

Sleep problems as mediator between stress and anxiety symptoms

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Abstract

Anxiety is a very prevalent phenomenon across all cultures with a high relevance for societies regarding disability and costs. Stress is considered as a possible cause of anxiety and it can be distinguished between objective stress, like stressful life events, or subjective stress, like the stress level for certain events. Previous research demonstrated a positive relation between stress and anxiety symptoms. However, little is known about the underlying mechanisms of this association. Sleep problems seemed to be a possible mediator by presenting a positive relation with stress and anxiety symptoms. This study aimed at replicating the findings about the relation between stress and anxiety symptoms, as well as testing sleep problems as possible mediator of this association. An online-study with questionnaires measuring stress, sleep problems and anxiety symptoms was conducted and analysed with linear regression and mediation analyses for 289 participants. Results showed a significant relation between stressful life events and anxiety symptoms, as well as between the stress level and anxiety symptoms. Moreover, sleep problems mediated the link between stressful life events and anxiety symptoms, as well as between the stress level and anxiety symptoms. This preliminary finding about sleep problems as underlying mechanism in the link between stress and anxiety can stimulate future research for replication and this knowledge can be useful in improving psychological interventions for individuals suffering from stress induced anxiety symptoms after further consolidation of the research results.

Although differing in presentation regarding quality and quantity, symptoms of anxiety are a common phenomenon across all cultures (Richmond). Anxiety disorders are one of the most frequently occurring psychiatric disorders with an estimate of a lifetime prevalence of 29% in the general population (Kessler et al., 2005). This widespread anxiety has tremendous consequences for every society. Baxter and her colleagues (2014) found anxiety disorders as the sixth leading cause of disability leading to huge costs for societies. For instance, 31.5% of the mental-illness costs from the United States in 1990 accounted for anxiety disorders with a total amount of \$46.6 billion (DuPont et al., 1996).

A possible cause of anxiety disorders is stress. An objective measure of stress are stressful life events (SLEs), like a divorce, the death of a loved one or assault. In this regard, a longitudinal relation between self-reported SLEs and anxiety symptoms was found (Michl et al., 2013). A subjective measure of stress is the stress level a person assigns to a certain event. In this respect, research demonstrated a significant association between perceived stress and anxiety (e.g., Bergdahl & Bergdahl, 2002).

In contrast to the extensive knowledge about a link between stress and anxiety symptoms, less is known about the mechanisms of this relation. However, knowing the mediators between

stress and anxiety symptoms might improve interventions which then can specifically target these mechanisms. A possible mediator of the link between stress and anxiety symptoms are sleep problems. Sleeping difficulties are a very frequent phenomenon: every third adult person in Western Europe reports to have sleeping problems in the last 12 months (Léger et al., 2008). However, sleep problems are a complex construct which is difficult to define. It consists of a quantitative component of sleep such as duration, latency or number of arousals and a subjective component like depth or restfulness of sleep (Buysse et al., 1989). People may vary in the specific components that assemble their sleep problems.

Previous research already investigated the relationship of sleep and stress indicating a negative relation. In terms of objective stress, a study by Li and his colleagues (2019) showed that increased amounts of stressful life events predicted more sleep difficulties. Moreover, a significant association between major stressful events and the onset of insomnia was revealed (Healy et al., 1981). In this line, research on subjective stress exhibited a significant relation between perceived stress and increased level of insomnia in the form of initiating sleep, maintaining sleep and non-restorative sleep (Garefelt et al., 2019).

The relation between sleep and anxiety has been investigated by past research indicating a bidirectional association. A study by Jansson-Fröjmark and Lindblom (2008) exhibited that anxiety was associated with later cases of insomnia and that insomnia predicted later anxiety. On the one hand, some studies showed anxiety leading to increased sleep problems. For instance, research displayed that state and trait anxiety impaired sleep initiation and maintenance (Horváth et al., 2016). A study by Papadimitriou and Linkowski (2005) illustrated that many people with anxiety disorders suffer from sleeping difficulties. On the other hand, research suggested that sleep problems can lead to increased anxiety. A study by Taylor and his colleagues (2005) demonstrated that participants showing difficulty sleeping were 17 times more likely to have anxiety that is clinically significant. Another study revealed anxiogenic effects of sleep deprivation (Minkel et al., 2012).

