

**Sleep quality, duration and associated sexual function at older age: findings
from the English longitudinal Study of Ageing**

Abstract

Background

This study aimed to explore associations between sleep quality, duration and sexual problems (erectile dysfunction, difficulty becoming aroused, difficulty reaching orgasm) in a large, representative sample of older adults.

Method

Data were from 2,568 men and 1,376 women participating in Wave 6 of the English Longitudinal Study of Ageing (2012/13). Sleep quality and duration and problems with erectile function, sexual arousal and orgasmic experience were self-reported, and associations examined using logistic regression models. Covariates included age, ethnicity, partner status, wealth, limiting long-standing illness, smoking, alcohol consumption, physical activity and depressive symptoms.

Results

In women, moderate (OR=1.53, 95% CI 1.09-2.13, $p=0.013$) and low sleep quality (OR=1.70, 95% CI 1.24-2.32, $p=0.001$) were associated with increased odds of arousal problems relative to high sleep quality. In men, moderate sleep quality was associated with increased odds of erectile difficulties (OR=1.47, 95% CI 1.16-1.85, $p=0.001$), the difference between low and high sleep quality did not reach statistical significance (OR=1.24, 95% CI 0.97-1.58, $p=0.091$). Sleep quality was not associated with difficulty achieving an orgasm in men, but in women low sleep quality was associated with increased odds of orgasmic difficulty (OR=1.63, 95% CI 1.18-2.25, $p=0.003$). No associations between sleep duration and problems with sexual function were observed in women, but in men, long sleep was associated with higher odds of difficulty achieving orgasm (OR=1.75, 95% CI 1.04-2.95, $p=0.036$) relative to optimal sleep duration.

Clinical Translation

Older adults presenting sleep problems should be screened for sexual dysfunction and vice versa.

Strengths and Limitations

Strengths of this study include the large representative sample of older English adults, the assessment of several aspects of sexual dysfunction and sleep, and the inclusion of potentially important confounding variables into statistical models. However, the study was cross-sectional, meaning we were unable to ascertain the direction of the observed associations.

Conclusion

Sleep problems are associated with sexual dysfunction in older English adults, although some variation is noted between men and women.

Key words: sexual activity; sexual dysfunction; erectile dysfunction; sleep problems; sleep duration

Background

Sexual activity, an important component of intimate relationships, tends to decline as people get older (1). This is likely to be attributable, at least in part, to an age-related increase in sexual problems, including loss of libido and disturbances in physiological or psychosocial aspects of sexual function (2–5). In a large, representative survey of US adults aged 57 to 85, 31-45% of men reported difficulty achieving or maintaining an erection and 36-44% of women reported difficulty with vaginal lubrication (1). When engaging in sexual activity, 16-33% of men and 33-38% of women reported an inability to climax and 21-30% of men reported climaxing too quickly. Sexual problems had a direct impact on participants' sex lives, with 22-30% of men and 23-34% of women who reported experiencing at least one sexual problem saying they avoided sex as a result (1). Importantly, problems with sexual function have also been shown to be associated with a range of adverse mental and physical outcomes, including depression (6) and cardiovascular disease (7). Identifying modifiable correlates of sexual dysfunction in older adults is important for informing the development of targeted interventions to improve sexual relationships, health and wellbeing in later life.

One factor that may plausibly be associated with sexual dysfunction is sleep disturbance. Like sexual problems, complaints of sleep disturbance increase with age (8) and are commonly reported by older adults, with approximately 23% to 34% of people aged 65 years and over experiencing symptoms of insomnia (9,10). Sleep problems also share some of the comorbidities associated with sexual dysfunction, including depression and cardiovascular disease. Meta-analyses have shown that insomnia doubles the risk of incident depression (12) and difficulty initiating sleep, difficulty maintaining sleep and non-restorative sleep are associated with an increased risk of future cardio-cerebral vascular events (11). Indeed, previous literature has suggested that sleep quality may influence erectile function using small samples and varying age groups <https://onlinelibrary.wiley.com/doi/full/10.1111/and.12631>. Other literature has suggested that sleep apnea is associated with erectile dysfunction <https://www.sciencedirect.com/science/article/pii/S1389945705000638> [https://www.goldjournal.net/article/0090-4295\(90\)80262-L/abstract](https://www.goldjournal.net/article/0090-4295(90)80262-L/abstract) <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0201930> However, to our knowledge, just one previous study has investigated the association between sleep and sexual dysfunction in older adults only; finding that poorer sleep quality was associated with higher levels of sexual dysfunction (erectile dysfunction in men and arousal problems in women) (13). However, while sociodemographic characteristics and health behaviours were controlled for, the analyses

were not adjusted for other potentially important confounders known to be associated with both sleep and sexual problems (e.g. depressive symptoms and limiting illness). There is a need for further investigation of the relationship between sleep quality and sexual dysfunction with a more comprehensive list of covariates. In addition, there is a lack of data on the association between sleep *duration* and sexual dysfunction. With the duration of sleep arguably more easily modified than sleep quality (e.g. by going to bed earlier), investigation in this area is warranted.

