

Who is Sleeping Beauty? Quality of Sleep and Adolescents' Sleep-Psychophysiological-Emotional-Personality Profile

Danilo Garcia^{1, 2, 3, 4*}, Erica Schütz^{3, 5}, Erik Lindskär^{1, 3}, Fernando Renee González Moraga^{3, 6},
Trevor Archer^{2, 3}, Kevin Cloninger^{3, 4}, Ali Al Nima^{1, 2, 3}

Abstract

Objective: We investigated gender differences among adolescents in quality of sleep, psychophysiological problems, dream frequency, emotional states, and personality traits and also if the effect of quality of sleep on psychophysiological problems, dream frequency, emotional states, and personality traits was moderated by gender.

Method: High school pupils ($n_1 = 155$, $n_2 = 142$, and $n_3 = 325$) responded to the Uppsala Sleep Inventory, the Positive Affect Negative Affect Schedule, Beck's Depression Inventory, the Type A-Personality Scale, and the Temperament and Character Inventory. Gender differences were investigated using Multivariate Analyses of Variance and moderation using multi-group Structural Equation Modeling.

Results: Girls scored higher in major sleep problems, difficulties falling asleep, night awakenings, psychophysiological problems, dream frequency, negative affect, depression, stress, and Type A-personality. Boys scored higher in novelty seeking, harm avoidance, and persistence. Girls' quality of sleep was related to their psychophysiological problems, dream frequency, positive affect, negative affect, stress, novelty seeking, reward dependence, persistence, and self-directedness. Boys' quality of sleep was related to their psychophysiological problems, negative affect, stress, Type A-personality, novelty seeking, harm avoidance, reward dependence, and self-directedness.

Conclusion: Girls showed the unhealthiest sleep-psychophysiological-emotional-personality profile. For both genders, good quality of sleep or "beauty sleep" might result in less psychophysiological problems, less negative affect, less stress, less novelty seeking, and less self-directedness. However, for boys, "sleeping beauty" comprises less Type A-behaviour, less harm avoidance, and more reward dependence; while for girls "sleeping beauty" comprises less frequency of vivid dreams, more positive affect, less reward dependence, and more persistent behaviour.

Keywords: affect; gender; personality, psychophysiological problems, quality of sleep.

"But before the sun sets on her sixteenth birthday, she will prick her finger on the spindle of a spinning wheel and fall into a sleep like death! A sleep from which she will never awaken!"

From the movie Maleficent

Introduction

Several aspects of human beings' daily lives involve situations associated with stress that might lead to both acute and long-term biopsychosocial consequences on health (Schütz, 2015). For instance, several studies indicate the effects of sleep quality

on positive and negative affect (Schütz, Garcia & Archer, 2013), stress and energy (Schütz, 2015), depressive symptoms (Ebmeier, Donaghey & Steele, 2006), and health-related personality profiles (Cloninger, 2004). In addition, females express more negative affect, stress and Type A-personality compared to males (Schütz, 2015). Some other studies (e.g., Han, Schepers, Stegen, Van den Bergh et al., 2000) have also revealed a complex interaction between negative affect, psychosomatic symptoms, breathing pattern, and gender (e.g., Balkin, Rupp, Piccioni & Wesensten, 2008; Han et al. 2000). In this context, psychophysiological coherence, a state of calm alertness that occurs naturally with sustained positive emotions, increases efferent parasympathetic activity and it's associated to increases in frontal lobe activity, thus, allowing the expression of

1. Blekinge Center for Competence, Blekinge County Council, Karlskrona, Sweden

2. Department of Psychology, University of Gothenburg, Gothenburg, Sweden

3. Network for Empowerment and Well-Being, Sweden

4. Anthropedia Foundation, St. Louis, Missouri, USA

5. Department of Psychology, Linnaeus University, Kalmar, Sweden

6. Barn- och ungdomshabiliteringen, Region Kronoberg, Växjö, Sweden

* Corresponding author, danilo.garcia@icloud.com

agentic, communal, and spiritual character traits that serve as health personality profiles (Zohar, Cloninger & McCraty, 2013). Importantly, since psychophysiological coherence is induced by slow, deep breathing, relaxing, and sleeping (Zohar et al., 2013), then good sleep quality might be associated with character maturity and personality per se. Thus, there are several reasons to study the health status of men and women in relation to quality of sleep and both emotional states and personality traits (cf. Cohen & Edwards, 1989).

Quality of sleep

Good quality of sleep increases well-being and removes tiredness after the day's activity and prepares the person for a new day. Bad quality of sleep or sleep disturbance is usually described as a perception by the person that their sleep is insufficient or inadequate: difficulty in initiating sleep, difficulty in maintaining sleep, non-restorative sleep, and disturbances of important areas of functioning (e.g., social, occupational) by tiredness and reduced performance. If these criteria is present for more than three days a week over three weeks or one month, then it is defined as sleep disturbance. (Åkerstedt, 2005). Bad quality of sleep, as less sleep time, is also associated to greater dream frequency and more intensive/vivid dreaming, that is, greater brain activity during sleep (Nielsen, Stenstrom, Takeuchi, Saucier, Lara-Carrasco et al., 2005).

Quality of sleep is linked to the total amount of sleep as well as the relative amount of the different sleep stages (Patterson, Suffoletto, Kupas, Weaver & Hostler, 2010), whereby sleep quality appears more important than sleep quantity (Barton, Spelten, Totterdell, Smith & Folkard, 1995). Individuals suffering from sleep loss and disturbance may express both alterations in behaviour and performance, such as, the inability to make correct decisions, reductions in their ability to concentrate, and increased irritability (Orzel-Gryglewska, 2010). Sleep problems are associated to experienced stress and anxiety, feelings of anger, depressive states and alteration of the 24-hour cycle (Dement & Vaughan, 2000). Previous studies indicate only small gender differences in

sleeplessness and sleep disturbances during puberty (Park, Matsumoto, Shinkoda, Nagashima et al., 2001). However, it appears that the condition of chronic sleep disturbance, insomnia, afflicts women to a greater extent than men (Ohayon, Zulley, Guilleminault, Smirne & Priest, 2001). Women also experience double the risk of sleep disturbance due to psychological pressures arising from stressful environments (Breslau, Roth, Rosenthal & Andreski, 1996).

Additionally, several earlier studies have shown that adults who report higher levels of negative affect have poorer sleep quality than those who report lower levels of negative affect (e.g., Parkes, 2002). Poor sleep quality is also associated to depressiveness and worriedness (Carmichael & Reis, 2005), which are synonymous with negative affect (Archer, Adolffson & Karlsson, 2008). For instance, depression is diagnosed if the patient has, during at least two weeks, lowered mood, loss of interest and pleasure, reduced energy, increased tiredness, lowered activity, less concentration and attention, less self-esteem and self-confidence, feelings of guilt and worthlessness, hopelessness and helplessness, less belief in the future, self-injurious feelings, sleep disturbance and less appetite. In sum, psychophysiological problems (e.g., heart-flutters, aches and pains, shakiness in the legs, and feelings of anxiety), dream frequency, and emotional states (e.g., positive affect, negative affect, stress, energy, depressiveness) are associated to poor sleep quality (Hamilton, Catley & Karlsson, 2007).

These observations are important because individuals with inherited affective conditions (e.g., gene susceptibility for depression, bipolar disorder, or anxiety) are more sensitive for negative events than those lacking these inherited characteristics (Munakata, Fujii, Nanko, Kunugi & Kato, 2007). However, neuroticism, a personality trait that is almost synonymous to negative affect (Archer et al., 2008), is strongly correlated to depression among individuals who lack genetic vulnerability to depression (Drieling, van Calker & Hecht, 2006). This implies that for individuals who lack genetic predisposition, personality factors may be critical for mental health. Thus, the way in which quality of sleep is related

to personality traits is also of interest (cf. Grucza, Przybeck, Spitznagel & Cloninger, 2003). Personality may be defined as the “dynamic organization within the individual of the psychobiological systems by which the person both shapes and adapts uniquely to an ever-changing internal and external environment” (Cloninger, 2012). Personality may, however, be measured in several ways. In the present set of studies we focus on Type A-personality and Cloninger’s biopsychosocial model of personality.

Personality: Type A-personality and Cloninger’s Biopsychosocial Model

Individuals characterized by aggressiveness, hostility, competitive spirit, fast pace, impatience and a tendency to engage in two or several activities concurrently, to interrupt when other people are speaking, and suffer from being a workaholic are postulated to present a Type A-personality. The Type A-personality is linked with several aspects of illness, for example, vascular diseases, enhanced blood pressure, and increased levels of adrenaline and noradrenaline in the blood (Friedman & Booth-Kewley, 1988). Certain studies show that this behaviour is more common for men than women and that Type A-personality does not hold the same risk for women as it does for men (Schütz, 2015). Although it is true that a Type A-personality profile results in low quality of sleep (e.g., Hayer & Hicks, 1993), the opposite is also possible. After all, what characterizes this specific profile are also patterns of behaviour caused by poor sleep quality (e.g., Dement & Vaughan, 2000). The question is if this could also be the case for other personality traits.