Despite evidence for a relation between stress and anxiety symptoms (e.g., Michl et al., 2013; Bergdahl & Bergdahl, 2002) and evidence for a link between stress and sleep problems (e.g., Li et al., 2019; Garefelt et al., 2019), as well as evidence for the association between sleep problems and anxiety symptoms (e.g., Taylor et al., 2005), there is no current literature directly investigating sleep problems as a possible mediator of the relation between stress and anxiety symptoms. However, more knowledge about possible underlying mechanisms linking stress and anxiety symptoms could improve interventions against anxiety for stressed patients knowing which mediators to target.

The current study investigated the question whether sleep problems mediate the relation

between stress and anxiety symptoms. The first aim of the study was to test the association between stress and anxiety symptoms. The second aim of this study was to investigate sleep problems as a mediator of the link between stress and anxiety symptoms. It was hypothesised that a positive association between stress and anxiety symptoms would be found. Moreover, it was predicted that the relation between stress and anxiety symptoms would be reduced by adding sleep problems as a mediator. This prediction was based on the findings of stress as a negative predictor of sleep problems (e.g., Li et al., 2019; Garefelt et al., 2019) and sleep problems as a negative predictor of anxiety symptoms (e.g., Taylor et al., 2005).

Method

Participants

Participants were recruited via social media, like What's App and facebook, as well as via the Utrecht University research participation site sona. If participants used the research participation site sona, they were rewarded for a full completion of the survey with one participation credit. Among all participants who wanted to take part an online shop coupon of 25 euros was raffled. Overall, 485 responses were recorded. Out of these, 196 responses had to be excluded because they did not accept the consent form, they did not fill in the survey completely or they did not meet the minimum age of 18 years. No other prerequisites had to be met. For the final analyses 289 participants were left. Their mean age was 31.66 ($SD = 12.95$). Two hundred two participants identified as female, 86 as male and one participant identified as other. The countries participants were currently living in were distributed as follows: 49.4% in the Netherlands, 35.5% in China, 11.3% in Germany and the remaining 3.8% were encompassed from seven other countries. Among the participants' highest attained educational level 57.8% had a college degree, 21.1% had a highschool diploma, 19.4% had a Master's degree, 1% had a doctorate and 0.7% had less than a highschool diploma. The participants' marital status was distributed as follows: 30.8% were married, 30.1% were single, 28% were in a relationship, but not living together, 7.3% were living together, 3.5% were divorced and 0.3% were widows.

Materials

To measure the first independent variables of *stressful life events* and *stress level* a modified short version of the Recent Life Changes Questionnaire (RLCQ, Miller & Rahe, 1997, see Appendix A) was used. Participants were asked to indicate eight incidents on their occurrence and rate them on their amount of stressfulness on a 6-point scale (ranging from 0 = *not stressful* to 5 = *very stressful*).

The second independent variable was *sleep problems*. It was measured with a slightly

shorter version of the Pittsburgh Sleep Quality Index (PSQI, Buysse et al., 1989, see Appendix B). In total 17 questions regarding sleep quality were filled in and rated on a 4-point scale (e.g. ranging from 0 = *not during the last month* to 3 = *three or more times a week*).

As measurement of the dependent variable *anxiety symptoms* the anxiety dimension of the Hospital Anxiety and Depression Scale (HADS, Zigmond & Snaith, 1983, see Appendix C) was used. This subsection of the questionnaire included seven items which were rated on a 4-point scale (e.g. ranging from 0 = *not at all* to 3 = *most of the time*). All questionnaires were originally in English and were translated into Dutch, German and Chinese.

Procedure

The study was conducted online via the survey platform Qualtrics. After reading the information letter and agreeing to the consent form, participants started with the survey. Participants answered demographic questions and the modified RLCQ, the PSQI and the HADS. In total, the study took approximately 45 minutes to complete. The study was approved by the Ethics Review Board of the faculty of Social and Behavioural Sciences of Utrecht University (FETC 20-0096).

