HHS Public Access

Author manuscript

Womens Health Issues. Author manuscript; available in PMC 2020 July 01.

Published in final edited form as:

Womens Health Issues. 2019 ; 29(4): 291–298. doi:10.1016/j.whi.2019.04.006.

Sexual Function among Women in Midlife: Findings from the Nurses' Health Study II

Christiana von Hippel, ScD, MPH[a,1], **Avanti Adhia, ScD**[a,2], **Shoshana Rosenberg, ScD, MPH**[b,c], **S. Bryn Austin, ScD**[a,d,e,f], **Ann Partridge, MD, MPH**[b,c], **Rulla Tamimi, ScD**[f]

[a]Department of Social and Behavioral Sciences, Harvard T.H. Chan School of Public Health, Boston, MA, USA.

[b]Department of Medical Oncology, Dana-Farber Cancer Institute, Boston, MA, USA.

[c]Department of Medicine, Harvard Medical School, Boston, MA, USA.

[d]Department of Pediatrics, Harvard Medical School, Boston, MA, USA.

[e]Division of Adolescent and Young Adult Medicine, Boston Children's Hospital, Boston, MA, USA.

[f]Channing Division of Network Medicine, Brigham and Women's Hospital and Harvard Medical School, Boston, MA, USA.

Abstract

Background: Women's sexual wellbeing is an important determinant of overall health and quality of life across the life course. Yet the factors associated with women's levels of sexual activity and sexual function in midlife are little understood.

Objective: This study sought to assess the prevalence of recent sexual activity and sexual dysfunction symptoms among middle-aged women and evaluate the associations of partner status, menopause, and health status factors with sexual dysfunction.

Methods: Participants of this cross-sectional study were 68,131 women who responded to the 2013 Nurses' Health Study II observational cohort questionnaire when they were age 48–68 years. Sexual activity and dysfunction symptoms were assessed with the Female Sexual Function Index (FSFI-6). Age adjusted multivariable regression models estimated risk ratios (RRs) for the association of health-related factors with past-month sexual dysfunction symptoms among women who were sexually active over the past month, overall and stratified by partner status.

Results: 73% of middle-aged women were sexually active (N=49,701) and 50% of sexually active women reported symptoms of sexual dysfunction. Symptoms of sexual dysfunction were

Corresponding Author's Present Address and Affiliation: Christiana von Hippel, ScD, MPH Wallace Center for Maternal, Child, and Adolescent Health, UC Berkeley School of Public Health, 1995 University Avenue, Suite 265, Berkeley, CA 94704 USA, Phone: 857-285-2261 | cvhippel@mail.harvard.edu.

[1]Wallace Center for Maternal, Child, and Adolescent Health, UC Berkeley School of Public Health, Berkeley, CA.

[2]Harborview Injury Prevention and Research Center, University of Washington, Seattle, WA, USA.

Conflicts of Interest: None to disclose.

less common among unpartnered than partnered women (42% vs. 51%, $p<.0001$). A positive association between menopause and sexual dysfunction was greater for unpartnered women (RR = 2.37, 2.99, $p<.001$) than partnered women (RR = 1.89, 2.00, $p<.001$).

Conclusions: Difficulty with sexual function is common among women in midlife, but less so than previously estimated. Regular monitoring of women's sexual function could enable clinicians to offer women timely, supportive interventions tailored by partner status and menopausal status.

Keywords

female sexual dysfunction; sexual activity; middle aged women; menopause; Female Sexual Function Index

Introduction

Women's engagement in satisfying sexual activity is a crucial determinant of their physical, mental, and relationship health, yet many woman experience significant challenges to their sexual function over the life course (Addis et al., 2006; Holmberg, Blair, & Phillips, 2010; Laumann, 1994; Laumann, Paik, & Rosen, 1999). A nationally representative, cross-sectional analysis of sexual dysfunction in the United States by Laumann et al (1999) estimated that 43% of women ages 18–59 experience symptoms including low desire and arousal, infrequent orgasm, vaginal dryness, and pain from penetration. More recent studies focused on midlife have estimated that 42–68% of middle-aged women are sexually active (Diokno, Brown, & Herzog, 1990; Hess et al., 2009; Laumann & Waite, 2008) and, of those, 42–88% experience symptoms of sexual dysfunction (Ambler, Bieber, & Diamond, 2012; Lorraine Dennerstein & Lehert, 2004; L. Dennerstein, Lehert, Burger, & Guthrie, 2005; Gracia, Freeman, Sammel, Lin, & Mogul, 2007; Guthrie, Dennerstein, Taffe, Lehert, & Burger, 2004; Hayes & Dennerstein, 2005). To be considered sexual dysfunction according to the *DSM-5*, these sexual symptoms must cause distress and persist for 6 months or more (American Psychiatric Association, 2013).

