

The Association Between Sexual Activity and Sexual Dreams in Norwegian Adults



Bachelor Thesis

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Abstract

Relationships between waking life and dream content have been a subject of interest since the very beginning of human history. However, few researchers have investigated into the relationship between waking life and sexual dreams. Dreaming provides meaningful insight in understanding psychological wellbeing and mood, and sexuality could be considered especially relevant in this connection. Sexual activity may help explain incorporations of sexual content in dreams, theorized through the continuity hypothesis of dreaming and the potential function of dreams as compensatory. The present study investigates sexual dream prevalence and frequency, as well as relationships with sexual activity before sleep, sexual dreams, gender, and relationship status. A four week long diary study consisting of 87 adults was used, implementing correlational measures of variables. Results gave no significant findings in support of a connection between sexual activity and sexual dreams, neither did gender or relationship status. A marginal difference in sexual dream frequency between men and women was found. The findings do not provide support for a compensatory theory of dreaming; however, they succeed in broadening the spectrum of interest on the field. Further research should include measures of sexual fantasizing and emotional intensity, preferably through longitudinal diary studies. Achieving a deeper understanding of factors associated with sexual dream prevalence and frequency may contribute to increased knowledge about the potential functions of dreaming. This might consequently facilitate for better treatment possibilities related to psychopathology.

Research on sexual dreams remains sparse, particularly regarding the predictive effect daily activities might have on dreaming. As dreams have been found to reflect both social, personal, and ethical concerns (Chen et al., 2015; Wang et al., 2022), the importance of adding weight to the field cannot be understated. More precisely, new findings regarding the relationship between sexual activity before sleep and sexual dreams may contribute to the development of current knowledge on continuity between waking life and dream content. Illustratively, an increase was found in dream recall frequency during the pandemic as a consequence of a different baseline of emotional intensity on average (Fränkl et al., 2021). Moreover, as dreams have been shown to affect the mood of the proceeding day (Schredl, 2009), potential findings are of possible value to be extracted into subsequent health research fields. This study aims to further develop the already expanding field of dream research, and aid in the general understanding of continuity between waking life and dreaming, and a potential compensatory theory of dreaming. This again, might subsequently lead to a greater comprehension of the potential benefits and implications of sexual dreaming.

Defining dreams

It is useful to properly define the term “dreaming” or “dream”. Even though there is no consensus on a clear definition, the term may be defined as the remembering of personal experiences which occurred during sleep (Schredl, 2018, p. 1). This definition explains dreams as a subjective experience occurring during sleep, not including potential sleep-walking or other parasomnia-related behaviors. For this thesis it is useful to look beyond the disagreements regarding elements of uncertainty connected to defining the term. Thus, the definition provided will be the point of departure linked to the thesis question. Dreams may contain an infinite variety of themes and imagery, hereby sexuality which one of the more common themes (Nielsen et al., 2003). Sexual dreams are characterized by sexual (erotic or pornographic) content, theme, or imagery (Chen et al., 2015). In the current study there is a distinction between ordinary dreams and sexual dreams, and the participant needs to recall whether the dream fits into the category of a sexual dream.

Bedtime activity

Bedtime activity refers to the activity the participant did prior to falling asleep, or rather, before attempting to fall asleep. The item included in the questionnaire lists several options (exercise/stretching, sexual stimulation, use of phone/TV, reading, thinking, and an option for “other”). It is necessary to draw a distinction between a potential evening routine not tightly connected to the before sleep process, and the bedtime activities. The term is to be understood as having to be in temporal proximity to the time of falling asleep, and a spatial proximity as in being situated in bed or close to it.

Sexual dream prevalence and frequency

As one of the themes most typically dreamt about (Mathes & Schredl, 2014; Nielsen et al., 2003; Schredl et al., 2004), human sexuality clearly manifests itself to some extent in the dreaming world. The frequency and prevalence of sexual dreams have been investigated with different measures. In a Canadian study of university undergraduate students, 36 % reported experiencing one sexual dream per week, while 17 % reported having 2-5 sexual dreams per week (King et al., 2009; Nielsen et al., 2003). Chen et al., (2014) found that 16.41 % of their sample had one or more sexual dreams over the course of a month. Forty-seven percent of a sample consisting of almost 3000 participants reported motifs characterized as erotic in more than 10 percent of their dreams (Schredl et al., 2019).

In everyday dream reporting, sexual dream frequency has been found to be somewhere between 4 % and 12 % in men’s reported dreams, and between 4 % and 8 % in women’s reported dreams (Mathes & Schredl, 2014). A 14 days long diary study sampling from college students found that 6.02 % of total dreams were erotic (Geißler & Schredl, 2020). The study of Mathes and Schredl (2014) also used a diary report design, which could be argued to be a satisfactory design to study the topic as sensitive questions such as those regarding sexual dream content and frequency have been shown to be underreported in lab and interview studies (Domhoff & Kamiya, 1964; Kramer et al., 2006; Weisz & Foulkes, 1970). Domhoff and Kamiya (1964) found in an analysis of 120 laboratory dreams and 120 home dreams a difference in sexual dream frequency: in home dream reports 9 % of the dreams included erotic themes, whereas only 2 % of the laboratory dreams contained erotic themes. Thus, research indicates an environmental effect on the frequency of sexual dreams. Likewise, daily thoughts and occupations will similarly affect the frequency and content of dreams.

