

Are changes in sexual functioning during midlife due to aging or menopause?

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Objective: To determine whether changes in women's sexual functioning during midlife are due to aging or menopause.

Design: Prospective, observational study.

Setting: Population-based sample assessed in own homes.

Patient(s): Four hundred thirty-eight Australian-born women aged 45–55 years and still menstruating at baseline. One hundred ninety-seven were studied for effects of the natural menopausal transition. Control group A (n = 44) remained premenopausal or early perimenopausal for 7 years. Control group B (n = 42) remained postmenopausal over 5 years.

Intervention(s): Nil; questionnaires and blood sampling annually.

Main Outcome Measure(s): Shortened version of the Personal Experiences Questionnaire.

Result(s): By the late perimenopause, there was a significant decline in the factors we had derived of sexual responsiveness and total score, and there was an increase in the partner's problems factor. By the postmenopausal phase, there was a further decline in the factors sexual responsiveness, frequency of sexual activities, libido, and in the total score, and a significant increase in vaginal dyspareunia and partner's problems. Sexual responsiveness significantly declined in both control groups.

Conclusion(s): Sexual responsiveness is adversely affected by both aging and the menopausal transition. Other domains of female sexual functioning were significantly adversely affected when the women became postmenopausal. The relationship with the partner and his ability to perform sexually is adversely affected by the menopausal transition. (Fertil Steril® 2001;76:456–60. ©2001 by American Society for Reproductive Medicine.)

Key Words: Sexuality, menopause, midlife, aging

Women attending menopause clinics often complain of increasing sexual problems (1), but clinical experience is known to be based on a small proportion of self-selecting and often symptomatic women and may not be representative of most women's experience (2, 3). Population-based surveys can help address the question of a link between aging, menopause, and sexuality. Aging and length of the relationship are known to affect sexual functioning of both men and women. For example, James (4) used cross-sectional and longitudinal data to show that coital rate halved over the first year of marriage and then took another 20 years to halve again. Studies that have included women of disparate ages have found a pattern of an incremental decline in sexual functioning in midlife (5–9).

Some studies have attempted to disentangle the age effect from the effect of menopausal status, with which it is confounded. The Gothenburg study of Hallstrom (6) was seemingly in a better position than most cross-sectional studies to address this issue because it was stratified by age instead of age groups. Within each age group of women aged 38, 46, 50, and 54 years were premenopausal, perimenopausal, and postmenopausal women. When age was controlled, the relationship between menopausal status and decreased sexual functioning remained significant, but when menopausal phase was held constant, the relationship between age and sexual functioning was not significant, indicating a significant independent contribution from the menopause. Other cross-sectional studies have found a significant inde-

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pendent effect of menopausal status on sexual functioning (5, 10, 11). Conflicting findings were reported by Oxford, UK (8, 9) and Danish studies (12).

Very few studies have used validated rating scales to measure the different aspects of female sexual functioning. The majority of studies have been cross-sectional, comparing women of different menopausal status. Yet prior level of sexual functioning is likely to differ substantially between women, and this may obscure differences related to menopausal status. The most appropriate way to assess the effects of changing endocrine phase is to study the same women prospectively as they pass through the endocrine stage of interest. Such longitudinal or prospective observational studies are also the only way in which change over time can be assessed. Clearly, menopausal status is confounded with aging.

A major problem is the need for appropriate data analysis techniques, which can disentangle the effects of aging from those of menopause. When the statistical problem is to examine the effect of an intrinsic event (such as reaching a particular menopausal phase), the simplified method of summary statistics—dividing into pre and post series, adjusting for the premenopausal values—is the simplest and most powerful method. Comparison of findings for those who change their menopausal status with those whose menopausal status remains unchanged over the same time period allows further delineation of which effects are related to aging and which effects reflect the menopausal transition.

This paper overcomes previous methodological flaws by using a longitudinal population-based cohort of Australian-born middle-aged women, a validated rating scale that examines different aspects of female sexual functioning, and statistical techniques to depict which changes are related to the menopausal transition and which reflect aging or length of time under study.