The present study therefore aimed to address these gaps in the literature by examining associations between sleep quality, duration and a range of sexual problems (erectile dysfunction, difficulty becoming aroused, difficulty reaching orgasm) in a large, representative sample of older adults, with adjustment for a number of key covariates.

Materials and Methods

Study population

This study uses data from the English Longitudinal Study of Ageing (ELSA), a population-representative longitudinal panel study of men and women aged ≥ 50 years living in England (14). ELSA began in 2002 (Wave 1) and participants are followed up at two-year intervals. The sample is refreshed periodically to maintain representation of the younger end of the age spectrum. Data are collected via computer assisted personal interview (CAPI) conducted by a trained researcher in the participant's home or residence, and additional self-completion questionnaires are returned by post after the CAPI. The present analyses are based on data from Wave 6 (2012/13) as this is the only wave in which problems with sexual function have been assessed. Ethical approval was obtained from the London Multi-Centre Research Ethics Committee and all participants provided full informed consent to participate in the study.

Measurement of exposures: sleep quality and duration

Sleep quality was assessed with three items assessing the frequency with which respondents experienced (i) delay in falling asleep, (ii) inability to stay asleep and (iii) waking up feeling tired (1=no difficulties, 2=less than once a week, 3=once or twice a week, 4=three times or more a week), and one item that provided an overall rating of sleep quality over the past month (1=very good, 2=good, 3=fairly bad, 4=very bad). Scores on the four items were summed and analysed as tertiles,

with the first (lowest) tertile representing the least sleep disturbance (i.e. highest sleep quality) and the third (highest) tertile the most sleep disturbance (i.e. lowest sleep quality) (15).

Sleep duration was assessed with an open-ended question that asked respondents to report how many hours they slept per night on average during the week. We categorised responses as <6 (short sleep), 6–8 (optimal sleep) and >8 hours (long sleep) for analysis (15,16).

Measurement of outcomes: problems with sexual function

All men were asked about their ability to get and keep an erection which would be good enough for sexual activity during the past month, with the response options *always*, *usually*, *sometimes*, or *never*. We considered responses of *sometimes* or *never* indicative of difficulty getting and keeping an erection.

Women who reported any sexual activity (defined as sexual intercourse, masturbation, petting or fondling) in the past year were asked how often they felt sexually aroused during sexual activity during the past month. Response options were *almost never/never aroused*, *aroused a few times (much less than half the time)*, *aroused sometimes (about half the time)*, *aroused most of the time (much more than half the time)*, and *almost always/always aroused*. We considered responses of *almost never/never aroused* and *aroused a few times (much less than half the time)* indicative of difficulty becoming sexually aroused.

Men and women who reported any sexual activity in the past year were asked how difficult they found it to reach orgasm in response to sexual stimulation during the past month. Response options were *extremely difficult/impossible*, *very difficult*, *moderately difficult*, *slightly difficult*, and *not at all difficult*. We considered responses from *moderately difficult* to *extremely difficult/impossible* indicative of difficulty reaching orgasm.

Measurement of covariates

Participants reported their age, ethnicity (white vs. non-white) and partnership status (married/cohabiting, separated/divorced, widowed, or single/never married). Socio-economic status (SES) was indexed using household non-pension wealth (which is particularly relevant to health outcomes in this age group (17)), categorised into quintiles across all Wave 6 ELSA participants. Smoking status was self-reported, (smoker or non-smoker) as was frequency of alcohol intake, categorised as never/rarely (never – once or twice a year), regularly (once every two months – twice

a week), or frequently (3 days a week – almost every day) (18). Physical activity was assessed with three items that asked about frequency of participation in vigorous, moderate and low-intensity activities (more than once a week, once a week, 1-3 times a month, hardly ever/never), and responses were grouped into three categories, as previously described (19): inactive (no moderate/vigorous activity on a weekly basis); moderate activity at least once a week; and vigorous activity at least once a week. Limiting long-standing illness was self-reported in response to two questions: (i) *“Do you have any long-standing illness, disability, or infirmity? By long-standing I mean anything that has troubled you over a period of time or that is likely to affect you over a period of time.”* If yes, (ii) *“Does this illness or disability limit your activities in any way?”* Declaration of a long-standing illness and any form of limitation classified the participant as having a limiting long-standing illness. Depressive symptoms were assessed using the 8-item Center for Epidemiologic Studies Depression Scale, a highly validated measure for use in this age group (20).