The continuity hypothesis of dreaming

In the field of dream research, the continuity hypothesis has played a key role in the general understanding, and potential interpretation, of dreams. As it was originally formulated it states that there is a continuity between dreams and waking life (Hall & Nordby, 1972, retrieved from Schredl, 2018, p. 71). Surely the idea that dreams and waking life are connected has been brought up long before the 1970s, as a topic of interest for both spirituality and religion. The original statement of the hypothesis is notably broad and unrestrictive in the claim of continuity between waking life and dreaming, thus subsequent research has actively attempted to nuance the imprecise nature of the phrasing.

Previous research about dreaming content has some indications for the further accuracy of the continuity hypothesis. A qualitative dream report study (Hartmann, 2000) investigated the relative prominence of everyday activities in waking life and dreaming, and found that activities such as walking, talking with friends, and sexual activity were far more prominent than activities like reading, writing and typing. The latter group of activities that involve a convergent mode of thinking occurs rarely in dreams, proposed by several to be due to the brain's state during REM sleep characterized by cholinergic activation (Hobson et al., 1998). As sexual content has been found to be a typical topic of dreams, scholars have investigated the specific connection between sexuality and dreaming.

The continuity hypothesis applied on the present topic has received partial support from King et al., (2009), and direct link indications from Erlacher & Schredl (2004). The former of the two studies found that sexual daydreaming and enjoyment of sexual fantasies during wakefulness were positively connected with incidences characterized as sexual in men's recent dreams. On the contrary, research investigating the continuity between daytime activities and dreaming activity found a negative relationship between sexual activity and sexual dream content, however non-significant and weak (Schredl, 2000). Scholars have attempted to determine whether sexual activity could aid in explaining the frequency of sexual dreams, but have struggled to find support for a connection (Schredl & Göritz, 2020). Furthermore, it is possible that the link with determining factors of sexual dream frequency might be affected by sexual thoughts and desires.

Sexual dreams seem to implicitly reflect people's sexual attitudes, sex-related issues, or sexual behaviors. In addition, sexual dreams may serve to fulfill an individual's sexual desires or unsatisfied sexual needs (Shao et al., 2020). The distinction between desires and needs is essential, as the sexual activity needed to fulfill an individual's sexual needs will vary

respectively. The diverse levels of fantasies and sexual thoughts might naturally play a role as well as the actual sexual behavior. This distinction between sexual behavior in terms of explicit sexual acts, and in terms of sexual fantasies and thoughts is important in understanding the nature of the continuity hypothesis.

Overt and covert behavior alike are relevant in explaining the continuity between waking life and dreaming. The observable overt behavior refers to actions and behavior easily measurable, whereas covert behavior refers to thoughts and feelings (Hall & Nordby, 1972, retrieved from Schredl, 2018, p. 72). In the present study there is no use of covert measures to identify continuity, however Schredl et al. (2009) reports findings indicating that the frequency of sexual dreams is related to covert sexual behavior, but not overt behavior such as intercourse or masturbation. Nevertheless, the hypothesis of continuity presents a satisfactory understanding of the content incorporation of dreams, which should be understood further by a theory of compensation.

Previous research indicates that dreams may appear to fulfill sexual desires not yet satisfied during the waking hours of the day (Yu, 2013). As proposed by Freud and Jung, this finding emphasizes the potentially compensatory nature and function of both sexual fantasizing and dreaming in general. Jung proposed we may dream of topics that we are yet to appropriately address during the waking hours, but which are of importance for our psychological balance (Jung, 1979, retrieved from Schredl, 2018, p. 72). The theory of dreams as compensatory accompanies the continuity hypothesis by suggesting the needs or desires not fulfilled in the waking hours of the day might manifest themselves in the content of the dreams. The partaking in sexual activity may on the other hand indicate a fulfillment of those needs or desires, thus potentially reducing the need for compensation through dreams. The complementary existence of the continuity hypothesis and the theory of dreams as compensatory has been studied by Mathes and Pietrowsky (2022). The relationship between these two theories could be argued to revolve around emotions of the waking day, especially in predicting the incorporation of dream content.

Whether or not an experience has a continuation in dreams is suggested to be partly explained by the emotional intensity of the experience (Schredl, 2006, 2018, p. 80-81). Numerous studies have researched the significance of the emotional valence and intensity of the waking experience for subsequent incorporation into dreams (DeDonato et al., 1996; Malinowski & Horton, 2014; Mellman et al., 2001), and found intensity to be a potentially deciding factor in predicting incorporation of events during the day into dreams. In other words,

the continuation of waking thoughts and occupations is assumed to be mediated by how emotionally intensive it is perceived by the individual (Malinowski & Horton, 2014). This is in line with knowledge on consequences of emotional trauma (Mellman et al., 2001). As emotions seem to play a part in preferential incorporation of dream content, attempts have been made to expose individuals to emotionally arousing content pre-sleep in an effort to directly influence the content of their dreams.

