The Effect of Intimacy on Sleep

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Abstract

In the pursuit of enhancing health and well-being through sleep, the current study investigates the extent to which the engagement in intimacy serves as a factor to benefit sleep. The existing literature demonstrates a correlation between sleep quality and sexual activity. While partnered sex with orgasm emerges as a powerful factor influencing sleep outcomes positively, masturbation with orgasm does not produce significant changes in sleep qualities. Henceforth, orgasm alone does not entirely explain the sleep-promoting effects of sexual activity. In the current study, the role of intimacy is explored as a determinant affecting this unexplained phenomenon. It is hypothesized that intimacy decreases sleep latency and increases subjective sleep quality. The current study conducted a cross-sectional study (N = 328) and a longitudinal study of that consisted of 3,569 measurements. The results supported the hypothesis that the engagement in intimacy benefits sleep quality. In addition, intimacy seems to play an inhibiting role to the negative effects on sleep variables due to not experiencing orgasm. Intimacy satisfaction and intimacy duration both were significant factors in the beneficial contribution to the sleep variables. The current study concludes that the unexplained difference between outcomes of partnered sex and masturbation in sleep variables appears to be linked to the presence of intimacy, and should be investigated further.

Keywords: intimacy, sexual behavior, sleep, orgasm, subjective sleep quality, subjective sleep latency

The Effect of Intimacy on Sleep

In the quest for overall well-being and an enhanced quality of life, the significance of healthy sleep cannot be overstated. Extensive research has established a strong connection between short or disrupted sleep and various adverse health outcomes, including obesity, hypertension, diabetes mellitus and even mortality (Anothaisintawee et al., 2015; Itani et al., 2017; Bertisch et al., 2018). Recognizing the societal and individual importance of understanding factors contributing to healthy sleep, the present study delves into the influence of sexual behaviour on our sleep quality and sleep latency.

The existing literature demonstrates a correlation between sleep quality and sexual activity (Brisette et al., 1985; Lastella et al., 2019; Pallesen et al., 2020). However, a consensus regarding the specific details of this relationship has not been reached among these studies. Even though sex and sleep have demonstrated significant impacts on our mental health (Dement & Vaughan, 1999), the interaction between these two factors yields mixed results and is in need of more extensive literature. Studies have shown that sexual engagement, particularly involving orgasm, plays a crucial role in sleep health (Brisette et al., 1985; Lastella et al., 2019; Pallesen et al., 2020). While Pallesen et al. (2020) observed the sleep-promoting effect of sexual activity exclusively when it included an orgasm, Lastella et al. (2019) found that sexual activity, with or without orgasm, had a positive impact on sleep.

Oesterling et al. (2023) conducted a study which revealed that orgasms, achieved through partnered sex, can significantly reduce sleep latency and enhance sleep quality for both men and women. On the other hand, partnered sex without orgasm has been associated with a perceived increase of sleep latency and reduced sleep quality. In order to make sense of the mixed results, we have to zoom in on the differences in experiencing sexual intercourse.

Delving further into the results of Oesterling et al. (2023) concerning sleep and sexual activity, it becomes clear that not all sexual experiences impact sleep in the same way. While

partnered sex with orgasm emerges as a powerful factor influencing sleep outcomes, masturbation with orgasm does not produce significant changes in sleep qualities. Henceforth, this research underscores that orgasm alone may not entirely explain the sleep-promoting effects of sexual activity. Following this notion, the question arises what factor(s) can be responsible for the difference in perceived sleep results after either partnered sex or masturbation.

Affective touch, shared with another person through activities like hugging or sexual activity, is linked to physiological relaxation (Brody & Kruger, 2006; Brody & Preut, 2003; Costa & Brody, 2012; Grewen et al., 2003) and might therefore be relevant to consider in order to explain the discrepancy in findings of partnered sex and masturbation on sleep. Tactile intimacy consists of a range of attitudes and experiences involving different types of touch, and emerges prominently in co-sleeping among couples (Hislop, 2007; Kirkman, 2010; Meadows et al., 2008; Venn, 2007). However, the lack of existing literature addressing the connection between affective touch and sleep is noteworthy. An extensive number of studies researching sex and sleep do mention intimacy in the form of touch, but do not further explore the subject (Hislop, 2007; Kirkman, 2010).

Another explanation for the difference in sleep benefits between masturbation and partnered sex could be the difference in how the orgasm is experienced. Brody and Krüger (2006) demonstrated that the surge in post-coital prolactin following orgasm during sexual intercourse is 400% higher compared to orgasm induced by masturbation. Prolactin plays a role in promoting sleep and is part of a feedback loop associated with sexual satiety. The findings align with evolutionary theory suggested by Brody and Krüger (2006), suggesting that the sexual activity with the potential for reproduction would be anticipated to be more physiologically rewarding than other sexual activities. The inquiry revolves around identifying the factor(s) in sexual intercourse that contribute to the clear difference in

prolactin release compared to masturbation. Raising the question whether intimacy may play a significant role in elucidating this unexplained phenomenon. Snowdon and Ziegler (2015) found that prolactin may function as a reward for both parenting and engaging in social sexual interactions with a partner. The results suggest that elevated prolactin levels are a consequence of sexual behavior and affiliation through physical contact. This suggest that intimacy could positively contribute to sleep, as not only orgasm, but also physical touch is associated with higher prolactin levels. The correlation between contact affiliation and prolactin demonstrated a weaker strength in females compared to males.

To further explore the subject of sexual behavior and sleep, it is essential to also examine the variations in post-coital behaviors and sleep patterns between genders. Symons (1979) conducted a study that yielded results that suggest that males generally experience a decrease in attraction to a sex partner following intercourse, while females exhibit an increase in commitment. Although this was a well-accepted theory by the time, one has to realize that in 1979 the landscape of sexual pleasure for women and the understanding of the clitoris were significantly understudied and lacked social acceptance. The term "pleasure gap," as reviewed by Laan and Klein (2021), highlights the gendered context in which sexual experiences are embedded, where women's pleasure is often subordinated to men. This disparity in sexual pleasure is further exacerbated by a long-standing history of neglect in research and sexual health policies, as described by Ford et al. (2019). A study by Reis et al. (2021) emphasizes the importance of recognizing and prioritizing women's sexual pleasure for overall sexual health. The idea that men's pleasure is considered the norm, while women's pleasure is often an afterthought, suggests a societal imbalance that has persisted over time (Tuana, 2004). This historical neglect has had lasting implications, potentially steering women towards prioritizing intimacy over achieving orgasm due to the lack of pleasure that is experienced by partnered sex.

Furthermore, women report experiencing more frequent orgasms when their sexual encounters involve deep kissing, manual genital stimulation, and/or oral sex in addition to intercourse (Mahar et. al, 2020). These findings highlight the importance of intimacy and support the hypothesis that the effect of intimacy might be stronger in women. Possibly due to the orgasm/pleasure gap that is prevalent across cultures, women may have deprioritized the orgasm, placing greater value on intimacy instead.

Halpern and Sherman (1979) discovered that men were more prone to falling asleep immediately after sexual activity. In a different study, it was observed that following sexual intercourse both men and women tended to fall asleep simultaneously after sexual activity (Kruger & Hughes, 2011). Levine (2003) suggested that men may prioritize sexual gratification, whereas women, seeking emotional intimacy, may refrain from immediately falling asleep after sex to enhance bonding. The mixed results in these studies shows the complexity of the subject. Kruger & Hughes (2011) suggested that a heightened probability of one's partner falling asleep first after sexual activity correlated with an increased desire for the partner's expression of affection and emotional bonding following sex, and that this effect is independent from gender. Following this theory, the present study will function as an exploration of the subject and add to the existing literature.

Across genders, Oesterling et al. (2023) found that masturbation and partnered sex both significantly improve sleep variables when asked retrospectively (which was also found in the research of Pallesen et al. (2020)), but when these variables were measured in the longitudinal study masturbation did not yield significant effects. This might be the case due to a culturally held notion that one sleeps better after an orgasm. Following these discrepant results, it is important to investigate which factors could be responsible for the measured difference between masturbation and sexual activity.

