2018

Sleep problems among higher educational students, working towards solutions.

Monique van Weeren

Student number: 2544731

Student Health Services

Bureau Studentenartsen
Oude Turfmarkt 1511012 CG Amsterdam
Universiteit van Amsterdam

On-site supervisors
Dr. Claudia M. van der Heijde
T: +31 (0)20 5255306
E: c.m.vanderheijde@uva.nl

Peter Vonk, M.D.
T: +31 (0)20 5254771
E: p.vonk@uva.nl

Vrije Universiteit Amsterdam

Management, Policy-Analysis and Entrepreneurship in Health and Life Sciences
Specialization: Policy
February – June 2018

VU-supervisor: Nina Cohen
E: n.e.cohen@vu.nl

Huisartsenpraktijk UvA

Preface and acknowledgements

This research was conducted through an internship at the Student Health Service of the University of Amsterdam for my master Management, Policy-analysis and Entrepreneurship in the Health and Life Sciences with the specialization policy at the Vrije Universiteit Amsterdam. The Student Health Service is a general practitioners practice with, amongst others, expertise in students. In addition to the practice, the section development, research and prevention conducts research into student health, eHealth related topics and general practice relevant issues.

I would like to thank Claudia van der Heijde and Peter Vonk for the opportunity to conduct my internship at the Student Health Service. Both gave me supportive feedback which continuously led to the improvement my report and I learned a lot on conducting survey research. Furthermore, I would like to thank Claudia for her time and effort but especially for the pleasant time I had during my internship. Last, I would also like to thank my VU supervisor Nina Cohen for guiding me in the right direction and providing me instructive feedback.

Executive summary

Introduction and contextual background

There is a growing recognition of the importance of sleep on our health and wellbeing. Short sleep duration and poor quality of sleep is associated with a higher risk of developing several diseases and mental health issues, which leads to a higher mortality risk. In addition to the effects on health, chronic sleep reduction is associated with lower academic achievement and reduced study concentration. Poor sleep has a high prevalence, especially among students; in the Netherlands, when compared to 20-30% of all adults, 54% of the students indicated poor sleep quality.

Although several studies have described the effects of sleep problems among students on health and academic achievement, as yet, no study seems to have been investigating the association between factors and effects of sleep problems on health and academic performance in the same study population. In order to reduce insufficient sleep among students, a better understanding of the associated factors and effects of sleep among students is required. This research aims to obtain a better understanding of sleep problems among higher educational students by gaining insight into the associated factors and effects of sleep problems on health and academic performance in order to make recommendations for policy options. The corresponding main research question is: *What is the extent of sleep problems among students in higher education and what are recommendations to work toward solutions for these problems?*

Theoretical background

In order to explore the associated factors and effects of sleep problems among higher educational students studying in Amsterdam, the model of Grandner, Hale, Moore & Patel (2010) was modified. The model has been further adapted by Watson et al. (2015). For this research, a combination of the Grander and Watson model has been used. The model has been adapted to the specific target group of higher educational students by including factors which are applicable to students. The individual level includes the factors: behavior, sleep need, psychology and sleep beliefs. The social level involves the factors: work, social network, associations, culture and study. Last, the societal level encompasses the factors: policy, technology, environment and society. This last level has mostly an indirect effect on sleep and may be particularly complex to change. Therefore, this study aims to investigates exclusively the factors in the individual level and social level with the exception of the factor policy in the societal level. All factors may have an effect on sleep of students and this may have a further effect on their physical health, mental health and academic performance. Although all factors in the individual and social level are individual perceptions, the factors in the social level are factors that are specific within a specific context caused by the surroundings of the student.

Methods

The design of this study was cross-sectional survey research. An online quantitative survey, termed 'Student Survey' was distributed among students in higher education in Amsterdam in order to investigate the extent of sleep problems in this population. The concept sleep was measured through the Pittsburg Sleep Quality Index (PSQI). The survey contained multiple validated scales developed in previous studies to measure associated factors in the individual and social level of the conceptual framework as well as the associated effects on health and academic performance. Participants were recruited through social media and e-mail. In total, 493 students filled out the survey of which 312 completed the survey.

Linear regression analysis determined the association between the factors in the individual level and social level versus sleep. Additionally, linear regression analysis was conducted for the association between sleep and mental health, physical health and academic performance. Backward-selection procedure was performed in order to determine the variables that predicted sleep problems. Multiple variables were examined on confounding during analysis.

In order to examine recommendations to work toward solutions for sleep problems among higher educational students, an small-scale informative qualitative survey, termed 'Expert Survey', was distributed among experts who can advise on policy guidelines in order to improve sleep of students of students. Participants were recruited via e-mail. In total, 24 experts filled out the survey among of which were student advisors/deans, student psychologists, student general practitioners and a researcher. Two frequent discussed policy proposals in literature were assessed on effectivity, feasibility, involvement, contribution and implementation. The first proposal was: schools/universities do not start around 9 o'clock in the morning, but the start times shift to 10 o'clock / 11 o'clock in the morning in order to allow students to sleep longer. The second proposal was: during education, more attention should be paid to education about sleep, and the links with health and performance, in order to increase the knowledge of sleep. Furthermore, respondents were allowed to recommend other policy options that may be potentially improve sleep of students.

Results

The student survey showed that 58.9% of higher educational students suffer from poor sleep quality. In the individual level, the factors that were significantly associated with poor sleep quality were: sleep need, behavior and psychology. In the social level, having a paid job in the evening/night and loneliness were factors that were significantly associated with sleep. Furthermore, having the Chinese and other ethnicity were found to be significant predictors of poor sleep quality. Besides these factors, having a sleep-related disorder was a significant predictor of poor sleep quality, whereas having a sleeping disorder was not found to be significant in the association with sleep quality. Sleep was significant in the association with mental health, suggesting that students who have a poor sleep quality have a higher chance of poor mental health. Furthermore, sleep was not significantly associated with physical health with the exception of vitality and drug use. Additionally, sleep was a significant predictor in the association with academic performance in the current academic year and study concentration, suggesting that students experiencing poor sleep quality have a worse academic performance in the current academic year.

Most experts were more favorable to policy proposal 2, which comprehended more education regarding sleep, on all aspects. Several other options to improve sleep among higher educational students were recommended by the respondents themselves. First, lowering study pressure of students by for example, abolishing the binding study advice in order to reduce stress. Second, extension of student health services and providing more attention to sleep in current services. Third, increasing awareness of the availability of student psychologists and student general practitioners. The last proposal recommended by the respondents was providing more education about the use and effects of drugs on mental and physical health.

Discussion

The aim of this study was to obtain a better understanding of sleep problems among higher educational students by gaining insight into the associated factors and effects of sleep problems on health and academic performance in order to make recommendations for policy options.

In this study, 58.9% of higher educational students suffered from poor sleep quality. Similar numbers were found in former studies among students. Most findings in the individual level and social level were corresponding to literature. However, there were some interesting findings; sleep beliefs, which represented the knowledge of sleep hygiene was not associated with sleep quality. Additionally, physical health with the exception of vitality was not found to be significant in the association with sleep. Last, poor sleep was only a significant predictor of academic performance in the current academic year and not in the past academic year.

Further research is recommended in order to obtain an in-depth understanding of the factors and effects associated with sleep quality. A longitudinal research design with a large sample of students is advised in order to investigate the causal and potential bidirectional relationships between poor sleep, the factors and effects. Furthermore, objective instruments can be used to measure sleep to eliminate bias in self-reported data. Moreover, it is recommended to study the factors and effects of sleep problems in a more diverse study population of higher educational students in order to increase generalization. Last, further research that measures both sleep quantity and sleep quality separately is required to establish the effects of these components independently in order to obtain a more comprehensive understanding.

The expert survey showed that most experts were more favorable regarding policy proposal 2. Therefore, this policy can be further explored in order to improve sleep among students. However, the results of the student survey do not support this policy proposal since there was no significant association found between the factor sleep beliefs and sleep quality. Additionally, previous study regarding the association of sleep hygiene knowledge showed a positive effect on sleep. This suggests that there are still opportunities for improvement concerning the knowledge of sleep.

