radio ads.

Most women reported either dating ($n = 176$; 60.5%) or being single ($n = 83$; 28.5%). Half of the participants were students ($n = 142$), whereas 12.3% reported working full-time ($n = 35$) and 22.9% part-time ($n = 65$). A total of 75.9% ($n = 208$) indicated an other-sex attraction or a heterosexual orientation, 13.9% ($n = 38$) indicated bisexual attractions or a bisexual orientation, and 3.3% ($n = 9$) indicated same-sex attractions or homosexual orientation. The majority of participants were of Euro-Caucasian decent ($n = 197$, 70.9%), whereas a substantial minority reported being Asian ($n = 40$, 13.4%). Other ethnicities were Latina ($n = 8$, 2.9%), African ($n = 2$, 0.7%), First Nations/Aboriginal ($n = 1$, 0.4%), and other/not specified ($n = 30$, 10.8%).

Development of RBF-D

Fourteen items of the RBF-D were based on the Report of Behaviors and Feelings Scale (Gangestad et al., 2002). Twenty-two items of the original scale assessing nonsexual mood states (e.g., "Felt happy for no good reason"), nonsexual interpersonal behaviors, or a partner's mate-retention behavior (e.g., "My partner got angry if he saw me walking alone with another man") were omitted as they were not targeting aspects related to sexual desire. To further assess specific aspects relevant to the concept of responsive sexual desire, four additional items describing the use of erotica (Item 39), masturbation with and without orgasm (Items 38 and 37), and the desire for stimulation once sexually aroused (Item 36) were added to the scale. For baseline assessment, women received the following instructions: "For the following items, please indicate the extent to which you have engaged in the behavior or had the feeling in a typical 3-day period (during which you were not menstruating)." For assessment of responsive desire in the 3 days following participation in the laboratory assessment, the following instructions were given: "For the following items, please indicate the extent to which you have engaged in the behavior or had the feeling in the past 3 days (72 hours). Use the following scale: 0 – not at all, 1 – once, 2 – twice, 3 – three times, 4 – four times, and 5 – five times or more."

Measures to assess validity

Convergent validity

For convergent validity, associations with the Solitary and Dyadic Sexual Desire subscales of the SDI (Spector et al., 1996), the Sexual Activity and Sexual Desire subscales of the SIDI-F (Clayton et al., 2010), and the Sexual Desire subscale of the FSFI (Rosen et al., 2000) were assessed. All three measures are commonly used to assess sexual desire in female populations and exhibit good psychometric properties (e.g., Clayton et al., 2006; Ter Kuile, Brauer, & Laan, 2006). In Studies 3 and 4 ($n = 113$), correlations between self-reported desire for solitary and dyadic sex assessed immediately following the sexual stimuli (i.e., "How strong is your desire to masturbate/have sex with a partner?" assessed on a 10-point Likert-type scale), and RBF-D factors were examined.

Discriminant validity

To establish discriminant validity, associations with sexual inhibition, a construct reflecting how sexual arousal and response can be inhibited by worries or concerns (Bancroft & Janssen, 2000) measured with the Sexual Excitation/Sexual Inventory for Women (Graham et al., 2006), were investigated. Associations with the Beck Depression Inventory–2 (Beck & Steer, 1984) were assessed to evaluate whether current mood significantly impacted responses to the RBF-D. In addition, the relationship between the RBF-D and socially desirable responding (i.e., the tendency to present oneself in a favorable light), measured with the Impression Management subscale of the Balanced Inventory of Socially Desirable Responding (Paulhus, 2002), was examined.

Construct validity

To assess construct validity, we compared baseline RBF-D with RBF-D completed 72 hr after laboratory assessment in a subsample of women. To maximize likelihood of partnered sexual behavior, only women with a sexual partner were included. As arousal and desire concerns may impact responsive sexual desire, this analysis was also limited to women who did not meet criteria for FSIAD. Given evidence that responsive desire is sensitive to stimulus intensity and content, with audiovisual stimuli depicting preferred coupled sexual activities eliciting greatest change in responsive desire (see Dawson & Chivers, 2014a), we also limited our comparisons to studies that presented a preferred audiovisual sexual stimulus (i.e., Studies 2–5).

