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Review article

A biopsychosocial approach to women's sexual function and dysfunction at midlife: A narrative review

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ABSTRACT

A satisfying sex life is an important component of overall well-being, but sexual dysfunction is common, especially in midlife women. The aim of this review is (a) to define sexual function and dysfunction, (b) to present theoretical models of female sexual response, (c) to examine longitudinal studies of how sexual function changes during midlife, and (d) to review treatment options. Four types of female sexual dysfunction are currently recognized: Female Orgasmic Disorder, Female Sexual Interest/Arousal Disorder, Genito-Pelvic Pain/Penetration Disorder, and Substance/Medication-Induced Sexual Dysfunction. However, optimal sexual function transcends the simple absence of dysfunction. A biopsychosocial approach that simultaneously considers physical, psychological, sociocultural, and interpersonal factors is necessary to guide research and clinical care regarding women's sexual function. Most longitudinal studies reveal an association between advancing menopause status and worsening sexual function. Psychosocial variables, such as availability of a partner, relationship quality, and psychological functioning, also play an integral role. Future directions for research should include deepening our understanding of how sexual function changes with aging and developing safe and effective approaches to optimizing women's sexual function with aging. Overall, holistic, biopsychosocial approaches to women's sexual function are necessary to fully understand and treat this key component of midlife women's well-being.

Contents

1. Background

A healthy and satisfying sex life is an important component of overall wellbeing for many midlife women. Multiple studies have shown a strong positive association between sexual function and health-related quality of life [1–4]. Sexual problems are common, estimated to affect 22–43% of women worldwide [1,5,6]. The preva-

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lence of sexual dysfunction peaks at midlife, with 14% of women aged 45–64 reporting at least one sexual problem associated with significant distress [5], yet only 21% of women with persistent sexual problems discuss it with their healthcare provider [7]. The aim of this narrative review is to (a) review the definition of sexual dysfunction, (b) understand the theoretical models of female sexual response, (c) examine the major longitudinal studies to understand how and why sexual function changes as women move through midlife, and (d) review the major treatment options for female sexual dysfunction.

The most recent edition of the Diagnostic and Statistical Manual (DSM 5), the major manual of psychiatric and behavioral disorders, states that sexual dysfunctions "are a heterogeneous group of disorders that are typically characterized by a clinically significant disturbance in a person's ability to respond sexually or to experience sexual pleasure" [8]. As such, "female sexual dysfunction" is an umbrella term for four distinct disorders recognized in the DSM 5: Female Orgasmic Disorder, Female Sexual Interest/Arousal Disorder (FSIAD, which encompasses what were previously termed Hypoactive Sexual Desire Disorder and Female Sexual Arousal Disorder in the DSM IV), Genito-Pelvic Pain/Penetration Disorder (which encompasses what were previously termed vaginismus and dyspareunia), and Substance/Medication-Induced Sexual Dysfunction. To diagnose any one of these disorders, the symptoms must be (a) present at least 6 months, (b) cause *clinically significant distress* in the individual [not solely in the individual's sexual partner(s)], and (c) not be better explained by another issue, such as relationship distress or other stressors [8].

In contrast to a sole focus on sexual dysfunction, researchers and healthcare providers should consider overall sexual health to help women maintain a satisfying sex life. The World Health Organization defines overall sexual health as "a state of physical, emotional, mental and social well-being in relationship to sexuality; it is not merely the absence of disease, dysfunction or infirmary. Sexual health requires a positive and respectful approach to sexuality and sexual relationships, as well as the possibility of having pleasurable and safe sexual experiences, free of coercion, discrimination and violence" [9]. The focus is not just on physical sexual function – are the genitals "working" – but whether the individual can be fulfilled and satisfied in their physical, emotional, and social experiences with sex.

2. Measurement of sexual function

A number of instruments have been developed to measure female sexual function, some of which are summarized in Table 1. A more comprehensive review of available measures was published in 2009 [10]. The most widely used instrument recently has been the Female Sexual Function Index (FSFI), a 19-item scale with six domains: desire, arousal, lubrication, orgasm, pain, and satisfaction. Questions are graded on a Likert scale, and domains are weighted and summed to give a total score ranging from 2 to 36, with a cutoff of less than 26.55 suggesting sexual dysfunction [11]. Subsequent research has shown that mean scores on the FSFI tend to be lower in midlife and older women [12]. Some have advocated for a scoring adjustment in this population [13], calling into question conceptions of normative or ideal sexual function in aging women. The FSFI has been validated in multiple languages, across age groups, and for multiple sexual disorders. Another commonly used instrument in sexual function studies is the Female Sexual Distress Scale – Revised (FSDS-R), which measures sexually related distress using 13 items [14]. As discussed above, a diagnosis of sexual dysfunction requires significant sexually related distress in addition to a sexual problem or complaint. Validation studies for the FSDS-R have focused on women with what was previously termed Hypoactive Sexual Desire Disorder [14,15].