It remains to be determined whether sexual activity alone is adequate to induce sleep-promoting effects or if the experience of orgasm is necessary (Oesterling, 2021). Sprajcer et al. (2022) found that orgasm frequency explained 3.1% of the variance in subjective sleep latency, as participants reporting an orgasm "every time" sexual activity occurs fell asleep on average 12 min faster than those who less frequently or never report orgasm. In order to answer the question if intimacy has such an impact on sleep, the primary objective of the present study is to explore the impact of intimacy on sleep and to compare this effect with partnered sex and masturbation, aiming to ascertain whether intimacy may serve as a potential contributing factor to the enhancement of sleep quality. The study posits a hypothesis that the presence of intimacy is accountable for the observed difference in scores when comparing partnered sex and masturbation, given that intimacy is an inherent component of partnered sexual activity. Additionally, the study will conduct an analysis to examine potential variations in this effect across genders. The current study expands upon findings from previous research employed by Oesterling et al. (2023), where both cross-sectional and longitudinal designs through a 14-day diary intervention were incorporated (first employed by Pallesen et al. (2020)). As we further investigate the relationship between sexual activity, intimacy, and sleep, our exploration aims to contribute valuable insights into optimizing sleep health and reaching a holistic understanding of the factors shaping our sleep. The paper will try to give answers to the questions: What roles do intimacy and orgasm play in subjective sleep? And are these roles different across genders?

In line with the findings of Oesterling et al. (2023) and Pallesen et al. (2020), it is expected that intimacy is a factor that increases subjective sleep quality (**Hypothesis 1**). It is also expected that intimacy decreases sleep latency (**Hypothesis 2**). Additionally, consistent with the research of Mahar et al. (2020) and Symons (1979) it is hypothesized that the female subset of the sample will exhibit a more pronounced effect in relation to both Hypotheses 1

and 2 (**Hypothesis 3**). The present investigation serves as a replication study of Oesterling et al. (2023), and as such, it is anticipated that comparable findings will be found in the domain of sexual activity (**Hypothesis 4**).

Method

Participants

A total of *N* = 396 participants were recruited through SONA and a participant recruitment platform of the University of Groningen. The majority (*n* = 256) comprised undergraduate psychology students who received course credits in exchange for their participation. The remaining participants (*n* = 140) were randomly recruited via social media platforms like Facebook, Instagram and LinkedIn and recruited via Paid Participant Pool. Exclusions were made for participants who were under 18 years of age during the time of research (*n* = 7). Additionally, *N* = 12 participants were excluded due to a lack of informed consent. In order to derive insights in the effects of sexual activity and intimacy on sleep between men and women, participants who did not identify as either male or female (*n* = 12) were excluded. Furthermore, participants that were on medication AND were diagnosed with a sleep disorder, depression or sexual dysfunction, were excluded (*n* = 19). The statistical analysis for the cross-sectional study was carried out on the remaining sample of *N* = 328 participants (*n* = 75 men, *n* = 253 women) aged between 18 and 58 years (*M* = 22,01, *SD* = 5.82; see Table 1 in Appendix B).

For the analysis of diary data, participants who completed less than 50% of the diary (< 7 days) were excluded. Thus, after filtering the data, 3,569 cases nested within *N* = 328 individuals (through the multiplication method) and were analysed. The study received approval from the Ethics Committee of Behavioral and Social Sciences (ECP: PSY-2223-S-0185).

Materials

Pre-test

The cross-sectional study consisted of items assessing gender, age, email address, available internet connection, diagnosis and current treatment of mental health or sleep

disorder or sexual dysfunction, medication and habitual alcohol and caffeine consumption. The nature and symptoms of sleep disturbances in the past two weeks were measured by the Insomnia Severity Index (Morin et al., 2011). The self-report questionnaire consists of seven items measuring the subjective perception of sleep and the frequency and severity of sleep disturbances, which were rated on a 5-point Likert scale ranging from 0 (no insomnia) to 4 (very severe insomnia). The total score of these questions enables the rating of the severity of one's insomnia (≤7 = *no insomnia*; 8–14 = *sub-clinical insomnia*; ≥15 = *clinical insomnia*; ≥22 = *very severe insomnia*). In the cross-sectional study, perceived sleep onset latency and subjective sleep quality will serve as dependent variables, with the use of the items formulated by Pallesen et al. (2020). The independent variables included are sexual intercourse with orgasm, sexual intercourse without orgasm, masturbation with orgasm, masturbation without orgasm and intimacy.

In an attempt to replicate the study of Oesterling et al. (2023) and Pallesen et al. (2020), the pre-test survey was used in order to investigate the retrospective judgement of the relation between sexual behaviour and sleep. The questionnaire includes eight items assessing the perceived impacts of sexual intercourse and masturbation, with and without orgasm, on subsequent sleep latency and sleep quality. Respondents used a 5-point Likert scale to answer questions such as: "*After having masturbated where you obtain orgasm, how long does it take you to fall asleep*?" Response options spanned from -2 ("*much longer than without sex*" for sleep latency and "*much worse than without sex*" for sleep quality) via 0 ("no effect") to 2 ("*much shorter than without sex*" for sleep latency and "*much better than without sex*" for sleep quality).

Diary study

The diary study evaluated subjective sleep by measuring onset sleep latency and sleep quality. The control variables considered were alcohol consumption and the Insomnia

Severity Index. To evaluate sleep-related these variables the Consensus Sleep Diary (Carney, 2012) was used, which is recognized as standard measure for subjective sleep assessment. For measuring sleep latency, the question was asked: "*How long did it take you to get to sleep*?", this was measured in minutes. Sleep quality was measured on a 5-point Likert scale with the question: "*In general, how was your sleep*?".

In an effort to be consistent between the pre-test and the diary, the items of sexual activity on sleep were formulated in the same manner as the cross-sectional items used by Pallesen et al. (2019). These items were presented with questions such as (e.g., "*Did you have sex with another person and have an orgasm*?", see Appendix B), allowing participants to respond with either "*yes*" or "*no*".

In the diary study the variable of intimacy was introduced. Participants were asked: *"Did you engage in any kind of intimate activity/intimacy task alone or with your partner during the last 24 hours",* and could answer *"yes"* or *"no".* To investigate the effect of intimacy, participants were also asked: "*Did the intimacy task occur within two hours of going to sleep"* and *"How satisfying was the intimacy activity for you yesterday".*

Procedure

Each participant was provided with the pre-test, which included the informed consent and the daily diary, through Qualtrics® (Qualtrics, 2014). On the initial day of the study, all participants received a questionnaire evaluating the retrospective impact of sexual activity on sleep. Qualtrics generated a unique code for each participant to ensure anonymity, allowing for the deletion of all email addresses once data collection concluded. Starting from the day after the pre-test administration and for the subsequent 14 days, each participant received a daily reminder email at 5 a.m., containing an individualized survey link. Consequently, the diary was completed once daily upon awakening.

Statistical analysis

Pre-test

To conduct the pre-test analysis, an Analysis of Variance (ANOVA) was employed as well as comparing means with t-tests. A priori power analysis indicated that a sample size of $N = 210$ participants is necessary to achieve a statistical power of 0.95.

Diary study

To determine whether the perceived effect of intimacy on sleep differs between men and women, an analysis of covariance (ANCOVA) with 'alcohol consumption' as covariate was conducted, as well as a regression model. Via multiple regression models the explained variance of 'Intimacy' and 'Orgasm' will be compared in the diary study, while controlling for alcohol consumption. In order to determine the influence of intimacy on sleep, difference scores were used to determine if there is a significant difference between the variance of sex with a partner or intimacy only. This will be done by employing multiple regression with an 'multiplication approach' (Leppink, 2017). In the multiplication approach, repeated measurements are handled as if they originated from distinct respondents rather than from the same individuals. Sexual activity variables were transformed into categorical variables with three levels, for instance for the variable of masturbation it was coded as follows: (0) "*did not engage in masturbation,*" (1) "*engaged in masturbation,*" and (2) "*engaged in masturbation and achieved orgasm*". Sexual activity was coded into (0) '*did not engage'*, (1) '*engaged but no orgasm*' and (2) '*engaged and achieved orgasm'*. For intimacy, there was no orgasm involved because this variable concerned intimacy without following sexual engagement. Hence, the variable was coded as follows: (0) '*no engagement in intimacy'* and (1) '*intimacy*'.

