

## **A national survey on how sexual activity is perceived to be associated with sleep**

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**Research involved human participants.**

**Consent was regarded provided by completing the survey – in line with approval from the regional ethics committee.**

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### Abstract

**Introduction:** There is a paucity of studies investigating how sexual activity is perceived to influence sleep, despite conceptions about significant gender differences regarding this issue. **Methods:** In all, 4000 persons, aged between 18 and 55 years, were randomly drawn from the Norwegian Population Registry and invited to participate in a postal survey. The respondents were asked how sexual activity with another person, with or without orgasm, and how masturbation, with and without orgasm, influenced sleep latency and sleep quality. **Results:** A total of 1080 persons participated (response rate 28.2%) of which 56.1% were women. The mean age of the sample was 38.7 years ( $SD = 10.8$ ). Sexual activity with an orgasm was perceived to have a soporific effect by both men and women. Sexual activity with another person, with an orgasm, was perceived to have a relatively stronger effect on men compared to women in terms of sleep quality. Sexual activity without an orgasm was by men reported to have a sleep impairing effect, whereas the perceived effect reported by women was equivocal. **Conclusions:** Sexual activity with orgasms was perceived as having a soporific effect in both men and women. Sexual activity without an orgasm had an equivocal perceived effect on sleep.

**Keywords:** gender differences; orgasm; sexual activity; sleep onset latency; sleep quality; soporific effect

### Introduction

The vast majority of research on the relationship between sexual activity and sleep has looked at the comorbidity between sexual dysfunction and sleep problems, or has regarded sexual dysfunction as a consequence of various sleep problems. The most studied topic concerns the impact of obstructive sleep apnea (OSA) on sexual function. In this context, OSA has been associated with sexual dysfunction in both premenopausal and postmenopausal women [1, 2]. Sleep apnea has further been shown to be associated with reduced sexual quality of life in men. Reduced libido, hormonal, neural, and endothelial dysfunctions have been proposed as mechanisms linking sleep disorders with sexual dysfunction in men. For women, sleep related sexual dysfunction seems to be related to menopause and low levels of testosterone and estrogen [3]. Sexual dysfunction has in one study been linked to insomnia [4]. Furthermore, in the general population there seems to be a link between sleep and sexual function. In one diary study of 171 female students, sleep duration was positively associated with next day sexual desire and the odds of engaging in partnered sexual activity [5].

Despite that fact that several studies have investigated how sleep may affect sexual function, it is conceivable that sexual behavior might influence sleep, albeit the empirical evidence to support such a notion is very limited. It has been suggested that sexual orgasm facilitates human sleep [6, 7], but this was not supported by an experiment including five men and five women for which sleep was recorded objectively following masturbation with an orgasm, masturbation without orgasm, and after reading neutral material [8]. A recent survey, where subjects were recruited through social media and professional networks, showed that men, to a greater extent than women, reported improved sleep onset and sleep quality following sex with a partner. However, when the questions concerned sleep onset latency and sleep quality after having reached orgasm with a partner or through masturbation, no gender differences emerged [9]. Still, a widespread and popular belief is that there is a soporific effect of sexual behavior, and that this is more prominent in males compared to females. This notion is in line with studies suggesting that men have a stronger and more biologically and genitally sexual drive, whereas women's sexual drive to a larger extent is more romantically driven with a higher emphasis on intimacy [10, 11]. Against this backdrop it can be hypothesized that men following sex with another person ending in orgasm may relax more than women. Specifically, we hypothesize that orgasms following sexual activity generally will be perceived to have a soporific effect (Hypothesis 1), but that this overall will be larger for men than for women. Further, we hypothesize that masturbation followed by orgasms relative to orgasms following sex with another person will be perceived to have relatively stronger soporific effect for women compared to men (Hypothesis 2). Finally, we hypothesize that sexual activity without orgasms will be perceived

to have no soporific effect (Hypothesis 3). As sexual activity may be influenced by age [12] and marital status [13] and since a potential soporific effect of sex may be influenced by sleep problems, we controlled for age, relationship status and insomnia symptoms in the analyses.