The research that has been conducted with middle-aged and older women has resulted in inconsistent findings about the influence of factors like age, menopause, and partner status on women's levels of sexual activity and sexual function. Although there is some evidence that the prevalence of sexual dysfunction decreases as women age (Laumann et al., 1999), other research has concluded that aging is associated with a decline in overall physical health status that may harm sexual function in many ways, including through chronic comorbidities such as diabetes and increasing use of pharmaceuticals such as beta-blockers that negatively affect sexual functioning (George & Weiler, 1981; Perez, Gadgil, & Dizon, 2009). Menopause is associated with women's sexual function independent of aging, affecting distinct domains of sexual function differently across the phases of the menopausal transition (Gracia et al., 2007). Prospective cohort research has demonstrated that for many women sexual desire begins to decrease in early menopause while physiologic symptoms related to decreased estrogen peak in late menopause (N. E. Avis, Stellato, Crawford, Johannes, & Longcope, 2000; Nancy E Avis et al., 2005; Guthrie et al., 2004; Woods, Mitchell, & Smith-Di Julio, 2010). A common cluster of physiologic symptoms is the genitourinary syndrome of menopause, which encompasses vaginal dryness, pain, and

atrophy, among other hormone-linked changes (Levine, Williams, & Hartmann, 2008; Moral et al., 2018).

With regard to partner status, several studies among middle-aged and older women (Addis et al., 2006; George & Weiler, 1981; Patel, Gillespie, & Foxman, 2003) have observed that being married or partnered is protective against female sexual dysfunction while other studies have demonstrated the opposite: that being *un*partnered may be protective against sexual dysfunction (N. E. Avis et al., 2000; Greendale, Hogan, Shumaker, & PEPI Trial Investigators, 1996; Mishra & Kuh, 2006; Worsley, Bell, Gartoulla, & Davis, 2017; Zeleke, Bell, Billah, & Davis, 2017). One study emphasizing both psychosocial and biological influences on older women's sexual function found a greater decrease in desire among partnered compared to unpartnered women during the menopausal transition (Woods et al., 2010). Thus, there is a great need for improved data on the direction and magnitude of the influence that aging and partner status, in particular, have on sexual function in order to inform the development of tailored, evidence-based clinical guidelines to best support women's sexual wellbeing.

Using the Nurses' Health Study II, we investigated the prevalence of sexual activity and sexual dysfunction among middle-aged women. We hypothesized that the prevalence of sexual activity would be higher among partnered women than among unpartnered women due in part to increased availability of sexual opportunity among long-term partners compared to dating or casual sex partners. Relatedly, we hypothesized that a greater proportion of partnered women than unpartnered women would report sexual dysfunction symptoms due to potential desire and arousal discrepancies between partners, increased frequency of opportunity for experience of penetration-related discomfort (i.e., vaginal dryness and pain), and personal characteristics or health issues of women's long-term partners. Based on prior research (N. E. Avis et al., 2000; West, Vinikoor, & Zolnoun, 2004; Zeleke et al., 2017), we also examined a number of other potential predictors of sexual functioning and hypothesized that post-menopausal status, poor self-rated health, and depression would be associated with sexual dysfunction. Finally, we hypothesized that there would be a higher magnitude association between certain predictors (e.g., post-menopausal status) and sexual dysfunction for unpartnered as compared to partnered women.

Methods

Study Population

The Nurses' Health Study II (NHSII) is a national longitudinal cohort of 116,429 female registered nurses. Nurses were enrolled and completed a baseline survey in 1989 when they were age 25–42 years. They have since completed self-administered follow-up questionnaires biennially. The response rate is 85–90% for each two-year cycle (Bao et al., 2016). A total of 87,299 women responded to the 2013 questionnaire when sexual functioning data was collected. After excluding 22% (n=19,150) of respondents with missing sexual functioning data and an additional 18 individuals missing data on partner status, the final analytic sample included 68,131 women. Women missing sexual function outcome data were less likely to be partnered, use menopausal hormone therapy, or have a history of cancer but more likely to be older, non-White, unemployed, and have

hypertension or type 2 diabetes as compared to women with complete sexual functioning data ($p<.05$). This study was approved by the Institutional Review Board of Brigham and Women's Hospital (Boston, Massachusetts).

Measures

Sexual functioning: In 2013, participants self-reported their experience of sexual activity over the past 4 weeks using the Female Sexual Function Index (FSFI-6) (Isidori et al., 2010). The FSFI-6 is an abridged form of the validated (Wiegel, Meston, & Rosen, 2005) FSFI-19, one of the most commonly used psychometric diagnostic tests of female sexual function (Rosen, 2000). Single items address each of 6 domains in the FSFI-6: desire, arousal, lubrication, orgasm, satisfaction with overall sexual life, and pain from vaginal penetration. The FSFI-6 does not assess distress related to sexual functioning. The items related to desire and satisfaction provide ordinal response options on a Likert scale scored from 1 ("very low" or "very dissatisfied") to 5 ("very high" or "very satisfied"). The four remaining items provide ordinal response options from 0 to 5. In the case of items relating to arousal, lubrication, and orgasm, a zero response indicates "no sexual activity." The FSFI-6 score is the sum total of all six item scores. A score ≤19 indicates symptoms of sexual dysfunction and a score >19 indicates no or sub-clinical symptoms (Isidori et al., 2010). Unlike the long-form FSFI-19 (Boehmer, Timm, Ozonoff, & Potter, 2012), the binary indicator produced by this abbreviated measure cannot reliably be computed without complete responses to each of the FSFI-6 items (Isidori et al., 2010). FSFI-6 scores also were not calculated for sexually inactive women because zero values are known to artificially inflate the proportion of women screening positive for difficulty with aspects of sexual function (Boehmer et al., 2012; Meyer-Bahlburg & Dolezal, 2007)