Cloninger’s biopsychosocial model of personality consists of two domains: temperament and character. The dimensions underlying each domain interact as a non-linear complex dynamic system (Cloninger, Przybeck, Svrakic & Wetzel, 1994). The formulation of temperament was inferred from genetic studies of personality and neurobiological studies of the functional organization of brain networks and includes the following four dimensions: novelty seeking (i.e., the tendency toward exploratory activity, intense excitement in response to novelty,

impulsive decision making, and active avoidance of monotony or frustration), harm avoidance (i.e., inhibition and social withdrawal, shyness, and slow adaptation to change), reward dependence (i.e., the tendency to respond intensely to signals of reward, in particular to signals of social approval), and persistence (i.e., resistance to extinction despite intermittent reinforcement) (Cloninger, 2004). While the temperament dimensions are defined in terms of basic stimulus-response characteristics, character stands for goals and values or what the individual intentionally makes of her/himself (Cloninger, 2004). The three character dimensions are: self-directedness (i.e., an individual’s ability to control, regulate, and adapt their behaviour in accord with chosen goals and values), cooperativeness (i.e., the tendency towards social tolerance, empathy, helpfulness, and compassion), and self-transcendence (i.e., the individual’s identification with nature, God or something bigger than the self, and the ability to accept ambiguity and uncertainty). The character dimensions have been suggested as good measures of mental health because these are goals and values that guide an individual’s behaviour by helping her/him to adjust to the changing world (Cloninger, 2004). Among adolescents, the character dimensions have been associated to dysfunction and suffering (Garcia, Anckarsäter & Lundström, 2013), neurodevelopmental disorders (Garcia, Lundström, Brändström, Råstam, Cloninger et al., 2013), and to depict positive measures of mental health (Garcia, Nima & Archer, 2013). The most common gender differences are found in reward dependence and cooperativeness, females reporting higher levels of these temperament and character traits, and self-directedness, a character trait in which males often report higher levels compared to females.

The present study

In the present set of studies, three different samples of adolescents, we investigated gender differences in quality of sleep, psychophysiological problems, dream frequency, and emotional states (Study I-III). We also investigated gender differences in personality traits (Study II: A Type-

personality, Study III: temperament and character). Our third and final aim was to investigate if the effect of quality of sleep on psychophysiological problems, dream frequency, emotional states, and personality traits was moderated by gender. The samples of adolescents used here have been used in other studies (see Schütz, 2015); however, here we focus on quality of sleep, a variable not addressed in these earlier studies. Importantly, we address the link between quality of sleep and psychophysiological problems, dream frequency, emotional states, and personality in order to understand if the findings seen among older populations apply for adolescents. At a general level, we expected that, compared to boys, girls would show the unhealthiest sleep-psychophysiological-emotional-personality profile.

Study I

Method

Participants and Procedure

The participants were one hundred and fifty-five pupils with a mean age of 17.27 ($SD = 1.07$) years (68 male and 87 female) at one high school in the West of Sweden. The participants were recruited by first contacting their teachers who were informed of the study and its general content. The pupils were informed about the purpose of the study, the approximate amount of time required, and prior to testing, pupils were ensured that all participation was on voluntary basis with total anonymity. The order of each instrument/questionnaire was randomly distributed and the pupils answered to the survey during school hours.

Measures

Sleep quality, psychophysiological problems, and dream frequency. The Uppsala Sleep Inventory (Hetta, Almqvist, Hambert, Liljenberg & Roos, 1985) contains 42 items that measure different dimensions of sleep quality: major sleep problems, difficulties falling asleep, sleep hours, awakening times/night, and time awake before falling to sleep. One example of a question is: "Do you have many problems falling asleep when you go to bed?" In addition, the Uppsala Sleep Inventory also measures psychophysiological

problems (e.g., heart-flutters, aches and pains, shakiness in the legs, and feelings of anxiety) and dream frequency. Response alternatives are ordered within five-graded scales (1 = *not at all* to 5 = *very much*). *Cronbach's α* for these scales varied between .68-.70.

Emotional states. Emotional states were measured using three instruments. Firstly, Positive Affect and Negative Affect Schedule (Watson, Clark & Tellegen, 1988), an instrument in which participants are instructed to rate to what extent they generally have experienced 20 different feelings or emotions (10 positive affect and 10 negative affect) for the last four weeks, using a 5-point Likert scale (1 = *very slightly*, 5 = *extremely*). The 10-item positive affect scale includes adjectives such as strong, proud, and interested. The 10-item negative affect scale includes adjectives such as afraid, ashamed, and nervous. *Cronbach's α* for these scales were as follows .87 for positive affect and .85 for negative affect.

Secondly, affective states were also measured using the Stress/Energy Questionnaire (Kjellberg & Iwanowski, 1989), which assesses experienced stress and energy using 12-items and a six-point Likert scale (0 = *not at all*, 5 = *very much*). Examples of items for the stress scale are: tense, stressed, pressured. Examples of items for the energy scale are: active, energetic, focused. *Cronbach's α* for these scales were as follows .79 for stress and .76 for energy.

The third and last measure for emotional states was the Beck Depression Inventory, which consists of 21 items that measure characteristic attitudes and symptoms of depression (Beck, Steer & Garbin, 1988). This measure reflects negative attitudes towards self, performance impairment, somatic disturbances, and a general depression factor (Brown, Schulberg & Madonia, 1995). One example of the items is: "When I look back over my life, I can only see masses of failure". The response alternatives are ordered in a scale ranging from 0 to 3. *Cronbach's α* for this measure was .91.

Results

Differences between gender

In the Multivariate Analysis of variance

(MANOVA), the independent factors were gender while the dependent factors were major sleep problems, difficulties falling asleep, sleeping hours, night awakenings, awake, psychophysiological problems, dream frequency, positive affect, negative affect, stress, energy and depression. Gender had a significant effect on these variables ($F(12,142) = 4.50; p < .001$, Pillai's Trace = .28). Girls scored higher in most variables as compared to boys: major sleep problems ($F(1,153) = 19.51, p < .001$), difficulties falling asleep ($F(1,153) = 33.65, p < .001$), night awakenings ($F(1,153) = 16.32, p < .001$), psychophysiological problems ($F(1,153) = 35.39, p < .001$), dream frequency ($F(1,153) = 8.05, p < .01$), negative affect ($F(1,153) = 10.04, p < .01$), stress ($F(1,153) = 14.83, p < .001$), and depression ($F(1,153) = 27.75, p < .001$). See Table 1 for the details.

Multi-group moderation analysis

The structural equation model analysis using quality of sleep as the independent variable and psychophysiological problems, dream frequency, and emotional states as the outcome showed that Chi^2 value was significant ($Chi^2 = 191.37, df = 42, p < .001$), the *goodness of fit index* was .84, the *comparative fit index* was .70, the *incremental fit index* was .75, and *root mean square error of approximation* was .15. Thus, indicating that the model was not a good-fitting model.

After modifying the model by adding covariances between errors and between regression weights (i.e., from depression to negative affect, from energy to positive affect, and from stress to psychophysiological problems) we could obtain a better fitting for this model. The Chi^2 value of the model was smaller but still significant ($Chi^2 = 70.90, df = 32, p < .001$). Nevertheless, the Chi^2 statistic is influenced by sample size, so with larger samples does this lead to both larger value of Chi^2 statistic and likelihood of being significant (Kline, 2010). The *goodness of fit index* for the default model was .93, the *comparative fit index* was .92, the *incremental fit index* was .94, and *root mean square error of approximation* was .09. Thus, indicating that the model, after the modifications,

was a good-fitting model. For boys, quality of sleep could explain the variance of psychophysiological problems ($R^2 = .45$), stress ($R^2 = .22$), and depression ($R^2 = .30$). For girls, quality of sleep could explain the variance of psychophysiological problems ($R^2 = .60$), dream frequency ($R^2 = .13$), positive affect ($R^2 = .32$), negative affect ($R^2 = .48$), stress ($R^2 = .31$), and depression ($R^2 = .44$). See Figure 1 and Table 2 for results among boys and girls

Study II

Method

Participants and Procedure

The participants were one hundred and forty-two pupils with a mean age of 18.66 ($SD = 0.50$) years (95 male, 47 female) from a high school in the South of Sweden. The procedure followed the same protocol as in Study I.

Measures

Sleep quality, psychophysiological problems, dream frequency, and affective states (positive affect, negative affect, stress, and energy) were measured using the same instruments as in Study I. Study II (and III) did not include depression as an emotional state, partially due to the model fitting issues encountered in Study I. Additionally, the combination of low positive affect and high negative affect is also a good measure of depression (Clark & Watson, 1991), thus, we considered that using the Positive Affect and Negative Affect Schedule covered this specific emotional state.

Personality. The Type A-Personality Scale (Kawachi, Sparrow, Kubzansky, Spiro, Vokonas & Weiss, 1998) contains 27 statements with binary answers (*yes, no*). Examples of these items are: "Do you try to fit more and more activities into your schedule within an ever shorter interval?" "Can you relax without getting a bad conscience?" In the present study, summarizing all items derived an overall Type A-personality score (*Cronbach's $\alpha = .89$*).