## **Materials and Methods**

### *Sample and procedure*

A total of 4000 potential participants, aged between 18 and 55 years, were randomly drawn from the National Population Registry of Norway. Permission for drawing the sample from the population registry was provided by the Tax Authorities following an application. An information technology company (“EVERY”) administered the registry on behalf of the Tax Authorities, drew the random sample, and sent a file containing information about the sample (name, address, age and gender) to the researchers. All individuals in the sample received a numbered (unique ID) questionnaire about sleep and the potential effect of sexual activity on sleep. Together with the questionnaire there was an information letter explaining the purpose of the study as well as a prepaid return envelope. Those who preferred to answer on the Internet could do so via a link provided in the information letter. In order to increase the response rate, a lottery including a total of 100 gift cards, each worth 500 NOK (~ 60 US \$), was drawn among those who completed the survey. The survey was conducted during autumn 2016.

In all, 166 questionnaires were returned due to wrong addresses, leaving a sample of 3834 potential respondents. Of these, 1080 responded, which yielded a response rate of 28.2%. In total, 64.1% responded without receiving any reminder, 24.7% responded after the first reminder and 11.2% responded after the second and last reminder, respectively. A total of 82.4% responded via the paper questionnaire, whereas 17.6% responded on the Internet. The final sample consisted of 43.9% men and 56.1% women. The mean age of the respondents was 38.7 years ( $SD = 10.8$ ). In order to make weights to adjust for discrepancies between the sample and the population of Norway, three age groups (18–30 years, 31–43 years, and 44–55 years) were created, which together with gender constituted six groups. The weights applied to these groups in the present study were as follows: 1.77 (men 18–30 years), 1.23 (men 31–43 years), 0.83 (men 44–55 years), 0.95 (women 18–30 years), 0.97 (women 31–43 years), and 0.72 (women 44–55 years), respectively. Answering and returning the questionnaire were regarded as giving informed consent.

### *Measures*

Information about age and gender was obtained from the Norwegian Population Registry. A question about habitual sleep onset latency was included. Insomnia symptoms, which were controlled for in the analysis, were assessed by the Bergen Insomnia Scale [14]. The questions about the effects of sexual activity on sleep were constructed for the purpose of the present study and are reproduced in Table 1. The questions differed between perceived effects of sexual activity with another person and masturbation, both with and without orgasm, where sleep latency and sleep quality represented the outcomes, respectively. The response alternatives ranged from -2 (denoting a strong perceived negative effect on sleep), via 0 (indicating no perceived effects on sleep) to +2 (suggesting a perceived strong positive effect on sleep). The sleep outcomes (sleep onset latency and sleep quality) are similar to those used in a previous study [9]. The response alternatives were also similar [9], although the previous study had three response alternatives (improved, the same, worsened) whereas a 5-point Likert scale was used in the present study.

### *Statistics*

The data analyses were performed with SPSS, version 24. The results were weighted according to the population distribution of age and gender, in order to correct for potential divergence between the sample and the distribution of age and gender in the general population. The mean habitual sleep onset latency was compared between genders by a t-test for independent samples. Gender differences regarding the perceived soporific effect of sexual activity on sleep were calculated with analysis of covariance (ANCOVA) controlling for age, relationship status and insomnia symptoms.

Weighted means with 95% confidence intervals (95% CI) were calculated separately for men and women. In the cases where the 95% CI did not include 0.00 the results were considered as statistically significant different from no perceived effect/neutral (the same as without sex). Positive values suggest a perceived soporific effect of sexual activity on sleep, whereas negative values would indicate a perceived sleep worsening effect of sexual activity. In order to investigate whether there was a differential gender effect of masturbation followed by orgasms relative to orgasms following sexual activity with another person, a difference score (the perceived soporific effect of masturbation with an orgasm – the perceived soporific effect of sex with another person with an orgasm) was calculated. Age, relationship status and insomnia symptoms were controlled for as covariates. The significance level was set to .05.

### **Results**

Habitual sleep onset latency was 22.4 (SD=21.1) minutes for men and 24.7 (SD=24.8) minutes for women ( $t=2.37$ ,  $df=1018$ ,  $p>.05$ ). Figure 1 depicts the distribution of the responses on the eight sex and sleep items, broken down by gender.

### *Sleep Onset Latency*

Regarding sexual activity with another person ending in orgasm, both men ( $p<.001$ ) and women ( $p<.001$ ) reported this to have a soporific effect, although significantly higher for men than for women ( $p<.001$ ). Sexual activity with another person without orgasm was perceived to lead to sleep impairment for both genders (men:  $p<.001$ , women:  $p=.014$ ), although men reported higher sleep impairment than women ( $p<.001$ ). Both genders ( $p<.001$ ) reported a soporific effect of masturbation ending in orgasm without differential gender effects. Masturbation without orgasm was experienced to impair sleep onset by men ( $p<.001$ ), whereas the perceived effect for women was neutral reflecting a significant gender difference ( $p=.004$ ). Comparing the relative soporific effect of masturbation and sexual activity with another person both ending in orgasm (effect of masturbation ending in orgasm – effect of sexual activity with another person ending in orgasm) a negative value for men ( $p<.001$ ) was noted, albeit a neutral value was found for women, reflecting a significant ( $p<.001$ ) gender difference (See table 2).