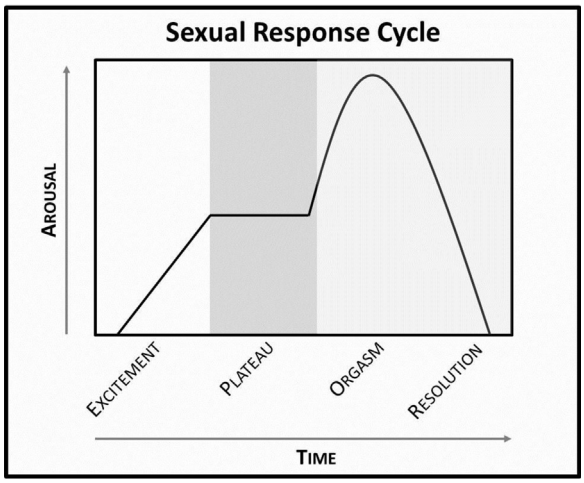

Fig. 1. Masters-Johnson Model of sexual response.
Adapted from Masters WH JV. Human Sexual Response. Boston: Little, Brown & Co; 1966.

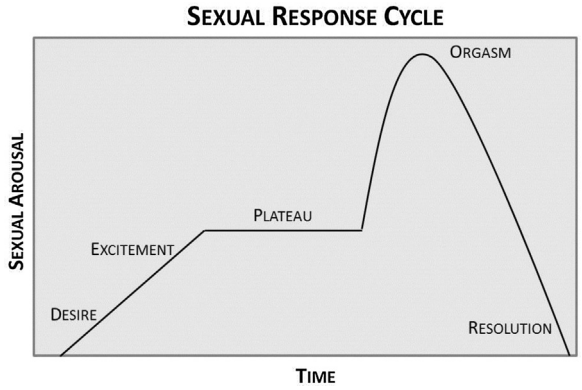

Fig. 2. Masters-Johnson-Kaplan Model of sexual response.
Adapted from Kaplan HS. Disorders of Sexual Desire: Simon and Schuster; 1979.

3. Models of female sexual response

Theoretical models of women's sexual response can provide a framework for understanding female sexual dysfunction. The Masters-Johnson model was one of the first, developed in the 1960s, and applies to both men and women (Fig. 1)[16]. According to this model, sexual response progresses predictably and linearly from excitement to plateau, orgasm, and resolution. The main focus of this model is on physical response of the genitals. Helen Singer Kaplan, a psychologist and sex therapist, noted that many individuals had problems with sexual desire, denoting the importance of desire to sexual response. In the 1970s she modified the Masters-Johnson model to a three-phase model of desire, excitement, and orgasm (Fig. 2) [17].

In 2000, Rosemary Basson and colleagues proposed an alternative circular model of female sexual response (Fig. 3) [18]. This model has several distinguishing features. First, spontaneous desire (or "sexual drive") on the part of the woman is not always the starting point for sexual activity. Instead, desire may result from feelings of emotional intimacy with one's partner that lead the woman to seek out sexual stimulation or to be more receptive to sexual stimulation initiated by her partner. Second, this model emphasizes that sexual stimuli often *precede* physical arousal and desire, and sexual

Table 1
Measurement tools for female sexual function and dysfunction.

Scale name	Citation	Number of items	Domains	Validity evidence
Golombok Rust Inventory of Sexual Satisfaction (GRISS)	Rust, *Archives of Sexual Behavior*, 1986 [93]	28	Anorgasmia, vaginismus, noncommunication, infrequency, avoidance, nonsensuality, dissatisfaction	Discriminatory validity r = 0.63 Agreement with therapist blind ratings = 0.54
Brief Index of Sexual Functioning – Women (BISF-W)	Taylor, *Archives of Sexual Behavior*, 1994 [94]	22	interest/desire, sexual activity, satisfaction	Overall alpha = 0.83 Test-retest r = 0.68–0.78
Changes in Sexual Functioning Questionnaire (CSFQ)	Clayton, *Psychopharmacology*, 1997 [95,96]	14	Pleasure, desire/frequency, desire/interest, arousal/excitement, orgasm/completion	Test-retest r = 0.45–1.00
Female Sexual Function Index (FSFI)	Rosen, *Journal of Sexual Medicine*, 2000 [97]	19	Desire, arousal, lubrication, orgasm, satisfaction, pain	Test-retest for domains r = 0.79–0.86 Internal consistency alpha 0.82 and higher
Short Form – Personal Experiences Questionnaire (SPEQ)	Dennerstein, *Sex & Marital Therapy*, 2002 [98]	9	Sexual responsivity, sexual frequency, libido	Test-retest for domains r = 0.71–0.95
Sexual Functioning Questionnaire (SFQ)	Quirk, *Journal of Women's Health & Gender-Based Medicine*, 2002 [99]	31	Desire, physical arousal-sensation, physical arousal-lubrication, enjoyment, orgasm, pain, partner relationship	Internal consistency domains = 0.65–0.91 Test-retest = 0.21–0.71
Menopause Sexual Interest Questionnaire (MSIQ)	Rosen, *Sex & Marital Therapy*, 2004 [100]	10	Desire, responsiveness, satisfaction	Internal consistency alpha 0.87 and higher Test-retest for domains r = 0.52–0.76
Profile of Female Sexual Function (PFSF)	McHorney, *Menopause*, 2004 [101]	37	Sexual pleasure, sexual desire, responsiveness, arousal, orgasm, sexual self image, sexual concerns, disinterest	Alpha 0.79–0.96 Test-retest 0.57–0.91
PROMIS Sexual Function and Satisfaction Scale	Weinfurt, *Journal of Sexual Medicine*, 2015 [102]	Varies, as uses item-response theory [103] and computer-adaptive testing [104]	Satisfaction with sex life, interest in sexual activity, vaginal lubrication, vaginal discomfort, orgasm-pleasure, orgasm-ability, vulvar discomfort, oral discomfort, oral dryness	Cronbach's alpha 0.85–0.97

