



# Sexual intercourse and sleep in older age: findings from the English Longitudinal Study of Ageing

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## ABSTRACT

**Objectives:** To investigate associations between sexual intercourse and sleep quality and duration, controlling for a range of confounders, in a large, representative sample of older English adults.

**Methods:** Data were from 2,743 men and 2,990 women aged  $\geq 50$  years, participating in the English Longitudinal Study of Ageing. Participants reported whether or not they had engaged in sexual activity in the last year, and those who were sexually active reported frequency of intercourse in the past month. Information on sleep disturbance and duration and socio-demographic and health-related covariates was also collected.

**Findings:** Being sexually active was not associated with sleep disturbance or sleep duration. Men who had less frequent intercourse reported greater sleep disturbance than those who reported no sexual intercourse (OR=1.29, 95% CI 1.02-1.65), but had lower odds of reporting longer than optimal sleep duration (OR=0.45, 95% CI 0.24-0.86). Men who engaged in sexual intercourse once a week or more (OR=0.43, 95% CI 0.23-0.80) also had lower odds of long sleep relative to those who reported no sexual intercourse. Women who engaged in more frequent ( $\geq$  once a week) intercourse reported less

sleep disturbance than those who reported no sexual intercourse in the last month (OR=0.68, 95% CI 0.53-0.86), and women who reported sexual intercourse once in the past month had lower odds of long sleep (OR=0.51, 95% CI 0.26-0.996).

**Conclusions:** In a population-based sample of older men and women in England, there was inconsistent evidence of an association between sexual activity and sleep disturbance and sleep duration.

## KEYWORDS

Older adults; sexual activity; sexual intercourse; sleep duration; sleep quality.

## 1. INTRODUCTION

Sleep disturbances are a common health complaint in the general population [1], but age-related changes in sleep architecture and physiology make achieving healthy sleep particularly difficult in later life [2]. Epidemiological studies have observed a strong association between older age and sleep complaints, with between 23% and 34% of individuals aged  $\geq 65$  years reporting symptoms of insomnia and up to 15% saying they rarely or never felt rested upon waking in the morning [3,4]. Aside from obvious side-effects of poor sleep, such as feelings of fatigue, experiencing sleep problems can have a profound impact on health and wellbeing. Thus, meta-analyses have demonstrated associations between sleep problems and cardiovascular disease [5] and depression [6], both of which are prevalent among older people [7-9]. A J-shaped relationship between sleep duration and all-cause mortality has also been documented, with both insufficient and prolonged sleep associated with increased risk of death [10]. As such, sleep problems in older adults represent a significant public health concern.

Identification of modifiable correlates of sleep quality and duration in older adults is important for the development of targeted interventions to improve health and wellbeing in later life. For example, one modifiable behaviour – low levels of physical activity – has been shown to be associated with greater sleep problems in older adults [11]. One domain of physical activity that remains understudied is that of sexual activity. Research has indicated that sexual activity is typically performed at a moderate intensity (5.8 metabolic equivalents) and expends approximately 85 kCal or 3.6 kCal/min [12], and may therefore potentially be considered significant exercise. Moreover, hormone levels such as oxytocin increase during sexual activity [13], which in turn likely promote high-quality uninterrupted sleep. Thus, it is plausible that sexual activity will result in positive sleep outcomes.

There has been little research into the effects of sexual activity on sleep quality or duration. One study of 6,916 adults aged 50 years and over found that poorer quality sleep was associated with less sexual activity [14]. However, this study had several important limitations. First, there was only limited adjustment for potential confounders, with factors that may have had a significant impact on both sexual behaviour and sleep (e.g., depression, chronic disease) were not controlled for. Second, the sexual activity variable incorporated intercourse, kissing, petting, fondling, and masturbation. There is likely to be substantial variation among these activities in the amount of energy expended while engaging in them and, potentially, the hormonal responses they induce (e.g., due to the presence or absence of sexual arousal and orgasm). As the most energetic sexual activity, intercourse may play a predominant role in the relationship between sexual activity and sleep quality and thus its association should be investigated separately. Third, data from women and men were analysed together despite relevant literature showing substantial differences between older men and women's sexual behavior [15] and sleep problems [2]. Finally, the focus of the analyses was on sleep quality and the association with sleep duration was not investigated, in spite of its known importance for health outcomes [10].