Assumptions

Pre-test

Since Analysis of Variance (ANOVA) and Independent T-tests were used for the analysis of the pre-test, the variables had to be checked for normality. For the pre-test variables, the normality assumption was violated significantly. A Kolmogorov-Smirnov test was employed for the sleep latency variables measured on a Likert scale such as 'Sex with orgasm' (D (202) = 0.276, $p < 0.001$), 'Sex without orgasm' (D (202) = 0.250, $p < 0.001$), 'Masturbation with orgasm' (D (202) = 0.209, $p < 0.001$), 'Masturbation without orgasm' (D (202) = 0.319, $p < 0.001$). For the variable of subjective sleep quality, 'Sex with orgasm' (D (202) = 0.251, $p < 0.001$), 'Sex without orgasm' (D (202) = 0.295, $p < 0.001$), 'Masturbation with orgasm' (D (202) = 0.262, $p < 0.001$) and 'Masturbation without orgasm' (D (202) = 0.365, $p < 0.001$) were violated (see Table 2 in Appendix C).

Due to previous research demonstrating that a violation of normality does not have much influence on large sample sizes and that transformations could create biased results (Schmidt & Finan, 2018; Kief & Forstmeier, 2021), the analysis was carried out on the original data.

Another assumption in an Analysis of Variance (ANOVA) is the homogeneity of variances. In the results of sleep latency, the variables 'Sex with Orgasm' ($\chi2(1) = 11.695$ $p < .001$) and 'Masturbation without orgasm' ($\chi2(1) = 11.252$ $p < 0.001$) violated the assumption of homogeneity (Appendix B). In the results of subjective quality, the conditions of 'Sexual activity', 'Masturbation without orgasm' and 'Intimacy' were violated in homogeneity of variances.

Diary study

For the sleep quality and latency variables, there was no indication of multicollinearity violation for sexual activity (VIF = 1.048), intimacy (VIF = 1.025), and masturbation (VIF =

1.013), affirming the assumption of their absence by not yielding results that have a greater *VIF* value than 5 (see Table 4 in Appendix B). During normality testing, the variables yielded a significant outcome on the Kolmogorov-Smirnov test, indicating a violation from normal distribution assumptions. Following the transformations to a logarithmic variable, the regression plots appeared to exhibit normality for both dependent variables, as depicted in Graphs 1 and 2 (Appendix C). However, the Kolmogorov-Smirnov test continued to yield significant results for both sleep quality ($p < 0.000$) and latency ($p < 0.000$) which indicate a violation of normality, as shown in Table 2 in Appendix B. Hence, with similar reasons as in the pre-test variables, we did not use the transformation variables due to our large sample size and potential bias to our results.

The only instance of a violation of the linearity assumption was observed for the interaction term sleep quality * sexual activity ($F = 8.841$, $p < 0.003$), as outlined in Table 18.

Results

Pre-test

After cleaning the data, N = 328 participants (75 male and 253 female) were included in the analysis. Overall, the sample perceived partnered sex with orgasm and masturbation with orgasm to have an almost equal positive effect on sleep latency (sex: M = 0.79, masturbation: M = 0.77). Not experiencing an orgasm in partnered sex yielded a mean that indicated a slightly negative but nearly no perceived effect on sleep latency (M = -0.08). Participants perceived not having an orgasm after masturbation as the most negative for falling asleep (M = -0.69; see Table 1). A comparable outcome was observed in relation to perceived sleep quality, as presented in Table 2. Partnered sex with orgasm (M = 0.76) and masturbation with orgasm (M = 0.60) both were associated with a positive effect on sleep quality. Partnered sex without orgasm (M = 0.117) was associated with little to no effect on sleep quality. The only observed difference was that individuals engaging in masturbation without orgasm did not perceive any effect on their sleep quality (M = -0.04), in contrast to the observed effect of sleep latency where this had a negative association.

Table 1

Means for perceived latency in the pre-test

	Sex with Orgasm	Sex without Orgasm	Mastrubation with Orgasm	Mastrubation without Orgasm
Mean	,79	-,08*	,77*	-,69
N	251	257	291	223

Note: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect.

*Significant difference for gender at α =0.05.

Table 2

Means for perceived sleep quality in the pre-test

	Sex with Orgasm	Sex without orgasm	Masturbation with Orgasm	Masturbation without Orgasm
Mean	,76	,117	,60	-,04*
N	258	257	291	241

Note: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect.

*Significant difference for gender at α =0.05.

For the woman in the data sample, experiencing an orgasm with partnered sex is associated with a higher perceived sleep quality (M = 0.74) compared to achieving orgasm through masturbation (M = 0.63; see Table 3 in Appendix A), but this difference did not reach statistical significance (t (176) = 1.350, p < 0.179; see Table 4 in Appendix A). Men reported a better sleep quality with a sex-induced orgasm (M = 0.79) compared to a masturbation-induced orgasm (M = 0.53), and this difference was statistically significant (t (62) = 2.312, p < 0.024), with a larger mean difference indicating a stronger effect for men. Women reported a shorter sleep latency following a sex-induced orgasm compared to a masturbation-induced orgasm. Similar findings were observed for men, with the effect being more pronounced in men due to larger mean differences.

Not experiencing an orgasm in either partnered sex or masturbation both were perceived to be a negative effect on sleep latency for men (masturbation: M = -0.97, partnered sex: M = -0.43). For women, this was only the case for masturbation, while partnered sex without orgasm was not perceived to have effect on sleep latency (masturbation: M = -0.63, partnered sex: M = 0.00; see Table 3 in Appendix A). The difference in partnered sex without experiencing an orgasm showed to be significant for gender (F = 4,149, p < .043; see Table 5 in Appendix A). Men also perceived a more negative effect of not experiencing an orgasm on

sleep quality, but no significant differences in the perception of negative effects between man and woman were found. The effect that men yielded a stronger negative result by not experiencing an orgasm was also demonstrated sleep quality, but no significant gender difference was shown (F = 0,974, p < .325). These results entail that people expect that not reaching orgasm negatively influences the sleep variables of sleep latency and sleep quality.

Diary study

The sample consisted of 3,569 measurements, where females constituted 76.6% (N = 2,763), while males accounted for 22.4% (N = 806; see Table 6 in Appendix A).

Sleep quality

Sexual activity (B = 0.099, t = 3.604, p < .001) and intimacy (B = 0.117, t = 3.144, p < .002; **Hypothesis 1**) significantly affect sleep quality in the regression model, while masturbation showed an insignificant effect (B = -0.002, t = -0.081, p < .936; Table 8 in Appendix A).

People who engaged in masturbation (M = 0.51) reported a similar average sleep quality as people who did not engage in any sexual activity. In other words, perceived sleep quality did not yield beneficial effects for engaging in masturbation (Table 9 in Appendix A; **Hypothesis 4**). There was no observed improvement in sleep quality for both males and females when involved in masturbation with orgasm. However, engaging in masturbation without orgasm resulted in a stronger decrease in sleep quality for males (M = 0.15) compared to females (M = 0.34). Nevertheless, no interaction effect for gender was identified when examining the variable of masturbation (F = 1,1255, p < 0.029; see Table 8 in Appendix A).

For ‘sexual activity’, a significant difference emerged between not engaging in partnered sex (M = 0.49) and participating in partnered sex with orgasm (M = 0.76; see Table 11 in Appendix A), indicating an enhancement in sleep quality when involved in sexual activity resulting in orgasm. Notably, not engaging in sex yielded a higher mean compared to

engaging without orgasm (M = 0.39). The interaction effect of gender was found to be significant (F = 4.769, p < .001; see Table 8 in Appendix A), primarily attributable to the negative impact on sleep quality for females when sexual activity did not culminate in orgasm (M = 0.37). In contrast, for men, engaging in sexual activity without orgasm (M = 0.57) still resulted in a higher sleep quality than abstaining from sexual activity (M = 0.49; see Table 10 in Appendix A).