Several studies have looked for signs of direct incorporation of pre-sleep thoughts and behavior into dreaming activity (Foulkes & Rechtschaffen, 1964; Lauer et al., 1987), without any solid support for the direct continuity of content incorporation. These studies implemented the use of films or thoughts not relevant to the person's life occupations or concerns but to induce certain emotions, whereas Wegner et al., (2004) used a technique enabling connections to the participant's own life experiences and relations. However direct incorporation attempts are rarely successful and the same goes for dream incubation (Schredl, 2018, p. 79). Dream incubation refers to the method of thinking of a topic which one would like to dream of just before sleep on-set in an attempt to experience a direct continuation into dream content. The direct incorporation of episodic memories does not seem to be frequent, which could reflect the function of sleep on memory consolidation (Fosse et al., 2003). Moreover, dream recall is in general found to be from the later parts of the night, often just prior to awakening. Further methodological issues arise from this, as dreams from the first cycles of REM-sleep were found to include more references to the previous day's waking events than the later phases of REM-sleep (Schredl & Reinhard, 2010). Interestingly, sociodemographic factors such as gender have been found to play a role in explaining the frequency and content of incorporations, hypothesized to be explained by the continuity hypothesis.

Gender

Empirical findings have quite consistently shown men reporting more sexual dreams than women (Chen et al., 2015; Schredl et al., 2009, 2019; Wang et al., 2022). Generally, through a meta-analysis, women have been proven to recall their dreams more often than men (Schredl & Reinhard, 2008). Specifically, Geißler and Schredl (2020) found men reporting erotic dreams made up 6.74 % of their total dreams, whereas women reported 5.96 %, hereby differing in number of total dreams reported on average as in line with Schredl and Reinhard's meta-analysis (2008). Even though some scholars have found no differences in sexual dream frequency between genders (Hmidan & Weaver, 2019), there is a general direction in literature

agreeing on a discrepancy. This gender difference is hypothesized to be due to differences in time spent on sexual activities and fantasizing during the day, thus in line with the continuity hypothesis (Schredl et al., 2019). The effect increased with age and may indicate a cohort effect. Sexual imagery has been found to differ between genders, as men tended to dream of more explicit and aggressive imagery whereas women tended to be less aggressive and rather more romantic (Rainville & Rush, 2009). The sexual dreams of men have been shown to be characterized by more positive emotions, while women on the other hand experienced emotions which were more passive, illustratively through content characterized by rape imagery (King et al., 2009). Besides gender, there has been other factors considered to affect the frequency of sexual dreams.

Relationship status

Sexual dream frequency has not yet been found to differ between those who are single and those who are in a relationship (Schredl, 2001; Schredl et al., 2009, 2019; Schredl & Göritz, 2020). Interestingly, this is hypothesized to be due to the potential independence of effect between sexual activity and frequency of sexual dreams, as sexual fantasies seem more apt in explaining the frequency of sexual dreams (Schredl et al., 2019). Regardless, it would be plausible to expect a relationship between the potential difference in sexual activity between singles and non-singles, and the frequency of sexual dreams. The plausibility stems from the theory of compensation. A couple is likely to engage in more sexual activity than single individuals, and one might imagine they to a bigger extent than single individuals fulfill their sexual needs (Park & MacDonald, 2022). Moreover, if not based on the frequency of sexual activity, this is potentially rather a result of the quality of the sexual behavior, mediated through sexual satisfaction. This might subsequently mean, through the theory of dreams as compensatory, that they report less sexual dreams.

The present study

As the current literature is sparse, and findings supporting a direct link between overt sexual behavior and sexual dreams in essence non-existent (Schredl et al., 2009), there is need for further research to elaborate on previous attempts. The continuity hypothesis and the theory of dreams as compensatory could to an extent be viewed as complementary. Even though one could derive from the continuity hypothesis that the sexual behavior before sleep could to some

extent be incorporated into the dream content, compensatory sexual dreams would mean that a potential desire or need is satisfied. Moreover, an individual rarely engaging in sexual activity might not be able to fulfill his or her sexual needs or desires. Generally, this is thought to lead to more sexual thoughts during the waking day, thus leading to a potential covert continuity through more sexual dreams. As there are findings supporting the continuity hypothesis and the compensatory hypothesis of dreaming simultaneously (Mathes & Pietrowsky, 2022), the current study aims to further the understanding of their coexistence.

With regards to studying the continuity between waking life and dreams, the field is currently lacking research implementing measurements of relationships between sexual activity before sleep onset and the frequency of sexual dreaming. Based on literature presented above, the following research questions and hypotheses are proposed:

What is the frequency and prevalence of sexual dreams, and its relationship with before sleep sexual activity, relationship status, and gender?

Hypothesis 1: Higher reporting of sexual activity before sleep is connected to a lower frequency of sexual dreams.

Hypothesis 2: Men report a significant higher frequency of sexual dreams compared to women.

Hypothesis 3: Participants in relationships report a significant lower frequency of sexual dreams compared to those not in a relationship.

The prevalence and frequency of sexual dreams will be explored, although no concrete hypothesis is stated.

Methods

Sample

The complete sample consisted of 87 Norwegian adults, thereby 40 (46 %) men, and 47 (54 %) women.). None of the participants reported identifying as “other” regarding their gender. The mean age of the participants was 29.27 (SD = 12.75). The median age was 24 (range 20-78) Of the 87 participants who filled out the initial survey on the first day, 17 failed to continue reporting through the survey. This illustrates a follow-up response rate of 81 %.

Design and procedure

This bachelor thesis is based on self-report data from the project “dreaming activities over a four-week period”. The study utilized a correlational longitudinal research design. Recruitment of participants through convenience sampling method was an ongoing process throughout January and February 2022 up until the initiation of data collection. With regards to the purpose of the project, potential participants were encouraged to contribute to the possibility of increasing the understanding of factors influencing the dreaming experience. The participants had to be above the age of 18 and did not receive any form of compensation for partaking in the study. The four week long diary study commenced in the middle of March and terminated one week into April. After eliciting interest to take part in the study, the participants received an email prior to the initiation of data collection. In the email there were instructions on how they were to fill out the questionnaires; each morning after awakening, preferably immediately, the participants were to answer the survey. However, there was no time frame set for when the participants had to fill out the survey for each day.