Data analysis

Descriptive values

We calculated mean, standard deviation, skewness, kurtosis, and interitem correlations of the RBF-D. Absolute values larger than 2 for skewness or larger than 7 for kurtosis were considered as reference for substantial non-normality (Kim, 2013).

Factor structure

To test the factor structure of the RBF-D, we conducted exploratory structural equation modeling (ESEM) using Mplus 7.4 (Muthén & Muthén, 2013). This statistical technique incorporates features of both confirmatory factor analysis (CFA) and exploratory factor analysis. Like CFA, ESEM tests whether a scale comprises distinct factors and provides fit indices, standard errors, and tests of significance. It is, however, less restrictive than CFA, relaxing the assumption that items should load only on their respective factors (i.e., main loading) without any cross-loading (Marsh, Morin, Parker, & Kaur, 2014). This approach was chosen, as some items of the RBF-D may load on several factors. For example, Item 22 ("Had strong feelings of sexual desire") was expected to relate to a primary sexual partner, other persons, as well as to autoerotic activities. When such cross-loadings are forced to be zero in CFA, latent factor correlations tend to be overestimated, as the only way for the cross-loadings to be expressed is through the inflation of these correlations (Marsh et al., 2014). By incorporating cross-loadings in a model, an ESEM approach overcomes these limitations. ESEM analyses were performed using maximum likelihood estimation and target rotation (Marsh et al., 2009). To assess whether the proposed model would fit the data, three fit indices were inspected (Hu & Bentler, 1999). The comparative fit index (CFI) compares a hypothesized model's chi-square with that resulting from the independence model. For an acceptable fit, CFI values above .90 are recommended. A good model fit requires values above .95 (MacCallum, Browne, & Sugawara, 1996). The root mean square error of approximation (RMSEA) measures the difference between the reproduced covariance matrix and the population covariance matrix, with values less than .06 indicating a small approximation error, suggesting a good model fit; values between .08 and .10 a mediocre fit; and values above .10 a poor model fit (Hu & Bentler, 1998). For the standardized root mean square residual (SRMR), values smaller than .09 indicated a good fit (Hu & Bentler, 1998).

Internal consistency

Cronbach's alpha indicated internal consistency and was considered acceptable above $\alpha > .70$ and good above $\alpha > .80$ (Cronbach, 1951).

Convergent and discriminant validity

To assess convergent and discriminant validity, nonparametric correlations between the RBF-D and other proximal and distal measures were investigated. For convergent validity, correlations

with the Solitary and Dyadic Sexual Desire subscales of the SDI (Spector et al., 1996), the Sexual Activity and Sexual Desire subscales of the SIDI (Clayton et al., 2010), and the Sexual Desire and Arousal subscales of the FSFI (Rosen et al., 2000) and solitary and dyadic desire immediately following a sexual stimulus were assessed. To establish discriminant validity, associations with sexual inhibition, a concept that describes how sexual arousal and response can be inhibited by worries or concerns (Bancroft & Janssen, 2000), were investigated. Associations with the Beck Depression Inventory–2 (Beck & Steer, 1984) were assessed to evaluate whether current mood significantly impact responses to the RBF-D. In addition, the relationship between the RBF-D and socially desirable responding, described as a tendency to present oneself in a favorable light (Paulhus, 2002), was examined.

Construct validity

Paired *t* tests were conducted in a subsample of women to examine changes in RBF-D scores from baseline to responsive desire experienced in the 3-day follow-up period following laboratory assessment and exposure to sexual stimuli.