The link between the factors in association with sleep could be the high demands of social life in combination with study which students often experience. The current society is more performance-oriented and this leads to a high pressure among students in order to meet all the demands which can explain the associated factors and can be at the expense of sleep. Universities may play an important role in lowering this pressure and providing students the needed guidance by giving more attention to the wellbeing of students through the recommendations made by the experts.

Conclusion

This study contributes to a better understanding sleep problems among higher educational students and supports previous findings of factors associated with poor sleep quality and the effects of poor sleep quality on health and academic performance. Furthermore, this study has made several recommendations to solutions for sleep problems of higher educational students. This obtained knowledge can be used in order to target sleep problems among students in higher education as well as improving their health and academic performance.

Contents

I. List of abbreviations and acronyms

ASHS	Adolescent Sleep Hygiene Scale
AUDIT-C	Alcohol Use Disorders Identification Test
CDC	Centre of Disease Control and Prevention
EK-10	Extended Kessler-10
ECTS	European Credit Transfer System
GPA	Grade Point Average
HBO	Hoger Beroepsonderwijs
HvA	University of Applied Sciences Amsterdam
ICSD	International Classification of Sleeping Disorders
LSVB	Landelijke Studentenvakbond
NSWO	Nederlandse vereniging voor Slaap- en Waak Onderzoek
PASS	Perceptions of Academic Stress Scale
PSQI	Pittsburgh Sleep Quality Index
PSS	Perceived Stress Scale
REM	Rapid Eye Movement
SBS	Sleep Beliefs Scale
SCAS	Socio-Cultural Adaptation Scale
SCP	Sociaal Cultureel Planbureau
SHS	Student Health Service
UvA	University of Amsterdam
VU	VU University
WHO	World Health Organization
WO	Wetenschappelijk onderwijs

Table 1: List of abbreviations and acronyms.

II. List of tables

Table 2: List of tables.

III. List of figures

Table 3: List of figures.

1. Introduction

There is a growing recognition of the importance of sleep on our health and wellbeing (Giri, Baviskar & Phalke, 2013). The exact function of sleep remains unknown; however, it is presumed to have important functions such as physical restoration and memory processing (Assefa, Diaz-Abad, Wickwire, Scharf 2015). Among students, one of the most common causes of sleepiness during the day is sleep deprivation. A sleep duration of 7 – 9 hours per night is recommended for young adults, but this recommendation is often not fulfilled (Hirshkowitz et al., 2015). Partial sleep deprivation, or short sleep, is defined as sleep time less of than 6 hours per night and, due to various aspects, occurs regularly among students (Brown, Buboltz & Soper, 2002).

The causes of sleep problems are multifactorial and can be divided into two main categories: behavioral and physical causes. Physical causes of sleep problems are sleeping disorders such as the ones classified by 'The International Classification of Sleeping Disorders' (ICSD-3). Moreover, sleep problems can be caused by lifestyle factors that have a negative effect on sleep, such as caffeine over-consumption or the abuse of drugs and alcohol (Herscher & Chervin, 2014). These behavioral aspects may be particularly apparent in higher educational students since they may be frequently prone to an unhealthy lifestyle (Brandão, Pimentel & Cardoso, 2011; Wang, Xing & Wu, 2013; Dodd, Al-Nakeeb, Nevill & Forschaw, 2010).

Short sleep duration and poor quality of sleep is associated with a higher risk of developing several diseases and mental health issues, which leads to an increase of the mortality risk, even when the symptoms are not considered as a clinical sleeping disorder (Irish, Kline, Gunn, Buysse & Hall, 2015). These diseases include cardiovascular conditions, diabetes and a weakened immune system (Schlarb, Friedrich & Claßen, 2017). In addition to the effects on health, chronic sleep reduction is associated with lower academic achievement and reduced study concentration. In the Netherlands, this correlation has also been demonstrated by the Nederlandse vereniging voor Slaap- en Waak Onderzoek, NSWO (The Dutch Association for Sleep - Wake Research): students in higher education suffering from sleep problems or chronic sleep deprivation tend to have lower grades and more difficulty concentrating compared to those students who sleep sufficiently (van der Heijden et al., 2017). Poor sleep has a high prevalence, especially among students; in the Netherlands, when compared to 20-30% of all adults, 54% of the students indicated poor sleep quality (NHG, 2014; van der Heijden et al., 2017).

Although several studies have described the consequences of sleep problems among students on health and academic achievement, as yet, no study seems to have been investigating the associated factors and effects of sleep problems on health and academic performance in the same study population. In order to reduce insufficient sleep among students, a better understanding of the associated factors and effects of sleep among students is required. Therefore, this research aims to obtain a better understanding of sleep problems among higher educational students by gaining insight into the associated factors and effects of sleep problems on health and academic performance in order to make recommendations for policy options. The corresponding research question is: *What is the extent of sleep problems among students in higher education and what are recommendations to work toward solutions for these problems?*

2. Contextual background

In this section, the contextual information will be provided to frame this research paper. First, the prevalence and regulation of sleep problems among higher educational students will be discussed. Second, the causes of sleep problems will be explained. Third, sleep hygiene recommendations that promote healthy sleep will be discussed. Fourth, the consequences of sleep problems on physical and mental health and academic performance will be explained and last, the actors who can advise on policy guidelines in order to improve the sleep of students will be described.

2.1 Prevalence of sleep problems and regulation of sleep

Several studies have found a significant higher prevalence of sleep problems among higher educational students (Schlarb et al., 2017; Buboltz, Brown & Soper, 2001; Lund, Reider, Whiting & Prichard, 2010). A previous study state that 60% of college students experience poor sleep quality and nearly 7.7% of students serve the criteria for insomnia disorder (Schlarb et al., 2017). There is a similar prevalence of sleep problems among higher educational students in the Netherlands. In a survey research conducted by van der Heijden et al. (2017), 54% of the students indicated a poor sleep quality, compared to 20-30% of all adults (NHG, 2014; van der Heijden et al., 2017).

There are two primary processes that regulates sleep: the circadian rhythm and the homeostatic sleep drive. The circadian system, often called the internal clock regulates sleep/wake cycles and hormonal secretions to induce sleep while the homeostatic sleep drive enhance the need for sleep as the time of wakefulness increases (Herscher & Chervin, 2014). Adolescents and young adults are more likely to have a physiologically delayed circadian rhythm. This change occurs during puberty and results in a preference for later bedtimes and a lower homeostatic sleep drive and therefore, decreased sleepiness (Herscher & Chervin, 2014). Nevertheless, students still need to rise early due to classes or employment which causes sleep insufficiency and this may contribute to the high prevalence of sleep problems among students. There are two sleep stages: rapid eye movement (REM) sleep and non-REM sleep. The exact function of REM sleep remains unknown, but several theories suggest that it is important for brain development and memory formation. In non-REM sleep, the energy homeostasis, cellular maintenance and repair and biosynthetic processes of the body is restored (Vyazovskiy & Delogu, 2014). Non-REM sleep can be further divided in three sub-stages. Each sub-stage is linked to distinct brain waves and neuronal activity. Deep non-REM sleep, also called slow wave sleep, is considered to be the most restorative sleep stage and is associated with sleep maintenance and sleep quality (Dijk, 2009).

2.2 Causes of sleep problems

There are several factors that may cause sleepiness and sleep problems among students. Overall, a distinguish can be made between physical and behavioral causes. In this section, the factors that negatively affect sleep will be discussed. Besides these factors, there are also factors that promote sleep. This will be discussed in chapter 3.4, where the factors of sleep in relation to higher educational students are explained more extensively.

2.2.1 PHYSIOLOGICAL CAUSES

The International Classification of Sleeping Disorders (ICSD-3) is the most widely used classification system for sleeping disorders. Sleeping disorders are defined by: "the difficulty with sleep initiation, duration, consolidation or quality that occurs despite the opportunity and circumstances for sleep, which results in some type of disability during the day" (ICSD-3, 2014). According to the ICSD-3, there are approximately 80 different types of sleeping disorders and they can be classified into six main clinical categories. The core symptoms shared by all of the sleep-wake disorders are daytime distress or impairment such as: fatigue, sleepiness, attentional- or memory complaints, and/or mood disturbance, which impair occupational, social or interpersonal functioning (Thorpy, 2012; Kierlin, Olmstead, Yokomizo, Nicassio & Irwin, 2012). Each category of sleeping disorders will be described briefly.