Ethics

For the data collection, an application to “Norsk senter for forskningsdata” (NSD) was filed and the notification form (nr. 637636) was approved, after some minor adjustments of question phrasing for better alignment with the general purpose of the project. The participants gave their digital consent to their data being stored temporarily until the end of the study, and their anonymity was secured through a recoding of usernames into number codes. Moreover, participants could whenever they liked, and without any reasoning, withdraw from the study.

Instruments

The current study implemented an electronic survey solution known as “Nettskjema” distributed through University of Oslo. Further, the survey comprised of three questionnaires : Dreaming record survey, *NEQ (Nightmare Experience Questionnaire)* developed by Chen et al., (2014) and *SDEQ (Sexual Dream Experience questionnaire)*(Chen et al., 2015). The former of the three was not structure validated and included general demographic questions on the first day of responding and was the only one of the three surveys which were used for analysis based on the research question.

The Dreaming record survey measured a variety of dream-recording related topics. The demographic questions included on the first entry of the survey were questions about gender, age, relationship status and general sexual satisfaction. Relationship status was operationalized by a yes or no question regarding whether the respondent was in a relationship at the time. The question about general sexual satisfaction was stated as follows: “In general, I feel sexually satisfied”, with the corresponding response alternatives on a Likert scale from one (“very accurate”) to five (“very inaccurate”). This question was reversed to clarify the logical interpretation of the response alternatives. The question regarding bedtime activities were phrased as follows: “Which activities did you engage in before falling asleep?”, with six possible response alternatives. These were: 1 = Exercise/stretching, 2 = sexual stimulation, 3 = TV/telephone, 4 = reading from a book, 5 = thinking, and 6 = other. The average number of reported sexual activity was extracted and transformed into a separate variable for further analyses. Likewise, for the remainder of variables included in the longitudinal data set, the sum of each variable for the participants was made transformed into averages. This was done to facilitate for suitable approaches for analyses.

Subsequent questions in the survey measured aspects such as before-sleep mood, alcohol and food intake and weather of the previous day. A question regarding which type of dream the participant had was posed, and if the participant had a nightmare or a sexual dream the corresponding survey (NEQ and SDEQ) would become visible. Due to this, the response time per entry varied from 2-10 minutes, depending on whether the participant dreamt or not, and what type of dream it was. The dreaming record survey included an open question inviting for a brief description of the content of their dream by using key words.

Students on the project participated in the design of the survey, through contribution of questions added to the Dream recording survey depending on the topic of interest. As it was constructed solely for the purpose of this project, the survey has not been used in previous studies before.

Statistical analyses

All the subsequent analyses were performed using software IBM SPSS version 27. The variable gender was transformed into a dichotomous variable to be suitable for relevant analyses.

Preliminary descriptive statistics about relevant variables were extracted, making it possible to investigate the prevalence of sexual dreams in the sample. A Pearson’s correlation

analysis was conducted to investigate the relationship between sexual activity before sleep and sexual dream prevalence. The correlation analysis also included age, gender, relationship status and subjective sexual satisfaction. All prerequisites were met as the variables were either continuous (sexual activity, sexual satisfaction, age) or dichotomous (gender, relationship satisfaction).

A hierarchical linear regression analysis was used for a further investigation of the relationship between sexual dreams and the variables included in the correlation analysis. Not all the different prerequisites for the regression analysis were met. Those that were met were the assumption of continuous or dichotomous variables, as the dependent variable was continuous, and the independent variables were either continuous or dichotomous. In addition, no multicollinearity was found, as the independent variables did not correlate. Both VIF and tolerance values were sufficiently low and high. However, regarding the independence of errors, scatterplots indicated a pattern of dependent errors, thus violating the assumption. Furthermore, standardized residuals seemed not to be normally distributed, according to histogram inspection. Lastly, the assumption of homoscedasticity was not met, as the scatterplot of residuals illustrated a stable pattern. Consequently, the assumption of linearity of the model was not met either. It should be noted that efforts to alter the variables to meet prerequisites could have been done through further transformation. The failure to meet numerous prerequisites for the regression analysis underlines the importance of interpreting the subsequent results with caution.

An independent t-test was conducted to investigate gender differences in sexual dream frequency. A subsequent independent t-test was used to compare sexual dream frequency between participants who reported being in a relationship and those who reported being single.

Results

Table 1 displays the mean scores, standard deviations and correlations for the variables gender, relationship status, age, sexual dreams, sexual activity before bedtime, and sexual satisfaction. The average amount of sexual dreams reported in the sample of the study was half a dream, $M = .05$, $SD = .81$. Of the 70 valid cases, 24 (34 %) participants reported having had at least one sexual dream throughout the period (range 0-4). A total of 46 (66 %) participants reported not having had a single sexual dream. Of the total number of reported dreams, 6.27 % were sexual dreams.

With regards to sexual activity before sleep, the average frequency was 1.62, $SD = 2.46$, $n = 66$. The range spanned from 0-15. Subjective sexual satisfaction had a mean of 3.59, $SD = 1.16$, $n = 87$. In the sample, there were 39 (45 %) participants who reported not being in a relationship at the outset of the study, and 48 (55 %) who reported being in a relationship.