Procedure

The present study aggregated data from five studies that each included at least one in-laboratory assessment. During these in-lab assessments, either a preferred erotic stimulus (e.g., a film of heterosexual sexual activity) or a series of images and films were presented to participants while aspects of sexual response were measured; depending on the study, genital responses (i.e., via vaginal photoplethysmography in Studies 2, 3, and 5 and via thermography in Study 4), self-reported sexual arousal, and visual attention to sexual cues were measured.

The sexual stimuli and procedures for Studies 3 and 4 were identical, and the same sexual stimulus was used for Study 2 in an eye-tracking paradigm paired with genital response assessment. In Study 1, still images depicting preferred and nonpreferred sexual partners were presented while eye movements were recorded with an eye tracker (Dawson & Chivers, 2016). In Study 5, women viewed two 13-min preferred sexual stimuli (i.e., heterosexual sexual activity), paired with an attention manipulation including a 6-min mindfulness meditation or mental imagery exercise (Velten, Margraf, Chivers, & Brotto, 2018), followed by another 13-min preferred sexual stimulus. At baseline, the RBF-D was administered as part of an online questionnaire that participants filled out before their lab session. Seventy-two hours after the in-lab session for each study, participants completed a second online questionnaire that also included the RBF-D. In three studies, sessions were scheduled to maximize the likelihood of partnered sex in the follow-up period. In Studies 3 and 4, sessions were scheduled at the end of the work week so that the follow-up period corresponded with the weekend. In Study 5, participants were asked the day of the week they were most likely to be sexually active. All participants provided written informed consent. All procedures were carried out in accordance with the provisions of the World Medical Association Declaration of Helsinki (2013). The ethics committees of Queen's University and the University of British Columbia approved the studies.

Results

Descriptive analyses

Descriptive values of the RBF-D items are displayed in Table 1. Endorsement rates of three items (i.e., Items 32, 34, and 37) were very low ($M < 0.50$) and six items (i.e., Items 26, 27, 30, 32, 34, and 35) showed substantial deviations from normality.

Table 1. Descriptive values and standardized factor loadings at baseline.

	Descriptive values					Standardized factor loadings				
Scale/Item	N	M	SD	Skewness	Kurtosis	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1: Desire for partner										
Item 22: Had strong feelings of sexual desire	283	2.24	1.54	0.22	−0.88	.62***	.08	−.04	.25***	.13**
Item 23: Felt strong sexual attraction toward my primary current partner	268	2.12	1.71	0.25	−1.19	.85***	.15***	−.05	−.12**	−.09**
Item 29: Fantasized about sex with a current partner	270	1.86	1.73	0.50	−1.06	.88***	−.08	.04	−.06	.01
Factor 2: Sex with partner										
Item 31: Had sex with a primary current partner	269	1.04	1.38	1.34	0.97	−.01	.90***	.03	−.03	−.07
Item 33: Experienced orgasm with a primary current partner	269	0.74	1.21	1.78	2.61	.06	.66***	.09	−.15**	.00
Item 35: Initiated sex (was the partner who was sexually assertive)	280	0.61	0.97	2.04	4.71	−.03	.80***	.02	.02	−.02
Item 36: Desired more stimulation after I started to feel sexually aroused	283	1.39	1.48	0.96	0.07	.20***	.45***	−.04	.21***	.19**
Factor 3: Sex with other persons										
Item 32: Had sex with someone other than a primary current partner	270	0.15	0.63	5.60	34.78	−.03	.05	.71***	.12**	.01
Item 34: Experienced orgasm with someone other than a primary current partner	270	0.12	0.57	5.96	39.37	−.01	.06	.91***	.01	.09**
Factor 4: Desire for other persons										
Item 24: Felt strong sexual attraction toward someone other than a current partner	271	0.92	1.30	1.63	2.07	.00	.06	.06	.87***	−.08*
Item 25: Felt sexually aroused by the sight of a very physically attractive person (other than a primary current partner)	283	0.90	1.30	1.61	1.87	.07	−.01	.01	.84***	.04
Item 26: Felt sexually aroused by the scent of someone (other than a primary current partner)	281	0.46	0.93	2.57	7.36	.01	−.06	.09	.50***	.09
Item 27: Flirted with someone other than a current primary partner	272	0.77	1.25	1.85	2.95	.17**	−.14**	.23***	.67***	−.13**
Item 28: Fantasized about sex with a stranger or acquaintance	283	0.96	1.40	1.55	1.54	−.05	.02	−.21***	.76***	.17***
Item 30: Fantasized about sex with a past partner	277	0.68	1.25	2.12	3.93	−.17**	.07	.01	.77***	−.05
Factor 5: Autoerotic activities										
Item 37: Masturbated without orgasm	282	0.28	0.73	3.47	13.94	.06	.04	.06	.03	.31***
Item 38: Masturbated to orgasm	283	1.03	1.30	1.27	0.88	−.03	.13*	−.02	.13	.57***
Item 39: Used any form of erotica (e.g. films, stories)	283	0.75	1.25	1.87	2.98	.01	−.07*	.08**	−.10	1.06***