The present study aimed to address the aforementioned limitations through an analysis of associations between sexual intercourse and sleep quality and duration in a large, representative sample of older English adults, controlling for a range of relevant confounders.

## 2. METHODS

Data were from men and women aged  $\geq 50$  years participating in Wave 6 (2012/13) of the English Longitudinal Study of Ageing [16]. Participants gave full informed written consent to participate in the study and ethical approval was obtained from the London Multi-Centre Research Ethics Committee. Sexual activity was assessed with the question "Have you had any sexual activity (sexual intercourse, masturbation, petting, or fondling) in the past year?" (yes/no). Those who reported being sexually active in the past year were asked "How many times have you had or attempted sexual intercourse (vaginal, anal, or oral sex) in the past month?", with the following response options: not at all, once in the past month, 2-3 times in the past month, once a week, 2-3 times a week, once a day, more than once a day. Due to low numbers of participants endorsing the latter three response options, we combined those reporting having or attempting sexual intercourse once a week or more for analyses. Sleep duration was assessed with an open-ended question that asked how many hours respondents slept on average during the week. Responses were categorised as  $< 6$  hours (short sleep), 6-8 hours (optimal sleep), and  $> 8$  hours (long sleep) for analyses [17,18]. Sleep disturbance 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). In addition, participants were asked to provide 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 categorised into tertiles, with the first tertile (lowest scores) representing the least sleep disturbance (i.e. highest sleep quality) and the third tertile (highest scores) the most sleep disturbance (i.e., lowest sleep quality) [17].

Data were weighted to account for sampling probability and non-response. Logistic regression models were used to examine associations between sexual activity and frequency of intercourse and sleep outcomes. Associations with sleep disturbance were tested using ordinal logistic regression, with odds ratios (ORs)  $> 1$  indicating an association with greater sleep disturbance and ORs  $< 1$  indicating an association with less sleep disturbance. Associations with short ( $< 6$  hours) and long ( $> 8$  hours) sleep were tested using separate binary logistic regression models, with optimal sleep duration (6-8 hours) used as the reference category. Covariates included age, ethnicity, marital status, wealth (an indicator of socio-economic status), cigarette smoking, alcohol consumption, physical activity, depressive symptoms and limiting long-standing illness. Data were analysed separately for men and women using SPSS version 24, with a p-value  $< 0.05$  used to indicate statistical significance.

### 3. RESULTS

The analytic sample comprised 2,743 men (mean [SD] age 64.4 [9.8] years) and 2,990 women (65.4 [10.1] years). Characteristics of the sample in relation to sleep quality and duration are shown in **Tables 1 and 2**, respectively.

In both men and women, greater sleep disturbance was associated with lower wealth ( $p<0.001$ ), the presence of limiting long-standing illness ( $p<0.001$ ), drinking alcohol never or rarely ( $p<0.001$ ), physical inactivity ( $p<0.001$ ), and greater depressive symptoms ( $p<0.001$ ) (**Table 1**). Moderate sleep disturbance was associated with older age ( $p=0.041$  in men,  $p=0.001$  in women) and White ethnicity ( $p=0.007$  in men,  $p<0.001$  in women). In men, but not in women, high sleep disturbance was also associated with being separated/divorced or single/never married ( $p<0.001$ ) and smoking ( $p<0.001$ ).