1. Insomnia disorders
2. Sleep related breathing disorders
3. Central disorders of hypersomnolence
4. Circadian rhythm sleep-wake disorders
5. Sleep-related movement disorders
6. Parasomnias
7. Other sleep disorders

The first category, insomnia, is the most commonly reported sleep problem among college students (Ohayon, 2002; Herscher & Chervin, 2014). Insomnia disorders involves difficulty initiating and/or maintaining sleep. It often includes prolonged periods of nighttime wakefulness and/or insufficient amounts of nighttime sleep (Thorpy, 2012). The ICSD-3 duration criterion for chronic insomnia disorder is 3 months, and it should occur at least 3 times per week to meet the requirements (Sateia, 2014). Second, sleep-related breathing disorders is characterized by a disordered ventilation during sleep. Obstructive sleep apnea is the most common disorder of this type, however, there are also other types of sleep apnea. For example, central sleep apnea which is characterized by a lack of drive to breathe while asleep, resulting in insufficient ventilation and a lower exchange of gas (Eckert, Jordan, Merchia & Malhotra, 2008). Third, the central disorders of hypersomnolence are marked by severe sleepiness during the day, which arise despite normal quality and timing of sleep (Khan & Trotti, 2015). Fourth, circadian rhythm disorders is defined by a chronic or recurrent pattern of sleep and wake disturbance caused by the dysfunction of the circadian rhythm, or misalignment between the timing of the externally demanding social and work cycles and the internal clock (Zhu & Zee, 2012). Fifth, sleep-related movement disorders represents simple and usually stereotyped movements of the body that results into disruption of sleep (Chokroverty & Ferini-Strambi, 2017). Sixth, parasomnias is associated with symptoms of sleepwalking, sleep terrors, sleep talking and sleep paralysis. It is a category of sleep disorders characterized by undesirable physical events or experiences that occur during the onset of sleep, while being asleep, or during awakening from sleep (Fleetham & Fleming, 2014). The last category of sleep disorders classified by the ICSD-3 includes sleep disorders that cannot be properly classified, for example due to overlapping with more than one category (Judd & Sateia, 2017).

2.2.2 Behavioral causes

There are several behaviors that have an influence on sleep. As mentioned before, students may be particularly prone to a lifestyle which is not contributing to sufficient sleep (Brandão et al., 2011; Wang et al., 2013; Dodd et al., 2010). For example, sleep problems can arise from poor sleep behavior such as over-consuming alcohol and caffeine prior to sleep. Herscher and Chervin (2014) reported that approximately four out of five college students drinks alcohol and nearly 40% of young adults indicated binge drinking (4 – 5 drinks) in the last 14 days. This was also stated by a report of the Trimbos Institute for mental health and addiction in the Netherlands, 89.5% of students attending university of applied sciences (hoger beroepsonderwijs; HBO) and university (wetenschappelijk onderwijs; WO) reported occasionally drinking and 27.8% is considered as a heavy drinker (Trimbos, 2015). Furthermore, energy drinks which contain caffeine are becoming increasingly popular. In the study of O'Brien et al. (2008) was found that among 679 college students, 24% have consumed these drinks in the past 30 days. Also, the use of technology before bedtime has an negative effect on sleep (Herscher & Chervin, 2014). The use of technology prior to bed was found to be high among young adults: 67% uses cell phones, 43% music devices, 60% computers, and 18% plays video games. In conclusion, students may have inadequate sleep behavior that, in addition to the delayed circadian rhythm, promote sleep problems (Hersher & Chervin, 2014). As these behaviors can be adapted when suffering from sleeping problems, it is considered as an important target for improvement. There are several so-called sleep hygiene recommendations to promote healthy sleep behavior, which are discussed in the next section.

2.3 Sleep hygiene

Sleep hygiene is defined as multiple behavioral and environmental recommendations in order to encourage healthy sleep (Irish et al., 2015). The most known sleep hygiene recommendation regards caffeine consumption. The advice concerning caffeine is ranging from complete abstinence to avoiding caffeine only in the afternoon or evening (Irish et al., 2015). Similar to caffeine, nicotine use promotes arousal and wakefulness. Sleep hygiene guidelines advice avoidance of nicotine use to stimulate better sleep since scientific evidence suggests that exposure to nicotine is associated with sleep problems (Irish et al., 2015). Furthermore, alcohol use is discouraged, with recommendations ranging from complete abstinence to avoidance of excessive use prior to sleep due to its high negative effect on sleep (Irish et al., 2015; Stepanski & Wyatt, 2003). Moreover, sleep hygiene recommendations often promote regular bed- and/or wake-times. If the sleep timing is consistent, it will maximize the synchrony between physiological sleep drive, circadian rhythms, and the sleep episode at night (Irish et al., 2015). Additionally, regular exercise is a common sleep hygiene recommendation, but exercise is advised to be avoided prior to bedtime (Irish et al., 2015). Daytime napping has also been considered to disturb the homeostatic sleep drive, and sleep hygiene recommendations often include the recommendation to avoid naps of more than 30 minutes (Irish et al., 2015; Stepanski & Wyatt, 2010). Furthermore, several recommendations have emerged over the years stimulating the reduce of worrying and engaging in relaxing activities, particularly before sleep (Irish et al., 2015). Last, the recommendation that is considered as most prominent among higher educational students is the use technology prior to sleep. As mentioned before, the use of technology is high among young adults and it was found to be associated with stress, sleep disturbances and depression (Thomée, Härenstam & Hagberg, 2011; Malone 2011).

2.4 Consequences of sleep problems

Sleep problems have several consequences that may have a negative effect on health and performance. In this chapter, the effects of sleep problems on physical health and mental health will be discussed as well as the effects of sleep problems on academic performance.

2.4.1 Effects on physical and mental health

Since the late '90s, research has changed the principle that sleep problems not only induce sleepiness but may also cause severe health issues. Therefore, it became accepted that good sleep is necessary for both physical health and mental health. Sleep loss has extensive effects on the cardiovascular, nervous, endocrine and immune systems (Colten & Altevogt, 2006). For instance, long-term effects of sleep loss and sleep disorders have been associated with multiple harmful health consequences including an increased risk of developing diabetes, hypertension, heart attack and even stroke (Colten & Altevogt, 2006; Sabanayagam & Shankar, 2010). Sleep deprivation increases sympathetic nervous system activity and this increased activity is considered to serve as a common pathophysiology for the association between sleep loss and cardiovascular diseases (Nagai, Hoshide & Kario, 2010).

Furthermore, sufficient sleep is essential for appetite regulation and normal functioning of daily metabolic and hormonal processes (van Cauter, Spiegel, Tasali & Leproult, 2008). Poor sleep is related to reduced levels of leptin, a hormone produced by an adipose tissue hormone that suppresses appetite and increased levels of ghrelin, a peptide that stimulates appetite (van Cauter et al., 2008; Taheri, Lin, Austin, Young & Mignot, 2004). Therefore, sleep problems are an important risk factor for diabetes and obesity (van Cauter et al., 2008). Last, sleep has a large influence on the strength of the immune system. Sleep deprivation increases susceptibility to infectious diseases and sleep patterns seems to change when the immune system is stimulated. Although it is accepted that the activity of the immune system has an effect on the sleep-wake cycle, very little is known on how these two systems interact (Prather & Leung, 2016).

Besides the effects on physical health, students who are experiencing sleep loss also frequently encounter problems regarding their mental health. In a previous study was found that students having sleep problems often suffer from stress, lower optimism, anxiety, depression, substance abuse and a lower quality of life (Schlarb et al., 2017). It has been acknowledged that there is a bidirectional relationship between psychological issues and sleep problems, meaning that sleep loss can cause mental health issues and vice versa (Owens, 2014). Although it is not entirely clear, underlying neurobiological factors, such as neurotransmitters, may account for the association between sleep and mental health (Bernert & Joiner, 2007).