*$p < .05$.
**$p < .01$.
***$p < .001$.

Factor structure

Using baseline data, the ESEM analysis used to test the a priori five-factor structure of the RBF-D showed a good model fit, $\chi^2(73) = 151.32$, $p < .001$, CFI = .970, RMSEA = .064, SRMR = .026. Almost all items loaded strongly on their respective factors ranging from .31 to 1.06 (M = .73), and cross-loadings were systematically weaker than the main loadings (−.17 to .25, M = .08;

see Table 1). An exception to these findings was Item 37 ("Masturbated to orgasm"), which showed the lowest loadings on all factors including its intended factor, autoerotic activities. In addition, some items showed substantial double loadings. Item 36 ("Desired more stimulation after I started to feel sexually aroused") showed significant loadings (.19–.21) on three other factors. The same was true for Item 22 ("Had strong feelings of sexual desire"), which loaded on three factors in total. A similar model fit was achieved using data gathered 3 days after the in-lab assessment including sexual arousal measurements, $\chi^2(73) = 161.183$, $p < .001$, CFI = .964, RMSEA = .065, SRMR = .032, suggesting that the same five-factor solution also fit the data at follow-up.

Internal consistency

At baseline, four out of five factors (i.e., desire for partner, sex with partner, desire for other persons, and sex with other persons) showed good internal consistency ($\alpha = .82–.89$). Internal consistency of the autoerotic activity factor was, however, unsatisfactory ($\alpha = .65$). Omitting Item 37 ("Masturbated without orgasm") improved this value to .78. Results at follow-up were comparable, with the internal consistency for four out of five factors being high ($\alpha = .83–.86$) and the remaining factor yielding a low consistency of $\alpha = .59$, which increased to $\alpha = .75$ when Item 37 was removed.

Validity

All factors of the RBF-D were positively correlated with one another (see Table 2). Strongest correlations were found between sex with partner and desire for partner, $r(283) = .62$, $p < .001$, and weakest correlations were found between desire for partner and sex with other persons, $r(270) = .18$, $p = .003$. None of the factors of the RBF-D showed significant correlations with age, ethnicity, or occupational status operationalized as being a student versus any other current occupation (see Table 3).

Convergent validity

Several questionnaires assessing different facets of sexual desire and/or activity were used to establish convergent validity. Overall, correlations were small to medium and in the expected directions. The Sexual Desire subscale of the FSFI showed positive correlations with all RBF-D factors. The Solitary Desire scale of the SDI showed largest correlations with RBF-D autoerotic activity, whereas the Dyadic Desire subscale of the SDI showed significant correlations with RBF-D desire for partner and sex with partner. The Sexual Desire and Activity subscales of the SIDI showed positive correlations with desire for partner and sex with partner.