Results

Differences between gender

In the MANOVA, the independent factors were

Table 1. Mean scores and standard deviations (\pm) for boys and girls in Study I, II and III.

| | Study I | | Study II | | Study III | |
|------------------------------|------------------|----------------------|------------------|---------------------|---------------------|---------------------|
| | Boys | Girls | Boys | Girls | Boys | Girls |
| | <i>n</i> = 68 | <i>n</i> = 87 | <i>n</i> = 94 | <i>n</i> = 47 | <i>n</i> = 195 | <i>n</i> = 128 |
| Major sleep problems | 15.72 \pm 7.83 | ***18.82 \pm 4.70 | 14.97 \pm 4.59 | *17.02 \pm 4.38 | 16.79 \pm 5.54 | ***19.40 \pm 4.66 |
| Difficulties falling asleep | 17.66 \pm 3.92 | ***22.41 \pm 5.79 | 18.05 \pm 4.64 | ***21.57 \pm 5.27 | 18.37 \pm 4.91 | ***22.85 \pm 5.84 |
| Sleeping hours | 7.35 \pm 1.44 | 7.40 \pm 1.58 | 7.34 \pm 1.22 | 7.11 \pm 1.11 | *7.28 \pm 1.25 | 6.95 \pm 1.16 |
| Night awakenings | .49 \pm .66 | ***1.17 \pm 1.24 | .60 \pm .84 | .64 \pm .94 | .58 \pm .96 | ***.99 \pm 1.15 |
| Awake | 2.68 \pm 1.92 | 2.98 \pm 1.82 | 1.93 \pm 1.49 | 1.89 \pm 1.20 | 2.50 \pm 1.91 | 2.91 \pm 1.86 |
| Psychophysiological problems | 6.25 \pm 1.63 | ***9.09 \pm 3.65 | 6.68 \pm 2.31 | **8.04 \pm 2.89 | 6.75 \pm 2.38 | ***9.04 \pm 3.20 |
| Dream frequency | 12.35 \pm 1.98 | **13.25 \pm 1.94 | 11.98 \pm 2.07 | **13.02 \pm 1.71 | 11.86 \pm 2.16 | ***13.09 \pm 2.06 |
| Positive affect | 3.25 \pm .70 | 3.03 \pm .83 | 2.92 \pm .75 | 2.91 \pm .71 | **3.53 \pm .54 | 3.31 \pm .64 |
| Negative affect | 2.00 \pm .63 | **2.36 \pm .76 | 1.72 \pm .62 | **2.04 \pm .65 | 1.96 \pm .61 | ***2.34 \pm .67 |
| Stress | 1.99 \pm .95 | **2.64 \pm 1.10 | 1.78 \pm .84 | ***2.35 \pm .95 | 1.73 \pm 1.05 | ***2.35 \pm 1.16 |
| Energy | 2.60 \pm .79 | 2.68 \pm .87 | 3.04 \pm 3.72 | 2.83 \pm .88 | 2.60 \pm .96 | 2.52 \pm .81 |
| Depression | 6.47 \pm 6.21 | ***14.26 \pm 10.88 | - | - | - | - |
| Type A-personality | - | - | 37.83 \pm 3.72 | **40.30 \pm 4.33 | - | - |
| Novelty seeking | - | - | - | - | *20.06 \pm 4.85 | 18.98 \pm 4.35 |
| Harm avoidance | - | - | - | - | ***16.03 \pm 3.76 | 13.90 \pm 3.83 |
| Reward dependence | - | - | - | - | 12.73 \pm 2.94 | 12.85 \pm 2.58 |
| Persistence | - | - | - | - | **4.02 \pm 1.62 | 3.48 \pm 1.47 |
| Self-directedness | - | - | - | - | 21.64 \pm 5.61 | 20.80 \pm 5.07 |
| Cooperativeness | - | - | - | - | 23.30 \pm 4.39 | 22.77 \pm 3.55 |
| Self-transcendence | - | - | - | - | 13.80 \pm 5.65 | 13.01 \pm 4.52 |

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

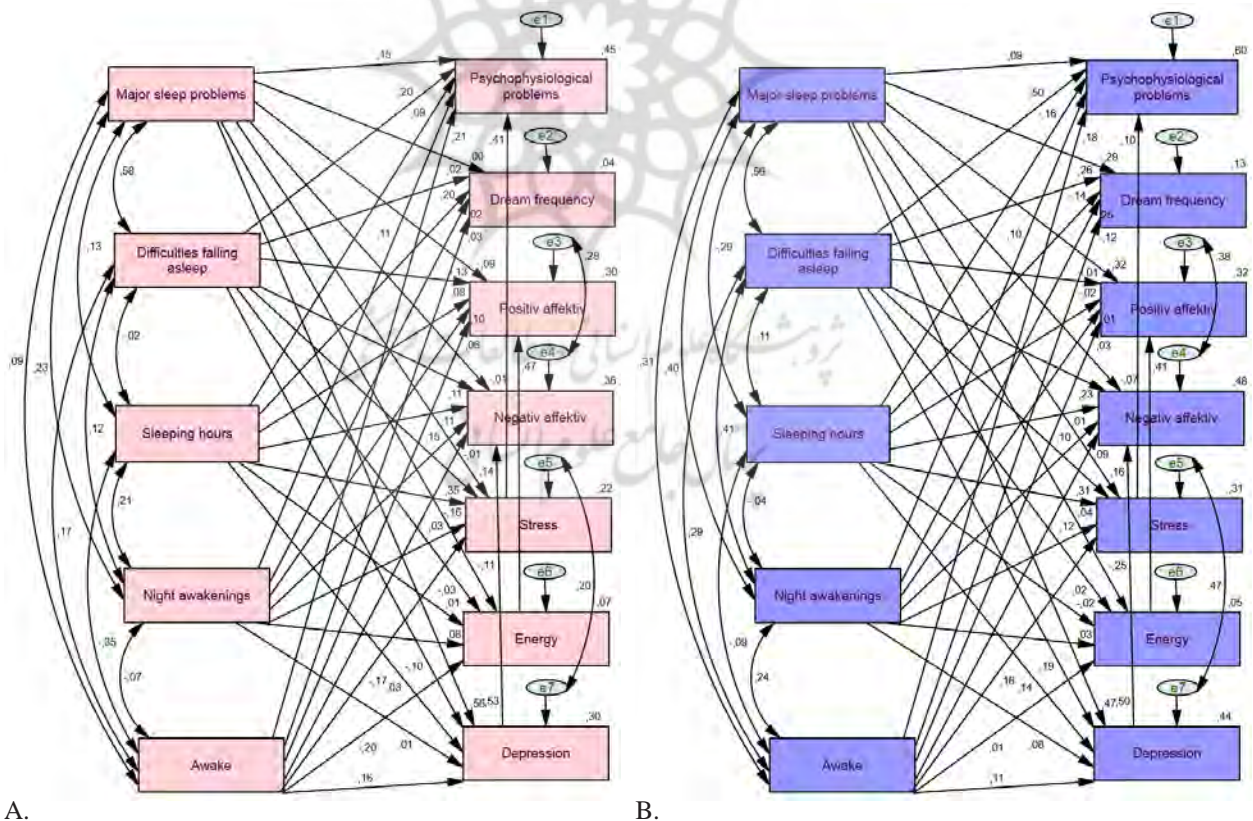


Figure 1. Structural equation model in Study I of the relationship between sleep quality and (A) boys' ($n = 68$) and (B) girls' ($n = 87$) psychophysiological problems, dream frequency, and emotional states.

Note: $\chi^2 = 71.37$, $df = 32$, $p < .001$, the goodness of fit index was .93, the comparative fit index was .92, the incremental fit index was .94, and root mean square error of approximation was .09.

Table 2. Results of the structural equation model in Study I, using sleep quality as the predictor of boys' ($n = 68$) and of girls' ($n = 87$) psychophysiological problems, dream frequency, and emotional states.

| Predictor | Outcome | Boys ($n = 68$) | | | | | Girls ($n = 87$) | | | | |
|-----------------------------|------------------------------|-------------------|------------|-------------|------------------|-----------------------|--------------------|------------|-------------|------------------|-----------------------|
| | | β | <i>SE</i> | <i>B</i> | <i>P</i> | <i>R</i> ² | β | <i>SE</i> | <i>B</i> | <i>P</i> | <i>R</i> ² |
| Major sleep problems | | .15 | .05 | .07 | <i>ns</i> | | .09 | .07 | .07 | <i>ns</i> | |
| Difficulties falling asleep | | .20 | .05 | .08 | <i>ns</i> | | .50 | .06 | .31 | < .001 | |
| Sleeping hours | Psychophysiological problems | .09 | .11 | .10 | <i>ns</i> | .45 | -.16 | .17 | .36 | < .05 | .60 |
| Night awakenings | | .11 | .24 | .27 | <i>ns</i> | | .10 | .23 | .28 | <i>ns</i> | |
| Awake | | .21 | .08 | .18 | < .05 | | .18 | .15 | .36 | < .05 | |
| Major sleep problems | | .00 | .08 | .00 | <i>ns</i> | | -.29 | .05 | -.12 | < .05 | |
| Difficulties falling asleep | Dream frequency | .02 | .01 | .01 | <i>ns</i> | | .26 | .09 | .09 | < .05 | |
| Sleeping hours | | .20 | .18 | .28 | <i>ns</i> | .04 | -.14 | .13 | -.18 | <i>ns</i> | .13 |
| Night awakenings | | .02 | .38 | .07 | <i>ns</i> | | .25 | .18 | .39 | < .05 | |
| Awake | | .03 | .13 | .04 | <i>ns</i> | | -.12 | .11 | -.12 | <i>ns</i> | |
| Major sleep problems | Positive affect | -.09 | .02 | -.02 | <i>ns</i> | | -.32 | .02 | -.06 | < .05 | |
| Difficulties falling asleep | | -.13 | .02 | -.03 | <i>ns</i> | | -.01 | .02 | -.00 | <i>ns</i> | |
| Sleeping hours | | .08 | .06 | .04 | <i>ns</i> | .30 | -.02 | .05 | -.01 | <i>ns</i> | .32 |
| Night awakenings | | .10 | .12 | .10 | <i>ns</i> | | .01 | .07 | .01 | <i>ns</i> | |
| Awake | Negative affect | .06 | .04 | .02 | <i>ns</i> | | .03 | .04 | .01 | <i>ns</i> | |
| Major sleep problems | | -.01 | .02 | .00 | <i>ns</i> | | -.07 | .02 | -.01 | <i>ns</i> | |
| Difficulties falling asleep | | .11 | .02 | .02 | <i>ns</i> | | .23 | .01 | .03 | < .05 | |
| Sleeping hours | | .11 | .05 | .05 | <i>ns</i> | .36 | .01 | .04 | .00 | <i>ns</i> | .48 |
| Night awakenings | Stress | .15 | .10 | .14 | <i>ns</i> | | .10 | .05 | .06 | <i>ns</i> | |
| Awake | | -.01 | .04 | .00 | <i>ns</i> | | .09 | .03 | .04 | <i>ns</i> | |
| Major sleep problems | | .14 | .03 | .04 | <i>ns</i> | | .16 | .03 | .04 | <i>ns</i> | |
| Difficulties falling asleep | | .35 | .03 | .08 | < .05 | | .31 | .02 | .06 | < .05 | |
| Sleeping hours | Energy | -.16 | .08 | -.10 | <i>ns</i> | .22 | .04 | .07 | .03 | <i>ns</i> | .31 |
| Night awakenings | | .03 | .16 | .04 | <i>ns</i> | | .12 | .09 | .11 | <i>ns</i> | |
| Awake | | -.17 | .06 | -.08 | <i>ns</i> | | .16 | .06 | .10 | <i>ns</i> | |
| Major sleep problems | | -.11 | .03 | -.02 | <i>ns</i> | | -.25 | .03 | -.04 | <i>ns</i> | |
| Difficulties falling asleep | Depression | -.03 | .03 | -.01 | <i>ns</i> | | .02 | .02 | .00 | <i>ns</i> | |
| Sleeping hours | | .08 | .07 | .00 | <i>ns</i> | .07 | -.02 | .06 | -.01 | <i>ns</i> | .05 |
| Night awakenings | | -.10 | .15 | .10 | <i>ns</i> | | .03 | .05 | .02 | <i>ns</i> | |
| Awake | | -.20 | .05 | -.08 | <i>ns</i> | | .01 | .08 | .01 | <i>ns</i> | |
| Major sleep problems | Energy | .56 | .21 | .90 | < .001 | | .47 | .24 | 1.10 | < .001 | |
| Difficulties falling asleep | | -.10 | .20 | -.16 | < .05 | | .19 | .19 | .35 | <i>ns</i> | |
| Sleeping hours | | -.03 | .49 | -.13 | < .05 | .30 | .14 | .59 | .99 | <i>ns</i> | .44 |
| Night awakenings | | .01 | 1.00 | .10 | <i>ns</i> | | .08 | .80 | .73 | <i>ns</i> | |
| Awake | | .16 | .36 | .52 | .30 | | .11 | .51 | .64 | <i>ns</i> | |