No significant correlation between sexual dreams and sexual activity before sleep was found, $r = .11$, $p = .402$. Likewise, sexual satisfaction had no significant correlation with sexual dreams, $r = .01$, $p = .949$. Sexual activity before sleep showed a correlation of $r = .19$, $p = .119$, with sexual satisfaction, however nonsignificant. Furthermore, there were no significant correlations between sexual dreams and the other variables.

Nevertheless, a significant correlation was found between relationship status and age, $r = .30$, $p = .006$. Subsequently, a strong correlation was found between relationship status and sexual satisfaction (Field, 2015), $r = .52$, $p < .001$.

Table 1

Descriptive statistics and correlations (N = 63-87)

	<i>M</i>	<i>SD</i>	Correlations				
			1	2	3	4	5
1. Gender	0.46 ^a	0.50					
2. Relationship status	0.56 ^b	0.50	-.10				
3. Age	29.27	12.75	.09	.30**			
4. Sexual dreams	0.50	0.81	.00	.02	-.21		
5. Sexual activity	1.62	2.46	.11	.08	-.15	.11	
6. Sexual satisfaction	3.59	1.16	-.05	.52***	.11	.01	.19

Note.

^a 0 = F, 1 = M

^b 0 = not in a relationship, 1 = in a relationship

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 2 shows the results from the hierarchical regression analysis conducted using two blocks. The first block consisted of gender and age as the control variables, and the second block included sexual activity, sexual satisfaction, and relationship status. Model 1, which included gender and age, did not significantly explain variance in sexual dreams, $R^2 = .05$, $F(2, 61) = 1.66$, $p = .198$. If significant, the result would have illustrated that 5,2 % of the variance in sexual dream frequency is accounted for by the two control variables gender and age. Gender was not a significant predictor in the model, $\beta = -.01$, $t(2, 61) = -0.05$, $p = .959$. Furthermore, age, however nonsignificant, was to a better extent able to account for some variance with $\beta = -.23$, $t(2, 61) = -1.82$, $p = .074$.

Model two included sexual activity as the central independent variable, as well as sexual satisfaction, and relationship status. The explained variance the new model had on the dependent variable merely increased by 1,2 %, $\Delta R^2 = .01$, $F(5, 58) = .80$, $p = .558$, and was not significant. Hereby sexual activity before sleep was not found as a significant predictor of sexual dream frequency, $\beta = .05$, $t(5, 58) = 0.36$, $p = .718$. Likewise for sexual satisfaction, $\beta = -.02$, $t(5, 58) = -0.12$, $p = .906$, and relationship status, $\beta = .11$, $t(5, 58) = 0.71$, $p = .480$. The variables of interest may from the data available seem like a poor indication of explanation for variance in frequency of sexual dreams.

Moreover, the relationship between gender and frequency of sexual dreams was investigated using a subsequent independent t-test. The results showed no significant difference in mean scores between men ($M = 0.50$, $SD = 0.75$) and women ($M = 0.50$, $SD = 0.88$), $t(68) = .00$, $p = 1.00$, with $\Delta M = .00$. Men reported having the same number of sexual dreams as women did. However, when comparing the sexual dream frequency with the total number of reported dreams per gender, men reported that 6.49 % of their dreams were sexual dreams, whereas women reported 6.07 %. Women reported on average more dreams in total, $M = 8.24$, $SD = 6.28$, than men did, $M = 7.70$, $SD = 6.64$. This finding was however non-significant, $t(65) = .34$, $p = .734$, with a corresponding effect size $d = 0.08$.

When it comes to the link between relationship status and frequency of sexual dreams, no significant correlation was found between the two variables, $r = .02$, $p = .881$. A further investigation using an independent t-test showed no significant difference in average sexual dreams between the two groups, $t(68) = -.15$, $p = .881$ with $\Delta M = -.03$. Similarly, the results did not show any significant difference in total sexual activity before sleep between the two groups, $t(64) = -.67$, $p = .505$.

Table 2*Hierarchical regression investigating relationships with sexual dreams (n = 64)*

Sexual dreams					
Variable	<i>b</i>	<i>SE b</i>	β	<i>R</i> ²	ΔR^2
Model 1				.05	
Gender	-0.01	0.21	-.01		
Age	-0.01	0.01	-.23		
Model 2				.06	.01
Gender	0.01	0.22	.00		
Age	-0.02	0.01	-.25		
Sexual activity	0.02	0.05	.05		
Sexual satisfaction	-0.01	0.11	-.02		
Relationship status	0.18	0.26	.11		

Discussion

The aim of the study was to investigate the prevalence and frequency of sexual dreams, and its subsequent relationship with before-sleep sexual activity, as well as gender and relationship status. The results showed no significant correlations between sexual dreams and the variables of interest. A moderate positive correlation was found between age and relationship status, indicating that the older participants were more likely to be in a relationship,

as one would expect. Additionally, results showed a strong positive correlation between relationship status and sexual satisfaction. From the regression analysis it was found that age and gender could not explain the variance in sexual dream frequency, merely accounting for 5.2 % of the variance, also non-significant. Sexual activity, sexual satisfaction and relationship status alike could not explain the variance of sexual dream frequency in the sample, illustrating only a 1.2 % increase in explained variance from the first model. None of the variables were significant predictors. The first independent t-test investigating differences in sexual dream frequency between males and females did not show a significant difference in mean score. As a percentage of total dreams, there was a minor difference. The second independent t-test showed no significant difference in sexual dream frequency between the singles and the non-singles.