Data analysis

The dependent variable was *anxiety symptoms* (continuous, range: 0-21) which was measured with the anxiety score of the HADS. A low score indicated a low level of anxiety symptoms. The first independent measurement was stress. This was distinguished between the amount of *stressful life events* (continuous, range: 0-9) and the average of the *stress level* (continuous, range: 0-5) among the stressful life events. The second independent variable was *sleep problems* (continuous, range: 0-21). For all independent variables a low score indicated a low level of the respective variable. All independent variables were within-subject factors. The data was gathered already anonymised and participants got subject numbers. Then, the data was cleaned by excluding all participants who did not complete the three aforementioned questionnaires or who did not fulfil the participation criteria. The data was prepared by coding and calculating total scores for the amount of SLEs, the PSQI and the HADS. The average of the stress level was calculated by the sum of stress ratings divided by the amount of SLEs. The association between SLEs or the stress level and anxiety symptoms was analysed with linear regression. Covariates were considered a confounding factor when their coefficient changed with more than 10% to the simple model. Following Preacher and Hayes (2008) a mediation analysis with bootstrapping was conducted to study whether sleep problems mediated the relation between SLEs (independent variable) or stress level (independent variable) and anxiety symptoms (dependent variable). For data analyses the SPSS program was used.

Results

The descriptive statistics of all four measures are displayed in Table 1. The data on objective (SLEs) and subjective (stress level) stress measures, showed similar patterns (see Table 1).

Table 1

Descriptive Statistics

	<i>M</i>	<i>SD</i>	Actual range	Possible range
Age	31.67	12.95	18 – 84	18 – 84+
Stress				
SLEs	3.18	1.70	0 – 9	0 – 9
Stress level	2.37	1.34	0 – 5	0 – 5
Sleep problems	5.44	2.50	1 – 12	0 – 21
Anxiety symptoms	6.77	2.84	0 – 16	0 – 21

Note. The statistics are based on $N = 289$ consisting of 202 female, 86 male and one other participants.

Analyses: Assumptions, correlations, covariates

Regarding the analyses of objective stress (stressful life events) and anxiety symptoms, an analysis of standard residuals was carried out on the data to identify any outliers, which indicated the existence of three outliers (Std. Residual Min. = -2.31, Std. Residual Max. = 3.51). However, the outliers were left in the data since they did not have any impact on the analyses given the size of the data set. Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (Tolerance = 1.00, $VIF = 1.00$). The data met the assumption of independent errors (Durbin-Watson value = 2.08). The histogram of standardised residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardised residuals, which showed points that were not completely on the line, but close. The scatterplot of standardised residuals showed that the data met the assumptions of homogeneity of variance and linearity. The data also met the assumption of non-zero variances (Anxiety, Variance = 8.09; SLEs, Variance = 2.88).

A linear regression analysis was conducted to predict anxiety symptoms from the number of stressful life events. The number of SLEs did explain a significant amount of the variance in anxiety symptoms, $F(1,287) = 4.894$, $p < .028$, $R^2 = .017$, $R^2_{\text{adjusted}} = .013$. The regression coefficient ($B = .22$) indicated that an increase in one SLE corresponded, on average, to an increase in anxiety

symptoms of .22 points.

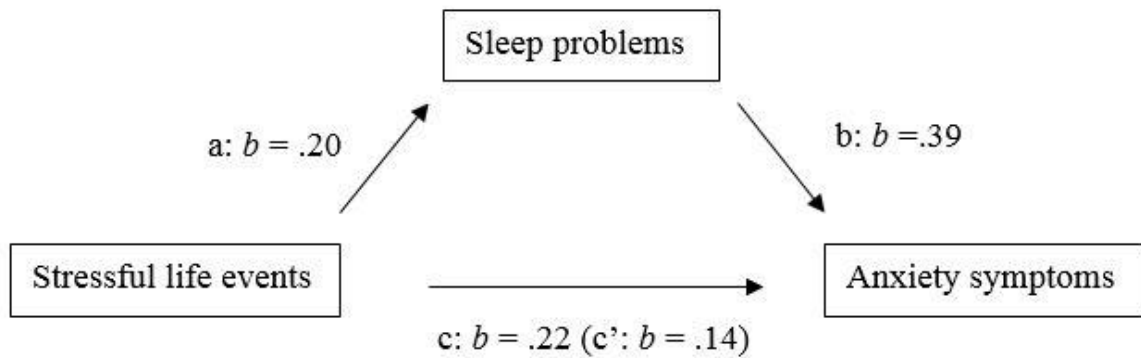
In regard of the analyses of subjective stress (stress level) and anxiety symptoms, an analysis of standard residuals was carried out on the data to identify any outliers, which indicated the existence of one outlier (Std. Residual Min. = -2.58, Std. Residual Max. = 3.80). However, the outlier was left in the data since it did not have any impact on the analyses given the size of the data set. Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (Tolerance = 1.00, $VIF = 1.00$). The data met the assumption of independent errors (Durbin-Watson value = 2.07). The histogram of standardised residuals indicated that the data contained approximately normally distributed errors, as did the normal P-P plot of standardised residuals, which showed points that were not completely on the line, but close. The scatterplot of standardised residuals showed that the data met the assumptions of homogeneity of variance and linearity. The data also met the assumption of non-zero variances (Anxiety, Variance = 8.09; Stress level, Variance = 1.78).