Statistical analyses

Analyses were performed using IBM SPSS Statistics version 24. We applied weights to the data to correct for sampling probabilities and for differential non-response and to calibrate back to the 2011 National Census population distributions for age and gender. The weights accounted for the differential probability of being included in wave 6 of ELSA and for non-response to the SRA-Q. Further details are available at http://doc.ukdataservice.ac.uk/doc/5050/mrdoc/pdf/5050_elsa_w6_technical_report_v1.pdf.

We used logistic regression to examine associations between the exposures and outcomes, adjusted for all covariates. In models testing associations with sleep quality, the reference category was the first tertile (highest sleep quality). In models testing associations with sleep duration, the reference category was 6–8 hours (optimal sleep duration). Results are reported as odds ratios (ORs) and 95% confidence intervals (CIs) of reporting sexual problems. All analyses were performed on complete cases and conducted separately for men and women. A p -value <0.05 was considered statistically significant.

Results

There were 10,601 individuals interviewed in Wave 6 of ELSA, of whom 7,079 (67% of those eligible) completed the paper-based questionnaire that included measures of sexual function. A total of 1,675 women reported no sexual activity in the last year and were therefore not asked about

problems with sexual function. We also excluded 1,460 participants with missing data, leaving a final sample for analysis of 3,944 older adults (2,568 men and 1,376 women).

Descriptive characteristics are shown in Table 1. The mean ages of men and women were 64.3 and 60.7, respectively. The majority of participants were married or cohabiting (73.9% of men, 76.9% of women), white (93.8% of men, 97.2% of women), non-smokers (85.6% of men, 86.6% of women) who drank alcohol regularly or frequently (84.2% of men, 80.2% of women), participated in regular moderate or vigorous physical activity (80.2% of men, 73.9% of women) and were free of limiting long-standing illness (68.9% of men, 73.0% of women). The sample overrepresented the upper quintiles of wealth, with 22.0% of men and 24.9% of women in the richest quintile of all Wave 6 ELISA participants.

Results of the logistic regression models are shown in Table 2. In women, moderate (OR=1.53, 95% CI 1.09-2.13, $p=0.013$) and low sleep quality (OR=1.70, 95% CI 1.24-2.32, $p=0.001$) were associated with increased odds of arousal problems relative to high sleep quality. In men, moderate sleep quality was associated with increased odds of erectile difficulties (OR=1.47, 95% CI 1.16-1.85, $p=0.001$) relative to high sleep quality, but the difference between low and high sleep quality did not reach statistical significance (OR=1.24, 95% CI 0.97-1.58, $p=0.091$). Sleep quality was not significantly associated with difficulty achieving orgasm in men, but in women low sleep quality was associated with increased odds of orgasmic difficulty (OR=1.63, 95% CI 1.18-2.25, $p=0.003$).

No significant associations between sleep duration and problems with sexual function were observed in women (Table 2). However, in men, long sleep (>8 hours) was associated with significantly higher odds of difficulty achieving orgasm (OR=1.75, 95% CI 1.04-2.95, $p=0.036$) relative to optimal sleep duration (6-8 hours), and there was a borderline significant association between long sleep and increased odds of erectile difficulties (OR=1.41, 95% CI 0.97-2.04, $p=0.071$).

Discussion

In this large, representative sample of older English adults, we found evidence that reduced sleep quality was associated with increased odds of arousal problems and difficulty reaching orgasm in women, and erectile difficulties in men. No significant associations between sleep duration and problems with sexual function were observed in women. However, in men, long sleep was associated with significantly higher odds of difficulty achieving orgasm relative to optimal sleep duration, and there was a borderline significant association between long sleep and increased odds of erectile difficulties. Taken together, these results suggest that sleep problems may be associated with sexual dysfunction in older English adults.