2.4.2 Effects on academic performance

In addition to the effects on health, sleep problems are often related to poor academic performance. However, students are frequently unaware of how sleep deprivation influences their cognitive functioning (Buboltz et al., 2001). It was found that students who stay up all night before examinations that require critical thinking rated their performances better compared to students who slept 8 hours, although the performance of the students with sleep deprivation was worse (Buboltz et al., 2001). The effects of poor sleep on academic performance will be further discussed in chapter 3.1, where the definitions of academic performance used in this report are explained. Figure 1 shows the significant correlation between the grade point average (GPA) and average number of hours of sleep per night which was found in the study of Lowry, Dean & Meanders (2010). In this study, the four-point GPA grade scale which commonly used in academic grading in the United States was used to measure academic performance (U.S. Department of Education, 2011).

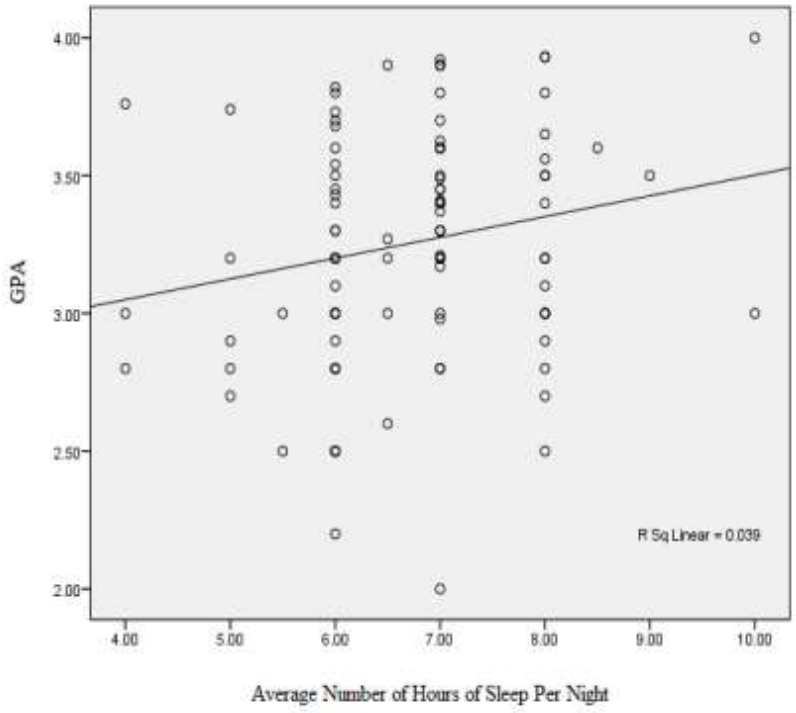

Figure 1: Association between GPA and sleep duration by Lowry et al. (2010).

2.5 Stakeholder map

Several stakeholders may be involved to improve sleep of students and therefore promote their health and academic performance. First, student general practitioners and student psychologists have substantial knowledge of sleep problems among students and may contribute to the development of policy guidelines through the experience of their profession. Second, universities may be involved since previous recommendations regarding the development of policy in order to improve sleep among students often include involvement of educational facilities. Representatives of the university could be student advisors and student deans due to their frequent personal contact with students in combination with their knowledge of study related affairs. Third, researchers with expertise in sleep may be involved. Their scientific knowledge of sleep in relation to higher educational students may be used in order to develop policy guidelines. Last, students themselves have the important task of indicating the issues that they experience in order to identify the key areas of concern.

3. Theoretical background

In this section, the theoretical basis of this study is described. First, the theories of sleep problems on physical health, mental health and academic performance along with their definitions will be discussed. Second, the definition of sleep problems which is used throughout this report will be explained. Third, the factors that were found to affect sleep and therefore may cause sleep problems will be discussed. Last, the conceptual framework in which the concepts of sleep problems, sleep factors, physical health, mental health and academic performance are operationalized in the context of this research will be reviewed.

3.1 Physical and mental health

The best known and most widely used definition of health is the definition formulated by the World Health Organization (WHO) (Card, 2017). According to the WHO, the definition of health is stated as follows: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 2017). Previous studies have found graded associations, meaning the greater the degree of sleep loss, the greater the negative effect on physical health (Colten & Altevogt, 2006). The study of Steptoe et al. (2006) found that short sleep durations are associated with poorer self-rated health among university students, whereas the study of Pilcher, Ginter & Shadowski (1997) state that sleep quality has a greater correlation to measures of health, well-being, and sleepiness. Additionally, there are multiple classified sleeping disorders affecting sleep which are discussed in chapter 2.2.1. Poor physical health caused by illness has also been reported to affect sleep, suggesting a bidirectional relationship (Bryant, Trinder & Curtis 2004). There are various infections associated with a change in sleep patterns. For example, infection with influenza virus resulted in a lower sleep quantity during the incubation period but higher sleep quantity during the symptomatic period, whereas the quality of sleep remained unaffected (Bryant et al., 2004).

In addition to the definition of health, the WHO formulated a more specific definition of mental health. According to the WHO, the definition of mental health is: "Mental health is defined as a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community" (WHO, 2014). The study of Liu (2004) has focused on the potential correlation between sleep and suicidal ideation. It was concluded that sleeping less than 8 hours per night was related to an almost threefold increased risk of suicide attempts in adolescents. This is further supported by Berner & Joiner (2007), who state that sleep disorders and general sleep complaints seems to be associated with higher risk of suicidal ideation and depression, as well as attempted and completed suicide. Moreover, the study of Zochil & Thorsteinsson (2018) concluded that mental health problems were significantly associated with decreased sleep quality in university students. As previously mentioned, several studies describe mental health having a bidirectional relationship with sleeping problems (Owens, 2014; Khurshid, 2016; Kahn, Sheppes & Sadeh, 2013). Sleep problems are common among individuals suffering from depression, it is even one of the core symptoms of the disorder (Riemann, Berger & Voderholzen, 2001). This suggests that poor mental health is an important factor for developing sleep problems and vice versa.

3.2 Academic performance

Academic achievement has shown to have a major impact on motivation, self-esteem and dedication in higher educational students (Jayanthi, Balakrishnan, Ching, Latiff & Nasirudeen, 2014). Academic performance is frequently defined as examination performance. It is characterized by the overall performance in each year which is measured by the Grade Point Average (GPA) (Jayanthi et al., 2014). Moreover, according to the annual results of the Student Health Check, 29% of the students indicate problems regarding study concentration (van der Heijde, Vonk & Meijman, 2013; van der Heijde, Vonk & Meijman, 2014; van der Heijde, Vonk & Meijman, 2016). It was found to be an important factor affecting academic achievement, and this can be possibly a mediator in the association between academic performance and sleep (van der Heijden et al., 2017; Plant, Ericsson, Hill & Asberg, 2005). Both sleep quantity and quality are closely related to student learning capacity and academic performance (Curcio, Ferrara & De Gennaro, 2006). Although several studies have shown the association between both sleep quantity and quality versus academic performance, academic performance was also found to have a unidirectional association with sleep quality in the study of Tavernier & Willoughby (2014) meaning that higher academic achievement predicted better sleep quality over time. The effect of sleep on performance is likely due to the function of sleep, it is critical for memory consolidation, critical thinking as well as learning and decision making (Curcio, Ferrara & De Gennaro 2006). Therefore, sleep is necessary for the optimal functioning of key cognitive processes related to academic success in higher education (Gilbert & Weaver, 2010).

3.3 Sleep problems

Throughout this report the term sleep problems will be used to refer to poor sleep quality. Sleep quality includes the following aspects: sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction based on subjective assessments (Buysse, Reynolds, Monk, Bernard & Kupfer, 1989). As stated before, young adults are recommended to have a sleep duration of 7 – 9 hours per night. Sleep deprivation refers to short sleep duration. It is defined as obtaining inadequate sleep to support adequate daytime alertness (Herscher & Chervin, 2014). In literature, sleep deprivation is often termed either acute sleep deprivation or chronic partial sleep deprivation. Acute sleep deprivation is particularly common among students since students pull often an so-called “all-nighter” for study related purposes, which means 24 hours or more of sleep deprivation (Thacher, 2008). Partial sleep deprivation means that a student obtains some, but not adequate sleep of approximately 6 hours per night which causes daytime sleepiness (Herscher & Chervin, 2014). Sleepiness refers to the inability or difficulty in maintaining alertness during the day which leads to unintentional lapses into somnolence or sleep. Sleepiness can be the consequence of voluntarily sleep deprivation due to study for instance, but sleepiness can also be caused by other factors which are discussed in the next section (Herscher & Chervin, 2014).