Categorical domain-specific scores were also calculated for each item. Desire, arousal, and satisfaction scores were assessed by level of intensity: high (item scores of 4 and 5), medium (scores of 3), or low (scores of 1 and 2). Orgasm and lubrication were assessed by frequency: often (item scores of 4 and 5), sometimes (scores of 3), or never (scores of 1 and 2). Frequency of pain was assessed as: often (item scores of 1 and 2), sometimes (scores of 3), never (scores of 4 and 5), or no intercourse (scores of 0). Categorical assessment enabled more granular comparison of sexual function domain intensity and frequency levels among women stratified by sexual activity and partner status than would be possible using mean domain scores. Three levels as opposed to the five original to the FSFI-6 (plus the "no intercourse" option for the pain item) ensured adequate sample size in each category post-stratification.

Assessment of sexual activity: Women were considered to be sexually active (meaning reporting sexual activity over the past 4 weeks) if they provided a non-zero response to all three of the FSFI-6 items where a response of "no sexual activity" was an option. In the case of the final FSFI-6 item related to pain, zero indicates "did not attempt intercourse." A response of zero to the item addressing pain was not used as an assessment of sexual activity status because not attempting intercourse did not preclude women from responding to the items about other forms of sexual activity they may have engaged in during this period.

Partner status: Current partner status was self-reported in 2013 and modeled dichotomously as partnered (married or in a domestic partnership) vs. unpartnered. For women missing 2013 partner status data, we used the most recent prior assessment of marital status from 2009 or 2005. Women missing partner status in all waves were excluded.

Sociodemographic covariates: Race was self-reported at baseline in 1989 and coded as White vs. all other races, given that cell sizes were insufficient to analyze race categorically. Age (continuous in years) and employment status at questionnaire return (categorical: employed, unemployed, retired, or other) were assessed in 2013. For women missing 2013 employment status data, we used the 2011 report.

Sexual orientation: In 1995 and 2009, participants characterized their sexual orientation as heterosexual, lesbian, bisexual, or other using a validated single item, which was modeled dichotomously as heterosexual vs. sexual minority (Case et al., 2006). If women identified as a sexual minority (lesbian, bisexual, or other) in either 1995 or 2009, they were categorized as such.

Health status exposures of interest: Health status was assessed using self-rated health, disease history, menopause-related factors, depression, anxiety, and BMI based on a meta-analysis of sexual dysfunction predictors (West et al., 2004) and previous research on the association between menopause and sexual dysfunction (N. E. Avis et al., 2000). Self-rated health status was assessed ordinally in 2013 with one item: “In general, would you say your health is” reported on a five-point Likert scale (poor-excellent) and assessed using “good,” the midpoint of the scale, as the reference category (Ware & Sherbourne, 1992). Disease history included type 2 diabetes mellitus, hypertension, or any cancer other than non-melanoma skin cancers. Each self-reported disease case was confirmed by medical record review to have been diagnosed in or before 2013 and modeled dichotomously. Self-reported menopausal status was assessed as pre-menopausal vs. post-menopausal. Use of menopausal hormone therapy (MHT) was assessed dichotomously as current use vs. past use or no use.

Women were classified as clinically depressed if they met one or both of the following criteria: had a self-reported history of clinician-diagnosed depression on a NHSII questionnaire between the years 2003 and 2013 or scored >16 on the Center for Epidemiologic Studies Depression Scale (CES-D) (Lewinsohn, Seeley, Roberts, & Allen, 1997) in 2013. Women with a history of depression were classified as taking anti-depressants if they self-reported use of selective serotonin reuptake inhibitors (SSRIs), serotonin-norepinephrine reuptake inhibitors (SNRIs), or tricyclic antidepressants in 2013. Anxiety was assessed as a score ≥10 on the 7-item Generalized Anxiety Disorder (GAD-7) scale from the Patient Health Questionnaire (Spitzer, Kroenke, Williams, & Löwe, 2006). Body mass index (BMI) was calculated from self-reported height and weight measurements and assessed categorically (underweight: 15–18.4, normal: 18.5–24.9, overweight: 25–29.9, obese: 30–50).

Statistical analysis

We examined the associations of sociodemographic, health status, and lifestyle covariates with past-month sexual activity status in our entire analytic sample (n=68,131). χ^2-tests were used to assess the differences in desire and satisfaction by sexual activity status. All remaining analyses were conducted among sexually active women (n=49,701). We examined the prevalence of past-month sexual dysfunction symptoms (referred to as "sexual dysfunction") and the distribution of levels of function in all six domains assessed by the FSFI-6. χ^2-tests were used to evaluate differences by partner status for each level of each domain score.