Longer than optimal sleep duration was associated with older age in both sexes ( $p<0.001$ ), and both short and long sleep were associated with lower wealth ( $p<0.001$ ), the presence of limiting long-standing illness ( $p<0.001$ ), and physical inactivity ( $p<0.001$ ) (**Table 2**). Being separated/divorced or single/never married was associated with short sleep in both sexes, and being widowed was associated with long sleep in men ( $p=0.033$ ) and short and long sleep in women ( $p<0.001$ ). In addition, less frequent alcohol consumption ( $p<0.001$ ) and greater depressive symptoms ( $p<0.001$ ) were associated

with both short and long sleep in women but with short sleep only in men (both  $p < 0.001$ ). Non-White ethnicity was associated with short sleep and White ethnicity was associated with long sleep in women ( $p = 0.001$ ), but the difference was only marginally significant in men ( $p = 0.053$ ). Being a smoker was associated with short sleep in men ( $p < 0.001$ ), but the difference was not significant in women ( $p = 0.099$ ).

Over three quarters (78.2%) of men and around half (55.1%) of women reported any sexual activity in the last year. After adjustment for covariates, being sexually active was not significantly associated with sleep disturbance (men OR=0.90, 95% CI 0.74-1.10; women OR=1.17, 95% CI 1.00-1.37) or either short (men OR=0.95, 95% CI 0.69-1.30, women OR=1.15, 95% CI 0.90-1.46) or long sleep duration (men OR=1.24, 95% CI 0.83-1.87; women OR=0.87, 95% CI 0.63-1.20) (**Table 3**). Among men who reported being sexually active, 35.2%, 16.0%, 23.5%, and 25.4% reported having sexual intercourse not at all, once, 2-3 times, and once a week or more, respectively, in the last month. Among sexually active women, the respective figures were 30.5%, 19.0%, 26.2%, and 24.4%. After adjustment for covariates, there were few significant associations between frequency of sexual intercourse and sleep disturbance or duration (**Table 3**).

Among men, those who reported sexual intercourse once in the past month reported greater sleep disturbance (OR=1.29, 95% CI 1.02-1.65,  $p = 0.036$ ) and had lower odds of reporting longer than optimal sleep duration (OR=0.45, 95% CI 0.24-0.86,  $p = 0.015$ ) than those who reported no sexual intercourse. Men who engaged in sexual intercourse once a week or more also had lower odds of long sleep relative to those who reported no sexual intercourse (OR=0.43, 95% CI 0.23-0.80,  $p = 0.008$ ). Among women, those who reported sexual intercourse once a week or more reported lower sleep disturbance than those who reported no sexual intercourse in the last month (OR=0.68, 95% CI 0.53-0.86,  $p = 0.002$ ). As was observed in men, women who engaged in sexual intercourse once in the past month had lower odds of long sleep than those who reported no sexual intercourse in the last month (OR=0.51, 95% CI 0.26-0.996,  $p = 0.049$ ). No other significant associations between frequency of intercourse and sleep quality or duration were observed.