A linear regression analysis was conducted to predict anxiety symptoms from the level of stress. The stress level did explain a significant amount of the variance in anxiety symptoms, $F(1,287) = 19.123, p = .000, R^2 = .062, R^2_{\text{adjusted}} = .059$. The regression coefficient ($B = .53$) indicated that an increase in one level of stress corresponded, on average, to an increase in anxiety symptoms of .53 points.

For stressful life events as independent variable none of the covariates of age ($B = .22$), gender ($B = .22$), level of education ($B = .21$), country currently living in ($B = .21$) or marital status ($B = .22$) was exhibited as confounding factors (cf. crude model $B = .22$). For the stress level as independent variable, none of the covariates of age ($B = .53$), gender ($B = .49$), level of education ($B = .47$), country currently living in ($B = .47$) or marital status ($B = .46$) was revealed as confounding factors (cf. crude model $B = .53$).

Mediation analyses

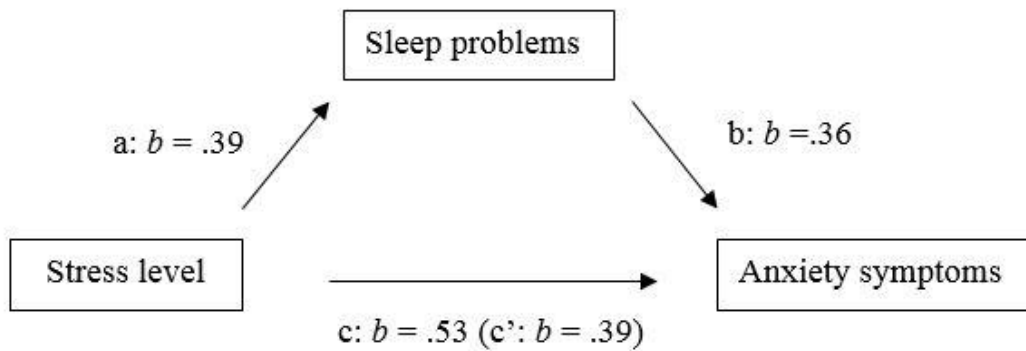
The mediation analysis with bootstrapping was used to investigate whether sleep problems mediated the relation between stressful life events and anxiety symptoms. SLEs significantly predicted both sleep problems (path [a] in Fig. 1; $b = .20, t(287) = 2.35, p = .019$) and anxiety symptoms (path [c]; $b = .22, t(287) = 2.21, p = .028$). When the association between sleep problems and anxiety symptoms was added (path [b]; $b = .39, t(286) = 6.19, p < .001$), SLEs predicted anxiety symptoms to a lesser extent (path [c']; $b = .14, t(286) = 1.48, p = .140$). The 95% confidence interval for the indirect effect did not include zero ($b = .08, 95\% \text{ CI } [.01, .16]$), indicating that sleep problems mediated the effect of SLEs on anxiety symptoms.

Figure 1*Mediation model*

Note. Sleep problems as mediator of the association between stressful life events and anxiety symptoms. The effect of stressful life events on sleep problems is path [a]. The effect of sleep problems on anxiety symptoms is path [b]. The effect of stressful life events on anxiety symptoms is path [c]. Path [c'] represents the effect of stressful life events on anxiety symptoms after including sleep problems in the model.