Sexual dream prevalence and frequency

Prevalence and frequency of sexual dreams was investigated, and 34 % ($n = 24$) reported one or more sexual dreams over the period of four weeks, which is lower compared to findings in a Canadian university sample (King et al., 2009; Nielsen et al., 2003). On the other hand, it is substantially higher compared to a study of Chinese university students where only 16.41 % of the sample ($N = 390$) reported at least one sexual dream per month (Chen et al., 2014). However, comparing findings from research is somewhat problematic, because of implementations of different measurements and study designs. To illustrate this [point], the study conducted by Chen et al., (2014) measured prevalence using a retrospective questionnaire. The biggest difference between retrospective measures and diary study measurements is that retrospective measurements might underestimate dream recall frequency as dreams originally recalled might easier be forgotten. Diary studies on the other hand have been shown to overestimate dream recall frequency as the attention of the participant is to a bigger extent focused on dream recall throughout the study (Schredl, 2018, p. 15-16). In addition, it is likely that the recording process on its own improves the participant's ability to recall their dreams (Reed, 1973), especially for low dream recallers (Schredl, 2002).

Looking at the percentage of sexual dreams reported compared to total dreams, the findings of the current study illustrated a percentage 6.27 %. This is consistent with previous research findings indicating a percentage between 4-12 %, although the mentioned study offers a rough estimate (Mathes & Schredl, 2014). The findings of the current study are consistent

with findings from Geißler and Schredl (2020), who found a percentage of 6.02 % erotic dreams in university students total dreams. However, other findings illustrate a percentage of 9 % in home dream reports (Domhoff & Kamiya, 1964).

Several factors might be of importance when discussing prevalence and frequency of sexual dreams. As it is a noteworthy sensitive topic, it is highly likely to be affected by social desirability, thus leading to an underreporting in dream content studies (Tourangeau & Yan, 2007). Similarly, it might simply be uncomfortable or embarrassing to report on such a personal topic. Moreover, the fact that the sample consisted of friends and family of the students on the project might as well have affected the results. This because they may not feel comfortable reporting on sensitive topics such as sexuality when they know one or more of the students conducting the study, even though they were informed the study was anonymous. Consequently, further studies are suggested to avoid the use of family and acquaintances when investigating sensitive topics such as the ones in the present study.

Sexual activity before sleep and sexual dreams

The primary hypothesis predicted a negative relationship between sexual activity pre-sleep and sexual dream frequency. This was not supported by the results. A positive weak non-significant correlation was found; however, the direction was opposite of the working hypothesis. Likewise, the regression analysis did not provide support for the hypothesis. This is consistent with empirical studies as sexual activity has not been shown to influence the frequency of sexual dreams (King et al., 2009; Schredl, 2000; Schredl et al., 2009).

Further, the results do not provide any direct support of the function of sexual dreams as compensatory or the continuity hypothesis of dreaming, but neither undermine the importance of discussing the presence of such a link. Significant findings could have provided confidence to the continuity hypothesis, however when using only the overt sexual behavior it is difficult to make stable claims. This stems from findings indicating that sexual fantasies, thoughts, and desires are separate from sexual behavior. The results are in direct opposition to Schredl (2000) who found a (nonsignificant) negative correlation of $r. = -.11$, a finding which would be in line with the primary hypothesis of the current study. It should be noted that, similarly to the conducted study, Schredls (2000) sample consisted of only 60 participants, thus the results should be interpreted with necessary caution.

Moreover, it might be reasonable to assume that the overt sexual behavior not necessarily provides an accurate indication of the time spent with covert sexual behavior. One

could imagine that a lower frequency of sexual activity might lead to more covert sexual behavior, thus manifesting through sexual dreams. At the same time, research indicate a connection between amount of sexual activity and amount of sexual fantasizing, as a Pearsons correlation between the two variables was in a study of Canadian university students found to be weak to moderate, $r = .29, p < .001$ (King et al., 2009). Those who engage in frequent sexual activity might have a higher sex drive which could also be accompanied by more sexual thoughts or fantasies, such as found in Santtila et al., (2007). In addition, it might be that those

who recently engaged in sexual activity begin to fantasize or desire more, naturally depending on the personal valuing of the experience.

The subject of emotional intensiveness might aid in explaining the present results. Although sexual experiences in general are emotionally intensive relative to other casual day-to-day experiences, it might be that sexual activity before sleep could by some be considered repetitive or routinely. In other words, theorizing about the possibility of sexual activity before sleep as a less emotionally intensive experience would in the light of the present results be in line with previous findings struggling to establish sexual activity as a factor influencing the frequency of sexual dreams (Malinowski & Horton, 2014; Schredl, 2006). As a result, further research should include a measure of the emotional intensiveness of participants experiences, although this could potentially interfere with the subsequent dream content as it may prove difficult for researchers to distinguish between the impact of the experience and the recording of it (Schredl, 2006).

An important novelty of the current study should be highlighted when interpreting the results: the measurement of sexual activity directly before sleep. As previous research has only measured total sexual activity in general, the current study intended to look for a potential relationship between sexual activity directly before sleep and sexual dreams. However, due to the nature and limitations of the dataset, only correlational analyses were possible. Nevertheless, is it necessary to be aware of a certain methodological challenge related to dream collection. This challenge being the notion of dream recollection being found to normally consist of dreams from the second half of the sleep duration. Correspondingly, it is found that references of the previous day are more likely to be incorporated in the first REM periods rather than late night REM dreams (Schredl, 2006). This might then pose a challenge as regards to further investigation of a potential relationship between sexual activity and incorporation into the dreaming content of the following night. Similarly, could this effect aid in explaining the

results of the current study, if sexual dreams were not as frequently reported due to the recollection challenges addressed above.