### *Sleep Quality*

Both genders reported a perceived soporific effect of sexual activity with another person ending in orgasm ( $p<.001$ ), albeit this was significantly higher for men than women ( $p<.001$ ). Men experienced a sleep impairing ( $p=.024$ ) whereas women perceived a neutral effect of sexual activity with another person without orgasm, reflecting a significant gender difference ( $p=.006$ ). Masturbation ending in orgasm had a perceived soporific effect for both genders ( $p<.001$ ) showing no significant gender difference. Masturbation without orgasm had a perceived sleep impairing effect for men ( $p=.007$ ) and a neutral effect for women, signifying a gender difference ( $p=.031$ ). The relative soporific effect of masturbation and sexual activity with another person both ending in orgasm (effect of masturbation ending in orgasm – effect of sex with another person ending in orgasm) indicated a negative effect for both men ( $p<.001$ ) and women ( $p=.004$ ) although significantly ( $p=0.10$ ) greater for men (see Table 3).

## **Discussion**

The mean self-reported habitual sleep onset latency reported by the sample was somewhat longer than normal for young adults, albeit within normal range for middle and older adults for both men and women [15]. Generally, sexual activity with orgasm was perceived to shorten sleep latency as well as improve sleep quality in

both men and women. This is in line with previous notions that orgasm has soporific effects [6, 7, 9], and supports as such our first hypothesis stating that orgasms following sexual activity generally will be perceived to have a soporific effect, albeit larger for men than for women. The exact mechanism behind the soporific effect of orgasms is not clear, but it may be attributable to the release of neurohormones such as oxytocin, prolactin, and endorphins that are assumed to have relaxing properties [16-18]. The effect seemed to be larger for men than for women, especially concerning orgasm following sexual activity with another person. The positive perceived effect on sleep of sex with an orgasm was also reported by the only previous survey on this topic, but in the previous survey no gender differences were found [9]. The gender difference regarding the perceived soporific effect of masturbation with orgasms was however not significant, a finding in line with the aforementioned survey [9].

The difference score (effect of masturbation with an orgasm – effect of sexual activity with another person with an orgasm) was negative for men, but neutral for women in terms of sleep latency. Thus, regarding sleep latency, men perceived a greater soporific effect of sexual activity with another person, with an orgasm, compared to masturbation with an orgasm, whereas no significant difference was reported by women. The difference score in terms of sleep quality was negative for both men and women. Still, it was significantly larger for men, implying that men, compared to women, seem to experience greater soporific effect of sexual activity with another person, with an orgasm, compared to masturbation with an orgasm. Hence, sex with another person, with an orgasm, had a stronger perceived soporific effect for men than women (both for sleep latency and sleep quality) compared to masturbation with an orgasm. This lends support to our second hypothesis (masturbation followed by orgasms relative to orgasms following sex with another person will be perceived to have relatively stronger soporific effect for women compared to men). One possible explanation to this finding is that men, according to some studies, have a higher energy expenditure during intercourse than women [19], which may promote sleep [20]. However, not all studies have shown that men spend relatively more energy during sexual activity than women [21], and since sexual activity often is of relatively short duration [22] potential differences in gender expenditure during sexual activity is not likely to explain gender differences concerning the perceived soporific effects of sexual activity on sleep. Another explanation to these gender differences is that men have a stronger and more biologically and genitally sexual drive, whereas women's sexual drive to a larger extent is romantically driven with a higher emphasis on intimacy [10, 11]. This view seems congruent with models of sexual selection which posit that males invest less in the offspring, have a higher reproductive rate and benefit more from mating multiply than women [23].

Hence, when having sex with another person women generally may put more emphasis on the relationship, whereas men may put more emphasis on sexual gratification [10, 11, 23]. This may contribute to men easier falling asleep after sexual activity with another person ending in orgasm, compared to women, as men at this point may have obtained their goal, whereas women still may want emotional intimacy or confirmations about the relationship. It is also known that most men following orgasms have a refractory period where they cannot experience further erection or orgasms, whereas women's postorgasmic genital arousal is more variable [24] which may influence the soporific effects of sexual activity differently across genders.