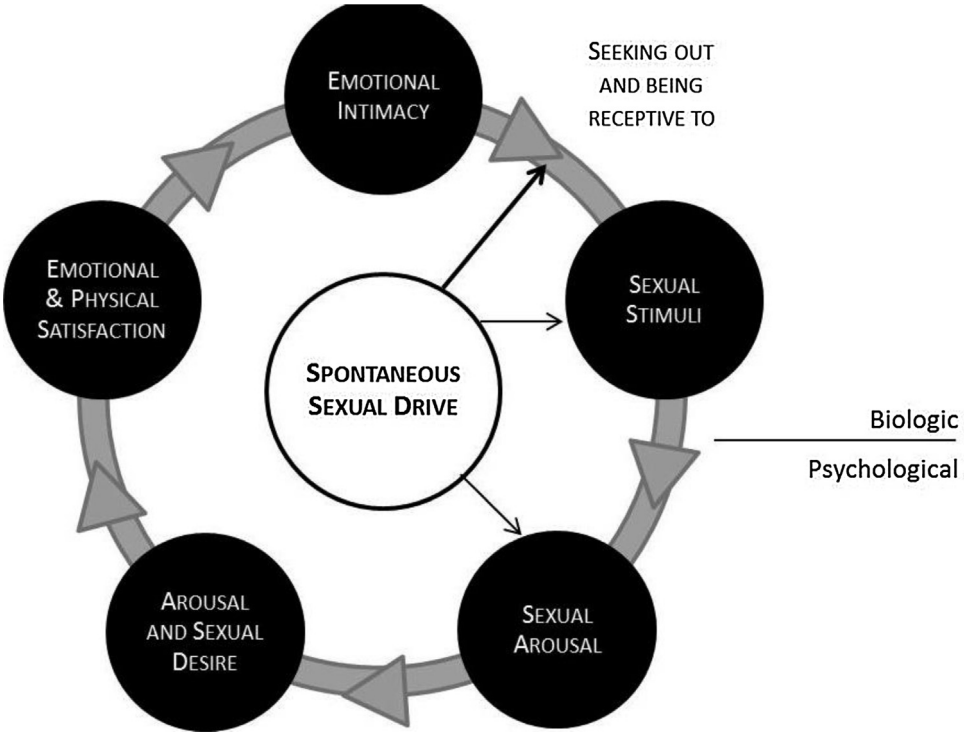

Fig. 3. Basson model of female sexual response.
Adapted from Basson R. The female sexual response: a different model. Journal of sex & marital therapy. 2000;26(1):51-65 with permission from the publisher.

arousal and desire often co-occur. This perspective lies in contrast to the Masters-Johnson-Kaplan model, in which desire always precedes arousal. Qualitative research suggests that for many women, the concepts of desire (the interest in or urge for sexual activity) and arousal (sexual excitement and pleasure) are difficult to distinguish; when asked to describe sexual desire, many women use

language that describes genital sexual arousal [19–21]. Finally, the Basson model acknowledges that both physical as well as emotional satisfaction are important outcomes of engaging in sexual activity. This physical and emotional satisfaction and can lead to higher emotional intimacy, which in turn can lead to greater receptivity and seeking out of sexual stimuli, hence the circular model.

There has been debate regarding which model best reflects the experiences of women. In a study of 133 women [22], most of whom were in their 40s and 50s, 30% endorsed the Masters-Johnson model, 27% endorsed the Masters-Johnson-Kaplan model, and 29% endorsed the Basson model. The remaining 14% of women did not endorse any model. Women who had FSFI scores falling into the "dysfunctional" range and postmenopausal women were more likely to endorse the Basson model.