Multivariable regression was used to assess independent associations between the predictors of sexual interest and sexual dysfunction. We also tested interactions between partner status and each predictor. The interaction terms were significant ($p < .05$) for menopause status, MHT, and sexual orientation, so we stratified all subsequent regression models by partner status. We employed log-binomial regression models (Spiegelman & Hertzmark, 2005) using the GENMOD procedure (SAS Institute Inc, 2008) in SAS 9.4 to estimate risk ratios (RR) and 95% confidence intervals (CI) for predictor variables. When convergence could not be reached with the log-binomial models, we used log-Poisson models with robust error variance (standard errors). RRs and 95% CIs estimated by log-Poisson models are known to be valid, yet slightly less efficient than estimates provided by maximum-likelihood-based log-binomial models (Spiegelman & Hertzmark, 2005; Zou, 2004). All regression models were adjusted for age, race, and employment status. In all analyses, we included indicator variables that were created for missing values of each covariate and predictor (Schernhammer et al., 2001; Smith-Warner et al., 2006). All tests of statistical significance were two-sided.

Results

Participants were predominately white (97%), partnered (80%), and self-identified as heterosexual (99%). Their mean age was 58.5 years (range 48 to 68) in 2013. The majority (93%) were post-menopausal and perceived their health status to be excellent or very good (71%). Table 1 shows the distribution of additional characteristics among participants by sexual activity status. Approximately three quarters of women were sexually active (73%) and a greater proportion of them were partnered (88%) compared to sexually inactive women (57%, p<.0001). Within our sub-sample of sexually active women, 43,870 were partnered and 5,831 were unpartnered. Sexually active women were slightly younger, less likely to have gone through menopause, and more likely to be currently using MHT compared to sexually inactive women. Significant differences in desire and satisfaction by sexual activity status were identified (Table 2, p-values<.0001). Approximately 41% of sexually active women reported a moderate or high level of desire, compared to only 12% of sexually inactive women. Three quarters (76%) of sexually active compared to 54% of sexually inactive women reported being highly or moderately satisfied with their overall sexual life.

Half (50%) of sexually active women reported experiencing recent sexual dysfunction symptoms. This prevalence was significantly lower among unpartnered women than among

partnered women (42% vs. 51%, $p<.0001$) (Table 3). Unpartnered women were more likely to report high levels of desire and satisfaction compared to partnered women. Unpartnered women were also more likely to report often becoming aroused, lubricated, and having an orgasm during sexual activity. Partnered and unpartnered women were equally likely (64%) to report often experiencing pain from vaginal penetration.

Independent predictors of sexual dysfunction included post-menopausal status, cancer history (excluding non-melanoma skin cancer), underweight BMI, anxiety, and depression diagnosis with or without use of anti-depressants (Table 4, column 1). Women classified as having overweight or obesity based on BMI (vs. women classified as having normal weight based on BMI), being unpartnered, using MHT, and having hypertension were associated with lower sexual dysfunction risk. Additionally, women's perceptions of their overall health as excellent or very good as compared to good were associated with reduced sexual dysfunction risk, while perceptions of their health as poor or fair compared to good were associated with increased risk.

Partner status modified the associations of sexual orientation identity, menopause, MHT use, BMI category, and cancer history with sexual dysfunction (Table 4). Among partnered women, being post-menopausal was associated with an 89% greater risk of sexual dysfunction compared to being pre-menopausal (RR = 1.89, CI: 1.78, 2.00), whereas among unpartnered women, being post-menopausal was associated with more than double the risk of sexual dysfunction (RR = 2.37, CI: 1.87, 2.99). Excellent self-rated health and current use of MHT were both associated with a greater protective effect for unpartnered than partnered women.

After stratification by partner status, we observed that the inverse association of overweight and the positive association of underweight with sexual dysfunction remained significant for partnered women only. Cancer history was associated with increased risk and diagnosis of hypertension was associated with reduced risk among partnered women only. Sexual orientation emerged as a significant risk factor for sexual dysfunction among unpartnered but not partnered women. Unpartnered women who identified as a sexual minority were at 19% greater risk of sexual dysfunction than heterosexual-identified women.

Discussion

This study identified a higher prevalence of sexual activity and a lower prevalence of symptoms of sexual dysfunction as measured by the FSFI-6 among women in midlife than many previous studies have estimated (Ambler et al., 2012; Lorraine Dennerstein & Lehert, 2004; L. Dennerstein et al., 2005; Diokno et al., 1990; Hayes & Dennerstein, 2005; Hess et al., 2009; Laumann et al., 1999; Laumann & Waite, 2008). Three quarters of women ages 48–68 years were sexually active, and the majority were satisfied with their overall sexual lives. The prevalence of sexual activity in our sample most closely resembled the estimate of 79% found by Cain et al. (2003) among their community-based sample of women in midlife. In our study, partnered women, as well as those who were younger, pre-menopausal, using MHT, and had a positive perception of their overall health, with no history of depression or anxiety were more likely to report being sexually active.