According to our third hypothesis, sexual activity without orgasm was expected to have no influence on sleep. However, men actually reported longer sleep onset latency and poorer sleep quality both when sexual activity with another person and masturbation did not provide orgasm. For women, this was only the case for sleep latency following sexual activity with another person without orgasm. Women reported no effect on sleep onset latency following masturbation without orgasm, and no effect on sleep quality when sexual activity with another person or masturbation did not end in orgasm. Taken together, these findings show that men seem to be negatively affected by sexual activity without an orgasm, whereas women appeared to respond less and more neutral to this. In this regard the present findings are in line with findings reported by the previous survey by Lastella and colleagues, where it was suggested that sexual activity, whether or not ending in orgasms, had a perceived soporific effect. However, it seems that the questions used in the previous survey were somewhat blurred in terms of absence of orgasms explicitly [9], which might explain the discrepancy in results. The third hypothesis was thus not supported for men, and only partly supported for women. Overall, it seems that lack of orgasm following sexual activity is reported to be more frustrating for men than for women, leading to perceived poorer sleep for men compared to women. This may again reflect different emphasis on behalf of men (e.g. sexual) compared to women (e.g. intimacy) when it comes to sexual activity. It is also known that sexual encounters more often end in orgasms for men compared to women [25], hence lack of orgasm may thus be more frustrating and sleep impairing for the male gender.

### *Limitations and Strengths*

The response rate of the present study was low, despite the fact that the questionnaire was short and up till two reminders were sent and material reinforcement (gift card lottery) was used. However, the low response rate can probably be explained by the sensitive (sexual) topic being investigated [26]. It should be noted that low response rates do not imply that results are invalid [27]. Still, we acknowledge that the findings should be

replicated in future studies. Although similar to those used in a recent survey [9], the questions about sexual activity's perceived effect on sleep were constructed for the purpose of the present study, hence their psychometric properties are unknown. This is a limitation and future research efforts should be taken to establish items for this topic, for example by the method of Delphi [28]. Questions about sexual behaviors are sensitive by nature, hence it cannot be ruled out that some did not answer truthfully. However, care was taken to inform about how the data would be registered and confidentiality ensured. In addition, self-completion questionnaires were used as this seems to result in more valid reports than interviews [29].

It should be noted that the questions were quite general (sexual activity with another person or masturbation), and future studies on this topic should therefore differentiate better between different sexual behaviors (e.g. sex with a new vs. familiar partner) and also assess their duration in order to investigate how sleep is affected by them. In some of the analyses the number of respondents was lower than the total sample, as those answering "not relevant" were left out of the analysis. The effect of sexual behavior on sleep was evaluated retrospectively, which may render the responses vulnerable to recall bias, thus the use of diaries in future studies on this topic is encouraged [30]. It should also be noted that only two sleep outcomes were evaluated (sleep onset latency and sleep quality), as these were regarded most sensitive to potential soporific effects of sex. Still, future studies should include a wider array of sleep variables as outcomes [31]. The present study was based on subjective rating of sleep only, hence the findings should be corroborated by objective sleep measures in the future. As orgasms may be described along several dimensions, and since there may be some gender differences in this regard [32], this should be taken into consideration in future studies on this topic. The present study did not differentiate between phases of the menstrual cycle for the female respondents, although this may influence both sleep [33] and sexual behavior [34]. Hence, future studies should take this into account. Prospect research should in addition aim at identifying variables beyond gender that might explain variance in the soporific effects of sexual activity.

In terms of strengths, it should be noted that the present study is one of the first large surveys that has addressed the soporific effect of sexual behavior on sleep and contributes as such with novel findings on a topic that is often debated and heavily surrounded by myths. The sample was drawn from the Norwegian Population Registry, which increases the generalizability of the present findings. The sample was weighted by the discrepancy between the general population and sample characteristics in terms of age and gender, and thus corrected for different response rates among subgroups.

### **Conclusions**

Sexual activity ending in orgasms had a perceived soporific effect in both men and women. Men tended to report sleeping relatively better after sexual activity with another person, with an orgasm, compared to women. The perceived soporific effects of masturbation with orgasms were similar for men and women. Sexual activity without orgasm was perceived to have a negative impact on sleep for men, whereas the effect on the sleep of women was equivocal.