A subsequent study of 404 women with a mean age of 35 found that women both with and without sexual dysfunction felt the Masters-Johnson-Kaplan model more accurately represented their sexual response. However, when the researchers modified the Basson model to combine the responsive desire and sexual arousal phases, women with sexual dysfunction were more likely to endorse the Basson model than the Masters/Johnson/Kaplan model [23]. Both these studies have been criticized for using the FSFI to classify women with sexual dysfunction, as the FSFI itself is rooted in the Masters-Johnson-Kaplan model [24].

It is likely that there are aspects of both models that are useful to women, healthcare providers, and researchers. The Masters-Johnson-Kaplan model is useful for conceptualizing the physical aspects of female sexual function and dysfunction, whereas the Basson model is useful for understanding the interplay between emotional, interpersonal, and physical aspects of sexual response. Notably, most recent epidemiologic studies and clinical trials exclusively use the FSFI, which places a greater emphasis on the physical aspects of sexual function, as an outcome measure. Researchers should include an evaluation of the psychosocial aspects of sexual function reflected in the Basson model, such as emotional intimacy, in studies of female sexual dysfunction, particularly since women with sexual dysfunction appear to be more likely to endorse this model. One such scale is the Personal Assessment of Intimacy in Relationships Scale [25]. A multidimensional assessment of physical, interpersonal, and emotional aspects of sexual function will enhance the current state of the science on women's sexual function.

4. Changes in sexual function over the menopause transition

One major question in the field of women's sexual health has been, "How and why does sexual function change as women progress through midlife and the menopause transition?". Several large longitudinal studies have attempted to answer this question (Table 2). Longitudinal studies are better suited to addressing changes in sexual function and satisfaction over time than cross-sectional studies. Longitudinal studies that follow a cohort of women over time allow comparison of a woman's sexual function to herself, provide more effective control of between-subject confounds and cohort effects, and allow characterization of trajectories in sexual function over time.

Most studies show that sexual function worsens with advancing menopause status, even when adjusting for age [26–31]. Vaginal dryness appears to play a key role in changing sexual function during the menopause transition [29,30]. In contrast, three smaller longitudinal studies that only assessed sexual function using one or two questions found that sexual activity and reports of desire were stable over time during midlife [32–34].

Among the studies that used a multidimensional assessment of sexual function, there were differences regarding *which* aspects of sexual function were most affected by menopause. In the second wave of the Massachusetts Women's Health Study, sexual desire, but not satisfaction, frequency, arousal, orgasm, or pain, were negatively affected by the menopause transition [26]. The Melbourne Women's Midlife Health project found that all domains of sexual function, including responsivity, frequency, libido, and pain, worsened with advancing menopause status [27]. The Penn Ovarian Aging Study found the sharpest decline in the lubrication domain [28], while the Study of Women's Health Across the Nation (SWAN) noted only desire and pain worsened with menopause, but not frequency, arousal, importance of sex, or overall satisfaction [30]. Notably, 3 out of 4 of these studies noted declines in sexual desire during the menopause transition.

A consistent theme throughout these studies, however, is the importance of other factors aside from menopause status to sexual function. Many studies note a positive correlation between overall physical health and sexual function [26,30,31,34]. Availability of a partner is also significantly related to better sexual function [26–28,30,31,34]. Stress or mood symptoms, such as depression and anxiety, are correlated with lower sexual function across several studies [26,28,29]. Finally, indicators of higher socioeconomic status are associated with better midlife sexual function in some studies [30,34,35].

These studies all face similar challenges. One challenge is the measurement of sexual function. These studies used different instruments to assess female sexual function, and few used validated instruments. Another challenge is distinguishing sexual problems or complaints from overt sexual dysfunction. Many women will report a sexual complaint, such as vaginal dryness, on a questionnaire. However, a diagnosis of sexual dysfunction requires significant distress due to the sexual complaint. None of these longitudinal studies assessed sexually-related distress. Finally, female sexual function is a complex biopsychosocial phenomenon, and a complete understanding of women's sexual function requires assessment of biologic, sociocultural, psychological, and interpersonal factors.

In summary, most of the larger longitudinal studies using multidimensional assessments of sexual function do suggest that advancing menopause status has a negative effect on sexual function. However, psychosocial variables also play an extremely important role in midlife women's sexual function. Loss of a partner, changes in the quality of the relationship with one's partner, and worsening mood symptoms are typically associated with worse sexual function.