Intimacy also yielded significant results in the regression model (Table 7), with a higher mean reported for engaging in intimacy (M = 0.61) as opposed to not engaging (M = 0.47; see Table 12 in Appendix A). Engaging in intimacy appears to exert a more substantial impact on males (mean difference of 0.34; **Hypothesis 3**), and this effect reached statistical significance (F = 19.130, p < .001). In contrast, the female sample exhibited a much smaller effect (mean difference of 0.06), which was found to be statistically insignificant (F = 2.099, p < .147; see Table 13 in Appendix A). To demonstrate the effect of intimacy, an ANOVA was conducted on the satisfaction of intimacy on sleep quality (see Table 14). The analysis on this particular variable shows that the sleep quality increases with increased intimacy satisfaction (see Table 15). The results demonstrate that satisfaction of intimacy plays a role in sleep, underscoring the importance of intimacy in sleep quality considerations.

Table 16 in Appendix A shows that the effect of intimacy becomes stronger when the intimate activity is experienced within two hours before going to sleep. An ANOVA was postulated to investigate if this difference in mean, which was only was significant for subjective sleep quality (F = 3.966, p < .050; Table 17), where intimacy within two hours before going to sleep had a subjective sleep quality of M = 0.71 and longer before going to sleep yielded a subjective sleep quality of M = 0.34 (see Table 16 in Appendix A). Sleep latency did not show effect in this model.

The satisfaction of intimacy was associated with a longer duration of intimacy, as depicted by Table. The intimacy rating of 'Very dissatisfying' had a mean of 23 minutes, while 'Very satisfying' had a mean of 44 minutes (see Table 18. The clear effect of the 'duration of intimacy' on 'intimacy satisfaction' showed to be significant in the ANOVA table ($F = 21.914$, $p < 0.001$; see Table 19 in Appendix A).

Engaging in partnered sex without engaging in intimacy (for instance not cuddling after or before sex) yielded results that demonstrate a strong difference on the sleep variables for orgasm or no orgasm experienced (see Table 20). Namely, participants that did not engage in intimacy but did have an orgasm with partnered sex, fell asleep almost 7 minutes faster than and rated their sleep of much higher quality (difference score $M = 0.48$). These clear differences were significant for sleep latency ($F = 6.755$, $p < .01$; **Hypothesis 2**) and for subjective sleep quality ($F = 10.965$, $p < .001$; **Hypothesis 1)**. When participants did engage in intimacy, the contribution of partnered sex was more positive on both sleep variables, and the differences in the scores between having an orgasm or not having an orgasm became much smaller (almost equal) and insignificant for latency ($F = 0.000$, $p < .989$) and sleep quality ($F = 0.049$, $p < .824$; see Table 21 in Appendix A. This demonstrates the positive effect of intimacy, as well as the inhibiting effect on the negative standard experienced when engaging in sex and not reaching orgasm.

The Insomnia Severity Index (ISI) score emerged as a significant covariate in the regression model for sleep quality ($B = -0.040$, $t = -11.613$, $p < .001$; see Table 7). Table 22 presents the means of various insomnia categories, illustrating a difference between those with no insomnia ($M = 0.84$) and clinical insomnia ($M = 0.40$), as could be expected. The impact of the ISI score on sleep quality becomes evident in this contrast. Similarly, the covariate of alcohol consumption demonstrated a significant effect in the sleep quality model ($B = -0.105$, $T = 4.563$, $p < .001$). Participants who consumed no alcohol reported an average

sleep quality of *M* = 0.54. As alcohol consumption increased, the sleep quality decreased, reaching a sleep quality of *M* = 0.19 at the level of 8 drinks or more (Table 24). This covariate was also significant in the regression model (*B* = -.105, *t* = -4,563, *p* < .001; see Table 7).

Table 7.

Sleep quality regression model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,074	,054		19,723	<,001
	SexualActivity	,099	,028	,063	3,604	<,001*
	Intimacy	,117	,037	,054	3,144	,002*
	Masturbation	-,002	,021	-,001	-,081	,936
	ISI_TOTAL	-,040	,003	-,199	-11,613	<,001*
	Alcohol consumption	-,105	,023	-,078	-4,563	<,001*

a. Dependent Variable: Sleep quality

*Significant at α =0.05

Latency

Sexual activity (*B* = -1.151, *t* = -1.447, *p* < .148) and intimacy (*B* = -1.031, *t* = -0.961, *p* < .336; **Hypothesis 2**) did not significantly affect sleep latency in the regression model, while masturbation showed a significant effect (*B* = 1.219, *t* = 2.004, *p* = .045; Table 25).

The variable exhibiting significant results in the regression model of latency was masturbation. However, the effect did not indicate that masturbation led to a reduction in latency (Table 9). Surprisingly, the lowest mean latency was associated with not engaging in masturbation (*M* = 23.15), while engaging in masturbation with (*M* = 26.64) or without orgasm (*M* = 23.53) resulted in considerably higher latency values. For women, engaging

with orgasm yielded a 6-minute higher average for the variable latency. For men, the effect was much more as hypothesized; engagement with orgasm yielded the lowest mean (*M* = 21.89), but most noticeable, engaging without orgasm yielded a surprisingly high average (*M* = 33.35; **Hypothesis 4**).

Although sexual activity initially appeared to be a significant contributor to sleep latency, particularly when considering the substantial difference in mean values between sex with an orgasm and no sexual activity, this effect became non-significant when controlling for ISI-score and alcohol consumption (**Hypothesis 2**). It must be noted that the lowest latency value across genders was yielded for men that engaged in sexual activity with orgasm (*M* = 17.25), while not engaging in sexual activity gave a much higher latency (*M* = 23; see Table 10 in Appendix A). In addition to this, men showed a decrease in latency when experiencing intimacy, whereas women did not show any decrease.

Further analyzing intimacy, a clear pattern demonstrated the effects on the sleep variables. When participants did not experience intimacy before or after sex, they showed a strong sensitivity in the sleep variables when comparing partnered sex with orgasm and without orgasm. Men who did not engage in intimacy and did not reach an orgasm had an average sleep latency of *M* = 29.00 minutes and people who did not engage in sex an average sleep latency of *M* = 24.13 minutes, whereas men who did not engage in intimacy but did reach orgasm had a mean sleep latency of *M* = 15.74 minutes, falling asleep 9 minutes faster than when not engaging in intimacy and not engaging in partnered sex. Also 14 minutes faster than when not reaching orgasm and not engaging in intimacy (see Table 26). These differences were significant ($F = 6.755$, $p < .010$; see Table 21 in Appendix A). Notably, when intimacy was experienced, the sleep latency values were much closer to each other. Not engaging (*M* = 20.94), not reaching orgasm (*M* = 21,33) and engaging with orgasm (*M* = 19,33) almost had the same mean. Hence, in this case, the differences between engaging and

not engaging in intimacy were insignificant ($F = 0.00$, $p < .989$; see Table 21). For women, the same pattern emerged, but for men this was stronger effect (**Hypothesis 3**). This shows a pattern which demonstrates the importance of intimacy for decreasing latency (**Hypothesis 2**), and furthermore, decreasing the negative experience of not reaching orgasm.

The ISI score, derived from pre-test data, demonstrated a significant impact on the latency variable ($B = 0.929$, $t = 9.364$, $p < .001$; see Table 25). Noteworthy is the finding that $N = 141$ participants exhibited an ISI score exceeding 15, indicative of subclinical insomnia, and N = 31 exceeded an ISI score of 22 which indicates clinical insomnia (see Table 23). It is a remarkable finding that 52,5 % of the participants in the sample got an ISI score that indicated subclinical insomnia (and for some clinical insomnia). As expected, the category of clinical insomnia was associated with the most adverse effects on sleep variables in the dairy study, presenting a latency of $M = 26.71$ (see Table 22). In contrast, participants without insomnia displayed significantly better outcomes, with an average latency of $M = 14.47$, highlighting the importance to consider this variable when delving into sleep-related variables.

Furthermore, alcohol consumption emerged as a significant covariate in the latency regression model ($B = -4.394$, $t = 9,364$, $p < .001$; see Table 25). Table 24 in Appendix A illustrates that latency decreases with alcohol consumption. Specifically, consuming no alcohol resulted in an average latency of $M = 24.73$, while the consumption of 8 or more drinks was associated with an average latency of $M = 8.00$.