3.4 Sleep factors

Previous studies indicate several factors affecting sleep of students in higher education. This subchapter will address these additional theories on the factors relevant to the study population which may either stimulate or discourage sleep and therefore may cause sleep problems. There has been a distinction made between the factors in the individual level, social level and societal level.

3.4.1 INDIVIDUAL LEVEL

The individual level is the level which is closest to the student and contain factors that can vary individually. The level includes the factors behavior, psychology and sleep beliefs. In the next section, each factor will be discussed.

Behavior is a crucial factor of good sleep. For example, drinking alcohol and using technology prior to sleep have a negative effect on sleep. Students may be more prone to show behavior which has a negative effect on sleep which is discussed in chapter 2.2.2. *Psychology* encompasses the effects of stress overload on sleep. The research of Kim & Dimsdale (2007) showed that experimental stress resulted in changes in sleep. Individuals experiencing stress were having a decrease in slow wave sleep, REM sleep, and a low sleep efficiency as well as an increase of sleep interruptions. The expectations of high demands or effort the next day seems to be important in the relation between sleep and stress. Shortened or disturbed sleep causes higher levels of traditional stress markers, such as cortisol and may therefore increase the effects of stress (Åkerstedt, 2006). This is further supported by the study of Almojali, Almalki, Alothman, Masuadi & Alaqueel (2017), who found a statistically significant association between stress and poor sleep quality among medical students. However, stress is not always by definition negative (Anderson & Pulich, 2001). Experiencing acute stress can be beneficial, since it stimulates to effectively work through challenging tasks and situations (Colligan & Higgens, 2008). However, if students are experiencing chronic high levels of stress it may lead to a higher risk of developing a burn-out. According to the research of the Landelijke Studentenvakbond, LSVB (National Student Association) (2013) in the Netherlands, students have a twice higher chance of developing a burnout compared to employed workers. This can result in lower motivation to do required course work, higher percentage of dropout and more absenteeism (Rahmati, 2015).

Sleep need varies depending on the individual and is influenced by genetic factors (Dijk, 2014). As previously mentioned, students need 7 – 9 hours of sleep per night on average. A report by the NSWO (2016) in the Netherlands showed an average sleep duration of 8 hours and 16 minutes among a total of 1378 students. However, 65% of the students still indicated to prefer to sleep longer, with an average duration of one hour and 30 minutes. Furthermore, research has showed that there is an association between sleep hygiene recommendations, which are explained in chapter 2.3, and sleep. Poor sleep habits in some students may be the result of late night parties and an associated lifestyle of alcohol, drug and tobacco abuse. However, students may be unaware that their sleep habits can contribute to sleep difficulties. This could be due to the fact that students may have incorrect *sleep beliefs*, or in other words inadequate sleep hygiene knowledge. For example, a previous study showed that students were unaware of the negative effect of daytime napping on their sleep at night (Al-Kandari et al., 2017). This lack of knowledge might be one of the underlying causes of chronic sleep reduction and reduced sleep quality in students (van der Heijden et al, 2017).

3.4.2 SOCIAL LEVEL

The social level includes the immediate surroundings of the student which were found in literature to have an effect on sleep. It has the factors study, work, associations, social network and culture. Each factor in the social level will be discussed separately in the next section.

Students are often experiencing some levels of stress regarding their *study* during college years. Several stressors have been identified that may cause academic stress, such as examinations, time demands and financial pressures (Robotham & Julian, 2006). Additionally, a study among 1100 students showed that study demands is the main cause of psychological distress and the most reported complaints were depression, stress, fatigue and insomnia (Schmid & Simons, 2013).

Students often have *work* besides their study for financial reasons, for instance to pay for tuition and rent. Students with a part-time job were found to have a significant reduction in average sleep duration and substantial increase in daytime sleepiness compared to students without a part-time job (Wing & Tsui, 2010). In the Netherlands, approximately 75% of the students combines study with work (Studentenmonitor, 2014). Furthermore, the sociaal leenstelsel (social loan system) was introduced in 2015, in which students no longer receive a basic grant as a gift, but it is replaced by a loan. Research of the Sociaal en Cultureel Planbureau, SCP (Social Cultural Planning Bureau) in the Netherlands showed that it is expected that students will compensate the loss of the grant by working more hours which is likely to have a negative effect on their sleep (SCP, 2013)

The study of Matthews et al. (2010) found that loneliness among young adults is associated with poor sleep indicating the importance of a good *social network*. Students experiencing loneliness were 24% more likely to feel tired and have more difficulty concentrating during the next day. This is further supported by the study of Galambos & Dalton (2009), which reported that socializing with friends was associated with a longer sleep duration of the previous night. Loneliness may be supported by the use of social media. The use of social media among adolescents and young adults is high and previous studies found that young adults with a high use of social media seemed to feel more socially isolated compared to young adults with a low use of social media (Primack et al., 2017; Burk, Marlow & Lento, 2010).

The study of Scott-Sheldon, Carey & Carey, 2008 found that students who are a member of a student *association*, reported more sleep hours per night compared to students who are not a member. They state that it could be that members recognize their sleep needs more in comparison to non-members and therefore, sleep hygiene was higher priority. According to the researchers, another explanation could be that member students use more alcohol and drugs than non-members. For this reason, members have an increase in sleep quantity but a decrease in sleep quality. However, the effect of associations on sleep may also be mediated by loneliness. The study of Lane and Daughtry (1999) indicated that members of campus student organizations reported significantly less social alienation than non-affiliated students and therefore being a member of an association indirectly improves sleep.

The role of *culture* on sleep is an important factor which should also be taken into consideration. Besides the concerns that every student may have, international students may experience additional stressors caused by cultural adjustment demands (Mori, 2000). Especially Asian students were found to experience more pressure due to the high academic expectations from their family. This results in higher levels of stress and therefore, a higher frequency of sleep problems among these students (Tan & Yates, 2011).

3.4.3 SOCIETAL LEVEL

The societal level has the factors society, environment, technology and policy. The societal level is the level which mostly has an indirect effect on sleep and may be particularly complex to change.

Western countries are currently more moving towards a 24/7 *society* and it is more performance-oriented (ISO, 2015; LSVB, 2017). Students often have the feeling of external pressure to perform. It is for students common to work outside the traditional working day, to study late into the night or early in the morning and to fit their work around other student lifestyle demands (Coveney, 2014). They perceive themselves to be in control of their sleep, they adapt sleep patterns by napping during the day as well as adjusting sleep time and duration at night in order to combine both study and social lives (Coveney, 2014). In this way, students sacrifice their sleep by prioritizing the escalating around-the-clock demands of the 24/7 society (Williams, Coveney & Gabe, 2013; Coveny, 2014).

The sleep *environment* is comprised of all environmental factors that promote or hinder the ability to fall asleep or staying asleep. One important sleep hygiene recommendation regarding the sleep environment is to minimize disturbances from excessive noise and light at bedtime (Pirerra, de Valck & Cluydts, 2010). Students often move to the city, with study as their primary reason (CBS, 2010). Research showed that noisy areas, such as cities, can disrupt sleep and this may results in a negative effect on health (Shepherd, Welch, Dirks & McBride, 2013; Stošić & Blagojević, 2011). Furthermore, communal sleep situations such as those in student houses often do not support the recommendation of avoiding excessive noise (Sexton-Radek & Hartley, 2013). Therefore, reducing environmental noise to improve sleep can be particularly challenging in university dormitories and students houses (Brown et al., 2002; van der Heijden et al., 2017). Additionally, the study of DeSantis et al. (2013) showed that social and physical environments as well as socio-economic status of neighborhoods were associated with a short self-reported sleep duration and daytime sleepiness. Moreover, Hale, Hill & Burdette (2010) found that residence in a neighborhood that is perceived as noisy, unclean, and crime-ridden was associated with poorer self-rated physical health, which was partially mediated by lower sleep quality.