Taken together, these findings remind us that the biopsychosocial approach is necessary for understanding and treating sexual dysfunction in midlife women (Fig. 4). The biopsychosocial approach recognizes that biologic, psychological, interpersonal, and sociocultural factors can all affect female sexual function, and these factors interact with each other in a dynamic system over time. *Biologic* factors may include hormonal changes that affect libido or medical/anatomical problems that affect genital sexual response. *Psychological* factors includes mood symptoms, like depression or anxiety, or negative behaviors such as critical self-monitoring during sexual activity. Some examples of *interpersonal factors* include general satisfaction in the woman's relationship with her partner, which is closely tied to overall sexual satisfaction, as well as quality of communication in the relationship. Finally, some *sociocultural* factors to consider include the woman's attitudes about menopause and aging, as well as religious, cultural, and other social values regarding sex. Researchers and healthcare providers for women should consider all these factors when addressing female sexual function.

Table 2
Longitudinal studies of sexual function during midlife.

Reference	Study details	Sexual function measure	Key findings
George and Weiler [105]	N = 278 men and women Age 46–71 at baseline 4 interviews 2 years apart	Only used 2 questions to evaluate sexual function	• Mean sexual activity remained relatively stable over the 6 years of the study, especially among women
Hallstrom et al. [106]	N = 497 women Age 38–54 at baseline 2 interviews 6 y apart	Only assessed sexual desire, and with only one question	• The majority of women reported no decrease in sexual desire between the two interviews • Lower desire was associated with poor relationship quality, partner alcoholism, and depression • No demographic variables were associated with lower desire
Koster and Garde [107]	N = 474 women Age 40 at baseline 3 interviews, 5 years apart	No validated instrument used to assess sexual function	• 70% of women experienced no change in desire during the study period • Menopause status was not related to frequency or change in sexual desire • Health status, prior sexual activity, partner availability, and social status were highly related to frequency of sexual desire • Anticipations of declining desire due to menopause predicted a decrease
Avis et al. [108]	N = 200 women Age 45–55 at baseline Yearly interviews for 4 years	Multidimensional, but unvalidated, measure of sexual function	• Advancing menopause status was significantly related to lower sexual desire • Advancing menopause status was unrelated to other aspects of sexual functioning, including satisfaction, frequency of intercourse, arousal, orgasm, and pain • Health, marital status, and mental health had a greater impact on sexual function than menopause status
Guthrie et al. [109] Dennerstein et al. [110] Dennerstein et al. [111] Dennerstein et al. [112] Dennerstein et al. [113]	N = 197 women Age 45–55 at baseline Annual interviews over 9 years	Used short form Personal Experiences Questionnaire (SPEQ)	• Sexual function declines during the menopause transition in all domains • Partner feelings, responsivity, and partner problems decrease in early menopause • Responsivity, frequency, libido, dyspareunia, and partner problems decrease in later menopause • Among women who were postmenopausal during the entire study period, the only domain that changes was responsivity, suggesting aging affects all domains, but menopause affects only responsivity • Worsening sexual function was correlated with decreasing estrogen but not decreasing androgen • Prior sexual function, partner status, and feelings towards partner are the most important determinants to sexual function
Mishra et al. [114]	N = 1525 women Age 47–54 at baseline Annual interviews over 8 years	Only used 2 questions to assess sexual function	• Compared to women who remained premenopausal, women who became peri- and postmenopausal had self-perceived declines in sexual function, even when accounting for aging and other factors • A majority of women report no change in sex life year to year • Vaginal dryness is a major risk factor for perceived decline in sex function. • Hot flashes are associated with intercourse difficulties • Stress, aging, smoking, mood symptoms were associated with a self-perceived decline in sex life
Gracia et al. [115]	N = 436 Age 35–47 at baseline Annual assessments over 3 years	Used the Female Sexual Function Index (FSFI)	• Higher DHEAS is associated with better sexual function in the domains of orgasm, lubrication, and pain • Advancing menopause status is associated with worse sexual function • Lack of a sexual partner is associated with worse sexual function in all domains • Having children in the house is associated with worse arousal, orgasm, and satisfaction • Higher anxiety is associated with worse sexual function in all domains • Age, race, and education are not significantly related to sexual function • Other hormones (testosterone, estradiol, FSH) are not significantly related to sexual function
Avis et al. [116]	N = 3302 women Age 42–52 at baseline Annual assessments over 6 years	Multidimensional, but unvalidated, measure of sexual function	• Menopause status is associated with decreasing desire and increasing vaginal pain, even when adjusting for age and other factors • Menopause status was NOT associated with frequency of sex, arousal, importance of sex, emotional satisfaction, or physical pleasure • Vaginal dryness had a negative effect on many aspects of sexual function • Age, importance of sex, education, marital status, change in relationship status, attitudes towards aging, mood symptoms, health status, and race were all related to sexual function

Table 2 (*Continued*)