Prior research supports the health benefits of sexual activity for women who desire sex (Addis et al., 2006; Holmberg et al., 2010; Laumann, 1994; Laumann et al., 1999). We investigated the difference in women's motivations for sex by sexual activity status by comparing their levels of sexual desire and overall satisfaction. Our results showed that while women who had not been recently sexually active have less interest in sex than their sexually active counterparts, the majority are satisfied with their sexual lives. Some women may indeed be completely satisfied without any sexual activity. Therefore, sexual inactivity may not be a reliable indicator of underlying sexual dysfunction absent a measure of distress. According to the Diagnostic and Statistical Manual 5, for a female sexual dysfunction such as Hypoactive Sexual Desire Disorder to be clinically diagnosed the patient must report significant personal distress associated with their sexual inactivity or low desire (American Psychiatric Association, 2013; Brotto, 2010). Since NHSII did not assess women's sex-related distress levels, we describe the following results as contributing to an increasing understanding of middle-aged women's sexual dysfunction symptoms that should be further explored and treated in psychosocial context (Thomas & Thurston, 2016).

As hypothesized, a smaller proportion of unpartnered women reported symptoms of sexual dysfunction than partnered women. This finding is consistent with prior studies (N. E. Avis et al., 2000; Greendale et al., 1996; Mishra & Kuh, 2006; Zeleke et al., 2017) among post-menopausal women that observed an inverse association of being unpartnered with experiencing sexual dysfunction. Future research should investigate whether the overall protective effect of being unpartnered arises from differences in frequency of sexual activity by partner status, differences in level of performance demand from long-term partners as opposed to casual partners, or other partner characteristics.

We observed differences by partner status for almost every factor associated with sexual dysfunction included in this analysis. Whereas previous studies have demonstrated inconsistent findings about whether being partnered is a risk or protective factor for sexual dysfunction among women in midlife, our finding that the relative risk estimates for sexual dysfunction associated with being post-menopausal, independent of age, were greater for unpartnered women than partnered women contributes needed evidence on the direction and magnitude of influence that age, menopause status, and partner status have on sexual function. Another notable finding that echoes the results of Greendale et al. (1996) was that hypertension diagnosis was associated with reduced risk of sexual dysfunction, perhaps due to the use of antihypertensive medication not assessed in this analysis.

Limitations and future research

Our findings must be interpreted with the following limitations in mind. The FSFI-6 has not been included on any NHSII survey before or since 2013. Therefore, the cross-sectional nature of our analysis precludes causal interpretations of our findings as well as characterization of sexual dysfunction in this cohort as episodic or chronic. As the FSFI-6 does not measure women's distress related to their sexual functioning issues, we could not clinically assess female sexual disorders such as Hypoactive Sexual Desire Disorder. Instead we assessed factors associated with reporting past-month symptoms of sexual dysfunction among recently sexually active women. Conducting these analyses only among women

reporting sexual activity over the past month may have caused underestimation of sexual dysfunction in the NHSII; some women may have recently been sexually inactive due to a sexual problem and others due to unavailability of a partner or unimportance of sex to the individual during the time period assessed (Worsley et al., 2017).

We were not able to capture all potential predictors of sexual functioning such as women's history of genitourinary syndrome of menopause commonly experienced by women in midlife (Moral et al., 2018), frequency of sexual activity, and their partners' sexual functioning or health status, which were not measured in the NHSII; nor did we examine sexual trauma history in this analysis. Additionally, the racial and socioeconomic homogeneity of the NHSII cohort limits the generalizability of our findings. Nevertheless, this work advances understanding of many physiologic and psychosocial factors that influence sexual dysfunction among women in midlife. Future research should consider longitudinal follow-up of sexual functioning and assessment of dysfunction-related distress, particularly among women with a history of cancer, chronic disease, or mental health conditions. Doing so would enhance our ability to assess change in sexual dysfunction as women age within the context of increasingly prevalent comorbidities. Findings from such studies will serve to inform future development of interventions for women in midlife and beyond.

Implications for practice and/or policy

Clinical applications of the FSFI-6 as a screening tool for identifying women at risk of sexual dysfunction may gain specificity by applying the modified scoring method used in this analysis. Our approach was to score the full FSFI-6 for sexually active women using the clinical cutoff score of ≤19 and assess sexually inactive women's scores on the items regarding desire and satisfaction that could be answered regardless of sexual activity status. This method of tailoring assessments of sexual functioning to women by sexual activity status for use in outpatient care contexts has the potential to reduce risk of pathologizing normal variation in women's levels of interest in sex and open a productive patient-provider discussion about sexual wellbeing. When the FSFI-6 is used, a measure of personal distress associated with sexual activity status and desire level should also be included to assess whether a woman's symptoms are normal variation and enable clinical assessment of distressing sexual disorders. For example, the long-form FSFI and the Female Sexual Distress Scale – Revised have been successfully applied together to assess Hypoactive Sexual Desire Disorder and demonstrate its strong association with poor quality of life among older women (DeRogatis, Clayton, Lewis-D'Agostino, Wunderlich, & Fu, 2008; Zeleke et al., 2017).