**Table 1.** Characteristics of the male and female subsamples in relation to tertiles of sleep disturbance

Sex	Men			<i>p</i>	Women			<i>p</i>
	Lowest tertile ( <i>n</i> =1082) <sup>1</sup>	Middle tertile ( <i>n</i> =952)	Highest tertile ( <i>n</i> =545)		Lowest tertile ( <i>n</i> =971)	Medium tertile ( <i>n</i> =1100)	Highest tertile ( <i>n</i> =1161)	
Age (mean [SD] years)	64.46 (9.35)	65.38 (9.74)	64.50 (9.60)	0.041	65.15 (9.80)	66.37 (9.64)	65.02 (9.71)	0.001
<b>Partner status</b>								
Married/cohabiting	76.8	73.7	67.7	<0.001	60.8	62.3	60.2	0.694
Separated/divorced	11.1	10.2	14.0	-	15.1	14.7	16.9	-
Widowed	5.0	7.5	6.3	-	18.5	17.6	16.6	-
Single/never married	7.1	8.5	12.0	-	5.7	5.4	6.2	-
<b>Ethnicity</b>								
White	92.3	95.5	94.2	0.007	94.2	98.4	95.6	<0.001
Non-white	7.7	4.5	5.8	-	5.8	1.6	4.4	-
<b>Wealth quintile</b>								
1 (poorest)	14.0	14.7	28.4	<0.001	17.3	16.0	25.4	<0.001
2	18.5	17.3	22.5	-	17.7	19.8	23.8	-
3	21.3	19.9	16.4	-	22.2	19.7	21.2	-
4	22.9	23.5	17.7	-	20.0	23.3	16.6	-
5 (richest)	23.3	24.5	15.1	-	22.8	21.3	13.0	-
<b>Limiting long-standing illness</b>								
No	80.2	70.9	44.0	<0.001	77.3	66.2	51.9	<0.001
Yes	19.8	29.1	56.0	-	22.7	33.8	48.1	-
<b>Smoking status</b>								
Non-smoker	86.1	89.7	77.6	<0.001	85.7	88.7	85.6	0.074
Smoker	13.9	10.3	22.4	-	14.3	11.3	14.4	-
<b>Alcohol intake<sup>2</sup></b>								
Never/rarely	14.0	13.7	23.2	<0.001	27.0	26.5	34.8	<0.001
Regularly	43.0	41.8	40.9	-	44.4	45.6	41.5	-
Frequently	43.0	44.5	35.9	-	28.6	27.9	23.6	-
<b>Physical activity</b>								
Inactive	15.3	18.0	31.0	<0.001	18.6	23.2	32.9	<0.001
Moderately active at least once a week	41.8	44.4	44.3	-	49.5	49.0	46.2	-
Vigorously active at least once a week	42.9	37.6	24.7	-	32.0	27.8	21.0	-
<b>Depressive symptoms (0-8) (mean [SD] years)</b>	0.37 (0.96)	0.92 (1.51)	2.76 (2.28)	<0.001	0.66 (1.30)	1.13 (1.59)	2.61 (2.24)	<0.001

<sup>1</sup> Unweighted sample sizes. Values are percentages unless otherwise stated. All figures are weighted for sampling probabilities and differential non-response. SD = standard deviation.<sup>2</sup> Never/rarely = never – once or twice a year; regularly = once every 2 months – twice a week; frequently = 3 days a week – almost every day.

**Table 2.** Characteristics of the male and female subsamples in relation to sleep duration (hours)

	Men				Women			
	<6 (n=312) <sup>1</sup>	6-8 (n=2089)	>8 (n=178)	P	<6 (n=552)	6-8 (n=2427)	>8 (n=253)	P
<b>Age (mean [SD] years)</b>	64.21 (9.82)	64.48 (9.49)	70.30 (8.12)	<0.001	65.86 (9.71)	65.17 (9.67)	67.74 (10.04)	<0.001
<b>Partner status</b>								
Married/cohabiting	68.3	74.7	72.5	0.033	53.0	63.1	60.1	<0.001
Separated/divorced	14.4	11.1	10.2	-	20.1	15.0	12.3	-
Widowed	5.3	6.1	9.0	-	20.6	16.1	23.0	-
Single/never married	12.3	8.1	8.4	-	6.3	5.8	4.5	-
<b>Ethnicity</b>								
White	91.7	94.0	97.0	0.053	93.7	96.2	99.2	0.001
Non-white	8.3	6.0	3.0	-	6.3	3.8	0.8	-
<b>Wealth quintile</b>								
1 (poorest)	30.2	15.0	21.0	<0.001	31.3	16.5	24.7	<0.001
2	20.3	18.8	18.6	-	23.2	20.0	21.0	-
3	14.7	20.5	20.4	-	23.0	20.4	21.4	-
4	19.3	22.0	27.5	-	14.2	21.3	18.9	-
5 (richest)	15.5	23.7	12.6	-	8.5	21.8	14.0	-
<b>Limiting long-standing illness</b>								
No	46.0	73.3	59.3	<0.001	50.2	68.8	54.9	<0.001
Yes	54.0	26.7	40.7	-	49.8	31.2	45.1	-
<b>Smoking status</b>								
Non-smoker	77.3	86.8	85.6	<0.001	83.8	87.2	87.7	0.099
Smoker	22.7	13.2	14.4	-	16.2	12.8	12.3	-
<b>Alcohol intake<sup>2</sup></b>								
Never/rarely	25.5	14.3	16.9	<0.001	43.8	25.6	35.7	<0.001
Regularly	46.1	41.2	44.6	-	38.3	45.7	38.5	-
Frequently	28.4	44.5	38.6	-	17.9	28.7	25.8	-
<b>Physical activity</b>								
Inactive	31.6	17.5	22.9	<0.001	37.3	21.6	32.8	<0.001
Moderately active at least once a week	40.6	43.7	44.6	-	46.7	48.5	47.1	-
Vigorously active at least once a week	27.8	38.8	32.5	-	16.1	29.9	20.1	-
<b>Depressive symptoms (0-8) (mean [SD] years)</b>	2.49 (2.41)	0.87 (1.54)	0.94 (1.80)	<0.001	2.74 (2.39)	1.25 (1.76)	1.44 (1.90)	<0.001