In the past two decades, the development of *technology* has raised due to the digital revolution (LeBourgeois et al., 2016). Currently, the use of technology such as smartphones has become a part of everyday life and this will likely increase even further due to new developments. Screens of smartphones, computers, tablets and television emit blue wavelength light which restrains the production of the hormone melatonin, which regulates the circadian rhythm. Therefore, the use of these devices prior to sleep leads to lower production of melatonin and can result into sleep problems (Chang, Aesbach, Duffy & Czeisler, 2015). As mentioned before, the use of technology is particularly high among young adults and may therefore promote a higher prevalence of sleep problems (Hersher & Chervin, 2014).

Currently, there is no public *policy* in order to improve sleep of young adults. However, several studies make several recommendations for the formulation of policy to improve the sleep of students. Levenson et al. (2016) state that sleep health promotion program among students is feasible and acceptable to implement, and that it can improve knowledge regarding sleep hygiene and behavior. Although some students will continue to show poor sleep hygiene, a sleep education program provided by schools can ensure that poor sleep behavior is a choice and not caused by a lack of knowledge (Brown & Buboltz, 2002). Furthermore, delaying the start times of school for students has been proposed as a policy change to address insufficient sleep in order to improve health and academic performance (Wheaton, Chapman, Croft, Chief & Branch, 2016). Several studies have showed evidence that delaying school start time resulted in an increased sleep duration among students, mainly through delay of rising. Most studies demonstrated a significant increase in sleep duration, even with relatively small delays in start times of 30 minutes (Owens, Belon & Moss, 2010; Minges & Redeker, 2015; Danner & Philips, 2008).

The Policy Analytical Framework developed by the Center of Disease Control and Prevention (CDC) (Figure 2) can be used as a tool in order to identify, analyze, and prioritize policies that can improve health. It can be divided in multiple domains: (I) problem identification, (II) policy analysis, (III) strategy and policy development, (IV) policy implementation and (V) policy evaluation (CDC, 2013). In domain I, the extent of sleep problems among students can be identified. In domain II and domain III, the two earlier mentioned policy proposals can be evaluated on effectivity, feasibility, involvement, contribution and implementation according to the framework in order to make recommendations toward solutions for sleep problems among higher educational students. Effectivity refers to the degree in which the policy addresses the problem or issue, which in this case reflects poor sleep among higher educational students. Feasibility is defined by the likelihood that the policy can be successfully implemented in order to improve sleep of students (CDC, 2013). Feasibility is dependent on the availability of resources. For example, the availability of sufficient lecture rooms and teachers. Involvement reflects to which stakeholders can be identified to support the policy. Contribution and implementation is defined by the steps that stakeholders need to take in order to implement the policy (CDC, 2013). Domain IV and V of The Policy Analytical Framework are steps in order to implement the policy. For this study, the focus will be on domain I – III since the aim is to make recommendations for policy options in order to improve sleep among higher educational students and not to directly enact and implement the policy.

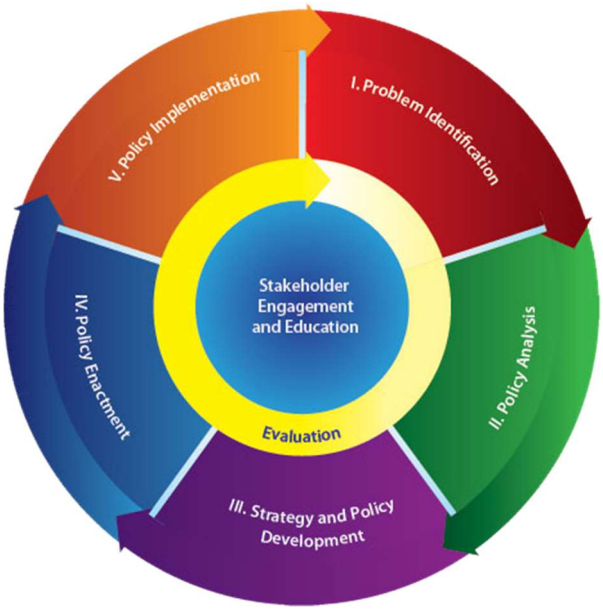

Figure 2: Policy analytical framework developed by CDC (2013).

3.5 Conceptual framework

In order to study the extent of sleep problems among higher educational students and to make recommendations toward solutions, the model of Grandner, Hale, Moore & Patel (2010) was used. They state that "this theoretical pathway has considerable implications for policies and interventions. It suggests that in order to reduce sleep-related mortality, interventions should occur at the individual, social, environmental, and policy levels". The model has been further adapted by Watson et al. (2015). For this research, a combination of the Grander and Watson model has been modified. The original models studies the effect of sleep duration on several aspects regarding health. In this study, the associated self-reported effects of poor sleep on physical health, mental health as well as academic performance will be assessed. For the purpose of this study, the model has been adapted to the specific target group of higher educational students by including factors in each level that may promote sleep or may cause sleep problems which are applicable to students as described previously. First, the individual level includes the factors: behavior, sleep need, psychology and sleep beliefs. Second, the social level involves the factors: work, social network, associations, culture and study. Last, the societal level encompasses the factors: policy, technology, environment and society. As previously mentioned, the societal level has mostly an indirect effect on sleep and may be particularly complex to change. Therefore, this study aims to investigates exclusively the factors in the individual level and social level with the exception of the factor policy in the societal level. The Policy Analytical Framework will be used to explore policy options which are frequently suggested in literature in order to make recommendations toward solutions for sleep problems among higher educational students. All factors may have an effect on sleep of students and may have a further effect on their physical health, mental health and academic performance. Although all factors in the individual and social level are individual perceptions, the factors in the social level are factors that are specific within a specific context caused by the surroundings of the student.

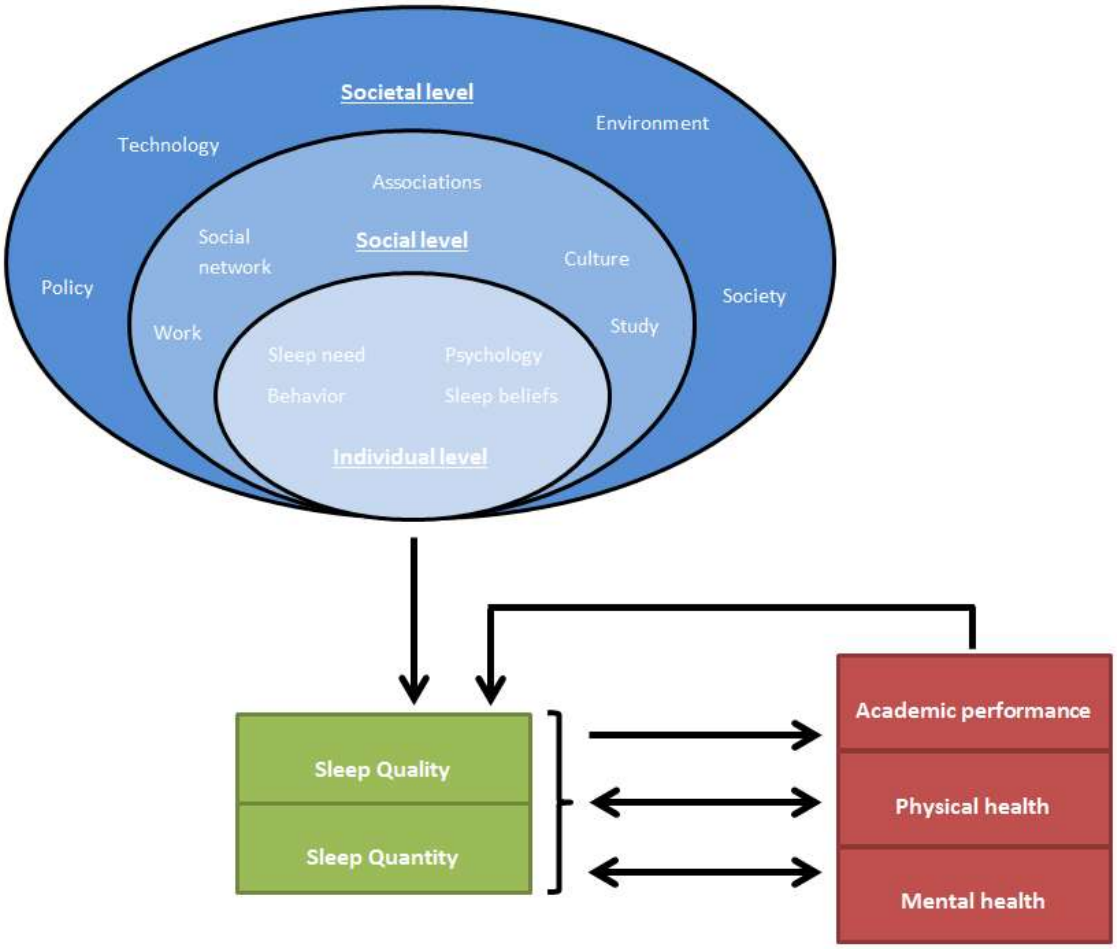

Figure 3: Model of sleep factors and effects among higher educational students based on Grandner et al. (2010) and Watson et al. (2015)