Whether a formal screening measure is used or not, all women – partnered and unpartnered – should be consulted regularly regarding their satisfaction with their level of sexual activity. If they express general dissatisfaction or distress related to a specific domain of sexual function, women should be offered symptomatic management, psychoeducational, or counseling interventions to reduce barriers to sexual activity that are appropriate for their partner status, menopausal status, and overall health (Laumann et al., 1999). Barriers include pain and vaginal dryness, both reported as frequent occurrences by over half of our sample,

as well as social and emotional barriers not assessed here (e.g. relationship problems). Adoption of a patient-centered framework for clinical evaluation and management of common sexual issues in their full physiological and psychosocial context has been recommended as one strategy to advance practice of sexual medicine as part of primary care (Hatzichristou et al., 2004; Thomas & Thurston, 2016).

Conclusion

In conducting the first study of women's sexual functioning in the NHSII and the largest study on the topic to date, we have found that the majority of middle-aged women are sexually active and satisfied with their overall sexual lives. Experiencing symptoms of dysfunction does not necessarily mean that these symptoms have clinical significance or are personally distressing for every woman. Still, a 50% prevalence of middle-aged women experiencing symptoms should serve as a call to action to address common sexual dysfunction symptoms as part of routine primary care visits. Doing so would allow clinicians to monitor changes in women's sexual function over time and identify women who might benefit from symptomatic management or counseling interventions appropriate for their partner status, menopausal status, and overall health.

Acknowledgements:

We acknowledge the Channing Division of Network Medicine, Department of Medicine, Brigham and Women's Hospital and Harvard Medical School for the management of NHSII. We would also like to express gratitude and appreciation to the team of NHSII investigators and the tens of thousands of women across the country participating in NHSII.

Funding: The Nurses' Health Study II was made possible by the National Cancer Institute (grant number UM1 CA176726). Dr. von Hippel was supported by the National Cancer Institute (grant number 3R25CA057711). Dr. Austin is supported by training grants T71-MC-00009 and T76-MC-00001 from the Maternal and Child Health Bureau, Health Resources and Services Administration, US Department of Health and Human Services. Dr. Rosenberg is supported by the Agency for Healthcare Research and Quality (grant number K01HS023680).

Author Biographies:

Christiana von Hippel, ScD, MPH is a Postdoctoral Research Fellow in the Wallace Center for Maternal, Child, and Adolescent Health at the University of California Berkeley School of Public Health.

Avanti Adhia, ScD, is a Postdoctoral Research Fellow in the Harborview Injury Prevention and Research Center at the University of Washington.

Shoshana Rosenberg, ScD, MPH, is an Assistant Professor in the Department of Medicine at the Harvard Medical School and the Department of Medical Oncology at the Dana-Farber Cancer Institute.

S. Bryn Austin, ScD, is a Professor in the Department of Social Behavioral Sciences at the Harvard T.H. Chan School of Public Health and in the Department of Pediatrics at the Harvard Medical School.

Ann Partridge, MD, MPH, is a Professor in the Department of Medicine at the Harvard Medical School and a Medical Oncologist at the Dana-Farber Cancer Institute.

Rulla Tamimi, ScD, is an Associate Professor of Epidemiology at the Harvard T.H. Chan School of Public Health and a Co-Investigator on the Nurses' Health Study 2.

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Table 1.

Distribution of participant characteristics among women in the Nurses' Health Study II by sexual activity status[a] (n = 68,131)[b]

Participant Characteristics (mean ± SD or %, n)	All Women (n=68,131)[b]	Sexually Active (n = 49,701)[a]	Sexually Inactive (n = 18,430)[a]	p-values
Age in 2013 (years)	58.5 ± 4.6	58.0 ± 4.6	59.7 ± 4.4	<.0001
Race				
White	96.7 (65,859)	97.0 (48,184)	95.9 (17,675)	<.0001
All other races	3.3 (2,272)	3.1 (1,517)	4.1 (755)	
Partner status				
Partnered	79.9 (54,435)	88.3 (43,870)	57.3 (10,565)	<.0001
Unpartnered[c]	20.1 (13,696)	11.7 (5,831)	42.7 (7,865)	
Sexual orientation identity				
Heterosexual	98.8 (65,330)	99.1 (47,798)	98.0 (17,532)	<.0001
Sexual minority	1.2 (807)	0.9 (442)	2.0 (365)	
Employment status				
Employed	62.9 (41,372)	64.3 (30,816)	59.2 (10,556)	<.0001
Unemployed	6.4 (4,229)	6.5 (3,132)	6.2 (1,097)	
Retired	18.7 (12,292)	17.6 (8,431)	21.7 (3,861)	
Homemaker/disabled/volunteer	11.9 (7,853)	11.6 (5,549)	12.9 (2,304)	
Self-rated health				
Excellent	25.3 (17,058)	27.6 (13,557)	19.2 (3,501)	<.0001
Very good	45.3 (30,511)	45.8 (22,519)	43.8 (7,992)	
Good	24.5 (16,531)	22.7 (11,171)	29.3 (5,360)	
Fair	4.6 (3,071)	3.6 (1,782)	7.1 (1,289)	
Poor	0.4 (264)	0.3 (137)	0.7 (127)	
Menopausal status				
Pre-menopause	7.3 (4,567)	8.7 (3,937)	3.6 (630)	<.0001
Post-menopause	92.7 (58,018)	91.3 (41,174)	96.4 (16,844)	
Menopausal hormone therapy				
Currently using	20.7 (12,083)	23.0 (9,743)	14.7 (2,340)	<.0001
Never or past user	79.3 (46,186)	77.0 (32,573)	85.3 (13,613)	
BMI category				
Underweight	1.3 (815)	1.3 (595)	1.3 (220)	<.0001
Normal	40.1 (25,960)	43.0 (20,320)	32.1 (5,640)	
Overweight	30.3 (19,663)	30.7 (14,508)	29.3 (5,155)	
Obese	28.4 (18,383)	25.0 (11,830)	37.3 (6,553)	
Depression[d]				
Not depressed	70.8 (48,210)	74.1 (36,841)	61.7 (11,369)	<.0001
Depressed, no medication	28.2 (19,241)	25.0 (12,429)	37.0 (6,812)	
Depressed, on anti-depressants	1.0 (680)	0.9 (431)	1.4 (249)	