Table 25

Latency regression model with alcohol consumption and insomnia score as covariates

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11,314	1,572		7,198	<,001
	SexualActivity	-1,151	,795	-,025	-1,447	,148
	Intimacy	-1,031	1,072	-,017	-,961	,336
	Masturbation	1,219	,608	,035	2,004	,045*
	ISI_TOTAL	,929	,099	,161	9,364	<,001*
	Alcohol consumption	-4,394	,662	-,115	-6,640	<,001*

a. Dependent Variable: Latency

*****Significant at $\alpha = 0.05$.

Discussion

The results of the present study provide insights into the relationship between sexual activity, intimacy, and sleep quality. Evidence was found for intimacy as a factor to benefit sleep. In addition, intimacy seems to play an inhibiting role to the negative effects on sleep variables due to not experiencing orgasm. Intimacy satisfaction and intimacy duration both were significant factors in the beneficial contribution to the sleep variables, further research should investigate these factors further, as they may play a crucial role in mediating the relationship between sexual activity and sleep quality.

Intimacy was identified to be a factor that increases subjective sleep quality. Thus, the results supported **Hypothesis 1**. One possible explanation for this phenomenon is the connection between affective touch, experienced through activities such as hugging or sexual activity with another person, and physiological relaxation (Brody & Kruger, 2006; Brody & Preut, 2003; Costa & Brody, 2012; Grewen et al., 2003). Due to the physiological relaxation that is induced by intimacy, the subjective sleep quality might increase. Another contributing factor may be the post-coital surge in prolactin following orgasm during sexual intercourse, which is 400% higher compared to orgasm induced by masturbation (Brody and Krüger, 2006). Snowdon and Ziegler (2015) found that prolactin may function as a reward for both parenting and engaging in social sexual interactions with a partner. The results suggest that elevated prolactin levels are a consequence of sexual behavior and affiliation through physical contact. This might explain why intimacy is a positive contributor to subjective sleep quality, as not only orgasm, but also physical touch is associated with higher prolactin levels.

Intimacy yielded fewer promising results in the decrease of sleep latency. While engagement in intimacy did result in a decrease in latency compared to not engaging in intimacy, the reduction was not statistically significant as anticipated. Hence, the study did not yield sufficient supporting evidence for **Hypothesis 2.** However, when analyzing the

variables of partnered sex and intimacy, a clear pattern emerged in sleep latency. The findings show that engaging in intimacy causes a decrease in sleep latency in the absence of partnered sex, something that engaging in masturbation did not demonstrate. Therefore, engaging in intimacy without engaging in sexual activity result in a similar positive effect on sleep as experienced after partnered sex with orgasm.

Considering gender differences, the results indicate that men generally exhibit a reduction in sleep latency when intimacy is experienced after or before no sex or sex without orgasm. However, when it comes to engaging in intimacy before or after partnered sex with orgasm, males show an increase in latency, whereas females show a decrease. Hence, for males, engagement in intimacy decreases sleep latency, except for the instance of sex with an orgasm. So, the context of sleep latency, it appears that men may experience greater sexual satisfaction post-orgasm without deriving notable benefits from intimacy, evidenced by their quicker onset of sleep in the absence of intimacy. Conversely, women seem to derive benefits from intimacy following orgasm, as reflected in their sleep latency patterns. This observation aligns with the theory of Levine (2003), which suggested that men may prioritize sexual gratification, whereas women, seeking emotional intimacy, may refrain from immediately falling asleep after sex to enhance bonding. However, it does not necessarily align with the theory of Symons (1979) that females, from an evolutionary standpoint, have a greater need for intimacy and pair-bonding to secure provisioning and care for themselves and their offspring. Contrary to this theory, overall, males exhibit a greater effect of intimacy than females. Hence, we did not find evidence for **Hypothesis 3**, expecting that women would show a stronger effect in intimacy than men. Snowdon and Ziegler (2015) found that the correlation between contact affiliation and prolactin demonstrates a weaker strength in females compared to males. Henceforth, a possible explanation for the effect that men

demonstrated a stronger effect of intimacy in the current study, may be due to the stronger connection between physical contact and prolactin.

Engaging in intimacy also functioned as an inhibiting factor for the negative effects when no orgasm was achieved. When intimacy was not experienced after or before sex, not reaching orgasm had strong negative effects on latency and sleep quality. However, when intimacy was experienced after or before sex, the negative effect almost completely vanished for both variables. This is an important finding due to the literature emphasizing the negative effects of not reaching orgasm (Oesterling et al., 2023), but the absence of the effect after the engagement in intimacy is a new finding. Intimacy may act as an inhibitor of negative effects when sexual intercourse does not lead to orgasm through several mechanisms, one of which involves oxytocin. Oxytocin, known as the 'hugging hormone', has a positive effect on social relationships and is suggested to be mediated the reduction of physiological stress (Robles & Kiecolt-Glaser, 2003). Oxytocin can increase the duration of positive behaviors relative to negative behaviors during conflict discussions and reduce salivary cortisol levels after conflicts in both men and women (Kiecolt-Glaser et al., 2005). This indicates that oxytocin, released during intimate moments, may contribute to a more positive emotional state and potentially inhibit the negative impact of not achieving orgasm during sexual intercourse. Furthermore, oxytocin's involvement in promoting trust, enhancing positive relationship memories, and reducing anxiety and stress during social interactions suggests that the hormone may contribute to creating a supportive and emotionally positive environment within intimate relationships (Ditzen, 2009). This positive context could potentially prevent negative feelings associated with the absence of orgasm, highlighting the broader role of intimacy in working against stress and promoting overall well-being.

The present investigation functions as a replication study of Oesterling et al. (2023), thus, findings were expected to be in line with previous results (**Hypothesis 4**). Results from

the pre-test questionnaire indicated that participants perceived masturbation to enhance subjective sleep quality and decrease latency, but such effects were not evident in the diary study. Participants' expectations regarding the positive effect of partnered sex with an orgasm were consistent with their predictions. Gender differences were not observed in this effect during the diary study. The absence of an orgasm, whether in partnered sex or masturbation, was anticipated to negatively influence sleep variables, with a stronger impact expected for males. This pattern was evident in the diary study, where the absence of an orgasm had a more negative impact on sleep variables compared to non-engagement, and males exhibited a more pronounced negative association. Comparing these results with the study of Oesterling et al. (2023), it quite literally yielded the same results. Therefore, the results corroborate the findings of Oesterling et. al. (2023), making the findings in that study more trustworthy and robust. The only finding that could not be replicated after controlling for alcohol consumption and insomnia score, was that sex with orgasm significantly decreased sleep latency. It only became significant when we took out the participants that experienced intimacy (as mentioned earlier). Alcohol consumption and the insomnia score index both proved to be significant covariates, so should also be included in future research.

In the sample, 52.5% of participants obtained an Insomnia Severity Index (ISI) score indicative of subclinical insomnia. This underscores the study's relevance, emphasizing the importance of incorporating the ISI score as a covariate in the statistical model.

These findings in the current study suggest that an orgasm alone may not solely be the factor to be beneficial to sleep quality and latency. Instead, the unexplained difference between partnered sex and masturbation outcomes in sleep variables seems to be linked to the presence of intimacy. The role of intimacy could be a critical factor in understanding the relationship between sexual activity and sleep. These results emphasize the importance of the emotional and relational aspects of sexual experiences. Intimacy satisfaction was a significant

factor in the contribution to the sleep variables, further research should investigate this factor further, as it may play a crucial role in mediating the relationship between sexual activity and sleep quality. The current study found that satisfaction of intimacy was associated with a longer duration of intimacy, hence, this could serve as a promising foundation for subsequent research endeavors.

Limitations and future directions

The participants of the present study mainly consisted out of Dutch students, potentially limiting the generalizability of the findings to a broader population. Given the substantial cultural variations in the understanding of sexuality concepts (Hall & Graham, 2012), there is a need for future replications with a sample that yields more generalizable data. Additionally, there is a necessity for a more balanced gender distribution in future studies, considering the disproportionate representation of women in the current data sample. Future research should explore individuals' perceived effects of intimacy on sleep, in the same manner done in the pre-test for masturbation and partnered sex. In the current study we used a multiplication approach, where repeated measurements are handled as if they originated from distinct respondents rather than from the same individuals. Future research could examine the same variables with an using multilevel linear modelling to examine the effect within subjects. Experimental research on the subject of intimacy could also be an important next step, since the study is observational and subjective. Intimacy satisfaction emerged as a significant factor influencing subjective sleep quality; thus, further research should delve deeper into this factor's contribution. A good starting point for future research could be intimacy duration, as this was found to positively effect intimacy satisfaction. Moreover, investigating the inhibiting role of intimacy in the context of negative effects associated with not engaging in sex or reaching orgasm is needed for a more comprehensive understanding of the effect of intimacy.