Similar results were found for the mediation analysis with bootstrapping investigating whether sleep problems mediated the relation between stress level and anxiety symptoms. The stress level predicted both sleep problems (path [a] in Fig. 2; $b = .39$, $t(287) = 3.60$, $p < .001$) and anxiety symptoms (path [c]; $b = .53$, $t(287) = 4.37$, $p < .001$). When the association between sleep problems and anxiety symptoms was added (path [b]; $b = .36$, $t(286) = 5.73$, $p < .001$), the stress level predicted anxiety symptoms to a lesser extent (path [c']; $b = .39$, $t(286) = 3.32$, $p < .001$). The 95% confidence interval for the indirect effect did not include zero ($b = .14$, 95% CI [.06, .24]), indicating that sleep problems mediated the effect of the stress level on anxiety symptoms.

Figure 2*Mediation model*



Note. Sleep problems as mediator of the association between stress level and anxiety symptoms.

The effect of stress level on sleep problems is path [a]. The effect of sleep problems on anxiety symptoms is path [b]. The effect of stress level on anxiety symptoms is path [c]. Path [c'] represents the effect of stress level on anxiety symptoms after including sleep problems in the model.

Discussion

The current study aimed at investigating the relation between stress and anxiety symptoms. In addition, the study investigated the research question whether sleep problems mediated the association between stress and anxiety symptoms. It was expected to find a positive relation between (objective and subjective) stress and symptoms of anxiety, as well as finding a mediation with sleep problems in the link between stress and anxiety symptoms. Results showed that both the number of stressful life events and the subjective stress level significantly related with anxiety symptoms, although these effects were rather weak. Moreover, increases in sleep problems were revealed to be an underlying mechanism in the association between both SLEs and anxiety symptoms, as well as the stress level and anxiety symptoms. This was based on the assumptions that stress predicts sleep problems and anxiety, as well as sleep problems leading to anxiety.

These findings were in line with previous research. For instance, the experience of stressful life events was demonstrated to predict the onset of anxiety disorders (Kendler et al., 2003) and increased levels of perceived stress were revealed to relate significantly with anxiety (Newbury-Birch & Kamali, 2001). The findings were also in line with appraisal theories of emotion, which indicate that the person's subjective appraisal of a stressful life event leads to a specific emotional reaction, like anxiety (Lazarus & Folkman, 1987). In this regard, research demonstrated that anxiety is related to the initial negative cognition and beliefs people generate after trauma (Ehring et al., 2006) which can be considered as an extreme form of a stressful life event. However, given possible bidirectionality between stress and anxiety and considering that the data was based on cross-

sectional self-report, more anxiety might have led to simply more reports of stressful life events and a higher stress level. This is supported by a possible memory bias in anxious people. For instance, individuals with social anxiety were shown to have a bias in the form of recalling more negative and more social anxiety-related autobiographical memories (Krans et al., 2014).

The findings of the current study have some implications for practice. The results indicate that health care practitioners treating people with anxiety symptoms should consider the objective and subjective stress experienced by their patients. For instance, mindfulness-based stress reduction is used as an intervention for people with anxiety (e.g., Vøllestad et al., 2011). Because it is part of life that stressful events happen and it is unlikely for people to prevent the happening of stressful events, people could change their reaction to it. The programme of mindfulness-based stress reduction helps to reduce these stress levels toward stressful life events and other stressors (e.g., Chiesa & Serretti, 2009).