THE MELBOURNE WOMEN'S MIDLIFE HEALTH PROJECT

Cross-sectional data was reported from the initial baseline study of a population sample of 2,001 randomly selected Australian-born women aged between 45 and 55 years (11). Although most women (62%) reported no change in sexual interest, 31% reported a decrease and 7% reported an increase in sexual interest (11). Reduction in sexual interest was significantly associated with natural menopause rather than with age, decreased well-being, lower education, lack of paid employment, and increased symptomatology (11). This initial study was limited by using only four questions about sexual functioning rather than a valid, reliable measure of sexual functioning.

A later paper (13) reported the internal validity, reliability, and utility of a detailed questionnaire, the Personal Experiences Questionnaire, which was adapted from the

McCoy Female Sexuality Questionnaire (14). Cross-sectional analysis of data from the 4th year of the longitudinal study (13) found good internal consistency (Cronbach's $\alpha = 0.71$). Six factors were found on principal-components factor analysis: factor 1, feelings for partner; factor 2, sexual responsivity; factor 3, frequency of sexual activities; factor 4, libido; factor 5, partner problems, and factor 6, vaginal dryness and dyspareunia. Using an optimization procedure, we reduced the number of items in the scale to produce a shortened version (SPEQ) with improved internal consistency (15).

The present analysis uses data drawn from baseline and the subsequent eight annual face-to-face follow-up interviews to model the effects of both the menopausal transition and aging on the different domains of female sexual functioning.

MATERIALS AND METHODS

Subjects

The study began in 1991 with population sampling by random telephone digital dialing and baseline interview of 2,001 Australian-born women aged between 45 and 55 years and resident in Melbourne (71% response rate) (16). All those women at baseline who had experienced menses in the prior 3 months and who were not taking the oral contraceptive pill or hormone replacement therapy (HRT) were invited to participate in a longitudinal study. Of those eligible, only 56% chose to do so ($n = 438$). Volunteers for the longitudinal study were more likely than nonparticipants to report better self-rated health, paid employment, >12 years of education, ever having had a pap smear, exercising at least once a week, and having undergone dilatation and curettage (17).

The retention rate by year 8 of follow-up was 88%. Women were excluded from analyses for the following reasons: dropouts, surgical menopause during the study, oral contraceptive use at any year. Women were also excluded from summary statistics analysis of the effects of the menopausal transition if they had not passed through enough menopausal categories. This left a sample size for summary statistics analysis of the menopausal transition (group M) of $n = 197$. Two control groups were selected from the subjects not included in the summary statistics analysis. These control groups provided information about change in sexual functioning with time while menopausal status was unchanged. Control group A stayed premenopausal or early perimenopausal between years 1 and 7 ($n = 44$), and control group B stayed postmenopausal between years 3 and 8 ($n = 42$).

Measures and Procedures

The study was approved by the Human Research Ethics Committee of the University of Melbourne, and the procedures followed were in accordance with the ethical standards

TABLE 1

The Personal Experiences Questionnaire.

PEQ Factor	Items	
	PEQ	SPEQ
1: Feelings for partner	Companionable love for partner Satisfied with partner as friend Passionate love for partner Satisfied with partner as lover Resentment toward partner Hostility toward partner	Passionate love for partner Satisfied with partner as lover
2: Sexual responsivity	Arousal during sexual activities Orgasm during sexual activities Enjoyment of sexual activities	Arousal during sexual activities Orgasm during sexual activities Enjoyment of sexual activities
3: Frequency of sexual activities	Sexual intercourse in last month (frequency) Sexual activities in the last 2 weeks (frequency) Satisfied with frequency of sexual activity	Sexual activities in the last 2 weeks (frequency)
4: Libido	Sexual thoughts/fantasies in last month (frequency) Masturbation (frequency)	Sexual thoughts/fantasies in last month (frequency)
5: Partner problems	Partner difficulties in sexual performance	Partner difficulties in sexual performance
6: Vaginal dryness/dyspareunia	Lack vaginal wetness during sexual activity Pain during intercourse	Pain during intercourse

Dennerstein. *Sexuality, menopause, and aging. Fertil Steril* 2001.

of the National Health and Medical Research Council. All subjects provided written informed consent for their participation in the study.

The Personal Experiences Questionnaire was based on the McCoy Female Sexuality Questionnaire (14), with modifications as already described (13, 15). The questionnaire is handed to each woman annually at the time of interview. The woman completes the questionnaire and hands it back to the fieldworker. Table 1 lists the items retained in the factors in both short and long versions of the scale. A mean is derived for all items within each SPEQ factor, and a total score is calculated as the sum of SPEQ factor 2 (sexual responsivity), SPEQ factor 3, (frequency of sexual activities), and SPEQ factor 4 (libido).