Note: Significant regression weights are shown in bold type.

gender while the dependent factors were major sleep problems, difficulties falling asleep, sleeping hours, night awakenings, awake, psychophysiological problems, dream frequency, positive affect, negative affect, stress, energy, and Type A-personality. Gender had a significant effect on most of these variables ($F(12,128) = 3.09$; $p < .01$, Pillai's Trace = .22). Girls scored higher in most variables as compared to the

males: major sleep problems ($F(1,139) = 6.44$, $p < .05$), difficulties falling asleep ($F(1,139) = 16.45$, $p < .001$), psychophysiological problems ($F(1,139) = 9.19$, $p < .01$), dream frequency ($F(1,139) = 8.90$, $p < .01$), negative affect ($F(1,139) = 8.11$, $p < .01$), stress ($F(1,139) = 12.75$, $p < .001$), and type A-personality ($F(1,139) = 12.33$, $p < .01$). The results here are almost identical to those from Study I, see Table 1.

Multi-group moderation analysis

The structural equation model analysis using quality of sleep as the independent variable and psychophysiological problems, dream frequency, positive affect, negative affect, stress, energy, and Type A-personality as the dependent variables showed that Chi^2 value was significant ($Chi^2 = 107.92, df = 42, p < .001$), the *goodness of fit index* was .89, the *comparative fit index* was .78, the *incremental fit index* was .83, and *root mean square error of approximation* was .11. Thus, indicating that the model was not a good-fitting model.

After modifying the model by adding one covariance between errors we could obtain a better fitting for this model. The Chi^2 value of the model was smaller but still significant ($Chi^2 = 63.66, df = 40, p < .05$). Nevertheless, the Chi^2 statistic is influenced by sample size, so with larger samples does this lead to both larger value of Chi^2 statistic and likelihood of being significant (Kline, 2010). The

goodness of fit index for the default model was .93, the *comparative fit index* was .92, the *incremental fit index* was .94, and *root mean square error of approximation* was .07. Thus, indicating that the model, after the modifications, was a good-fitting model (see Figure 2). For boys, quality of sleep could explain the variance of psychophysiological problems ($R^2 = .32$), negative affect ($R^2 = .19$), energy ($R^2 = .13$), and Type A-personality ($R^2 = .35$). And for girls, quality of sleep could explain the variance of psychophysiological problems ($R^2 = .53$), positive affect ($R^2 = .29$), negative affect ($R^2 = .26$), and stress ($R^2 = .29$). See Figure 2 and Table 3 for the details.

Study III

Methods and materials

Participants and Procedure

The participants were three hundred and twenty-five pupils with a mean age of 17.78 ($SD = 0.80$) years (197 male, 128 female) from a high school

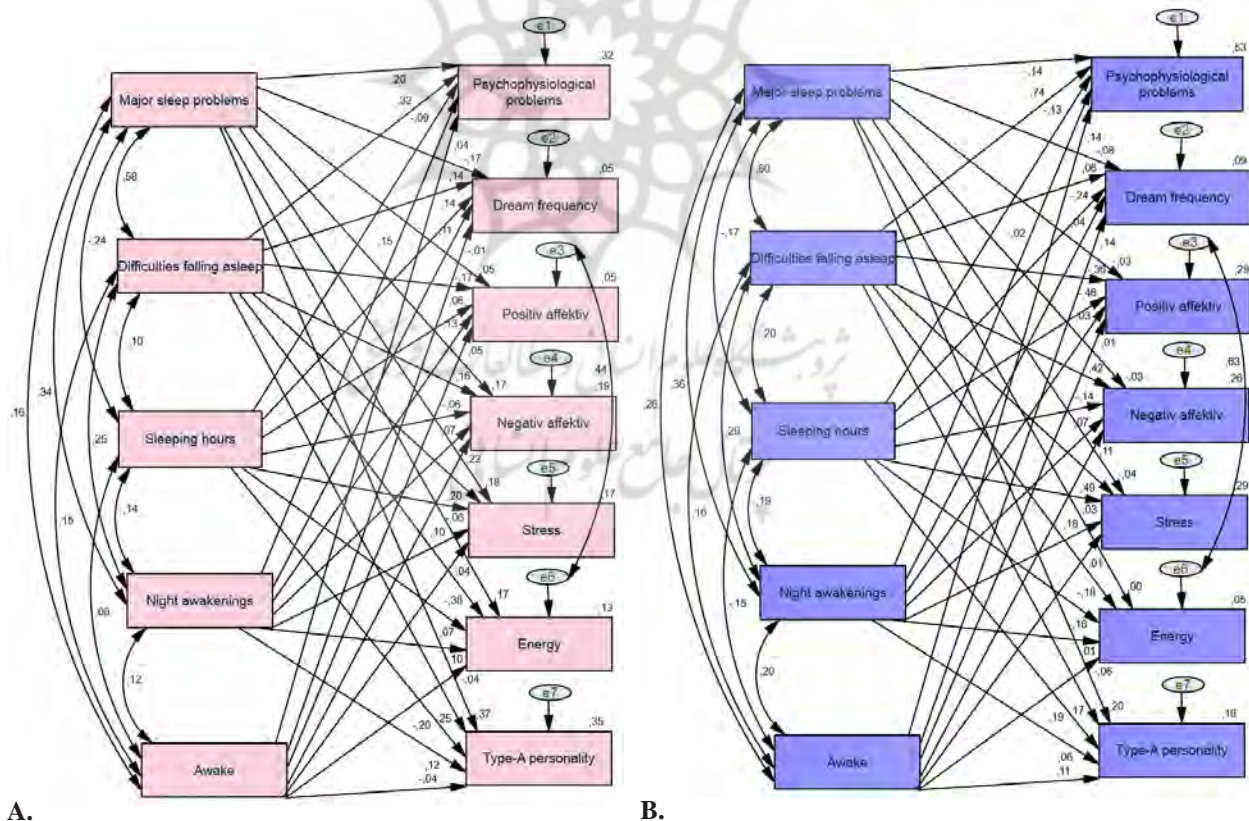


Figure 2. Structural equation model in Study I of the relationship between sleep quality and (A) boys' ($n = 94$) and (B) girls' ($n = 47$) psychophysiological problems, dream frequency, and emotional states, and Type A-personality.

Note: $Chi^2 = 63.66, df = 40, p < .05$, the *goodness of fit index* was .93, the *comparative fit index* was .92, the *incremental fit index* was .94, and *root mean square error of approximation* was .07.