3.6 Sub-questions

In order to achieve the aim of this study, to obtain a better understanding of sleep problems among higher educational students by gaining insight into the associated factors and effects of sleep problems on health and academic performance in order to make recommendations for policy options, the following main research question is formulated: *What is the extent of sleep problems among students in higher education and what are recommendations to work toward solutions for these problems?*

To answer this main research question, six sub-questions were formulated based upon the model 'Model of sleep factors and effects among higher educational students'. The sub-questions 1 up to 5 are part the main component of this study, here only the factors in the individual and social level as well as the unidirectional associated effects of poor sleep on physical health, mental health and academic performance will be assessed. The sixth sub-question is a small-scale informative component of this study in order to make policy recommendations. In this informative component, the factor policy in the societal level will be examined. Based on The Policy Analytical Framework, policy proposals were explored among experts who can advise on policy guidelines in order to make recommendations toward solutions of sleep problems among higher educational students.

1. What is the prevalence of sleep problems among higher educational students?
2. Which factors in the individual and social level are associated with sleep problems?
3. What are the self-reported associated effects of sleep problems on physical health?
4. What are the self-reported associated effects of sleep problems on mental health?
5. What are the self-reported associated effects of sleep problems on academic performance?
6. What are options for developing policy guidelines in order to make recommendations for improving sleep of higher educational students?

4. Methods

This chapter will address the methodology chosen for this study. First, the study design and study population will be discussed. Second, the ethical considerations of this study will be reviewed. Last, data collection and the statistical analysis will be explained.

4.1 Study design

The design of this study was cross-sectional survey research. This method was chosen since it allows researchers to gain an overall picture of a certain issue or event by supporting a large number of research units. Therefore, surveys are more focused more on breadth and generalization than depth and specificity (Verschuren & Doorewaard, 2010). This research was performed to obtain a better understanding of sleep problems among higher educational students by gaining insight into the associated factors and effects of sleep problems on health and academic performance in order to make recommendations for policy options. The main research question was divided in six sub-questions and were addressed via a quantitative and qualitative survey study. For sub-question 1 up to 5, the aim was to gain a broad view of sleeping problems among higher educational students by exploring the associations between factors and effects of sleep problems. In order to accomplish this, a quantitative approach is considered most appropriate (Verschuren & Doorewaard, 2010). This quantitative study, termed 'The Student Survey', was held among higher educational students to identify the prevalence, associated factors and effects of sleep problems on physical health, mental health and academic performance. The sixth sub-question was focused on obtaining more in-depth knowledge by investigating individual opinions and perceptions of experts on policy options in order to make recommendations for policy options. A small-scale informative qualitative questionnaire, termed 'The Expert Survey', was held among experts who can advise on policy guidelines to improve sleep of higher educational students, those that can be considered in developing policy for these causes.

There are advantages as well as disadvantages of this type of research which has been taken into consideration. The advantages are for instance: inexpensive, fast data generation, simple data analysis and anonymity assurance (Wright, 2005; Verschuren & Doorewaard, 2010). In addition, online questionnaires have the benefit that the respondent can complete the survey at a time and place of choice and socially desirable answers are less likely to be given (Wright, 2005). However, there are also disadvantages of collecting data through questionnaires. For example, a low response rate, no guarantee of accuracy of answers, less flexibility, no opportunity for the respondents and the researchers to ask additional questions while filling in the questionnaire (Gillham, 2007).

4.2 Study population

For the student survey, the study population consisted of students attending higher education. To be approached for the study, students had to attend a higher education facility in Amsterdam, since the SHS is a section of student healthcare of the University of Amsterdam. Study participants were recruited through social media (Facebook) and e-mail. 9249 students of the University of Amsterdam received the invitation letter via e-mail. The invitation letter and the social media post of the student survey can be found in Appendix A.

Sample size calculation showed that this study aimed for a response number of 383 students (Kadam & Bhalerao, 2010). 33 students were excluded since they were either not a student or not attending a higher educational facility in Amsterdam. In total, 493 students filled out the survey of which 312 students completed the survey, indicating a response rate of 5.3%.

For the expert survey, experts who can advise on policy options in order to improve sleep of students were included by means of purposive sampling (Grey, 2013). Included experts were student practitioners, student psychologists, study advisors and researchers that conduct research about sleep. Participants were recruited via e-mail. In total, 24 participants filled out the expert survey. The invitation letter of the expert survey can be found in Appendix B.

4.3 Ethical considerations

This project has been approved by the Ethics Committee of the psychology department of the University of Amsterdam. While conducting this research study, two ethical issues were taken into consideration. Respondents participated voluntarily and were fully informed about the purpose of this study and potential risks in participating and written consent was collected. This information was provided before starting the surveys. Furthermore, answers given by all respondents were anonymously and confidentially processed.

4.4 Data collection

Two online questionnaires were developed, using the software Qualtrics (Qualtrics, 2005). First, the development of the student survey, the corresponding scales and the self-developed questions will be discussed. Second, the expert survey will be explained in which all questions were self-developed.

4.4.1 Student survey

In the student survey we will focus primarily on domain I of The Policy Analytical Framework, namely problem identification. In the student survey, the factors presented in 'Model of sleep factors and effects among higher educational students' in the individual and social level were measured since these levels have a more direct impact on sleep. Additionally, these two levels are more responsive to modification compared to the societal level and are therefore potential targets for improvement. The student survey included multiple validated scales that were developed in previous studies. The scales were, amongst others, selected on content validity and internal reliability. Scales with a Cronbach's alpha higher than 0.60 were included exclusively to increase reliability of the survey (Cronbach, 1960). If multiple validated scales were available to measure a concept, the scale that was most appropriate for the student population was selected. The Cronbach's alpha for every scale included in this study was calculated after data collection.

The student survey was developed in English as well as in Dutch, since it was expected that the study population included both Dutch as well as international students. It was preferred to use scales that had a validated Dutch translation besides the English version. For one scale (PASS), no Dutch translation was available. As no suitable alternative was available, the translation-back-translation procedure (Brislin, 1970) was performed. First, the scale was translated into Dutch by the main researcher. Afterwards, the scale was back-translated by a senior researcher with an excellent comprehension of the English language. Certain concepts could be measured by single questions or no suitable scales were available. In order to measure these concepts, questions were self-developed for the aim of this research. Table 4 provides an overview of the scales used in this research to measure the concepts. Additionally, the corresponding Cronbach's alpha for both the English and if available, the Dutch version are given. Table 5 shows the concepts for which no validates scales were available or concepts that could be measured by a single question. The background variables: age, gender, studying in Amsterdam, educational facility and department, current study year and year start of study could be measured by a single question and were used as control variables in the analysis between the factors in the individual and social level versus sleep as well as in the analysis between sleep and health and academic performance. The English version of the survey can be found in Appendix B. Each scale presented in Table 4 and Table 5 will be described in the next section.