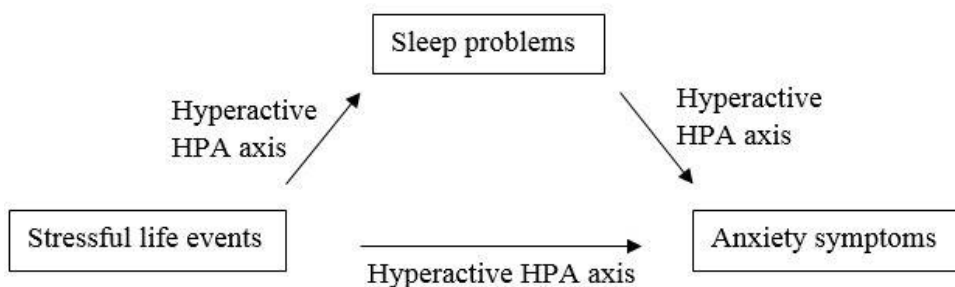
No previous evidence seems to exist for the results revealing sleep problems as a mediator of the link between stress and anxiety symptoms. However, evidence could be found for all three respective associations separately. For instance, previous research demonstrated a positive association between stress and anxiety symptoms (e.g., Michl et al., 2013; Bergdahl & Bergdahl, 2002), a positive relation between stress and sleep problems (e.g., Li et al., 2019; Garefelt et al., 2019) and a positive link between sleep problems and anxiety symptoms (e.g., Taylor et al., 2005). However, these associations might also function in the opposite directions as presumed by the mediation triangle of the current study. Indeed bidirectionality between sleep problems and anxiety symptoms have previously been shown (cf. Jansson-Fröjmark & Lindblom, 2008). Moreover, a study revealed that more sleep problems predicted an increased stress reaction to a social stress test (Mrug et al., 2016). Furthermore, anxiety might lead to increased stress due to a memory bias in anxious people who then report more stressful events and a higher stress level (cf. Krans et al., 2014). Still, the support for stress influencing sleep problems and anxiety, as well as sleep problems predicting anxiety is stronger than for the opposite directions. Stress leading to symptoms of anxiety was illustrated by a longitudinal study over 12 months (Michl et al., 2013). Stress predicting sleep problems could be considered as common-sense knowledge since stress causes physiological and psychological activation which is the opposite to the deactivation needed for sleep. In this regard, the relation between stress and sleep problems was demonstrated with a prospective study by Linton (2004) who proved that work stress predicted insomnia one year after. Lastly, an experimental study displayed that sleep deprivation induced anxiety (Vardar et al., 2007).

The findings are also in line with existing theories that could explain the underlying mechanism between stress, sleep and anxiety. The hypothalamic-pituitary adrenal (HPA) axis and the autonomic nervous system representing the stress system have frequently been shown to be

hyperactive in people suffering from anxiety (e.g., Condren et al., 2002). This hyperarousal can disturb sleep. Previous research illustrated that sleep problems are associated with hyperactivation of the stress system (Meerlo et al., 2008). However, questions remain whether a hyperactive HPA axis leads to anxiety or whether anxiety leads to a hyperactive HPA axis. One study found an association between prenatal stress in the form of anxiety and individual differences in cortisol levels of pre-adolescent children (O'Connor et al., 2005). However, this association still lacks the possibility to draw causal conclusions. According to Faravelli and his colleagues (2012) “currently the most widely accepted theory is that early stressful life events may provoke alterations of the stress response and thus of the HPA axis, that can endure during adulthood, predisposing individuals to develop psychopathology” (p. 13). Moreover, the association between sleep problems and the HPA system seems to be bidirectional as well (Steiger, 2002). Studies demonstrated that a hyperactive HPA axis can cause sleep problems. For instance, in a study the HPA system was artificially activated by a corticotropin-releasing hormone which generated sleep problems (Vgontzas et al., 2001). Other studies showed that sleep deprivation predicts higher cortisol levels at night and the following day (e.g., Chapotot et al., 2001). Overall, research about the bidirectional relations between anxiety and the HPA axis, as well as between sleep and the HPA axis support the idea and results of the current study (see Figure 3). Stress on the one hand leads to a hyperactive HPA axis which then causes anxiety. On the other hand, stress leading to a hyperactive HPA axis contradicts sleep which increases the hyperarousal of the HPA axis even further and is therefore heightening anxiety symptoms.

Figure 3

Mediation model



With the current findings that sleep problems function as a mediator of the link between stress and anxiety symptoms, some implications for practice can be considered. The knowledge about underlying mechanisms of the relation between stress and anxiety might be helpful to improve interventions. Especially for anxiety patients suffering from stress targeting their sleep problems might increase the likelihood of successful treatment. In this regard, Blake, Trinder and

Allen (2018) suggested sleep interventions for adolescents with anxiety symptoms based on the fact that insomnia may cause and/or maintain anxiety symptoms. They further proposed hyperarousal due to stress as a mechanism of the association between insomnia and anxiety (Blake et al., 2018). For instance, cognitive-behaviour therapy for insomnia was shown to improve sleep and anxiety (Taylor & Pruiksma, 2014).