Table 3. Results of the structural equation model in Study II using sleep quality as the predictor of boys' ($n = 94$) and of girls' ($n = 47$) psychophysiological problems, dream frequency, emotional states, and Type A-personality.

| Predictor | Outcome | Boys ($n = 94$) | | | | | Girls ($n = 47$) | | | | |
|-----------------------------|------------------------------|-------------------|------------|-------------|------------------|----------------|--------------------|------------|-------------|------------------|----------------|
| | | β | SE | B | P | R ² | β | SE | B | P | R ² |
| Major sleep problems | | .20 | .10 | .10 | ns | | -.14 | .09 | -.09 | ns | |
| Difficulties falling asleep | | .32 | .16 | .16 | < .001 | | .74 | .07 | .41 | < .001 | |
| Sleeping hours | Psychophysiological problems | -.09 | .14 | -.17 | ns | .32 | -.13 | .27 | -.34 | ns | .53 |
| Night awakenings | | .15 | .06 | .43 | ns | | -.02 | .34 | -.07 | ns | |
| Awake | | .04 | .05 | .06 | ns | | .14 | .25 | .34 | ns | |
| Major sleep problems | | -.17 | .06 | -.08 | ns | | -.08 | .07 | -.03 | ns | |
| Difficulties falling asleep | Dream frequency | .14 | .06 | .06 | ns | | .06 | .06 | .02 | ns | |
| Sleeping hours | | .14 | .18 | .23 | ns | .05 | -.24 | .22 | -.37 | ns | .09 |
| Night awakenings | | .11 | .27 | .28 | ns | | .04 | .28 | .07 | ns | |
| Awake | | -.01 | .14 | -.02 | ns | | .14 | .21 | .20 | ns | |
| Major sleep problems | Positive affect | .05 | .02 | .01 | ns | | -.03 | .03 | -.01 | ns | |
| Difficulties falling asleep | | -.17 | .02 | -.03 | ns | | -.36 | .02 | -.05 | < .05 | |
| Sleeping hours | | .06 | .06 | .04 | ns | .05 | -.46 | .08 | -.29 | ns | .29 |
| Night awakenings | | -.13 | .10 | -.12 | ns | | -.03 | .10 | .03 | ns | |
| Awake | Negative affect | .05 | .05 | .09 | ns | | .01 | .08 | .01 | ns | |
| Major sleep problems | | .17 | .02 | .02 | ns | | -.03 | .02 | .02 | ns | |
| Difficulties falling asleep | | .16 | .02 | .02 | ns | | .42 | .02 | .02 | < .05 | |
| Sleeping hours | | -.06 | .05 | -.03 | ns | .19 | -.14 | .08 | .08 | ns | .26 |
| Night awakenings | Stress | .07 | .07 | .05 | ns | | .07 | .10 | .10 | ns | |
| Awake | | .22 | .04 | .09 | < .05 | | .11 | .07 | .07 | ns | |
| Major sleep problems | | .18 | .18 | -.03 | ns | | -.04 | .02 | .02 | ns | |
| Difficulties falling asleep | | .20 | .20 | .41 | ns | | .49 | .02 | .02 | < .001 | |
| Sleeping hours | Energy | -.06 | -.06 | -.04 | ns | .17 | .03 | .07 | .07 | ns | .29 |
| Night awakenings | | .10 | .10 | .10 | ns | | .18 | .10 | .10 | ns | |
| Awake | | .04 | .04 | .02 | ns | | .01 | .05 | .05 | ns | |
| Major sleep problems | | .17 | .02 | .03 | ns | | .00 | .04 | .00 | ns | |
| Difficulties falling asleep | Type A-personality | -.38 | .02 | -.06 | < .001 | | -.18 | .03 | -.03 | ns | |
| Sleeping hours | | .07 | .06 | .04 | ns | .13 | -.16 | .11 | -.13 | ns | .05 |
| Night awakenings | | -.10 | .09 | -.08 | ns | | .01 | .14 | .01 | ns | |
| Awake | | -.04 | .05 | -.02 | ns | | -.06 | .10 | -.05 | ns | |
| Major sleep problems | Type A-personality | .37 | .09 | .30 | < .001 | | .20 | .18 | .20 | ns | |
| Difficulties falling asleep | | .25 | .08 | .20 | < .05 | | .17 | .14 | .14 | ns | |
| Sleeping hours | | -.20 | .27 | -.60 | < .05 | .35 | .19 | .54 | .72 | ns | .16 |
| Night awakenings | | -.12 | .40 | -.52 | ns | | .06 | .68 | .27 | ns | |
| Awake | | -.04 | .22 | -.10 | ns | | .11 | .51 | .39 | ns | |

Note: Significant regression weights are shown in bold type.

in the west of Sweden. The procedure followed the same protocol as in Study I and II.

Measures

Sleep quality, psychophysiological problems, dream frequency, and affective states (positive affect, negative affect, stress, and energy) were measured using the same instruments as in Study I.

Personality. The Temperament and Character Inventory (Cloninger et al., 1994) was designed to measure the two personality domains in Cloninger's biopsychosocial model of personality. The four temperament dimensions are: novelty seeking, harm avoidance, reward dependence, and persistence. The three character dimensions are: self-directedness, cooperativeness and self-transcendence. The test

consists of 238 statements with binary answers (yes, no). The *Cronbach's alpha* for the seven personality dimensions were between .71-.80.

Results

Differences between gender

In the MANOVA, the independent factors were gender while the dependent factors were major sleep problems, difficulties falling asleep, sleeping hours, night awakenings, awake, psychophysiological problems, dream frequency, positive affect, negative affect, stress, energy, novelty seeking, harm avoidance, reward dependence, persistence, self-directedness, cooperativeness and self-transcendence. Gender had a significant effect on these variables ($F(18,304) = 7.92; p < .001$, *Pillai's Trace* = .32). Girls scored higher in major sleep problems ($F(1,321) = 24.91, p < .001$), difficulties falling asleep ($F(1,321) = 55.44, p < .001$), night awakenings ($F(1,321) = 11.99, p < .001$), psychophysiological problems ($F(1,153) = 54.40, p < .001$), dream frequency ($F(1,321) = 26.41, p < .01$), negative affect ($F(1,321) = 28.44, p < .01$), and stress ($F(1,321) = 24.41, p < .00$). Boys scored higher in sleeping hours ($F(1,321) = 5.74, p < .05$), positive affect ($F(1,321) = 8.97, p < .01$), novelty seeking ($F(1,321) = 4.16, p < .05$), harm avoidance ($F(1,321) = 23.91, p < .001$), and persistence ($F(1,321) = 9.28, p < .01$). See Table 1 for the details.

Multi-group moderation analysis

Psychophysiological problems, dream frequency, and emotional states. The structural equation model analysis using quality of sleep as the independent variable and psychophysiological problems, dream frequency, and emotional states as the dependent variable showed that Chi^2 value was significant ($Chi^2 = 169.47, df = 30, p < .001$), the *goodness of fit index* was .92, the *comparative fit index* was .83, the *incremental fit index* was .84, and *root mean square error of approximation* was .12. Thus, indicating that the model was not a good-fitting model.

After modifying the model by adding covariances between some errors we could obtain a better fitting for this model. The Chi^2 value of the model was smaller but still significant ($Chi^2=90.90, df=24,$

$p<.001$). Nevertheless, the Chi^2 statistic is influenced by sample size, so with larger samples does this lead to both larger value of Chi^2 statistic and likelihood of being significant (Kline, 2010). The *goodness of fit index* for the default model was .95, the *comparative fit index* was .92, the *incremental fit index* was .93, and *root mean square error of approximation* was .09. Thus, indicating that the model, after the modifications, was a good-fitting model (see Figure 3). For boys, quality of sleep could explain the variance of psychophysiological problems ($R^2 = .37$), dream frequency ($R^2 = .11$), negative affect ($R^2 = .26$), stress ($R^2 = .22$), and energy ($R^2 = .07$). For girls, quality of sleep could explain the variance of psychophysiological problems ($R^2 = .58$), dream frequency ($R^2 = .10$), positive affect ($R^2 = .16$), negative affect ($R^2 = .38$), stress ($R^2 = .17$), and energy ($R^2 = .21$). See Figure 3 and Table 4 for the details.

Personality. The structural equation model analysis using quality of sleep as the independent variable and temperament and character as the dependent variable showed that Chi^2 value was significant ($Chi^2 = 1000.62, df = 42, p < .001$), the *goodness of fit index* was .53, the *comparative fit index* was .28, the *incremental fit index* was .33, and *root mean square error of approximation* was .27. Thus, the *fit index* indicates that the model is not a good-fitting model.

After modifying the model by adding covariances between some errors and between some regression weights we could obtain a better fitting for this model. The Chi^2 value of the model was smaller but still significant ($Chi^2 = 58.38, df = 16, p < .001$). Nevertheless, the Chi^2 statistic is influenced by sample size, so with larger samples does this lead to both larger value of Chi^2 statistic and likelihood of being significant (Kline, 2010). The *goodness of fit index* for the default model was .97, the *comparative fit index* was .97, the *incremental fit index* was .97, the *normed fit index* was .96 and *root mean square error of approximation* was .09. Thus, indicating that the model, after the modifications, was a good-fitting model (see Figure 4).

For boys, quality of sleep could significantly explain the variance of novelty seeking ($R^2 = .49$), harm avoidance ($R^2 = .54$), reward dependence ($R^2 =$

.22), and self-directedness ($R^2 = .49$). For girls, quality of sleep could explain the variance of novelty seeking ($R^2 = .33$), reward dependence ($R^2 = .22$), persistence ($R^2 = .39$), and self-directedness ($R^2 = .49$). See Figure 4 and Table 5 for the details.

Discussion and Conclusion

The present study investigated, using three samples of adolescents, gender differences in quality of sleep, psychophysiological problems, dream frequency, and emotional states (Study I-III). We also investigated gender differences in personality traits (Study II: A Type-personality, Study III: temperament and character) and if the effect of quality of sleep on psychophysiological problems, dream frequency, emotional states, and personality traits was moderated by gender.

With respect to gender differences in quality of sleep and across all three studies, girls reported higher levels of major sleep problems, difficulties falling asleep, and night awakenings. In addition,

girls also reported more psychophysiological problems and dream frequency. With respect to gender differences in emotional states, girls reported higher levels of negative affect, depression, and stress. Finally, for personality, while girls scored higher in Type A-personality, boys scored higher in novelty seeking, harm avoidance, and persistence. All these results resonate with those findings among adults; females express more negative affect, stress, and Type A-personality. Additionally, earlier research points out to complex interaction between negative affect, psychosomatic symptoms, breathing pattern, and gender (e.g., Schütz, 2015; Han et al., 2000). In other words, our findings replicate in adolescents the differences found among adults.