These findings extend the existing literature relating poor sleep quality and sleep conditions (i.e. sleep apnea) to greater sexual dysfunction. Our results indicate that the relationship between sleep problems and sexual dysfunction is not as simplistic as previously suggested (poorer quality sleep = greater dysfunction) (13). Rather, when important potential confounding variables (e.g. depressive symptoms, chronic illness) are included in the statistical models and various indices of sleep are considered, the relationship between sleep problems and sexual dysfunction is complex, and differs according to gender, the type of sleep problem (quality, duration), and type of sexual problem.

On the whole, our results suggest that poorer sleep quality is associated with increased odds of sexual dysfunction in both men and women. One plausible explanation may be that poor sleep and sexual problems are being driven by a common cause, such as cardiovascular disease or depression. Indeed, cardiovascular disease and depression and their associated risk factors, such as hypertension-lowering drugs or antidepressants, have been shown to be associated with sleep problems and also sexual dysfunction, specifically erectile dysfunction (13). In women, the first sign of sexual arousal is an increase in the blood flow to the vaginal wall (21). Diminished pelvic blood flow secondary to atherosclerotic disease leads to vaginal wall and clitoral smooth muscle fibrosis. This can ultimately result in symptoms of vaginal dryness and dyspareunia (22), which may result in a decrease in sexual arousal problems and the ability to reach orgasm in women.

The finding that in men, long sleep was associated with significantly higher odds of orgasmic difficulties and marginally increased odds of erectile difficulties relative to optimal sleep duration is interesting. Previous studies have shown that people who report prolonged sleep duration are at modestly increased risk of all-cause mortality, cardiovascular disease, and developing symptomatic diabetes (23,24) <https://www.ncbi.nlm.nih.gov/pubmed/20815184>. This may be because long duration of sleep could be related to sleep disordered breathing or poor sleep quality <https://www.ncbi.nlm.nih.gov/pubmed/15164896> <https://www.ncbi.nlm.nih.gov/pubmed/19573557>. Such underlying conditions may be driving the association between long sleep and sexual dysfunction in men (7). Indeed, cardiovascular disease and diabetes have been shown to be associated with erectile dysfunction <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4291872/>

The null relationship between sleep duration and sexual function in women but not in men should be noted. It is possible that the prevalence of specific sleep complications that likely influence sexual function are higher in men. For example, sleep apnea has been shown to influence sexual function <https://www.sciencedirect.com/science/article/pii/S1389945705000638> [https://www.goldjournal.net/article/0090-4295\(90\)80262-L/abstract](https://www.goldjournal.net/article/0090-4295(90)80262-L/abstract)

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0201930> and sleep apnea is more prevalent in men than women <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2642982/>. There are a number of pathophysiological differences to suggest why men are more prone to sleep conditions than women. Although the exact mechanisms are unknown, differences in obesity, upper airway anatomy, breathing control, hormones, and aging are all thought to play a role.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2642982/>

Clear strengths of this study include the large representative sample of older English adults, the assessment of several aspects of sexual dysfunction (erectile dysfunction, arousal problems, orgasmic difficulties) and sleep (quality and duration), and the inclusion of potentially important confounding variables into statistical models. However, the study must be interpreted in light of its limitations. The study was cross-sectional, meaning we were unable to ascertain the direction of the observed associations. For example, it may be that people are anxious about sexual problems and this is causing sleep problems. Future longitudinal research is needed. Self-reporting of sleep and sexual problems may have been subject to reporting bias, and it is possible that participants who were particularly embarrassed about sexual problems they were experiencing were more likely to have missing data on the variables of interest. However, steps were taken to try and maintain a sense of privacy, including assessing sexual problems via written questionnaire rather than in the face-to-face interview, and assuring every participant that responses would remain completely anonymous. The present study asked men about their ability to get and keep an erection which would be good enough for sexual activity during the past month. Therefore our measure of erectile dysfunction did not consider sleep related erection. Indeed, for those in the present sample who reported a negative response to this question it is possible that they still experience sleep related erections and thus future studies may wish to investigate this sleep related physiological phenomena in relation to sleep quality and duration. It is possible that some participants in the present sample may be suffering from testosterone deficiency. Testosterone deficiency may lead to erectile dysfunction <https://www.ncbi.nlm.nih.gov/pubmed/18313109> and sleep complications. Data on testosterone deficiency was not available to be included in the analyses of the present study. However, estimates suggest that such deficiencies influence only a small proportion of European males, just 3.2% of males aged 60 to 69 years <http://www.bssm.org.uk/wp-content/uploads/2018/09/guidelines-on-adult-testosterone-deficiency-with-statements-for-uk-practice.pdf>. This equates to approximately 82 men in the current analyses and thus unlikely to influence the present findings. Finally, it should be noted that sleep problems can vary from hypersomnia to insomnia and insomnia can be differentiated into difficulties in falling asleep or awakening during night. Future research may wish to build on the

present work to unpick the relationship between specific sleep conditions with the present sexual function variables or others.