Conclusion

The results of the present study provide insights into the relationship between sexual activity, intimacy, and sleep quality. The absence of an orgasm, whether experienced in partnered sex or masturbation, was expected to have a negative impact on sleep variables, particularly for males. In the analysis of the dairy study this was only the case for partnered sex. Participants' expectations aligned with the anticipated positive effects of partnered sex with orgasm, but contrary to participants perceptions, masturbation was not found to enhance subjective sleep quality or decrease latency. Intimacy emerged as a significant factor positively influencing subjective sleep quality, serving as a substitute for the positive sleep effects usually associated with partnered sex and orgasm. Men appeared to experience greater sexual satisfaction post-orgasm without deriving notable benefits from intimacy, as evidenced by their quicker onset of sleep in the absence of intimacy. Conversely, women seemed to derive benefits from intimacy following orgasm, reflected in their sleep latency patterns. However, overall, males exhibited a greater effect of intimacy than females. The findings suggest that an orgasm alone may not be the sole factor contributing to beneficial sleep quality and latency. The unexplained difference between outcomes of partnered sex and masturbation in sleep variables appears to be linked to the presence of intimacy. Intimacy satisfaction emerged as a significant contributor to sleep variables, emphasizing the need for further research to explore its role in mediating the relationship between sexual activity and sleep quality

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Appendix A

Table 3

Pre-test Means across Gender

Group Statistics

	What gender do you identify with?	N	Mean
SexOrgasmLatency	Male	63	,86
	Female	188	,77
SexNoorgasmLatency	Male	49	-,43
	Female	208	,00
MastrubationOrgasmLatency	Male	68	,59
	Female	223	,83
MastrubationNoOrgasmLatency	Male	39	-,97
	Female	184	-,63
SexOrgasmQuality	Male	66	,79
	Female	192	,74
SexNoorgasmQuality	Male	52	,000
	Female	205	,146
MastrubationOrgasmQuality	Male	68	,53
	Female	223	,63
MastrubationNoOrgasmQuality	Male	43	-,16
	Female	198	-,02

note: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect.

Table 4

Paired T test of 'Sex Orgasm' and 'Masturbation Orgasm' for sleep quality and latency

Paired Samples Test

What gender do you identify with?			t	df	Significance One-Sided p	Significance Two-Sided p
Male	Pair 1	SexOrgasmLatency - MastrubationOrgasmLatency	1,913	61	,030*	,060
	Pair 2	SexOrgasmQuality - MastrubationOrgasmQuality	2,312	62	,012*	,024*
Female	Pair 1	SexOrgasmLatency - MastrubationOrgasmLatency	-,961	176	,169	,338
	Pair 2	SexOrgasmQuality - MastrubationOrgasmQuality	1,350	179	,089	,179

*Significant at α =0.05.

Table 5

Independent Samples Test for Pre-test

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Mean Difference
SexOrgasmLatency	,093	,761	,677	249	,091
			,629	94,871	,091

SexNoorgasmLatency	4,149	,043*	-2,805	255	-,429
			-2,680	68,831	-,429
MastrubationOrgasmLatency	5,848	,016*	-1,920	289	-,241
			-1,796	100,883	-,241
MastrubationNoOrgasmLaten	2,660	,104	-2,488	221	-,344
cy			-2,505	55,670	-,344
SexOrgasmQuality	1,105	,294	,392	256	,043
			,361	98,670	,043
SexNoorgasmQuality	,974	,325	-1,256	255	-,1463
			-1,206	75,136	-,1463
MastrubationOrgasmQuality	,151	,698	-,963	289	-,098
			-,941	107,104	-,098
MastrubationNoOrgasmQualit	12,872	<,001*	-1,456	239	-,148
y			-1,101	49,663	-,148

note: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect.

*Significant at α =0.05.

Table 6

Frequencies of gender

What gender do you identify with?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	806	22,4	22,6	22,6
	Female	2763	76,9	77,4	100,0
	Total	3569	99,4	100,0	

Table 8

Regression model of Sleep quality with interaction of gender

Tests of Between-Subjects Effects

Dependent Variable: Sleepquality

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	164,485[a]	13	12,653	15,547	<,001
Intercept	159,502	1	159,502	195,985	<,001
Intimacy * Genderclean	13,219	2	6,609	8,121	<,001
Masturbation * Genderclean	4,086	4	1,021	1,255	,285
SexualActivity * Genderclean	15,524	4	3,881	4,769	<,001
ISI_TOTAL*	105,251	1	105,251	129,325	<,001
Alcohol consumption	16,662	1	16,662	20,473	<,001
Error	2616,530	3215	,814		
Total	3616,000	3229			
Corrected Total	2781,016	3228			

a. R Squared = ,059 (Adjusted R Squared = ,055)

*Significant at α =0.05.

Table 9

Sleepquality & Latency means in Masturbation variable

Masturbation		Sleepquality	Latency
Did not engage or missing	Mean	,51	22,8275
	N	2635	2650
	Std. Deviation	,941	25,61362
Engage but no orgasm (Masturbation no orgasm = 1)	Mean	,27	28,1455
	N	55	55
	Std. Deviation	,781	32,20962
Engaged and orgasm (Masturbation orgasm = 1)	Mean	,51	26,0664
	N	557	557
	Std. Deviation	,881	30,47007
Total	Mean	,51	23,4703
	N	3247	3262
	Std. Deviation	,929	26,65080

Note: for sleep quality: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect.

Table 10

Latency & sleep quality difference means for gender in different (non) sexual behavior

Report

Mean

What gender do you identify with?	SexualActivity	Latency	Sleepquality
Male	Did not engage or missing	23,2686	,49
	Engage but no orgasm (sex no orgasm = 1)	25,7143	,57
	Engaged and orgasm (sex orgasm = 1)	17,2500	,76
	Total	22,4932	,52
Female	Did not engage or missing	23,9488	,49
	Engage but no orgasm (sex no orgasm = 1)	24,4295	,37
	Engaged and orgasm (sex orgasm = 1)	21,3121	,75
	Total	23,7957	,50

	Masturbation	Latency	Sleepquality
Male	Did not engage or missing	22,2945	,53
	Engage but no orgasm (Masturbation no orgasm = 1)	33,3500	,15

	Engaged and orgasm (Masturbation orgasm = 1)	21,8942	,54
	Total	22,4932	,52
Female	Did not engage or missing	22,9839	,51
	Engage but no orgasm (Masturbation no orgasm = 1)	25,1714	,34
	Engaged and orgasm (Masturbation orgasm = 1)	28,3736	,51
	Total	23,7957	,50

	Intimacy	Latency	Sleepquality
Male	No engagement in Intimacy	23,2650	,42
	Intimacy	20,6372	,76
	Total	22,4932	,52
Female	No engagement in Intimacy	23,9693	,49
	Intimacy	23,2318	,55
	Total	23,7957	,50

Note: for sleep quality: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect.

Table 11

Sleepquality & Latency means in Sexual activity variable

SexualActivity		Sleepquality	Latency
Did not engage or missing	Mean	,49	23,7820
	N	2806	2821
	Std. Deviation	,923	26,74796
Engage but no orgasm (sex no orgasm = 1)	Mean	,39	24,4364
	N	165	165
	Std. Deviation	1,034	31,82810
Engaged and orgasm (sex orgasm = 1)	Mean	,76	19,7065
	N	276	276
	Std. Deviation	,887	21,58461
Total	Mean	,51	23,4703
	N	3247	3262
	Std. Deviation	,929	26,65080

Note: for sleep quality: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect.