At a general level, quality of sleep was related to boys' reported psychophysiological problems, negative affect, stress, Type A-personality, novelty seeking, harm avoidance, reward dependence, and self-directedness. Girls' quality of sleep was related to their scores in psychophysiological problems, dream

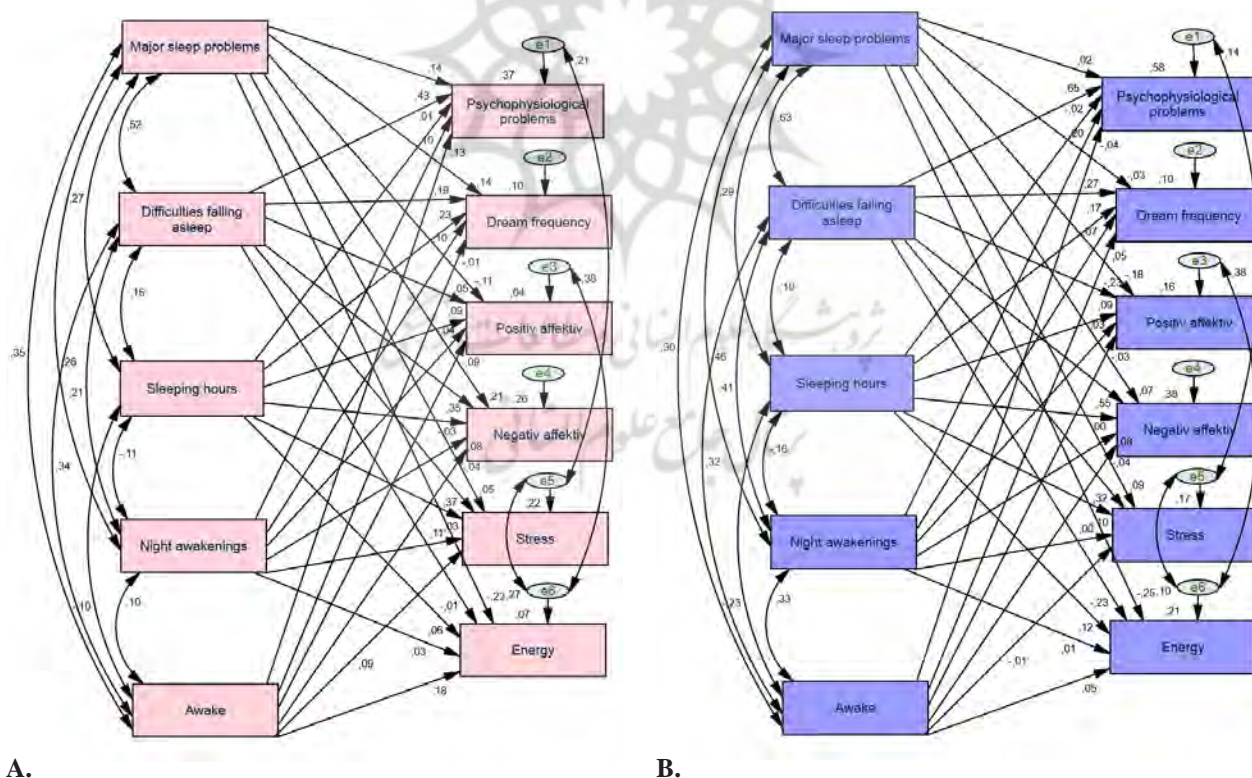


Figure 3. Structural equation model in Study I of the relationship between sleep quality and (A) boys' ($n = 195$) and (B) girls' ($n = 128$) psychophysiological problems, dream frequency, and emotional states.

Note: $\chi^2 = 90.90$ $df = 24$, $p < .001$, the goodness of fit index was .95, the comparative fit index was .92, the incremental fit index was .93, and root mean square error of approximation was .09.

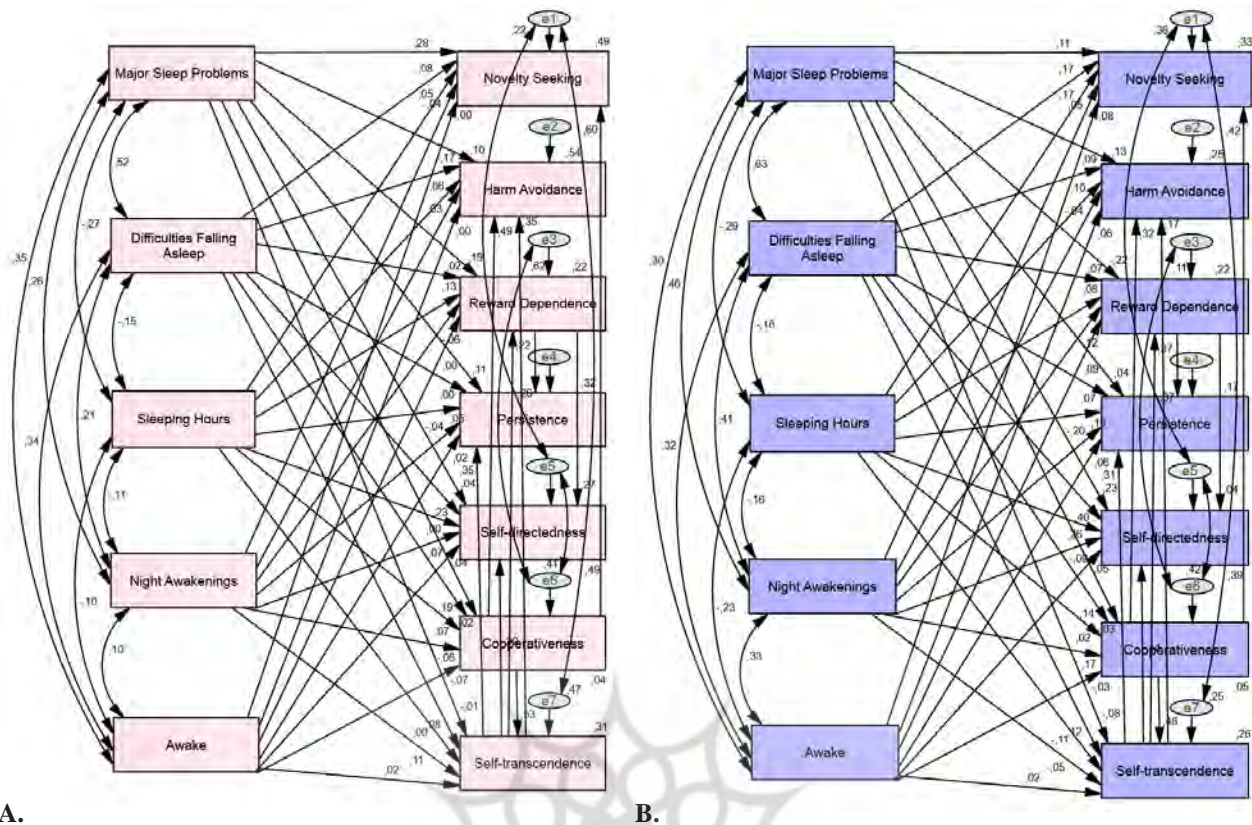
Table 4. Results of the structural equation model in Study III using sleep quality as the predictor of boys' ($n = 195$) and of girls' ($n = 128$) psychophysiological problems, dream frequency, and emotional states.

| Predictor | Outcome | Boys ($n = 195$) | | | | | Girls ($n = 128$) | | | | |
|-----------------------------|------------------------------|--------------------|------------|------------|------------------|------------|---------------------|------------|-------------|-----------------|------------|
| | | β | SE | B | P | R^2 | β | SE | B | P | R^2 |
| Major sleep problems | Psychophysiological problems | .14 | .04 | .07 | < .05 | <i>.37</i> | .02 | .05 | .14 | <i>ns</i> | <i>.58</i> |
| Difficulties falling asleep | | .43 | .03 | .20 | < .001 | | .65 | .04 | .36 | < | |
| Sleeping hours | | .00 | .11 | .01 | <i>ns</i> | | -.01 | .17 | -.04 | .001 | |
| Night awakenings | | .09 | .14 | .24 | <i>ns</i> | | .20 | .19 | .55 | <i>ns</i> | |
| Awake | | .13 | .08 | .16 | < .05 | | -.04 | .11 | -.07 | < .01 | |
| Major sleep problems | Dream frequency | .14 | .08 | .07 | <i>ns</i> | <i>.11</i> | -.02 | .05 | -.01 | <i>ns</i> | <i>.10</i> |
| Difficulties falling asleep | | .19 | .01 | .08 | < .05 | | .27 | .04 | .10 | < .05 | |
| Sleeping hours | | .23 | .18 | .39 | < .001 | | .17 | .16 | .30 | <i>ns</i> | |
| Night awakenings | | -.10 | .38 | -.23 | <i>ns</i> | | .07 | .18 | .13 | <i>ns</i> | |
| Awake | | -.01 | .13 | -.01 | <i>ns</i> | | .05 | .10 | .05 | <i>ns</i> | |
| Major sleep problems | Positive affect | -.11 | .01 | -.02 | <i>ns</i> | <i>.04</i> | -.18 | .02 | -.03 | <i>ns</i> | <i>.16</i> |
| Difficulties falling asleep | | .05 | .01 | .01 | <i>ns</i> | | -.23 | .01 | -.03 | < .05 | |
| Sleeping hours | | .09 | .04 | .04 | <i>ns</i> | | .09 | .05 | .05 | <i>ns</i> | |
| Night awakenings | | -.04 | .05 | -.03 | <i>ns</i> | | .03 | .05 | .02 | <i>ns</i> | |
| Awake | | -.09 | .03 | -.03 | <i>ns</i> | | -.03 | .03 | -.01 | <i>ns</i> | |
| Major sleep problems | Negative affect | .21 | .03 | .03 | < .01 | <i>.26</i> | .07 | .01 | .01 | <i>ns</i> | <i>.38</i> |
| Difficulties falling asleep | | .35 | .04 | .04 | < .001 | | .55 | .01 | .06 | < | |
| Sleeping hours | | -.03 | -.01 | -.01 | <i>ns</i> | | .00 | .04 | .00 | .001 | |
| Night awakenings | | .08 | .05 | .05 | <i>ns</i> | | .08 | .04 | .05 | <i>ns</i> | |
| Awake | | -.04 | -.01 | -.01 | <i>ns</i> | | -.04 | -.01 | -.01 | <i>ns</i> | |
| Major sleep problems | Stress | .06 | .02 | .01 | <i>ns</i> | <i>.22</i> | .09 | .02 | .02 | <i>ns</i> | <i>.17</i> |
| Difficulties falling asleep | | .37 | .02 | .08 | < .001 | | .32 | .02 | .06 | <i>ns</i> | |
| Sleeping hours | | .03 | .06 | .03 | <i>ns</i> | | -.10 | .08 | -.10 | < .05 | |
| Night awakenings | | .10 | .07 | .12 | <i>ns</i> | | .00 | .09 | .00 | <i>ns</i> | |
| Awake | | .09 | .04 | .05 | <i>ns</i> | | -.01 | .06 | -.01 | <i>ns</i> | |
| Major sleep problems | Energy | -.23 | .02 | -.05 | <i>ns</i> | <i>.07</i> | -.25 | .02 | -.04 | < .05 | <i>.21</i> |
| Difficulties falling asleep | | -.01 | .00 | .00 | <i>ns</i> | | -.22 | .02 | -.03 | < .05 | |
| Sleeping hours | | .06 | .05 | .05 | <i>ns</i> | | .17 | .06 | .08 | <i>ns</i> | |
| Night awakenings | | -.03 | .07 | -.03 | <i>ns</i> | | .01 | .01 | .02 | <i>ns</i> | |
| Awake | | .18 | .04 | .09 | < .05 | | .05 | .04 | .01 | <i>ns</i> | |