Reference	Study details	Sexual function measure	Key findings
Woods et al. [117]	N = 286 women Mean age 41.4 at baseline Annual questionnaires from beginning of study until 5 years postmenopause	Assessed only sexual desire in the prior 24 h with a single question	• Desire decreased significantly during late per menopause and early post menopause • Higher urinary estrogen byproducts and testosterone were associated with higher sexual desire • Higher FSH was associated with lower sexual desire • Higher stress was associated with lower sexual desire • Menopause symptoms (vasomotor, mood, insomnia) were associated with lower desire • Better self-perceived health was associated with higher desire • Having a partner was associated with lower desire
Prairie et al. [118]	N = 459 women Ages 40–65 at baseline Annual questionnaires over 3 years	Multidimensional, but unvalidated, measure of sexual function	• Higher life purpose was associated with higher sexual enjoyment • Younger age, more social support, and higher emotional well-being was associated with more engagement in sexual activities • Higher social support and better emotional well-being were associated with higher enjoyment of sex • Menopause status was not associated with engagement or enjoyment in sexual activities

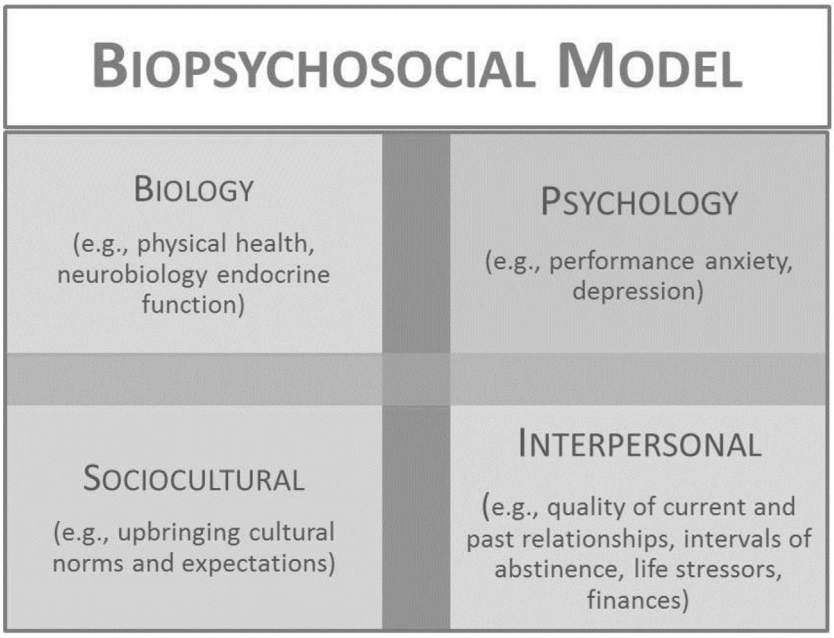

Fig. 4. Biopsychosocial model of female sexual function.
Adapted from Rosen RC, Barsky JL. Normal sexual response in women. Obstetrics and gynecology clinics of North America. 2006;33(4):515-26 and Althof SE, Leiblum SR, Chevret-Measson M, Hartmann U, Levine SB, McCabe M, et al. Psychological and interpersonal dimensions of sexual function and dysfunction. The journal of sexual medicine. 2005;2(6):793-800.

One outcome that may be more important to women than the physical aspects of sexual function is overall satisfaction with sex. Sexual satisfaction has been less well-studied than sexual function. In SWAN, emotional and physical satisfaction with sex did not significantly change with advancing menopause status, although current and former hormone therapy users reported higher physical pleasure compared to premenopausal women [30]. Many of the predictors of increased satisfaction in SWAN were psychosocial as opposed to physical; availability of a partner (especially a new partner), higher ratings of the importance of sex, fewer mood symptoms, and more positive attitudes about aging were associated with better emotional and physical sexual satisfaction. A cross-sectional analysis of 1345 women in the second Midlife in the United States (MIDUS 2) study likewise found that menopause status was not associated with overall sexual satisfaction, but psychosocial variables, including relationship satisfaction, communication with one's partner, and importance of sex were associated with overall sexual satisfaction [36]. These findings suggest that while some aspects of physical sexual function may decline during midlife, sexual satisfaction appears to be stable. This discrepancy between function and satisfaction may be explained by the fact that midlife women adapt to physical changes (by using sexual aids, trying varying types of sex, etc.) in order to maintain a satisfying sex life with aging.

5. Treatments for female sexual dysfunction

In order to help women maintain a satisfying sex life as they move through midlife and beyond, treatment of sexual dysfunction is sometimes required. When a woman presents to her healthcare provider with a sexual complaint, assessing menopause status and symptoms is essential, with a particular focus on vaginal dryness and pain issues. However, interpersonal, psychological, and sociocultural factors must be addressed as well. Some women may initially report no sexual concerns when first questioned, but if a woman is allowed time and a supportive listening environ-

Table 3
Medical and psychiatric conditions that are associated with female sexual dysfunction.