Fasting morning blood samples for hormone radioimmunoassays were taken between days 4 and 8 of the menstrual cycle for those still cycling or after 3 months of amenorrhea, as described elsewhere (17).

Menopausal status was determined from change in menstrual status asked at each annual interview for those women who were not taking HRT. Premenopausal status was assigned to women who reported no change in menstrual frequency. Early perimenopausal status was used when women reported change in menstrual frequency. Late perimenopausal status was assigned when women reported at least 3 months of amenorrhea but <12 months amenorrhea. Women were deemed to be postmenopausal when there had been amenorrhea for ≥ 12 months. Reports of ≥ 3 months of amenorrhea were verified by fieldworkers from prospectively kept daily menstrual diaries. Current HRT users were

placed in a separate category from those in the natural menopausal transition.

Statistical Analysis

The summary statistics method used calculated the arithmetic mean of SPEQ domains for each of the following menopausal states: PRE (premenopause and early perimenopause combined), LPERI (late perimenopause), and POST (postmenopause). We chose to compare these three states because we and colleagues have previously shown that hormonal change of FSH and E_2 are maximal at the late perimenopause (18) and that this is also the phase at which there is a significant increase in the reporting of vasomotor symptoms (19).

Study years on HRT or after surgical menopause were excluded from the calculation of summary means. Changes between the menopausal states PRE to LPERI and LPERI to POST were then calculated and compared with the null hypothesis of zero change using one-sample *t* tests. Mean changes are presented with 95% confidence intervals and nominal *P* values. Mean SPEQ factor scores were examined for changes between years 1 and 7 for control group A (stayed PRE) and between years 3 and 8 for control group B (stayed POST).

Power Analysis

Using the summary statistics technique and a sample size of 197, the one-sample *t* test is able to detect with <5% alpha error and > 90% power a decline of ≤ 0.4 on the SPEQ total score. The range of possible values for the SPEQ total score is 1 to 25.

TABLE 2

Mean ($\pm 95\%$ CI) change in SPEQ domains for premenopause and early perimenopause to late perimenopause and late perimenopause to postmenopause.

SPEQ domain	PRE/EPERI to LPERI			LPERI to POST		
	Mean change	95% CI	<i>P</i>	Mean change	95% CI	<i>P</i>
SPEQ1 (partner feelings)	-0.13	-0.25 to -0.02	<.05	0.01	-0.12 to 0.12	.9
SPEQ2 (responsivity)	-0.44	-0.56 to -0.32	<.0001	-0.17	-0.29 to -0.05	<.01
SPEQ3 (frequency)	-0.09	-0.20 to 0.02	.096	-0.14	-0.26 to -0.03	<.05
SPEQ4 (libido)	-0.15	-0.32 to 0.01	.069	-0.20	-0.34 to -0.05	<.01
SPEQ5 (vaginal dyspareunia)	0.05	-0.09 to 0.19	.5	0.27	0.09 to 0.46	<.01
SPEQ6 (partner problems)	0.27	0.12 to 0.42	<.001	0.15	0.00 to 0.29	<.05
SPEQ total score	-0.71	-0.98 to -0.43	<.001	-0.44	-0.73 to -0.16	<.01

Note: PRE/EPERI = premenopause and early perimenopause; LPERI = late perimenopause; POST = postmenopause.

Dennerstein. Sexuality, menopause, and aging. *Fertil Steril* 2001.

RESULTS

Sample Profile for Group M

The women had a mean age of 48.5 years ($SD \pm 2.3$) at baseline. Thirty-seven percent had more than 12 years education. The median parity was 3, range 0 to 9. Eighty-six percent of women were married or living with a partner in year 1, and 81% of women were married or living with a partner by year 8 of follow-up.