Table 12

Sleepquality & Latency means for the variable of Intimacy

Intimacy		Sleepquality	Latency
No engagement in Intimacy	Mean	,47	23,7497
	N	2438	2453

	Std. Deviation	,936	27,19437
Intimacy	Mean	,61	22,6230
	N	809	809
	Std. Deviation	,899	24,92727
Total	Mean	,51	23,4703
	N	3247	3262
	Std. Deviation	,929	26,65080

Note: for sleep quality: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect.

Table 13.

Gender differences intimacy

ANOVA Table

What gender do you identify with?			Sum of Squares	df	Mean Square	F	Sig.
Male	Latency * Intimacy	Between Groups (Combined)	1048,567	1	1048,567	1,637	,201
		Within Groups	467646,399	730	640,612		
		Total	468694,966	731			
	Sleepquality * Intimacy	Between Groups (Combined)	17,292	1	17,292	19,130	<,001*
		Within Groups	656,263	726	,904		

		Total	673,555	727			
Female	Latency * Intimacy	Between Groups (Combined)	245,765	1	245,765	,335	,563
		Within Groups	1839648,429	2509	733,220		
		Total	1839894,194	2510			
	Sleepquality * Intimacy	Between Groups (Combined)	1,769	1	1,769	2,099	,147
		Within Groups	2105,445	2499	,843		
		Total	2107,214	2500			

*Significant at α =0.05.

Table 14

Intimacy satisfaction means in different levels of sleepquality

Report

How satisfying was the intimacy activity for you yesterday?

Sleepquality	Mean	N	Std. Deviation
Very poor	5,00	13	,816
Poor	5,07	73	,871
Fair	5,16	252	,735
Good	5,25	353	,753
Very good	5,58	118	,512
Total	5,25	809	,744

Table 15

Means for sleep Latency with or without Intimacy in the last 24 hours

Masturbation	Intimacy = 1 (FILTER)	Mean	N	Std. Deviation
Did not engage or missing	Not Selected	23,1510	1994	26,35206
	Selected	21,8445	656	23,21661
	Total	22,8275	2650	25,61362
Engage but no orgasm (Masturbation no orgasm = 1)	Not Selected	23,5349	43	24,45730
	Selected	44,6667	12	49,27720
	Total	28,1455	55	32,20962
Engaged and orgasm	Not Selected	26,6418	416	31,04663

(Masturbation orgasm = 1)	Selected	24,3688	141	28,74082
	Total	26,0664	557	30,47007
Total	Not Selected	23,7497	2453	27,19437
	Selected	22,6230	809	24,92727
	Total	23,4703	3262	26,65080

Table 16

Means for intimacy within two hours of sleep (or not)

Did the intimacy task occur within two hours of going to sleep?		Sleep quality	Sleep latency
Yes	Mean	,71	24,5714
	N	35	35
	Std. Deviation	,750	29,13688
No	Mean	,34	23,3200
	N	50	50
	Std. Deviation	,917	23,55059
Total	Mean	,49	23,8353
	N	85	85
	Std. Deviation	,868	25,83687

Table 17

ANOVA on sleep quality/latency and intimacy within two hours (or not)

			Sum of Squares	df	Mean Square	F	Sig.
Sleep qualtiy * Intimacy within two hours	Between Groups	(Combined)	2,884	1	2,884	3,966	,050*
	Within Groups		60,363	83	,727		
	Total		63,247	84			
Sleep Latency * Intimacy within two hours	Between Groups	(Combined)	32,243	1	32,243	,048	,828
	Within Groups		56041,451	83	675,198		
	Total		56073,694	84			

*Significant at α =0.05.

Table 18

Levels of Intimacy satisfaction and the mean of Intimacy duration

How satisfying was the intimacy activity for you yesterday?	Mean	N	Std. Deviation
Very dissatisfying	23,2333	3	6,73003
Dissatisfying	20,8500	8	19,53122
Neither satisfying nor dissatisfying	22,1057	70	18,24810
Satisfying	27,0268	421	22,31528
Very satisfying	43,7808	307	32,32467
Total	32,8837	809	27,59067

Table 19

ANOVA Table Intimacy satisfaction and Intimacy duration

			Sum of Squares	df	Mean Square	F	Sig.
Intimacy duration * Intimacy statisfaction	Between Groups	(Combined)	60466,037	4	15116,509	21,914	<,001*
	Within Groups		554619,988	804	689,826		
	Total		615086,025	808			

*Significant at α =0.05.

Table 20

Means for engaging and not engaging in intimacy

Intimacy		SexualActivity	N	Mean	Std. Deviation
No engagement in Intimacy	Latency	Engage but no orgasm	96	26,6771*	38,33522
		Engaged and orgasm	158	19,9557*	21,49310
	Sleepquality	Engage but no orgasm	96	,22*	1,126
		Engaged and orgasm	158	,70*	,842
Intimacy	Latency	Engage but no orgasm	69	21,3188	19,31663
		Engaged and orgasm	118	19,3729	21,79383
	Sleepquality	Engage but no orgasm	69	,64	,840
		Engaged and orgasm	118	,85	,939

*Significant at α =0.05.

Table 21

Independent Samples Test for not engaging in intimacy, and engaging in intimacy

				t-test for Equality of Means
Intimacy		F	Sig.	df
No engagement in Intimacy	Latency	6,755	,010*	252
	Sleepquality	10,965	,001*	252
Intimacy	Latency	,000	,989	185
	Sleepquality	,049	,824	185

*Significant at α =0.05.

Table 22

ISI score coded means

ISIcoded		Latency	Sleepquality
No Insomnia (ISI<7)	Mean	14,4756	,84
	N	82	82
	Std. Deviation	15,85912	,838
Subclinical	Mean	20,4930	,63
insomnia (ISI=8-14)	N	1564	1557
	Std. Deviation	24,78936	,883
Clinical insomnia	Mean	26,7062	,40
(ISI=15-22	N	1426	1420
	Std. Deviation	28,50290	,952
Total	Mean	23,2165	,53
	N	3072	3059
	Std. Deviation	26,60528	,924

Note: for sleep quality: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect.

Table 23

ISI-score frequenties

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ISI < 7	6	1,8	1,8	1,8
	ISI 8-14	150	45,7	45,7	47,6
	ISI 15-21	141	43,0	43,0	90,5
	ISI > 22	31	9,5	9,5	100,0
	Total	328	100,0	100,0	

Table 24

Means for latency and sleep quality for different levels of alcohol consumption

How many drinks containing alcohol did you have in the last 24h?		Latency	Sleepquality
Zero	Mean	24,7313	,54
	N	2564	2564
	Std. Deviation	27,62805	,912
1 - 3	Mean	21,0235	,50
	N	426	426
	Std. Deviation	21,56641	,968
4 - 7	Mean	18,1657	,27
	N	169	169
	Std. Deviation	25,04441	1,009
8 or more	Mean	8,0000	,19
	N	88	88
	Std. Deviation	11,12107	,945
Total	Mean	23,4496	,51
	N	3247	3247
	Std. Deviation	26,63397	,929

Note: for sleep quality: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect

Table 26

Gender differences in engagement of intimacy and sexual activity

What gender do you identify with?	SexualActivity	Intimacy		Latency	Sleepquality
Male	Did not engage or missing	No engagement in Intimacy	Mean	24,1308	,40
			N	451	447
		Intimacy	Mean	20,9401	,71
			N	167	167
	Engage but no orgasm (sex no orgasm = 1)	No engagement in Intimacy	Mean	29,0000	,50
			N	8	8
		Intimacy	Mean	21,3333	,67
			N	6	6
	Engaged and orgasm (sex orgasm = 1)	No engagement in Intimacy	Mean	15,7414	,60
			N	58	58
		Intimacy	Mean	19,3333	,98
			N	42	42
Female	Did not engage or missing	No engagement in Intimacy	Mean	23,9003	,49
			N	1736	1726

	Intimacy	Mean	24,1347	,50
		N	453	453
Engage but no orgasm (sex no orgasm = 1)	No engagement in Intimacy	Mean	26,6322	,18
		N	87	87
	Intimacy	Mean	21,3387	,63
		N	62	62
Engaged and orgasm (sex orgasm = 1)	No engagement in Intimacy	Mean	22,8144	,72
		N	97	97
	Intimacy	Mean	19,3947	,78
		N	76	76

Note: for sleep quality: 2 = strong negative effect, 0 = no effect, 2 = strong positive effect.