In conclusion, the present results indicate that reduced quality and prolonged sleep may be associated with sexual dysfunction in later life. Observed associations vary between men and women. Further research of a longitudinal and experimental nature is needed to provide further insight into relationships between sleep problems and sexual dysfunction and potential mechanisms driving these associations.

Declarations of Interest

None.

Conflicts of Interest

None.

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Tables

Table 1 Sample characteristics

| | Men (n=2,568) | Women (n=1,376) |
|---------------------------------------|---------------|-----------------|
| Age (mean [SD] years) | 64.27 (9.72) | 60.74 (7.95) |
| Partner status | | |
| Married/cohabiting | 73.9 | 76.9 |
| Separated/divorced | 11.5 | 14.1 |
| Widowed | 6.0 | 4.4 |
| Single/never married | 8.7 | 4.6 |
| Ethnicity | | |
| White | 93.8 | 97.2 |
| Non-white | 6.2 | 2.8 |
| Wealth quintile | | |
| 1 (poorest) | 17.2 | 12.7 |
| 2 | 19.0 | 17.8 |
| 3 | 19.9 | 20.6 |
| 4 | 21.9 | 24.1 |
| 5 (richest) | 22.0 | 24.9 |
| Limiting long-standing illness | | |
| Yes | 31.1 | 27.0 |
| No | 68.9 | 73.0 |
| Smoking status | | |
| Smoker | 14.4 | 13.4 |
| Non-smoker | 85.6 | 86.6 |
| Alcohol intake ¹ | | |
| Never/rarely | 15.8 | 19.8 |
| Regularly | 42.2 | 46.8 |
| Frequently | 42.0 | 33.4 |
| Physical activity | | |
| Inactive | 19.8 | 16.1 |
| Moderate at least once a week | 43.4 | 49.6 |
| Vigorous at least once a week | 36.8 | 34.3 |
| Depressive symptoms (0-8) (mean [SD]) | 1.13 (1.82) | 1.32 (1.86) |

Values are percentages unless otherwise stated.

All figures are weighted for sampling probabilities and differential non-response.

SD = standard deviation.

¹ Never/rarely = never – once or twice a year; regularly = once every couple of months – twice a week; frequently = 3 days a week – almost every day.

Table 2 Adjusted associations between sleep and problems with sexual function in older men and women

| | Men | | | | Women | | | |
|------------------------|---|----------|--------------------------------|----------|--------------------------------|----------|--------------------------------|----------|
| | Difficulty having/ keeping an erection | | Difficulty achieving orgasm | | Difficulty becoming aroused | | Difficulty achieving orgasm | |
| | OR [95% CI] | <i>p</i> | OR [95% CI] | <i>p</i> | OR [95% CI] | <i>p</i> | OR [95% CI] | <i>p</i> |
| Sleep quality | | | | | | | | |
| High | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| Moderate | 1.47 [1.16-1.85] | 0.001 | 1.34 [0.96-1.87] | 0.091 | 1.53 [1.09-2.13] | 0.013 | 1.24 [0.87-1.77] | 0.229 |
| Low | 1.24 [0.97-1.58] | 0.091 | 1.05 [0.73-1.51] | 0.801 | 1.70 [1.24-2.32] | 0.001 | 1.63 [1.18-2.25] | 0.003 |
| Sleep duration (hours) | | | | | | | | |
| 6-8 | 1.00 | | 1.00 | | 1.00 | | 1.00 | |
| <6 | 0.90 [0.68-1.20] | 0.468 | 1.21 [0.81-1.81] | 0.361 | 0.87 [0.61-1.25] | 0.461 | 1.33 [0.93-1.91] | 0.117 |
| >8 | 1.41 [0.97-2.04] | 0.071 | 1.75 [1.04-2.95] | 0.036 | 1.13 [0.71-1.80] | 0.603 | 0.85 [0.50-1.46] | 0.560 |

OR = odds ratio; CI = confidence interval.

All figures are adjusted for age, ethnicity, partner status, wealth, smoking, alcohol consumption, physical activity, depressive symptoms and limiting long-standing illness, and weighted for sampling probabilities and differential non-response.