Participant Characteristics (mean ± SD or %, n)	All Women (n=68,131)[b]	Sexually Active (n = 49,701)[a]	Sexually Inactive (n = 18,430)[a]	p-values
Anxiety[e]				
No anxiety	94.6 (64,347)	95.1 (47209)	93.1 (17,138)	<.0001
Generalized anxiety disorder	5.4 (3,696)	4.9 (2,427)	6.9 (1,269)	
Disease history				
Hypertension	39.5 (26,921)	36.9 (18,318)	46.7 (8,603)	<.0001
Type 2 diabetes	7.5 (5,126)	6.1 (3,042)	11.3 (2,084)	<.0001
Cancer[f]	9.4 (6,378)	8.8 (4,375)	10.9 (2,003)	<.0001

Note. Counts may not sum to sample size totals due to missing data and percentages may not total 100% due to rounding.

[a] Sexual activity status was determined by a "no sexual activity" response to one or more items on the Female Sexual Function Index (FSFI-6), an abridged form of the FSFI-19 that assesses sexual function over the past 4 weeks.

[b] Sample includes women with complete Female Sexual Function Index (FSFI-6) data.

[c] Unmarried includes women who were divorced, widowed, or never married at the time of the 2013 NHSII questionnaire.

[d] Assessment of depression was based on a CES-D score >16 and/or a history of physician diagnosis. Anti-depressant medication use was self-reported in 2013.

[e] Assessment of anxiety was based on a GAD-7 score ≥10 at the time of questionnaire completion.

[f] Our assessment of cancer history includes any cancer except for non-melanoma skin cancer diagnosed before the 2013 NHSII questionnaire.

Table 2.

Distribution of levels of sexual desire[a] and satisfaction[a] among middle-aged women in the Nurses' Health Study II by sexual activity status (n = 68,131)

	Sexual Activity Status (%, n)		
	Sexually Active Women (n = 49,701)	**Sexually Inactive Women (n = 18,430)**	**p-values[b]**
Desire			<.0001
High	7.9 (3,922)	1.7 (312)	
Moderate	33.5 (16,628)	10.1 (1,858)	
Low	58.7 (29,151)	88.2 (16,260)	
Satisfaction			<.0001
High	51.4 (25,519)	26.7 (4,918)	
Moderate	24.8 (12,337)	27.2 (5,007)	
Low	23.8 (11,845)	46.2 (8,505)	

Note. Percentages may not sum to 100% due to rounding.

[a] Desire for sex and satisfaction with overall sexual life were each assessed by a single item from the Female Sexual Function Index (FSFI-6).

[b] p-values based on χ^2-tests.

Table 3.

Distribution of overall sexual function[a] and domain-specific levels of sexual function[b] among sexually active middle-aged women by partner status (n = 49,701)

	Partner Status (%, n)		
Domains of sexual function	**Partnered Women (n = 43,870)**	**Unpartnered Women (n = 5,831)**	**p-values[b]**
Overall sexual function[a]			<.0001
No symptoms of dysfunction	49.0 (21,482)	57.8 (3,371)	
Some symptoms of dysfunction	51.0 (22,388)	42.2 (2,460)	
Desire level			<.0001
High	6.2 (2,701)	20.9 (1,221)	
Moderate	33.1 (14,507)	36.4 (2,121)	
Low	60.8 (26,662)	42.7 (2,489)	
Arousal level			<.0001
High	25.4 (11,144)	38.9 (2,269)	
Moderate	37.8 (16,602)	32.6 (1,902)	
Low	36.8 (16,124)	28.5 (1,660)	
Lubrication frequency			<.0001
Often	44.4 (19,465)	59.8 (3,485)	
Sometimes	15.6 (6,820)	11.4 (665)	
Never	40.1 (17,585)	28.8 (1,681)	
Orgasm frequency			<.0001
Often	58.3 (25,554)	65.6 (3,822)	
Sometimes	13.3 (5,853)	11.8 (690)	
Never	28.4 (12,463)	22.6 (1,319)	
Satisfaction level			<.0001
High	51.1 (22,433)	52.9 (3,086)	
Moderate	25.1 (11,030)	22.4 (1,307)	
Low	23.7 (10,407)	24.7 (1,438)	
Dyspareunia/pain frequency			<.0001
Often	63.6 (27,912)	63.8 (3,717)	
Sometimes	12.7 (5,564)	7.8 (456)	
Never	16.0 (7,027)	8.3 (486)	
No intercourse[c]	7.7 (3,367)	20.1 (1,172)	

Note. Percentages may not sum to 100% due to rounding.