Discriminant validity

To assess discriminant validity, associations with sexual inhibition were investigated. No significant correlations were observed between each of the RBF-D factors and sexual inhibition. The desire for partner and desire for other persons factors showed negative associations with impression management, indicating that individuals who prefer to present themselves in a positive light indicated lower endorsement of these factors. Last, no associations of the RBF-D factors and depression, measured with the BDI-II, were found ($r = -.12$ to .18, *ns*), suggesting that responses to the RBF-D were not significantly related to current mood.

Table 2. Nonparametric bivariate correlations between the five factors of the RBF-D at baseline.

		1	2	3	4	5
Desire for partner	1	1	.62***	.26***	.18**	.31***
Sex with partner	2		1	.28***	.23***	.33***
Desire for other persons	3			1	.41***	.41***
Sex with other persons	4				1	.26***
Autoerotic activities	5					1

Note. $N = 270–283$. RBF-D = Report of Behavior and Feelings–Desire.
** $p < .01$.
*** $p < .001$.

Construct validity

The RBF-D factors of desire for partner and autoerotic activity demonstrated convergent validity with state sexual desire assessed immediately following the sexual stimulus for the pooled sample of women without FSIAD symptoms completing Studies 3 and 4. Nonparametric bivariate correlations (Spearman's rho) between self-reported desire for dyadic sex and the RBF-D factor of desire for partner was small and positive, $r(82) = .3$, $p = .006$, as were correlations between self-reported desire for solitary sex and the autoerotic activity factor, $r(82) = .25$, $p = .024$.

Comparisons between baseline and follow-up scores on the RBF-D factors provided very modest evidence of construct validity for responsive sexual desire following exposure to a preferred sexual stimulus ($n = 124$). Paired t tests showed increases in the sex with partner factor (baseline: $M = 0.97$, $SD = 1.05$; follow-up: $M = 1.19$, $SD = 1.20$), $t(123) = -1.95$, $p = .054$, $d = 0.22$; all other comparisons showed no significant change from baseline. When we excluded data from Study 5 (because they included an experimental manipulation between sexual stimuli) and compared baseline and follow-up RBF-D scores for those studies using an identical sexual stimulus (i.e., Studies 2–4), there was a statistically significant increase in the sex with partner factor (baseline: $M = 0.79$, $SD = 0.99$; follow-up: $M = 1.14$, $SD = 1.19$), $t(95) = -2.83$, $p = .006$, $d = 0.36$, and no significant change in other factors.

Discussion

The objective of this study was to evaluate the psychometric properties and validity of the RBF-D using data from five studies that administered the scale before and 3 days after an in-laboratory arousal assessment. The following sections discuss our findings with respect to the descriptive values, factor structure, internal consistency, and validity of the scale.

Descriptive values

All items of the RBF-D were endorsed to some degree, suggesting that the feelings and behaviors included in this measure were experienced by participants over a 72-hr time frame. When aiming to assess sexual activity with a nonprimary partner, however, a longer time frame might be warranted, especially when investigating women in committed, monogamous relationships. In addition, some items showed substantial deviation from normality, mostly in the form of a leptokurtic, positively skewed distribution, suggesting that the majority of participants endorsed one of the two lowest Likert-scale categories (i.e., 0 or 1). When using RBF-D items for statistical analyses, it is important to be aware of these deviations from normality and apply the appropriate statistical techniques for non-normal variables.

Factor structure

A five-factor solution was confirmed using ESEM both at baseline and follow-up. Almost all items loaded strongly on their respective factors, and cross-loadings were weaker than main

Table 3. Nonparametric bivariate correlations between the five factors of the RBF-D at baseline and other proximal and distal variables.