Appendix B

Table 1

Descriptive Statistics age

	N	Minimum	Maximum	Mean	Std. Deviation
Please indicate your age.	328	18,0	61,0	22,018	5,8257
Valid N (listwise)	328				

Table 2

One-Sample Kolmogorov-Smirnov Test

			Sleepquality	Latency
N			3247	3262
Normal Parameters[a,b]	Mean		,51	23,4703
	Std. Deviation		,929	26,65080
Most Extreme Differences	Absolute		,247	,207
	Positive		,175	,207
	Negative		-,247	-,189
Test Statistic			,247	,207
Asymp. Sig. (2-tailed)[c]			,000	,000
Monte Carlo Sig. (2-tailed)[d]	Sig.		,000	,000
	99% Confidence Interval	Lower Bound	,000	,000

		Upper Bound	,000	,000

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 926214481.

Table 3

Tests for linearity

			Sum of Squares	df	Mean Square	F	Sig.
Sleepquality * SexualActivity	Between Groups	(Combined)	20,775	2	10,387	12,126	<,001
		Linearity	13,202	1	13,202	15,412	<,001
		Deviation from Linearity	7,573	1	7,573	8,841	,003
	Within Groups		2778,791	3244	,857		
	Total		2799,565	3246			
Latency * SexualActivity	Between Groups	(Combined)	4337,880	2	2168,940	3,058	,047
		Linearity	3310,607	1	3310,607	4,667	,031
		Deviation from Linearity	1027,273	1	1027,273	1,448	,229
Sleepquality * Masturbation	Between Groups	(Combined)	3,087	2	1,544	1,791	,167
		Linearity	,021	1	,021	,025	,875
		Deviation from Linearity	3,066	1	3,066	3,556	,059

Latency * Masturbation	Between Groups	(Combined)	6051,048	2	3025,524	4,268	,014
		Linearity	5320,545	1	5320,545	7,506	,006
		Deviation from Linearity	730,503	1	730,503	1,031	,310

Sleepquality * Intimacy	Between Groups	(Combined)	10,378	1	10,378	12,073	<,001
	Within Groups		2789,188	3245	,860		
	Total		2799,565	3246			
Latency * Intimacy	Between Groups	(Combined)	772,291	1	772,291	1,087	,297

a. With fewer than three groups, linearity measures for Sleepquality * Intimacy cannot be computed.

b. With fewer than three groups, linearity measures for Latency * Intimacy cannot be computed.

Table 4

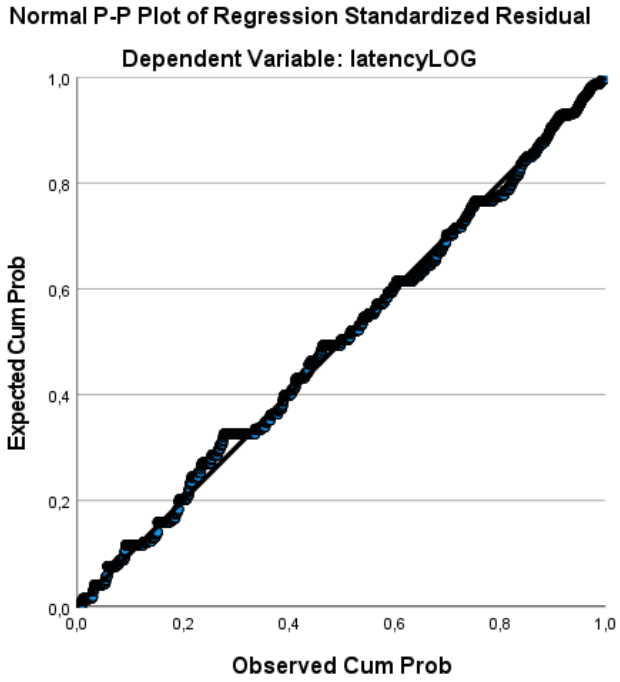
Tests for multicollinearity Sleep quality

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	1,074	,054		19,723	<,001		
	SexualActivity	,099	,028	,063	3,604	<,001*	,968	1,033
	Masturbation	-,002	,021	-,001	-,081	,936	,987	1,013
	Intimacy	,117	,037	,054	3,144	,002*	,976	1,025
	ISI_TOTAL	-,040	,003	-,199	-11,613	<,001*	,999	1,001
	How many drinks containing alcohol did you have in the last 24h?	-,105	,023	-,078	-4,563	<,001*	,990	1,010

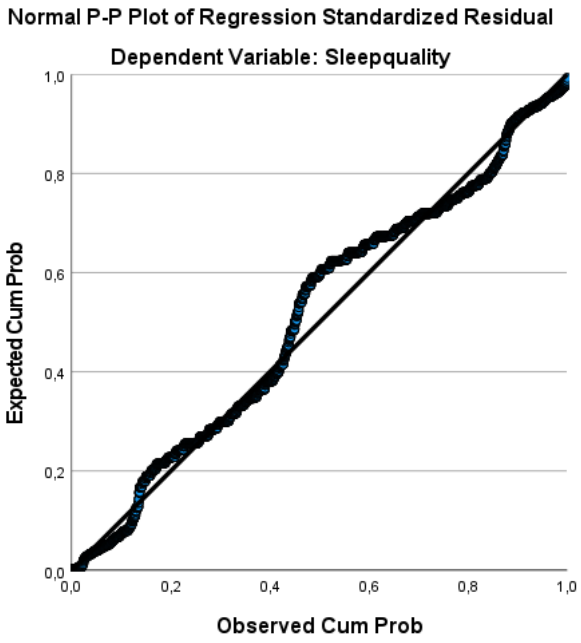
a. Dependent Variable: Sleep quality

Appendix C

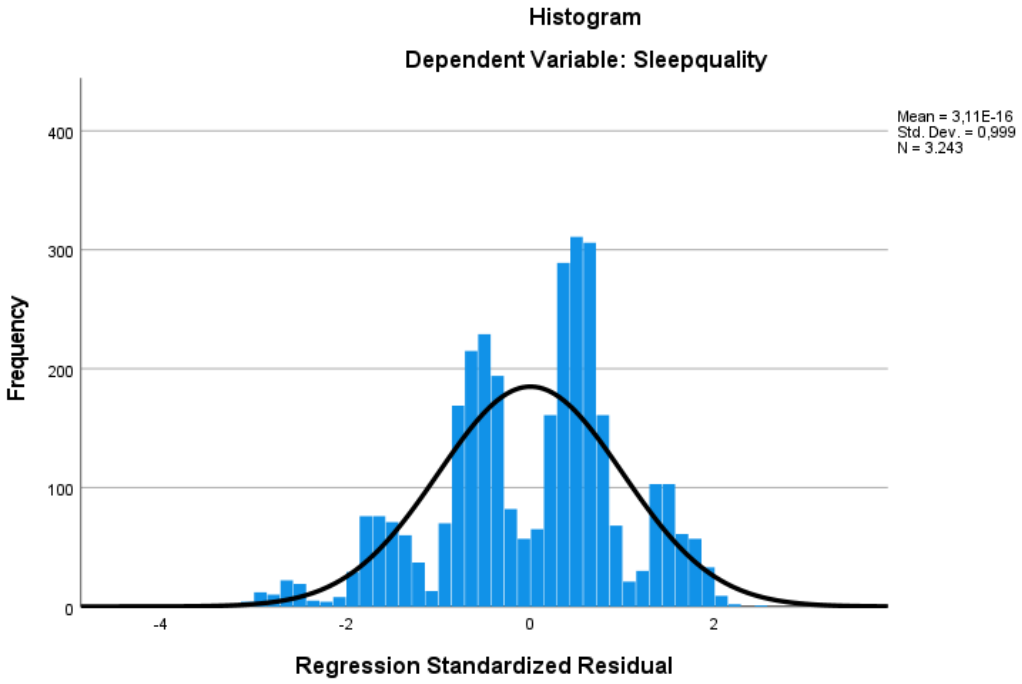
Graph 1.



Graph 2.



Graph 3.


Histogram
Dependent Variable: Sleepquality
Mean = 3,11E-16
Std. Dev. = 0,999
N = 3.243
Frequency
400
300
200
100
0
-4
-2
0
2
Regression Standardized Residual