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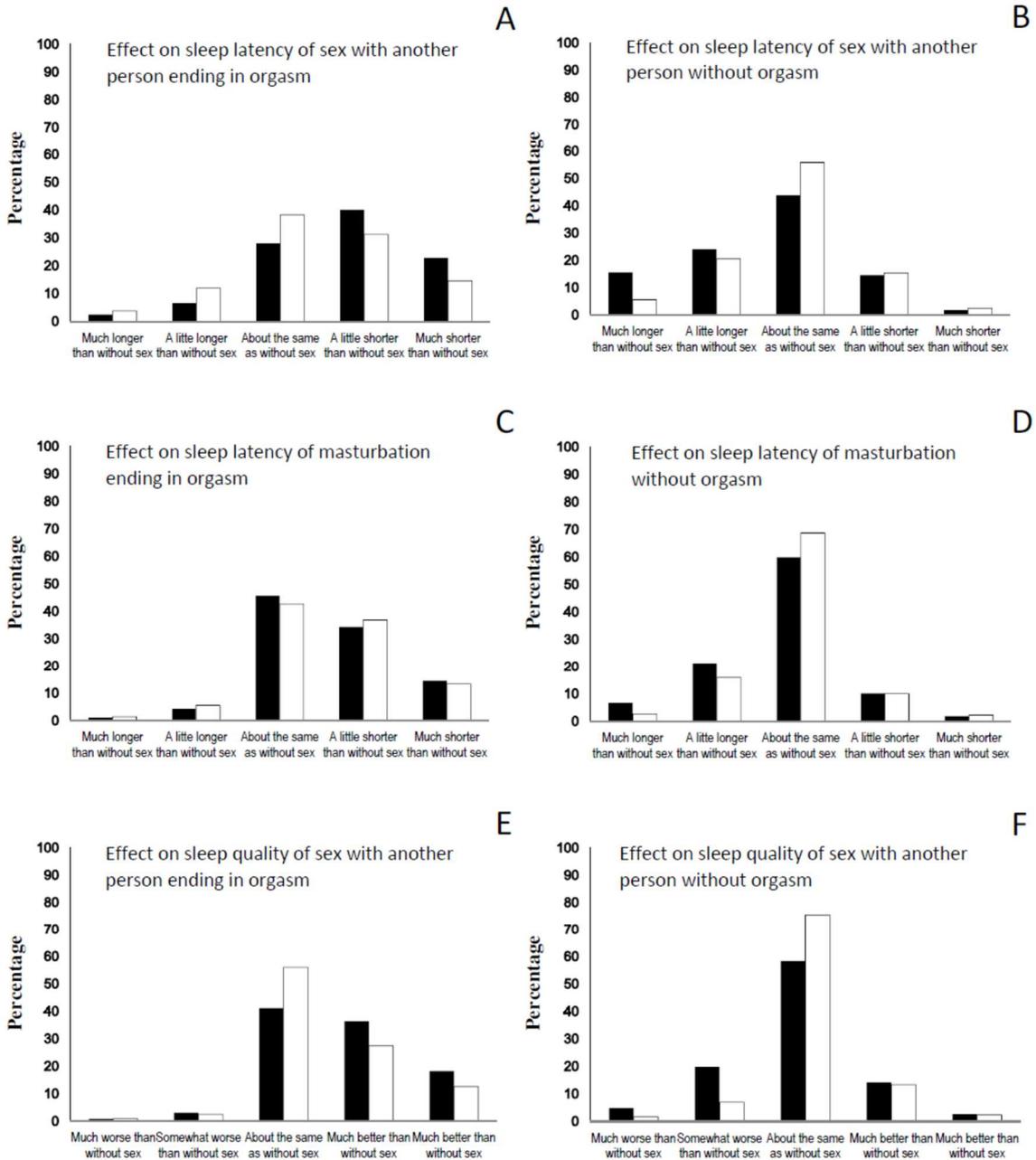
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#### Figure legend

Figure 1.

The distribution/percentage of the responses to questions pertaining to the perceived impact of sexual activity on sleep latency (Panel A-D) and sleep quality (Panel E-H), broken down on gender: Panel A: Sex with another person ending in orgasm. Panel B: Sex with another person without orgasm. Panel C: Masturbation ending with orgasm. Panel D: Masturbation without orgasm. Panel E: Sex with another ending with orgasm. Panel F: Sex with another person without orgasm. Panel G: Masturbation ending in orgasm. Panel H: Masturbation without orgasm.