However, the results of the current study should be taken with caution. The responses to the questionnaires were based on self-report. Therefore, the answers by the participants might not correctly represent their actual behaviour due to possible social-desirability effects. Moreover, the study is cross-sectional in nature which limits conclusions of the linear regression analyses to correlational rather than causal reasoning. This gives room to consider possible bidirectionality of the association between sleep problems and anxiety symptoms (cf. Jansson-Fröjmark & Lindblom, 2008). Furthermore, measuring the predictor, mediator and outcome happened at the same point in time. This might limit the conclusions of the mediation analyses and might make it difficult to disentangle the exact temporal and causal relations of stress, sleep and anxiety. These self-report and design problems could be solved with true experiments in future investigations. Sleep problems could be observed and influenced in the lab (cf. Horváth et al., 2016) and participants could be compared between a clinical anxiety group and a healthy control group (cf. Horváth et al., 2016). Alternatively, a longitudinal design could be considered to expand possible conclusions towards causal relations (cf. Michl et al., 2013). Lastly, the current study only found a partial mediation for sleep problems in the association between stress and anxiety symptoms. Future studies might be stimulated to investigate other possible mediators, like rumination (Michl et al., 2013) which might cause sleep problems.

All in all, this study indicated that sleep problems mediate the association between objective, as well as subjective stress and anxiety symptoms. With these findings research regarding mediators of the relation between stress and anxiety symptoms has made a step forward. This contribution might encourage further research to replicate the current findings in order to improve the understanding of underlying mechanisms of the link between stress and anxiety symptoms. Moreover, these findings have important implications for future interventions since sleep problems should be considered when intervening on stressed anxiety patients.

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Appendix B
Shorter Version of the Pittsburgh Sleep Quality Index

The following questions relate to your usual sleep habits during the past month *only*. Your answers should indicate the most accurate reply for the *majority* of days and nights in the past month. Please answer all questions.

1. During the past month, when have you usually gone to bed at night?
(Please enter the time in 24h time system, for instance 22.30) _____
2. During the past month, how long (in minutes) does it usually take you to fall asleep each night? _____
3. During the past month, when have you usually gotten up in the morning?
(Please enter the time in 24h time system, for instance 8.30) _____
4. During the past month, how many hours of *actual sleep* did you get at night? (This may be different than the number of hours you spend in bed.) _____

For each of the remaining questions, check the one best response. Please answer *all* questions.

5. During the past month, how often have you had trouble sleeping because you...
 - a. Cannot get to sleep within 30 minutes
Not during the past month - less than once a week - once or twice a week - three or more times a week
 - b. Wake up in the middle of the night or early morning
 - c. Have to get up to use the bathroom
 - d. Cannot breathe comfortably
 - e. Cough or snore loudly
 - f. Feel too cold
 - g. Feel too hot
 - h. Had bad dreams
 - i. Have pain
 - j. Other reasons, please describe _____
6. During the past month, how would you rate your sleep quality overall?
Very good - fairly good - fairly bad - very bad

7. During the past month, how often have you taken medicine (prescribed or “over the counter”) to help you sleep?

Not during the past month - less than once a week - once or twice a week - three or more times a week

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the past month - less than once a week - once or twice a week - three or more times a week

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all - only a very slight problem - somewhat of a problem - a very big problem

Appendix C**Anxiety Dimension of the Hospital Anxiety and Depression Scale**

Choose the reply that is closest to how you have been feeling in the past week. Don't take too long to reply; usually your immediate response is best.

I feel tense or 'wound up'

Most of the time, a lot of the time, from time to time, not at all

I get a sort of frightened feeling as if something awful is about to happen

Most of the time, a lot of the time, from time to time, not at all

Worrying thoughts go through my mind

Most of the time, a lot of the time, from time to time, not at all

I can sit at ease and feel relaxed

Most of the time, a lot of the time, from time to time, not at all

I get a sort of frightened feeling like 'butterflies' in the stomach

Not at all, occasionally, quite often, very often

I feel restless as if I have to be on the move

Most of the time, a lot of the time, from time to time, not at all

I get sudden feelings of panic

Very often; quite often; occasionally; not at all