As the participants reported to what extent they were sexually satisfied at the time in the first entry of the Dreaming record survey, the variable sexual satisfaction could have proposed an alternative measurement to investigate the continuity hypothesis as well as the compensatory theory of dreaming. Especially considering previous research has found support for a coexistence of the somewhat complementary theories (Mathes & Pietrowsky, 2022). However, caution is advised in interpretation of mentioned study as it consisted of only 23 participants, as well as using a one-time retrospective measure of a vividly remembered nightmare. The results connected to the variable sexual satisfaction are nevertheless somewhat discouraging as it was not significantly correlated with sexual dreams. Furthermore, as sexual satisfaction showed a weak non-significant correlation with pre-sleep sexual activity it might be taken as an indication of a relationship between the two. It is important to make note of the fact that sexual satisfaction was only measured at the outset of data collection, thus being potentially fallible and susceptible to environmental factors when reporting. Repeated measures of sexual satisfaction are of beneficial value in order to achieve a more accurate measure over the period of the study.

Gender

An unexpected finding of the present study was the lack of a significant result on the independent t-test investigating gender differences in sexual dreaming. Hypothesis two was consequently not supported by these results. Whereas past researchers almost exclusively have found men reporting more sexual dreams compared to women (Chen et al., 2015; Schredl, 2009; Schredl et al., 2019; Wang et al., 2022), the present study has shown no difference in average sexual dreams reported. However, men reported slightly more sexual dreams as a percentage of their total dreams compared to women. Even though the discrepancy is marginal ($M = 6.49\%$, $F = 6.07\%$) it is consistent with recent research (Geißler & Schredl, 2020), which found men reporting 6.74% of their total dreams as erotic, and women 5.96%. The aforementioned study implemented an equivalent design through a 14-day long diary study. Tendencies in literature supporting a gender difference in frequency of sexual dreams rely on the continuity hypothesis as a theorized explanation, as men have been found to be more sexually active in waking life and report sexual fantasies more often than women (Schredl et al., 2009). Moreover, a gender difference in the present sample would support the continuity hypothesis of dreaming and the

theory of dreams as compensatory as well. It might then be of interest that the current study failed to find a significant difference in total pre-sleep sexual activity between men and women.

Relationship status

Hypothesis number three was not supported, as the results did not illustrate any significant difference in sexual dream frequency between those in a relationship and those who were single. The hypothesis derived from the assumption of the primary hypothesis that pre-sleep sexual activity would be connected to a lower frequency of reported sexual dreams. Thus, it was reasoned that participants in relationship would report a higher frequency of sexual activity, consequently they were hypothesized to report less sexual dreams. The results are however in line with a recent study (Schredl & Göritz, 2020), discussing the possibility that sexual activity might not be a factor influencing the frequency of sexual dreams. It might be affected by differences in sexual fantasizing during the day. Even though sexual satisfaction significantly differed between the two groups, as participants in relationships reported being more sexually satisfied, it did not influence the frequency of sexual dreams in the two groups, as sexual satisfaction did not correlate with sexual dream frequency. As a result of this, as previous research has suggested (Schredl et al., 2009, 2019; Schredl & Göritz, 2020) it seems that sexual dream frequency is to a bigger extent explained by sexual thoughts and fantasies, rather than the overt sexual behavior.

Strengths and limitations

The present sample included roughly as many men as women, something scholars on the field usually struggle to achieve, especially when sampling from student populations (Schredl et al., 2009). Additionally, as far as we know no studies have been conducted on this topic in a Norwegian population, which signifies the importance of investigating potential culture differences in dreaming. Furthermore, the broadness of the Dreaming record survey could be considered beneficial as it reduces the risk of selection bias for erotic topics (Sousa et al., 2004). Regarding the design of the study, a diary study should be considered appropriate when sensitive questions are included, as both interview and laboratory studies alike have been proved to affect the reporting of such topics (Domhoff & Kamiya, 1964; Weisz & Foulkes, 1970). Similarly appropriate is the length of the study, as a duration of four weeks, stands out

as a noteworthy strength since researchers tend to use shorter diary studies of 14 days or retrospective measures (Schredl, 2018, p. 15; Schredl & Göritz, 2020).