Cardiovascular disease [119]
Major depressive disorder and generalized anxiety disorder [120,121]
History of emotional, physical, or sexual abuse [122,123]
Diabetes mellitus [124,125]
Neurologic disease (stroke, multiple sclerosis, spinal cord injury) [126–128]
Hypertension [129–131]
Substance use disorders [132–134]
Genitourinary syndrome of menopause [114,116,135]
Breast, ovarian, uterine, and cervical cancer [136–140]
History of gynecologic surgery [141,142]
Chronic renal failure [143–145]
Urinary incontinence [146,147]
Medications that are associated with female sexual dysfunction
Antidepressants (selective serotonin reuptake inhibitors, serotonin norepinephrine reuptake inhibitors, tricyclic antidepressants) [148–155]
Opiates [134]
Cancer therapies, especially for breast and gynecologic cancer [136,156–159
Antihypertensives (mixed evidence),particularly beta-blockers [160,161]
Antiepileptics, particularly gabapentin [162], topirimate [163], and phenytoin [164]
Benzodiazepines [165,166]

ment, a clearer picture of precipitating and maintaining factors may emerge. For example, a woman may initially report her main problem is that it takes longer to orgasm. However, on further discussion, she reveals that her male partner is having difficulty maintaining erections, but she is hesitant to discuss trying non-penetrative forms of sexual activity at the risk of upsetting her partner. Issues around relationship quality and communication can affect sexual function in couples, even if a "relationship problem" is not readily evident. These issues may be readily amenable to improvement with limited psychoeducational interventions or counseling.

When addressing a new sexual complaint, a thorough history using a biopsychosocial approach should be undertaken, including assessment of any current or past psychiatric disorders; medication use and health problems; a history of emotional, physical, or sexual abuse; beliefs and attitudes regarding sex, menopause, and aging; and body image concerns. Particular attention should be paid to symptoms of depression, anxiety, and sleep problems, all of which are common during the menopause transition [37–48]. Providers should inquire about alcohol or drug use, as substance use disorders are also associated with sexual dysfunction [49]. Any health or sexual problems affecting the woman's sexual partner(s) should also be explored. Providers should inquire about relationship discord or communication issues, and if present, recommend therapy with a therapist certified by the American Association of Sexuality Educators Counselors and Therapists (AASECT).

Women presenting for a new sexual problem should be seen by their primary healthcare provider for a comprehensive physical examination, including a pelvic examination. Medical problems and medications should be reviewed for any that may potentially contribute to sexual dysfunction (Table 3), and treatment of the underlying condition or adjustments in medication regimens should be undertaken if possible. Antidepressants, including tricyclic antidepressants (TCAs), selective serotonin reuptake inhibitors (SSRIs), and serotonin-norepinephrine reuptake inhibitors (SNRIs), are commonly implicated, particularly in disorders of arousal and orgasm [50–55]. Buproprion is an antidepressant that appears to have few sexual side effects [55–58]. There is also evidence that bupropion [59–61] and, to a lesser extent, sildenafil [62], are effective for treating antidepressant-induced sexual dysfunction in women, although some conflicting evidence exists [63,64]. Screening for intimate partner violence should take place, and if positive, appropriate referrals and resources should be provided.

Treatments depend on the specific disorder(s) in question. Treatment options for specific sexual dysfunctions are summarized in Table 4. Providers should recognize that women often have more than one sexual complaint; treatment should be individualized to target the primary problem, but should be supplemented by treatment of other problems as needed. General lifestyle counseling that may be useful for all types of female sexual dysfunction include recommending setting aside time for connecting with one's partner, increasing the woman's exposure to sexual stimuli such as erotic literature or films, encouraging maintenance of a healthy weight and ensuring adequate physical activity and sleep, enhancing skills for coping with stress, and recommending books women can use for self education. Some major titles include *Becoming Orgasmic* [65], *Getting the Sex You Want* [66], *Naked at Our Age* [67], and *Come as You Are* [68]. A book that may be helpful for male partners is *She Comes First* [69]. The websites for the North American Menopause Society (menopause.org) and MiddlesexMD (middlesexmd.com), an online resource spearheaded by a certified menopause healthcare physician, also contain useful, evidence-based information for patients regarding menopause and sex.

Some providers use testosterone for the treatment of FSIAD, and there is a growing body of evidence supporting its efficacy, at least in the short term [70,71]. However, this treatment is not FDA-approved, and there remains concern regarding side effects, including hirsutism, dyslipidemia, and given the physiologic conversion of androgens to estrogens, possible estrogen-related side effects (including venous thromboembolism and breast or endometrial cancer) [71–74]. A black box warning was recently added to testosterone products marketed to men after a longitudinal study suggested a 30% higher risk of adverse cardiovascular outcomes [75], although this study has been criticized due to methodology concerns [76–79], and whether it is generalizable to women is unknown. Finally, it appears supraphysiological serum testosterone levels may be necessary to yield any benefit on sexual desire and arousal [80,81]. The use of compounded testosterone products for transdermal use is on the rise, but these products are not regulated and amount of testosterone in the product can be highly inconsistent [82]. Hormone therapy (estrogen with or without progesterone) does not appear to have a significant impact on sexual function, with the exception of vaginal estrogen in women with genitourinary syndrome of menopause [83].