<sup>1</sup>Unweighted sample sizes.

Values are percentages unless otherwise stated.

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

SD = standard deviation.

<sup>2</sup>Never/rarely = never – once or twice a year; regularly = once every 2 months – twice a week; frequently = 3 days a week – almost every day.

**Table 3.** Adjusted associations between sexual activity and sleep disturbance and duration in men and women

	Sleep disturbance <sup>1</sup>		Short sleep <sup>2</sup>		Long sleep <sup>3</sup>	
	Men OR [95% CI]	Women OR [95% CI]	Men OR [95% CI]	Women OR [95% CI]	Men OR [95% CI]	Women OR [95% CI]
<b>Any sexual activity in the last year</b>						
No	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.90 [0.74-1.10]	1.17 [1.00-1.37]	0.95 [0.69-1.30]	1.15 [0.90-1.46]	1.24 [0.83-1.87]	0.87 [0.63-1.20]
<b>Frequency of sexual intercourse in the last month<sup>4</sup></b>						
Not at all	1.00	1.00	1.00	1.00	1.00	1.00
Once in the past month	1.29 [1.02-1.65]*	1.08 [0.83-1.41]	1.18 [0.79-1.77]	0.88 [0.58-1.32]	0.45 [0.24-0.86]*	0.51 [0.26-0.996]*
2-3 times in the past month	0.98 [0.79-1.22]	0.95 [0.75-1.21]	1.13 [0.77-1.63]	0.95 [0.64-1.40]	0.82 [0.49-1.35]	1.36 [0.83-2.25]
Once a week or more	1.04 [0.84-1.30]	0.68 [0.53-0.86]**	0.88 [0.60-1.30]	0.84 [0.56-1.27]	0.43 [0.23-0.80]**	0.72 [0.40-1.29]

OR = odds ratio; CI = confidence interval.

<sup>1</sup>Ordinal logistic regression. ORs > 1 indicate an association with greater sleep disturbance, ORs < 1 indicate an association with less sleep disturbance.

<sup>2</sup>Binary logistic regression. ORs are for short sleep (<6 hours) relative to optimal sleep duration (6-8 hours).

<sup>3</sup>Binary logistic regression. ORs are for long sleep (>8 hours) relative to optimal sleep duration (6-8 hours).

<sup>4</sup>Among participants who reported being sexually active.

\*p<0.05, \*\*p<0.01.

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.