	N^a	Desire for a partner	Sex with a partner	Desire for other persons	Sex with other persons	Autoerotic activities
Sociodemographic variables						
Age	270	−.05	.02	.00	−.04	.005
Ethnicity (Caucasian vs. other)	259	.02	.006	.06	−.08	−.06
Occupation (student vs. other)	263	.05	.02	.03	−.03	−.05
Proximal variables (convergent validity)						
Female Sexual Function Index: Desire subscale	204	.56***	.33***	.17*	.17*	.27***
Female Sexual Function Index: Arousal subscale	203	.54***	.40***	−.06	.10	.08
Sexual Desire Inventory: Solitary sexual desire	203	.04	.03	.15*	.15*	.37***
Sexual Desire Inventory: Dyadic sexual desire	209	.44***	.25***	.12	.10	.11
Sexual Interest and Desire Inventory: Desire	147	.24**	.17*	.01	−.04	.04
Sexual Interest and Desire Inventory: Sexual activity	100	.27**	.24*	−.18	−.04	.04
Distal variables (discriminant validity)						
Sexual Excitation Sexual Inhibition Inventory for Women: Sexual inhibition	267	−.06	.07	.02	.003	.03
Balanced Inventory of Socially Desirable Responding: Impression management	239	−.19**	−.13	−.14*	−.09	−.10
Beck Depression Inventory II	111	−.09	−.12	.18	.07	.18

Note. $N = 270–283$. RBF-D = Report of Behavior and Feelings–Desire.
[a]Lowest number of participants per line.
*$p < .05$.
**$p < .01$.
***$p < .001$.

loadings. Two items—one referring to sexual desire in general and another describing responsive sexual desire triggered by feelings of arousal—loaded on two or more factors. A main advantage of ESEM in comparison to CFA is, however, that it allows items to load onto more than one factor, which may be especially appropriate when examining closely related concepts such as sexual desire and behavior for a primary partner. When using the subscales independently, however, cross-loadings of items between factors should be considered.

Internal consistency

Four of five factors of the RBF-D showed good internal consistency. Excluding an item that referred to masturbation without orgasm (Item 37) improved unsatisfactory internal consistency of the autoerotic activity factor. In future studies targeting autoerotic behavior, researchers may decide to eliminate this item before including this RBF-D factor in their analysis. Bivariate correlations between masturbation with and without orgasm were nonsignificant at baseline and follow-up, and only a few women (11%, $n = 31$) indicated engaging in both behaviors at least once in the 3-day period.

Validity

Convergent validity was shown by significant, positive correlations of all factors of the RBF-D with other instruments assessing sexual desire. These correlations were small to medium. As the RBF-D is the first instrument aiming to assess feelings and behaviors associated with sexual desire over a 3-day period, a gold-standard measure of responsive desire was not available to assess convergent validity. Given this limitation, the small to medium effects reported for convergent and construct validity with existing measures of state and trait desire, although lower than the strong correlations traditionally expected, are sufficient to demonstrate preliminary support for validity of the measure. As expected, the autoerotic activity factor of the RBF-D showed largest correlations with solitary sexual desire on other measures, suggesting that the desire to engage in autoerotic behaviors is significantly associated with actually engaging in self-stimulation over a 3-day period. Of interest, the desire for other persons and sex with other persons factors were not significantly correlated with most of the other proximal variables. A possible explanation could be that there was low endorsement on these items in our sample. As most women in our studies were in committed relationships, many of them might not experience desire for other partners in day-to-day life or might decide not to act on desire for other persons.

The desire for a partner and desire for other persons factors showed negative associations with impression management, which can be described as biasing responses to appear socially desirable (Paulhus, 2002). This finding is in line with a previous study showing that women who report higher levels of impression management also report lower levels of sexual arousal after viewing sexual stimuli (Huberman, Suschinsky, Lalumière, & Chivers, 2013). Traditional gender stereotypes that encourage sexual modesty and passivity in women (Conley, Moors, Matsick, Ziegler, & Valentine, 2011) might bias women who prefer to present themselves in a positive light to report lower desire for sex.