There are several limitations of the present study that should be addressed, such as sample size, survey construction, selection method, variables not measured and operationalizations. A noteworthy shortcoming of the current study is the sample size. As the present study only had 87 participants, and 70 who followed up after the first day, the probability of achieving significant results on small effects are slim (Khalilzadeh & Tasci, 2017). Using Cohen's recommended level of power of .8, one would need 783 participants to detect a small effect size of $r = .1$. Further, to detect a medium ($r = .3$) effect size one would need a sample of 85, but only 28 participants to detect a large effect size (Cohen, 1992, retrieved from Field, 2015). Thus, both the complete sample and the sample sizes of individual groups were proven too small to identify any significant findings with lower effect sizes. Secondly, the Dreaming record survey was constructed by students, student assistants and the project coordinator for the study, thus it is not structure validated which again impacts the generalizability of the findings. The method of convenience sampling of the present study may have led to selection bias in terms of participants being above average interested in dreams, thus leading to a non-representative sample (Sousa et al., 2004). However, the results do not indicate a sample differing from those used by previous scholars. Except from the fact that the sample consisted of friends and family of the students conducting the study, which may have influenced the reporting of sensitive questions which are already susceptible to underreporting. Thirdly, even though it might be viewed as a strength of the study, the lack of depth and nuance in measuring variables could be considered as a shortcoming of the study. As the topic of interest of the thesis is sexual dreams, it would have been valuable to include additional variables such as daily sexual activities accompanied by a measure of emotional intensity, and sexual thoughts or fantasies to further investigate the continuity between sexuality and dreams. Finally, a limitation that should be brought up is the operationalization of variables. The question of relationship status could have had response alternatives aligned with the different sorts of relationships, e.g., friends with benefits, married, and committed. Additionally, the question should have been posed at least one more time through the course of the study, to identify couples potentially splitting apart over the duration of the study. This should be considered in samples with young participants are relationships tend to be less stable than in adulthood. Furthermore, the operationalization of sexual activity either should have made it clear to participants whether masturbation is included in the definition or include a separate

measure for that. A definition of sexual dreams should also have been included in the preliminary survey to improve the reliability and validity of the study.

Implications and further research

Despite these limitations, the results of the study do suggest some theoretical and practical implications. Firstly, the measurement of pre-sleep sexual activity highlights the possibility of direct incorporations of waking experiences into dream content. The results of the present study may alone, as well as accompanied by previous research (Schredl et al., 2009, 2019; Schredl & Göritz, 2020), suggest that direct continuity between overt sexual behavior and dream content is unlikely. However, much of the research on this topic suffers from small sample sizes, thus such inferences should be explored further. The theory and potential function of dreams as compensatory was not supported by the results, though implementation of nuanced and appropriately operationalized variables might give other results. Moreover, it is important to fathom the theorized utility of the compensatory theory as it may aid in the understanding of sexual health and health in general of the population.

Secondly, the failure to statistically identify the previously documented gender difference in sexual dreams (Chen et al., 2015; Schredl, 2009; Schredl et al., 2019; Wang et al., 2022) could be attributed to lacking sample sizes, even though a portion of the results is consisted with a recent study (Geißler & Schredl, 2020). Nevertheless, the contradicting result on the primary investigation of gender differences in sexual dreams do elicit the need for subsequent research to build confidence in previous findings.

Thirdly, as no significant or practical difference was found in sexual dream frequency between those in a relationship and those who were single, it may indicate the importance of considering other explaining factors such as personality traits (Geißler & Schredl, 2020) and emotional intensity (Malinowski & Horton, 2014; Schredl, 2006). Considering this, subsequent research looking at couples at the peak of love affairs might be of value when investigating the role of emotional intensity. Additionally, further research should aim to distinguish between different forms of relationships, and thereby strive to explore nuances.

Much work remains to be done before a holistic understanding of the continuity between waking life and dream content is established. Specifically, further scholars should utilize longitudinal diary studies with measurements of different kinds of sexual activity (e.g., sexual intercourse, masturbation), as well as covert sexual behavior. However, researchers

implementing measurements of waking thoughts and behavior should exhibit caution, as this measurement on its own might affect content incorporation (Schredl, 2006). Moreover, investigating this by using a substantially bigger sample, preferably random sampling in the adult population, would build confidence in a subfield of dream research that has not been explored thoroughly. Experimental design variations could in certain settings be preferable over diary studies, to investigate causal relationships linked to sexual dreams and sexual behavior, as well as thoughts and fantasies. Such a study would however have to be designed delicately, both with regards to research ethics, reliability, and validity. Lab studies could generally be considered unsuitable for studying sensitive questions such as those of the present study, as it might directly affect the accuracy of both frequency and content of sexual dreams (Domhoff & Kamiya, 1964; Weisz & Foulkes, 1970). Lastly, to explore a potential theory of dreams as compensatory, further studies should include repeated measures of both sexual satisfaction and desired sexual activity.

Conclusion

The purpose of the study was to explore the prevalence and frequency of sexual dreams in a Norwegian population and investigate the possible connections with sexual activity before sleep, gender, and relationship status respectively. Results indicated a lower prevalence of sexual dreams than previously documented in research, but the frequency was roughly consistent with previous findings. Methodological factors such as sample size and method, as well as design factors such as content descriptions help explain the results regarding prevalence and frequency. The findings illustrated no significant effects between sexual dreams and sexual activity, nor with the other variables investigated. Previously supported findings of a gender difference in prevalence of sexual dreams were not supported, though most likely attributed to methodological limitations of the study. However, the slightly larger frequency of sexual dreams in men compared to their total dreams reported is in line with previous findings. Lastly, no statistically significant or practical difference in sexual dreaming between those in a relationship compared to those who were not in a relationship were found. Answering the research question, a third of the sample reported at least one sexual dream over the course of the four weeklong study. No relationships were found with sexual activity before sleep, gender or relationship status. However, results of the present study should be interpreted with necessary caution due to limitations accounted for. Hence, future research should especially investigate the nuances of the continuity hypothesis of dreaming and potentially the function of dreams as compensatory, to establish whether sexual activity, or possibly only sexual fantasies, explain

differences in sexual dreaming. More longitudinal diary studies with randomized samples including measures of sexual thoughts and fantasies, emotional intensity and sexual satisfaction are called for, to establish a better foundation of theory in an expanding field.

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