Note: Significant regression weights are shown in bold type.

frequency, positive affect, negative affect, stress, novelty seeking, reward dependence, persistence, and self-directedness. That is, gender moderated the relationship between quality of sleep and dream frequency, positive affect, Type A-personality, and persistence. Some of our findings go in line with gender differences found among adults. For example, for boys in contrast to girls bad quality of sleep does not hold the same risk in influencing typical Type A-personality behaviour, such as, aggressiveness, hostility, and impatience (Schütz, Garcia & Archer,

2014). On the other hand, to the best of our knowledge, no other study has shown the patterns between sleep quality and personality found here. When it come to girls, for example, their ability to be self-acceptant, goal-oriented, and self-controlling (i.e., high levels of self-directedness) increases when they experience major sleep problems, have difficulties falling asleep, and the amount of sleep hours. Although paradoxically at a first sight, these findings are actually in line with studies showing that females have more sleep disturbances than males (Breslau et al., 1996) and



A.

B.

Figure 4. Structural equation model in Study I of the relationship between sleep quality and (A) boys' ($n = 195$) and (B) girls' ($n = 128$) temperament and character.

Note: $\chi^2 = 58.38$, $df = 16$, $p < .001$, the goodness of fit index was .97, the comparative fit index was .97, the incremental fit index was .97, the normed fit index was .96 and root mean square error of approximation was .09.

at the same time are more goal-oriented at school (Garcia, Jimmefors, Mousavi, Adrianson, Rosenberg & Archer, 2015). Importantly, while bad quality of sleep made boys more attentive to social rewards (i.e., high reward dependence), it influenced girls in the other direction. This phenomenon has, as far as we know, not been present in earlier research and therefore needs to be explored in future venues (see for example Steffen & Bowden, 2006, who showed that sleep disturbance mediated the way individuals think they are perceived by their social environment and symptoms of depression). Finally, although boys scored higher in persistence, this temperament trait or rather the tendency to not giving up and being a perfectionist was not related to the quality of sleep they are getting on a daily basis. In contrast, more sleeping hours and less night awakenings increased girls' persistent behaviour. Suggesting that, at least in adolescence, changes in life style (e.g., sleeping more hours) might positively influence females' tendency to be persistent, but not for boys (cf. Krystal, 2007).

Concluding remarks

The present study found, in three different samples, that girls showed the unhealthiest sleep-physiological-emotional-personality profile. These findings are in accordance to those found among adults. Gender moderated the relationship between quality of sleep and dream frequency, positive affect, Type A-personality, harm avoidance, and persistence. Even when quality of sleep was related to psychophysiological problems or the same emotional states and personality traits across gender, different constructs of quality of sleep were influencing the outcome. For example, for both boys and girls, quality of sleep was associated to psychophysiological problems. However, while the quality of sleep construct "difficulties falling asleep" was the common denominator influencing psychophysiological problems among both boys and girls, for girls the number of sleeping hours and night awakenings influenced the recurrence of heart-flutters, aches and pains, shakiness in the legs,

Table 5. Results of the structural equation model in Study III using sleep quality as the predictor of boys' ($n = 195$) and of girls' ($n = 128$) temperament and character traits.

| Predictor | Outcome | Boys ($n = 195$) | | | | | Girls ($n = 128$) | | | | |
|-----------------------------|--------------------|--------------------|------------|-------------|-----------------|----------------|---------------------|------------|-------------|-----------------|----------------|
| | | β | SE | B | P | R ² | β | SE | B | P | R ² |
| Major sleep problems | | .28 | .07 | .29 | <.001 | | .11 | .09 | .11 | ns | |
| Difficulties falling asleep | | .08 | .06 | .08 | ns | | .17 | .07 | .13 | ns | |
| Sleeping hours | Novelty seeking | .05 | .21 | .18 | ns | .49 | .17 | .29 | .64 | <.05 | .33 |
| Night awakenings | | -.04 | .27 | -.19 | ns | | .05 | .33 | .19 | ns | |
| Awake | | .00 | .14 | -.01 | ns | | .08 | .19 | .18 | ns | |
| Major sleep problems | | .10 | .05 | .08 | ns | | .13 | .09 | .11 | ns | |
| Difficulties falling asleep | Harm avoidance | -.17 | .05 | -.13 | <.001 | | .09 | .07 | .06 | ns | |
| Sleeping hours | | .06 | .15 | .17 | ns | .54 | .10 | .27 | .34 | ns | .25 |
| Night awakenings | | .03 | .20 | .13 | ns | | -.04 | .30 | -.13 | ns | |
| Awake | | .00 | .10 | .00 | ns | | .06 | .17 | .12 | ns | |
| Major sleep problems | | .19 | .05 | .12 | <.05 | | -.22 | .06 | -.12 | <.05 | |
| Difficulties falling asleep | Reward dependence | .02 | .05 | .01 | ns | | .07 | .05 | .03 | ns | |
| Sleeping hours | | .13 | .15 | .31 | <.05 | .22 | .08 | .19 | .17 | ns | .22 |
| Night awakenings | | -.06 | .20 | -.19 | ns | | .12 | .21 | .27 | ns | |
| Awake | | .00 | .11 | -.01 | ns | | .09 | .12 | .12 | ns | |
| Major sleep problems | | .11 | .03 | .04 | ns | | .04 | .04 | .01 | ns | |
| Difficulties falling asleep | Persistence | .00 | .02 | .00 | ns | | .07 | .03 | .02 | ns | |
| Sleeping hours | | .05 | .08 | .06 | ns | .32 | .18 | .11 | .23 | <.05 | .17 |
| Night awakenings | | -.04 | .11 | -.06 | ns | | -.20 | .12 | -.26 | <.05 | |
| Awake | | .02 | .05 | .02 | ns | | .06 | .07 | .05 | ns | |
| Major sleep problems | | .04 | .08 | .05 | ns | | .23 | .11 | .25 | <.05 | |
| Difficulties falling asleep | Self-directedness | .23 | .07 | .26 | <.001 | | .40 | .08 | .35 | <.001 | |
| Sleeping hours | | .00 | .24 | -.01 | ns | .22 | .26 | .32 | 1.15 | <.001 | .39 |
| Night awakenings | | .07 | .31 | .43 | ns | | -.09 | .36 | -.41 | ns | |
| Awake | | .04 | .16 | .13 | ns | | .05 | .21 | .13 | ns | |
| Major sleep problems | | .02 | .09 | .02 | ns | | -.03 | .09 | -.03 | ns | |
| Difficulties falling asleep | Cooperativeness | .19 | .08 | .17 | ns | | .14 | .07 | .08 | ns | |
| Sleeping hours | | .07 | .26 | .26 | ns | .04 | .02 | .28 | .06 | ns | .05 |
| Night awakenings | | -.06 | .34 | -.27 | ns | | .17 | .31 | .53 | ns | |
| Awake | | -.07 | .18 | -.17 | ns | | -.03 | .18 | -.05 | ns | |
| Major sleep problems | | -.01 | .09 | -.02 | ns | | .00 | .10 | -.07 | ns | |
| Difficulties falling asleep | Self-transcendence | .08 | .08 | .09 | ns | | .12 | .08 | .09 | ns | |
| Sleeping hours | | .00 | .28 | .01 | ns | .31 | -.11 | .31 | -.42 | ns | .26 |
| Night awakenings | | .11 | .36 | .63 | ns | | -.05 | .35 | -.18 | ns | |
| Awake | | .02 | .19 | .07 | ns | | .02 | .20 | .04 | ns | |

Note: Significant regression weights are shown in bold type.

and feelings of anxiety (i.e., psychophysiological problems).