■ Men □ Women



**Table 1.**

## Questions about the perceived effects of sexual activity on sleep

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**Introduction:** The questions below aim to assess if and how your sleep is affected by sexual activity. Below we ask you to indicate how different types of sex affect your sleep. The effect of sex on sleep likely varies by many more things than covered by these questions (e.g. sex with a new or well-known partner, menstruation cycle etc.). We thus ask you to answer the questions based on how sex affects your sleep based on what is average or typical for you. If the question is irrelevant for you tick off for “not relevant”

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1. After having sex with another person where you obtain orgasm, how long does it take you to fall asleep?<sup>a</sup>
  2. After having sex with another person where you do not obtain orgasm, how long does it take you to fall asleep?<sup>a</sup>
  3. After having masturbated where you obtain orgasm, how long does it take you to fall asleep?<sup>a</sup>
  4. After having masturbated where you do not obtain orgasm, how long does it take you to fall asleep?<sup>a</sup>
  5. After having sex with another person where you obtain orgasm, how is your sleep quality?<sup>b</sup>
  6. After having sex with another person where you do not obtain orgasm, how is your sleep quality?<sup>b</sup>
  7. After having masturbated where you obtain orgasm, how is your sleep quality?<sup>b</sup>
  8. After having masturbated where you do not obtain orgasm, how is your sleep quality?<sup>b</sup>
- 
- a) Response alternatives: “Much longer than without sex” = -2, “A little longer than without sex” = -1, “About the same as without sex” = 0, “A little shorter than without sex” = 1, “Much shorter than without sex” = 2 and “Not relevant”
- b) Response alternatives: “Much worse than without sex” = -2, “Somewhat worse than without sex” = -1, “About the same as without sex” = 0, “Somewhat better than without sex” = 1, “Much better than without sex” = 2 and “Not relevant”

**Table 2.**

Effects of sexual activity on sleep onset latency, ranging from -2 (strong sleep impairment effect) to 0 (no effect) to +2 (strong soporific effect) in men and women\*

<b>Sexual activity</b>	<b>Gender difference</b>	<b>Men</b>		<b>Women</b>	
	<b>F<sup>degree of freedom</sup></b>	<b>Mean</b>	<b>95% CI mean</b>	<b>Mean</b>	<b>95% CI mean</b>
Sex with other person with orgasm	$F_{1,900} = 26.72, p < .01$	0.76	0.69, 0.85	0.42	0.32, 0.51
Sex with other person without orgasm	$F_{1,737} = 16.37, p < .01$	-0.38	-0.48, -0.28	-0.11	-0.19, -0.02
Masturbation with orgasm	$F_{1,768} = 0.34, p > .05$	0.57	0.50, 0.67	0.55	0.46, 0.64
Masturbation without orgasm	$F_{1,499} = 8.15, p < .05$	-0.24	-0.30, -0.14	-0.05	-0.13, 0.04
Effect of masturbation with orgasm – effect of sex with another person with orgasm	$F_{1,710} = 24.13, p < .01$	-0.23	-0.31, -0.15	0.08	-0.01, 0.17

\* with age, relationship status and insomnia symptoms as covariates

**Table 3.**

Effects of sexual activity on sleep quality ranging from -2 (strong sleep impairment effect) to 0 (no effect) to +2 (strong soporific effect) in men and women\*

<b>Sexual activity</b>	<b>Gender difference</b>	<b>Men</b>		<b>Women</b>	
	<b>F<sub>degree of freedom</sub></b>	<b>Mean</b>	<b>95% CI mean</b>	<b>Mean</b>	<b>95% CI mean</b>
Sex with other person with orgasm	$F_{1,892} = 12.38, p < .01$	0.67	0.59, 0.74	0.47	0.40, 0.55
Sex with other person without orgasm	$F_{1,735} = 7.57, p < .05$	-0.08	-0.15, -0.01	0.07	-0.00, 0.13
Masturbation with orgasm	$F_{1,777} = 2.68, p > .05$	0.44	0.37, 0.50	0.35	0.28, 0.43
Masturbation without orgasm	$F_{1,546} = 4.66, p < .05$	-0.11	-0.19, -0.04	-0.00	-0.07, 0.07
Effect of masturbation with orgasm – effect of sex with another person with orgasm	$F_{1,717} = 6.70, p < .01$	-0.25	-0.32, -0.19	-0.12	-0.19, -0.04

\* with age, relationship status and insomnia symptoms as covariates