New models of sexual response have proposed that sexual desire is responsive, emerging from the experience of arousal, and is elicited by exposure to sexually competent stimuli (reviewed in Dawson & Chivers, 2014b). Convergent validity in our study was established through an examination of the relationships between the RBF-D, a potential new measure of responsive desire, and established trait-based measures of sexual desire and state-based items that follow exposure to a sexual stimulus (e.g., Dawson & Chivers, 2014b; Timmers et al., 2018). An examination of these modest correlations is evidence of convergent validity and simultaneously provides support for the assertion that responsive and trait sexual desire are distinct, albeit related, constructs. As

such, in addition to being one of the first measures to assess responsive sexual desire, these analyses provide some of the first empirical support that these two types of desire are not synonymous and that our new measure is capturing unique variance not captured in existing trait measures. It also follows that we should expect that these two types of desire would function differently in certain contexts, such as following activation of the sexual response system.

No associations of the RBF-D factors and depression, measured with the BDI-II, were found, suggesting that mood over the past month may not impact state experiences of sexual desire. This contrasts with a large literature showing the consistent and strong bidirectional relationship between mood and trait sexual desire (Clayton, McGarvey, Clavet, & Piazza, 1997; Cyranowski et al., 2004; Zajecka et al., 2002). A large number of studies have documented an association between depressed mood and sexual dysfunction, suggesting a bidirectional relationship between these domains. For example, a meta-analysis of 14,000 participants, followed longitudinally, showed that those with a history of depression had a 50%–70% increased risk of developing a sexual dysfunction, and those with a sexual dysfunction had a 130%–210% increased risk of developing depression (Atlantis & Sullivan, 2012). The potential implications of depressed mood not being associated with state levels of sexual desire deserve more consideration in light of the potential clinical implications of the findings.

To establish that the RBF-D does not measure other constructs related to sexual motivation, associations with sexual inhibition were investigated. None of the RBF-D factors were significantly correlated with sexual inhibition. This finding suggests that the specific aspects of desire and sexual activities assessed with the RBF-D are different from trait levels of sexual inhibition, which describe how easily sexual response and behavior are hindered by worries or internal or external distractions (Bancroft et al., 2009; Velten, 2017).

To further investigate the construct validity of the RBF-D, the relationship between its factors and dyadic and solitary state sexual desire assessed immediately following the sexual stimulus was examined in a subsample of women without sexual concerns. Validity was confirmed via positive correlations between self-reported state dyadic and solitary desire with the RBF-D factors desire for partner and autoerotic activities, respectively. Exposure to preferred audiovisual sexual stimuli in the laboratory session was associated with small increases in the sex with a partner factor among women with sexual partners and no symptoms of low desire and arousal; however, we interpret this small effect cautiously given the borderline significance. No statistically significant change was observed in other RBF-D factors. We note that the increase in the sex with a partner factor showed a medium effect when we limited the analysis to studies using the same audiovisual sexual stimulus and not including an experimental manipulation. This pattern, with responsive desire emerging for sexual activity but not other factors, is similar to the small effect reported by Both et al. (2004) for increases in sexual activity, but not reported desire, following exposure to a sexual stimulus among women. In line with the incentive motivation model (e.g., Toates, 2009), exposure to preferred sexual stimuli should lead to increases in sexual desire, which may translate directly into feelings of desire (i.e., sexual thoughts or wishes) and/or sexual activities. There are several possible explanations for why only very modest increases in responsive desire were found in our study. Although the RBF-D administered at baseline encouraged women to think about a "typical three-day period over the last month," the RBF-D at follow-up referred to the previous 3 days. Thus, at baseline women may have estimated the frequency of sexual desire and activities retrospectively rather than counting actual sexual encounters, which may have resulted in an overestimation of sexual responses. In addition, a sequence effect cannot be ruled out, as the baseline assessment was, per definition, before the in-lab arousal measurement and the follow-up assessment. We also did not control for potential exposure to sexual stimuli before the baseline assessment. Thus, it may be possible that exposure to similar or even more arousing sexual stimuli (e.g., an attractive partner, an erotica of their choice) before baseline may have increased baseline levels of desire.