At the end, we give here deeper knowledge about how sleep quality is associated to positive psychophysiological, emotional, and personal patterns for boys and girls. For both boys and girls, good quality of sleep or "beauty sleep" might result in less psychophysiological problems, less negative

affect, less stress, less novelty seeking, and less self-directedness. However, for boys, "sleeping beauty" would also comprise less Type A-behaviour, less harm avoidance, and more reward dependence, while for girls "sleeping beauty" would also comprise less frequency of vivid dreams, more positive affect, less reward dependence, and more persistent behaviour.

References

- Archer, T., Adolfsson, B., & Karlsson, E. (2008) Affective personality as cognitive emotional presymptom profiles regulatory for self-reported health predispositions. *Neurotoxicity Research*, 14, 1-25.
- Balkin, T. J., Rupp, T., Piccioni, D., & Wesensten, N. J. (2008). Sleep loss and sleepiness: current issues. *Chest* 134, 653-660.
- Barton J, Spelten E, Totterdell P, Smith L, & Folkard S. (1995). Is there an optimum number of night shifts? Relationship between sleep, health and well-being. *Work Stress*, 9, 109-23.
- Beck, A. T., Steer, R. A., & Garbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: twenty-five years of evaluation. *Clinical Psychological Reviews*, 8, 77-100.
- Breslau, N., Roth, T., Rosenthal, L., & Andreski, P. (1996). Sleep disturbance and psychiatric disorders: a longitudinal epidemiological study of young adults. *Biological Psychiatry*, 39, 411-418.
- Brown, C, Schulberg, H. C., & Madonia, M. J. (1995). Assessing depression in primary care practice with the Beck Depression Inventory and the Hamilton Rating Scale for Depression. *Psychological Assessment*, 7, 59-65.
- Carmichael, C. L., & Reis, H. T. (2005) Attachment, sleep quality, and depression affect. *Health Psychology*, 24, 526-531.
- Clark L. A, & Watson D. (1991). Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology* 100:316-336
- Cloninger, C. R. (2004). *Feeling good: The science of well-being*. New York: Oxford University Press.
- Cloninger, C. R. (2012, March). Science of Well-Being: How to be healthy, happy, & fulfilled in the face of current world challenges. Lecture conducted from the University of Gothenburg, Gothenburg, Sweden.
- Cloninger, C. R., Przybeck, T. R., Svrakic, D. M., & Wetzel, R. D. (1994). The temperament and character inventory (TCI): a guide to its development and use. St. Louis, Missouri Center for Psychobiology of Personality: Washington University; 1994.
- Cohen, S., & Edwards, J. R. (1989). Personality characteristics as moderators of the relationship between stress and disorder. In R. W. Neufeld (Ed.), *Advances in the Investigation of Psychological Stress* (pp. 235-283). New York: John Wiley & Sons.
- Dement, W. C., & Vaughan, C. (2000). *The Promise of Sleep: A Pioneer in Sleep Medicine Explores the Vital Connection Between Health, Happiness, and a Good Night's Sleep*. Delacourt Press.
- Drieling, T., van Calker, D., & Hecht, H. (2006) Stress, personality and depressive symptoms in a 6.5 year follow-up of subjects at familial risk for affective disorders and controls. *Journal of Affective Disorders*, 91, 195-203.
- Ebmeier, K. P., Donaghey, C., & Steele, D (2006) Recent developments and current controversies in depression. *Lancet*, 367, 153-167.
- Friedman, H. S., & Booth-Kewley, S. (1988). Validity of the Type-A construct: a reprise. *Psychological Bulletin*, 104, 381-384.
- Garcia, D., Anckarsäter, H., & Lundström, S. (2013). Self-directedness and Cooperativeness, Psychosocial Dysfunction and Suffering in ESSENCE. *The Scientific World Journal*. DOI: 10.1155/2013/416981.
- Garcia, D., Jimmefors, A., Mousavi, F., Adrianson, L., Rosenberg, P., & Archer, T. (2015). Self-regulatory Mode (Locomotion and Assessment), Well-Being (Subjective and Psychological), and exercise behavior (Frequency and Intensity) in Relation to High School Pupils' Academic Achievement. *PeerJ* 3:e847. DOI: 10.7717/peerj.847.
- Garcia, D., Lundström, S., Brändström, S., Råstam, M., Cloninger, C. R., Kerekes, N., Nilsson, T., & Anckarsäter, H. (2013). Temperament and Character in the Child and Adolescent Twin Study in Sweden (CATSS): Comparison to the General Population, and Genetic Structure Analysis. *PLoS ONE* 8(8): e70475. DOI: 10.1371/journal.pone.0070475.
- Garcia, D., Nima, A. A., & Archer, T. (2013). International note: Temperament and Character's Relationship to Subjective Well-Being in Salvadorian Adolescents and Young Adults. *Journal of Adolescence*, 36, 1115-1119. DOI: 10.1016/j.adolescence.2013.08.018.
- Gruzca, R. A., Przybeck, T. R., Spitznagel, E. L., & Cloninger, C. R. (2003). Personality and depressive symptoms: a multi-dimensional analysis. *Journal of Affective Disorders*, 74, 123-130.
- Hamilton, N. A., Catley D., & Karlsson, C (2007). Sleep and the affective response to stress and pain. *Health*

- Psychology*, 26, 288-295.
- Han, J. N., Schepers, R., Stegen, K., Van den Bergh, & Van de Woestijne, K. P. (2000). Psychosomatic symptoms and breathing pattern. *Journal of Psychosomatic Research*, 49, 319-333.
- Hayer C. A., & Hicks, R. A. (1993) Type A-B scores and insomnia among college students: a replication and extension of earlier studies. *Perceptual and Motor Skills*, 77, 1265-1266.
- Hetta, J., Almqvist, M., Ågren, H., Hambert, G., Liljeborg, G. B., & Roos, B. E. (1985). Prevalence of sleep disturbances and related symptoms in a middle-aged Swedish population. In *Sleep '84*, W.P. Koella, E. Ruther & H. Schultz (Eds.), pp. 373-376, Stuttgart: Gustaf Fischer Förlag.
- Kawachi, I., Sparrow, D., Kubzansky, L.D., Spiro, A., Vokonas, P.S., & Weiss, S.T. (1998). Propective study of a self-report Type A scale and risk of coronary heart disease: test of the MMPI-2 Type A scale. *Circulation*, 98, 405-412.
- Kjellberg, A., & Iwanowski, S. (1989). *Stress/energiformuläret: Utveckling av en metod för skattning av sinnesstämning i arbetet. [Stress/energy questionnaire: development of a method for studying mood at work]*. Enheten för psykofysiologi, Arbetsmiljöinstitutet [Unit of Psychophysiology, Institute for the Work Environment]. Solna, Sweden.: (Undersökningsrapport 1989:26).
- Kline, R. B. (2010). *Principles and practice of structural equation modeling.*, 3rd ed. New York, NY, US: Guilford Press.
- Krystal, A. D. (2007) Treating the health, quality of life, and functional impairments in insomnia. *Journal of Clinical Sleep Medicine*, 3, 63-72.
- Munakata, K., Fujii, K., Nanko, S., Kunugi, H., & Kato, T. (2007) Sequence and functional analyses of mtDNA in a maternally inherited family with bipolar disorder and depression. *Mutat Res* 617, 119-124.
- Nielsen, T., Stenstrom, P., Takeuchi, T., Saucier, S., Lara-Carrasco, J., Solomonova, E., & Martel, E. (2005). Partial REM-Sleep Deprivation Increases the Dream-Like Quality of Mentation From REM Sleep and Sleep Onset. *Sleep*, 28, 1083-1089.
- Ohayon, M. M., Zuley, J., Guilleminault, C., Smirne, S., & Priest, R. G. (2001) How age and daytime activities are related to insomnia in the general population: consequences for older people. *Journal of the American Geriatric Society*, 49, 360-366.
- Orzel-Gryglewska, J. (2010). Consequences of sleep deprivation. *International Journal of Occupational Medicine and Environmental Health*, 23(1), 95-114.
- Park, Y. M., Matsumoto, K., Shinkoda, H., Nagashima, H., Kang, M. J., & Seo, Y. J. (2001). Age and gender difference in habitual sleep-wake rhythm. *Psychiatry clin Neurosci*, 55, 201-202.
- Parkes, K. (2002) Age, smoking and negative affectivity as predictors of sleep patterns among shift workers in two environments. *Journal of Occupational Health Psychology*, 7, 156-173.
- Patterson, P. D., Suffoletto, B. P., Kupas, D. F., Weaver, M. D., & Hostler, D. (2010) Sleep quality and fatigue among prehospital providers. *Prehosp Emerg Care*. 14(2):187-193.
- Schütz E. (2015). The affective profiles model: ill-being and well-being. Ph.D thesis, University of Gothenburg, Gothenburg, Sweden
- Schütz, E., Archer, T., & Garcia, D. (2013). Character Profiles and Adolescents' Self-reported Affect. *Personality and Individual Differences*, 54, 841-844. DOI: 10.1016/j.paid.2012.12.020.
- Schütz, E., Garcia, D., & Archer, T. (2014). Affective State, Stress, and Type A-personality as a Function of Gender and Affective Profiles. *International Journal of Research Studies in Psychology*, 3, 51-64. DOI: 10.5861/ijrsp.2013.450
- Steffen, P. R., & Bowden, M. (2006) Sleep disturbance mediates the relationship between perceived racism and depressive symptoms. *Ethnic Disorders*, 16, 16-21.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect. The PANAS scale. *Journal of Personality and Social Psychology*, 54, 1063-1070.
- Zohar A. H., Cloninger, C. R., & McCraty, R. (2013). Personality and heart rate variability: exploring pathways from personality to cardiac coherence and health. *Open Journal of Social Sciences*, 1:32-39. DOI: 10.4236/jss.2013.16007
- Åkerstedt, T. (2005) Shift work and sleep disorders. *Sleep*, 28, 9-11.