Change in Domains of Sexual Functioning With the Menopausal Transition

When data from group M were analyzed, summary statistics found a significant decline in sexual functioning. The various domains of sexual functioning were differentially affected by the menopausal transition. The change in the domain factors is shown in Table 2. It can be seen that the total score of sexual functioning fell dramatically from early in the menopausal transition to the late perimenopause ($P < .001$). Sexual responsivity was the only domain of female sexual functioning to decline significantly from early in the transition to late perimenopause ($P < .0001$). During the same phase, partner's problems with sexual performance increased significantly ($P < .001$), and the woman's positive feelings for partner declined significantly ($P < .05$). From late perimenopause to postmenopause, there were further but less dramatic declines in the total score of female sexual functioning ($P < .01$), sexual responsivity ($P < .01$), and significant declines in libido ($P < .01$) and frequency of sexual activities ($P < .05$), a significant increase in vaginal dyspareunia ($P < .01$), and a further significant increase in partner's problems in sexual performance ($P < .05$).

Change in Domains of Sexual Functioning With Time

Data from control group A ($n = 44$) were available for 7 years, during which time they remained premenopausal or early perimenopausal. The only parameter to show any significant change over 7 years in this group was sexual respon-

sivity (mean change = -0.67 ; confidence interval, -1.04 , -0.31 ; $P = .0005$). Although women who remained in this group appeared to be in the earlier part of the menopausal transition in that they had not reported 3 months of amenorrhea, their FSH levels increased significantly from the 1st to the 7th year (mean change = $+19.3$; confidence interval, $+10.6$, $+28.0$; $P < .0001$), and E_2 levels decreased (mean change = -212 ; confidence interval, -366 , -58 ; $P < .01$) between years 3 and 8.

Data from control group B ($n = 42$) were analyzed for 5 years, during which the women remained postmenopausal. The only parameter of sexual functioning to show any change was again sexual responsivity (mean change = -0.42 ; confidence interval, -0.81 , -0.03 ; $P = .036$). There were no significant changes in hormone levels of FSH or E_2 during these 5 postmenopausal years.

DISCUSSION

The longitudinal analysis confirms previous studies that show a decline in aspects of female sexual functioning with both age and the menopausal transition. The use of comparison groups chosen from the same sample so that the effect of aging could be studied while menopausal status remained stable demonstrated that sexual responsivity decreased with time. The other domains studied were not significantly affected by aging. Frequency of sexual activities and libido were decreased most in the postmenopause and may relate to the significant increase in vaginal dyspareunia in the postmenopause. Bothersome hot flushes also increased in the late perimenopause (19), and the occurrence of such symptoms may impact on other areas of quality of life, including sexual functioning.

The menopausal transition is a time of psychosocial as well as biologic change. Population-based surveys have found that many psychosocial and health status factors are associated with female sexual functioning in midlife (5–9,

11, 12). These include presence of a sexual partner, partner's age, and health, which clearly affects male sexual functioning, length of the relationship, feelings toward the partner, level of past sexual functioning, social class, educational level, stressors, employment, personality factors, negative attitudes toward the menopause, and experience of physical or psychological ill health.

Pooled data from the Melbourne Women's Midlife Health Project (20) was used to depict the interrelationships between different domains of women's sexual functioning and a number of possible determinants. In the latter study (20), the statistical technique of structural equation modeling found some effects of hormone levels (indicated through a significant effect of menopausal status on vaginal dyspareunia and direct effects of menopausal status on the number of bothersome symptoms). The number of symptoms affected well-being, which influenced sexual responsiveness, which in turn influenced frequency of sexual activities and libido. A powerful effect of feelings for partner was found on libido. Other social factors such as educational level, experience of interpersonal stress, and daily hassles affected sexual functioning indirectly by influencing symptoms and/or well-being (20).

The structural equation modeling used a pooled-analysis technique rather than longitudinal modeling, so it was not able to disentangle the effect of change in menopausal status from that of aging. Although no direct effect of hormone levels on the sexuality factors was found in this latter analysis (20), further longitudinal modeling using hormone profiles for each individual and cluster analysis may assist in determining whether hormonal change plays a role for certain groups of women. Given that we have already found that the amount of bioavailable testosterone (free androgen index) is increased significantly as women pass through the menopausal transition (21), we do not expect that changes in testosterone can explain the decline in sexual functioning associated with the menopausal transition.

In conclusion, sexual responsiveness declines significantly with both time and the menopausal transition. Other parameters of female sexual functioning are differentially affected by the menopausal transition. Detrimental effects on libido, frequency of sexual activities, and vaginal dyspareunia become more pronounced as women become postmenopausal. Aspects of the relationship with the partner are also affected

by the menopausal transition. Both biologic and psychosocial factors affect women's sexual functioning during the midlife years, with the relationship with the partner having particularly powerful effects.

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