[a]Overall sexual function was determined by the clinical cutoff of the Female Sexual Function Index (FSFI-6), an abridged form of the FSFI-19 that assesses sexual function over the past 4 weeks. A score ≤19 indicated self-reporting of potentially clinically-relevant symptoms of sexual dysfunction.

[b]Levels of function in domains of sexual function are each represented by the score of one item from the FSFI-6.

[c]Women who reported not attempting intercourse in the past 4 weeks were still considered sexually active if they responded to the other FSFI-6 items with reference to sexual activity other than intercourse (e.g., oral sex).

Table 4.

Adjusted multivariate risk ratios (RR) and confidence intervals (CI) estimating middle-aged sexually active women's risk of experiencing any symptoms of sexual dysfunction overall and stratified by partner status

	Adjusted Risk Ratios (95% CI)			
Covariates	**Overall (n = 49,701)**	**Partnered (n = 43,870)**	**Unpartnered (n = 5,831)**	**p-values[a]**
Partner status				
Married or partnered	1.00			
Not married or partnered	0.78 (0.76, 0.80)***			
Sexual orientation identity				
Heterosexual	1.00	1.00	1.00	-
Sexual minority	1.06 (.98, 1.15)	1.01 (0.92, 1.11)	1.19 (1.02, 1.39)*	0.03
Self-rated health				
Excellent	0.75 (0.73, 0.77)***	0.75 (0.73, 0.77)***	0.66 (0.60, 0.73)***	<0.00
Very good	0.86 (0.84, 0.87)***	0.86 (0.84, 0.88)***	0.85 (0.79, 0.91)***	0.34
Good	1.00	1.00	1.00	-
Fair	1.09 (1.05, 1.13)***	1.08 (1.04, 1.12)***	1.11 (1.01, 1.23)*	0.58
Poor	1.27 (1.17, 1.38)***	1.27 (1.16, 1.38)***	1.33 (1.03, 1.72)*	0.92
Menopausal status				
Pre-menopause	1.00	1.00	1.00	-
Post-menopause	1.92 (1.81, 2.03)***	1.89 (1.78, 2.00)***	2.37 (1.87, 2.99)***	<0.00
Menopausal hormone therapy				
Never or past user	1.00	1.00	1.00	-
Currently using	0.88 (0.86, 0.90)***	0.89 (0.86, 0.91)***	0.79 (0.73, 0.86)***	<.00
BMI category				
Underweight	1.08 (1.01, 1.16)*	1.08 (1.00, 1.16)*	1.12 (0.87, 1.46)	.61
Normal	1.00	1.00	1.00	-
Overweight	0.94 (0.92, 0.96)***	0.93 (0.91, 0.95)***	1.06 (0.98, 1.15)	<0.00
Obese	0.90 (0.88, 0.92)***	0.88 (0.86, 0.90)***	1.08 (1.00, 1.17)*	<0.00
Depression				

	Adjusted Risk Ratios (95% CI)			
Covariates	**Overall (n = 49,701)**	**Partnered (n = 43,870)**	**Unpartnered (n = 5,831)**	**p-values[a]**
Not depressed	1.00	1.00	1.00	-
Depressed, no medication	1.22 (1.20, 1.24)***	1.22 (1.20, 1.25)***	1.18 (1.11, 1.26)***	0.77
Depressed, on anti-depressants	1.26 (1.18, 1.35)***	1.25 (1.16, 1.35)***	1.39 (1.11, 1.76)**	0.34
Anxiety				
No anxiety disorder	1.00	1.00	1.00	-
Generalized anxiety disorder	1.25 (1.21, 1.28)***	1.25 (1.21, 1.29)***	1.19 (1.08, 1.30)***	0.55
Disease history				
Hypertension vs. none	0.96 (0.94, 0.98)***	0.96 (0.94, 0.98)***	0.95 (0.89, 1.02)	<0.00
Type 2 diabetes vs. none	1.00 (0.96, 1.03)	1.00 (0.97, 1.04)	0.94 (0.85, 1.04)	0.34
Cancer history vs. none	1.10 (1.07, 1.12)***	1.11 (1.08, 1.14)***	1.02 (0.93, 1.11)	0.24

Note. All models are adjusted for age, race, and employment status at the time of the 2013 questionnaire.

[a]p-values for between partner status group interaction terms.

*p < 0.05,

**p < 0.01,

***p < 0.001