Implications for clinical practice and research

The RBF-D may be useful to investigate the impact of interventions (e.g., attention manipulation, psychological treatments) on women's sexual behaviors and feelings both in experimental and clinical studies. A clinical implication of the findings presented in this study is that the RBF-D may allow for new research exploring patterns of responsive sexual desire, and how those patterns are impacted by treatment. For example, if an intervention is designed to help women cultivate sexual desire in a certain context (and perhaps in response to effective triggers for her), then a measure of sexual desire that asks women to recall their average level of desire over the past month would not be expected to show any changes with this intervention.

Moreover, it would be important to compare and contrast measures of state versus trait desire and their relationship to many of the identified variables known to affect sexual desire in women. It would also allow for comparisons between men and women and a direct test of the long-standing assumption that men have higher levels of sexual desire than women. The availability of a state measure of sexual desire would allow for a direct test of whether there are also gender differences in sexual desire that are elicited in response to an arousing stimulus. We might predict that the strength of state desire in such situations would not show such strong gender differences, as in the case of trait sexual desire. Indeed, preliminary support from the few experimental studies suggest that responsive desire is not gendered (e.g., Dawson & Chivers, 2014a; Goldey & van Anders, 2012). Additional research is needed to examine other properties of the RBF-D to further inform our understanding of responsive sexual desire. For example, whether the RBF-D is able to capture expected context-dependent fluctuations in desire (e.g., across the menstrual cycle, over the course of a long-term relationship). Clinically, the validation of a measure of state sexual desire may be used by health care providers who may be equipping clients with skills and tools for eliciting sexual desire in the moment, and this measure would allow for a direct test of the efficacy of such strategies. In addition, the five-factor structure of the RBF-D would also allow clinicians to observe which facet of responsive desire and activity was elicited in response to a particular intervention or instruction (e.g., whether it was the desire to have sex with a partner or nonpartner or with oneself).

Limitations

Several limitations reduce the generalizability of our findings. Although the sample(s) used to validate the RBF-D showed some diversity with respect to socioeconomic status and ethnicity, only premenopausal women who were predominantly or exclusively attracted to men were included in most of the studies. Future studies should examine the psychometric properties of the RBF-D in a broader sample of women, including trans, nonheterosexual, and older women. Although research on responsive desire has been limited to female populations, more research is needed to determine whether the concept applies to male and/or nonbinary individuals as well.

Pooling participants across five studies from two laboratories allowed us to assess the dimensionality of the RBF-D measure. Diverging inclusion and exclusion criteria of the five studies, however, limit the applicability of findings to specific target populations. In other words, it remains unclear how certain participant characteristics (e.g., hormonal contraception that was allowed in some studies but not all) affected our findings. In addition, previous studies have shown that women participating in in-lab studies that include erotic stimuli and/or genital arousal assessments may be less sexually inhibited (Velten, Scholten, Graham, Adolph, & Margraf, 2016) and hold more liberal sexual attitudes (Dawson et al., 2019) than women not participating in such studies and/or many women with sexual dysfunctions in general.

Conclusion

This study showed the RBF-D to be a valid and reliable 18-item self-report questionnaire that assesses sexual desire for and activities with primary partners, other persons, and autoerotic activities over the last 3 days. The factor structure of the RBF-D resembled a predetermined five-factor solution. Internal consistency of four out of five factors was good. Convergent validity was shown via positive small-to-medium associations with other measures of sexual desire in women. The RBF-D showed no significant correlations with distal constructs such as depression or sexual inhibition. The RBF-D may be useful for clinical and research settings where assessment of patterns of responsive sexual desire and behavior is needed.

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We declare that we have no competing interests.

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