6. Future directions

Much advancement has been made over the past 5 decades in our understanding of female sexual function and dysfunction. We now have clearer definitions of female sexual disorders that better reflect the lived experience of women; models of female sexual response that reflect both the physical and emotional aspects of a women's sexual experience; a clearer picture of how menopause affects sexual function; and new and emerging treatment options. However, there is still much work to be done.

First, we need a deeper understanding of women's typical sexual activity and sexual function patterns during midlife and beyond, including how sex may or may not change with aging, and why some women are distressed by changes in sexual function while others are not. Clarifying longitudinal patterns of change in sex and associated distress in large groups of midlife women will help us define what are normative changes over time versus what are "dysfunctions." While taking women's sexual concerns seriously, researchers and clinicians must also be mindful not to pathologize all age-related changes in sexual function, or we risk labeling healthy women as "dysfunctional." In fact, some have expressed

Table 4
Treatment options for female sexual dysfunctions.

Disorder	Treatment options	Considerations
Female sexual interest/arousal disorder	Psychological and behavioral interventions	There is evidence for modified Masters and Johnson treatment [167], behavioral sex therapy [168], cognitive-behavioral therapy [169,170], and mindfulness-based approaches [171,172]
	Flibanserin	It is only approved by the Food and Drug Administration (FDA) for the treatment of hypoactive sexual desire disorder in premenopausal women. The clinical effects are somewhat limited, there are notable side effects and medication interactions, and women taking the medication cannot use alcohol [173–176]
Female orgasmic disorder	Psychological and behavioral interventions	There is evidence for directed masturbation [177–180] and sensate focus. Anxiety reduction techniques (systematic desensitization, cognitive behavioral therapy) if anxiety is co-occurring [181,182]
	Sexual aids, such as vibrators [183]	
Genito-pelvic pain/penetration disorder	Psychological and behavioral interventions	There is evidence for mindfulness-based approaches [184,185] and cognitive-behavioral therapy/biofeedback [186–190]
	Treatment of genitourinary syndrome of menopause, if present (i.e., vaginal estrogen, ospemifene) [191–193]	
	Pelvic floor physical therapy [188]	It must be conducted by a specially-trained physical therapist
	Topical lidocaine [190]	It often causes burning when first applied
	Tricyclic antidepressants [194]	These can interact with other medications and cause sleepiness, dry mouth, or urinary retention (the latter more common in older patients)
	Vestibulectomy	There are high reported success rates, but it is usually not performed until less invasive treatments have failed [195–199]

concern that the concept of "female sexual dysfunction" has been overstated – the "making of a disease" in order to develop and sell medications [84–87]. An emphasis on women's sexual satisfaction and complete assessment of the biopsychosocial contributors to sexual function may help avoid over-medicaliztation of age-related changes. Understanding longitudinal patterns in sexual function is essential to ensuring that we can confidently educate our patients regarding what to expect as they grow older and to optimally tailor treatments for sexual dysfunctions.

Second, we need to continue to develop safe and effective treatments for female sexual dysfunction, particularly for midlife and older women. Postmenopausal women have been excluded from many of the trials of pharmaceutical medications. Additionally, concerns about side effects and medication interactions are increased in an older population. Behavioral treatment approaches have shown promise for the treatment of several types of female sexual dysfunction. However, these treatments are not typically widely available [88–92]. Future research should focus on ensuring that these behavioral interventions are optimized to meet the needs of midlife and older women, on targeting the outcomes that are most important in this population, and on exploring ways to disseminate behavioral interventions more widely. Finding ways to integrate these behavioral interventions into primary care and general gynecology practices will ensure that they reach the greatest number of women in need.

In summary, sexual dysfunction is highly prevalent among midlife women and is associated with lower quality of life, and sexual function declines over the menopause transition for many women. Research regarding theoretical models of female sexual response as well as longitudinal cohort data reveals that psychosocial factors, such as relationship satisfaction and importance of sex, are key to women's sexual function at midlife. Both researchers and healthcare providers can benefit from a biopsychosocial approach to women's sexual function. By addressing *all* aspects of women's sexual function, researchers and healthcare providers can better understand and improve this key component of midlife women's well-being.

Contributors

HNT conceived idea for manuscript, conducted literature review, interpreted data, prepared initial draft of the manuscript, edited manuscript, submitted manuscript, approved final version to be published.

RCT conceived idea for manuscript, interpreted data, revised manuscript for significant intellectual content, approved final version to be published.

Conflict of interest

None declared.

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