#### 4. DISCUSSION

In this large, representative sample of older English adults, after controlling for important covariates, being sexually active (defined as any sexual activity in the past year) was not found to be associated with sleep disturbance or with either short or long sleep duration. However, among men who were sexually active in the past year, those who reported sexual intercourse once in the past month reported greater sleep disturbance and had lower odds of reporting longer than optimal sleep duration than those who reported no sexual intercourse. Men who engaged in sexual intercourse once a week or more in the past month also had lower odds of long sleep relative to those who reported no sexual intercourse. Among women who were sexually active in the past year, those who reported sexual intercourse once a week or more in the past month reported lower sleep disturbance than those who reported no sexual intercourse in the last month. Women who engaged in sexual intercourse once in the past month had lower odds of long sleep than those who reported no sexual intercourse in the last month.



These findings build upon previous literature, which suggested less sexual activity is associated with poorer quality sleep [14]. We found that, once potential confounding by depressive symptoms and limiting long-standing illness was controlled for, the association between sexual activity and sleep quality was inconsistent and differed between men and women. There were also differences between associations with sleep quality and sleep duration, highlighting the importance of analysing multiple types of sleep problems when trying to identify modifiable correlates.

Men and women who reported sexual intercourse once in the past month, and men who reported having intercourse once a week or more, had lower odds of reporting longer than optimal sleep duration than those who reported no sexual intercourse. The available literature has shown that people who have longer than optimal sleep duration are at modestly increased risk of all-cause mortality, cardiovascular disease, and developing symptomatic diabetes [10,19]. Findings from the present study suggest that “frequent” sexual intercourse may protect against long sleep duration. However, it should be noted that no significant associations with sleep duration were observed for men and women who reported sexual intercourse 2 to 3 times a month and women who reported intercourse once a week or more. The reason for these inconsistencies is not clear and further research is needed.

Women who reported sexual intercourse once a week or more reported less sleep disturbance, suggesting that frequent sexual intercourse may elicit better sleep. This may be attributable to the release of oxytocin during sexual intercourse [13]. Oxytocin plays a role in regulating corticotropin-releasing hormones, which regulate a variety of processes within the brain, including sleep, and an increase in oxytocin levels promotes sleep onset [20]. An association between frequent sexual intercourse and reduced sleep disturbance was not observed in men; there was no significant association between sleep disturbance and intercourse more than once in the past month and men who reported sexual intercourse just once in the past month reported higher levels of sleep disturbance than those who reported no intercourse at all. The discrepancy in findings between the sexes may be due to biological differences. Women have a higher density of oxytocin receptors in the brain (Lee et al., 2009) and may be more sensitive to its effects in terms of promoting higher quality of sleep. Meanwhile, the high levels of testosterone released in men during sexual activity may have an adverse effect on sleep: studies have shown that testosterone raises the nocturnal metabolic rate, which can impair sleep patterns and quality of sleep [21,22].

Strengths of this study include the large, representative sample, the investigation of intercourse separate from other forms of sexual activity, the inclusion of potentially important confounding variables in the statistical models, and the analysis of sleep duration as well as disturbance. However, there were also several limitations. The cross-sectional design precludes inferences on the direction of

causation in the observed associations. It is possible that poor sleep could make people less interested in sexual intercourse. Sexual information was self-reported and participants may not have responded honestly for fear of stigmatisation or to conform to perceived gendered stereotypes of sexual behaviour. However, these data were collected via paper-based questionnaires rather than face-to-face interviews and participants were informed that survey responses would remain anonymous.

## 5. CONCLUSIONS

In conclusion, the present results demonstrate that the relationship between sexual intercourse and sleep problems is complex and differences exist between men and women and according to the type of sleep problem (i.e., quality vs. duration). Further research of a qualitative, longitudinal, and experimental nature is needed to better understand the relationship between sexual activity and sleep problems in older adults before any recommendations can be made.

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## **AUTHOR CONTRIBUTIONS**

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

## **CONFLICTS OF INTEREST**

The authors declare no conflict of interest.

## **FUNDING**

This research received no external funding.

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