HEALTH

Physical health was measured with the SF-36 Health survey (Ware & Sherbourne, 1992). For this research, four subscales were used namely: general health perceptions, vitality, health change and role limitation due to physical problems. The lower the score, the poorer the physical health of the respondent. Furthermore, alcohol use was measured within the concept physical health. In order to measure alcohol consumption, the Audit-C scale was used. This scale contained three questions about the use of alcohol. The total score ranged from 0 – 12, higher scoring indicating more alcohol abuse (Saunders, Aasland, Babor, de la Fuente & Grant, 1993). Additionally, drug use was also measured within the concept physical health. Two self-developed questions asked if respondents use drugs and if yes, the frequency of use of the various substances. Furthermore, two questions regarding sleeping disorders were accommodated in the concept of physical health. Respondents were asked if they have ever been diagnosed with a sleeping or sleep-related disorder and if yes, which kind of disorder.

Mental health was measured through the extended Kessler Psychological Distress Scale (EK-10). The original K6 scale involves 6 questions about emotional states each with a five-level response scale. The EK-10 is an extended version of the Kessler Scale, with five additional questions on anxiety symptoms and medication use (Donker et al., 2010). It is designed to yield a global measure of psychological distress based on questions about anxiety and depressive symptoms experienced in the past 4 weeks. Low scores indicate low levels of psychological distress and high scores indicate high levels of psychological distress (Kessler et al., 2003).

ACADEMIC PERFORMANCE

For the concept academic performance, the Learning and Study Strategies Inventory (LASSI) was used. In light of this research, only the sub-scale concentration was measured. The concentration scale assesses the ability of students to direct and maintain attention on academic tasks (Weinstein, Sculte & Palmer, 1987). Items are based on a 5 point Likert scale ranging from 1 = very much typical of me to 5 = not very much typical of me. Students who have trouble maintaining their concentration will have lower scores indicating a lower academic performance. Academic performance was measured through four self-developed 4 scale questions to examine the average grades of current year and past year as well as the grade of the last exam. Furthermore, the amount of achieved credits (ECTS) in the past academic year was asked in order to measure academic performance.

SLEEP PROBLEMS

Sleep problems were measured by the Pittsburgh Sleep Quality Index (PSQI) (Buysse, Reynolds, Monk, Berman & Kupfer, 1988). The 19 self-rated questions assess a wide variety of factors relating to sleep quantity and quality, including estimates of sleep duration and latency and of the frequency and severity of specific sleep-related problems (Knufinke, Nieuwenhuys, Geurts, Coenen & Kompier, 2018). The 19 items are grouped into seven component scores (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication and daytime dysfunction), each weighted equally on a 0-3 scale. Subjective sleep quality is measured via a single question in which respondents indicate the perceptions of quality of sleep, sleep latency is asked via two questions to measure the average time to fall asleep in the past month and if respondents had trouble because they cannot get to sleep within 30 minutes in the past month. Sleep duration is divided in 4 groups, > 7 hours, 6 – 7 hours, 5 – 6 hours and < 5 hours.

Habitual sleep efficiency is the number of hours slept divided by the number of hours spent in bed. This number is further multiplied by 100 to calculate the percentage of the habitual sleep efficiency. For the component sleep disturbances, respondents indicated the frequency of several disturbances of sleep in the past month. The use of sleep medication was measured by a single question in which respondents indicated the frequency of use in the past month. The final component, daytime dysfunction was measured via two questions in which respondents indicated having trouble staying awake while driving, eating meals or engaging in social activity and to the degree of problem to keep up enough enthusiasm to get things done.

The seven component scores are then summed to yield a global PSQI score, which has a range of 0-21; higher scores indicate worse sleep quality. Nevertheless, the final score of sleep quality includes also quantitative aspects of sleep, such as sleep duration, sleep latency, or number of arousals, as well as more purely subjective aspects, such as depth or restfulness of sleep (Buysse et al., 1988). Therefore, the concept sleep quality represents both quantitative as well as qualitative aspects of sleep for the remainder of this study. A global PSQI score greater than 5 showed a diagnostic sensitivity of 89.6% and specificity of 86.5% in distinguishing good and poor sleepers (Buysse et al., 1988; Casement, Harrington, Miller & Resick, 2012).

SLEEP FACTORS - INDIVIDUAL LEVEL

In the individual level, to measure the factor *sleep beliefs*, the Sleep Beliefs Scale (SBS) was used. It is a 20-item questionnaire that explores knowledge of respondents on the influence of specific factors on sleep, such as consumption behaviors, everyday behaviors, activities and thoughts prior to sleep (Adan, Fabri, Natale, & Prat, 2006). The respondents selected whether they believed the factors had no effect, a positive effect or a negative effect on sleep in general. A total score (range 0–20) is obtained by means of 1 point for each correct item, higher scores correspond to better knowledge of sleep hygiene (van der Heijden et al., 2017). The factor *behavior* was measured via the Adolescent Sleep Hygiene Scale revised questionnaire (ASHSr). The scale contains 24 items and measured adolescent sleep hygiene. Respondents indicated how often each item occurred in the last month through a 6-point ordinal rating scale ranging from 1 = never to 6 = always. The items are reverse-coded and therefore, higher scoring is indicating better sleep hygiene practices among adolescents (Storfer-Isser, LeBourgeois, Harsh, Tompsett & Redline, 2013; de Bruijn, van Kampen, van Kooten, Meijer, 2014). *Psychology* was determined by self-reported stress. In order to measure this factor, the Perceived Stress Scale (PSS) was used. The PSS scale is the psychological instrument that is most broadly used for measuring the perception of stress (Cohen, Kamark & Mermelstein, 1983) The scale contains of 14 items and scores are obtained by reversing the scores on the seven positive items and then summing all 14 items to generate the total score. The questions in the PSS ask about the frequency of feelings and thoughts during the last month. The Likert scale ranges from 0 = never to 4 = very often, higher scoring is considered as higher perceived stress (Cohen, Kamark & Mermelstein, 1994). *Sleep need* was measured through a single self-developed open question in which respondents indicated their beliefs on how much sleep they need to function optimally. This factor was used as an control variable in the analysis between the factors in the individual and social level versus sleep and in the analysis between sleep versus health and academic performance.

SLEEP FACTORS – SOCIAL LEVEL

In the social level, the factor *study* was represented by study related stress. The Perceptions of Academic Stress Scale (PASS) contains 18 items. Students were asked to rate on a 5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree) their perceptions and experiences regarding study related items in measuring levels of academic stress (Bedewy & Gabriel, 2015). The factor *culture* was measured through the Social-Cultural Adaptation Scale-R (SCAS-R). The 20 items are based on a Likert scale of 1 (= not at all competent) to 5 (= extremely competent). Scores are calculated by averaging the individual item scores, where higher scores represent greater competency (skills or behaviors) in a new cultural environment (Wilson, 2013). Additionally, two questions were added regarding the ethnic/cultural background and if the respondent was an international student or exchange student.

The factor *work* was measured through either having a paid job or volunteer job. If respondents were having either a paid or volunteer job, they had to indicate if the work requires irregular working times and if the respondent has to work during the evening and/or night. Additionally, they had to indicate the amount of hours per week spend on their job. *Association* was measured by two questions in which respondents indicated if they were a member of a student association and if yes, how many hours they spend at the association each week.

The factor *social network* included the frequency of contact with different social relations and the feeling of loneliness. Loneliness was measured through the Loneliness Scale (De Jong Gierveld, 1987). The scale includes 11 items that measured an emotional loneliness score, a social loneliness score and an overall loneliness score. Answers were given on a five-point scale ranging from yes! to no!. The total loneliness score ranged from 0 to 11, a score of 0-2 was indicated as no loneliness, 3-8 indicated moderate loneliness and a score of 11-12 indicated severe loneliness.

Concept	Factor	Scale (Author)	Item example	Cronbach's alpha E* (α /α)**	D*
Sleep Quantity & Quality	-	PSQI (Buysse et al., 1988)	*'Wake up in the middle of the night or early morning'*	.83 (.78/.76)	.77
Individual level	Sleep beliefs	SBS (Adan et al., 2006)	*'Drinking alcohol in the evening'*	.714 (.81/.61)	.76
	Behavior	ASHSr (LeBourgeois et al., 2005)	*'I have drinks with caffeine'*	.84 (.82/.76)	.67
	Psychology	PSS (Cohen et al., 1983)	*'In the last month, how often have you felt nervous and "stressed?'*	.85 (.86/.89)	.86
Social Level	Study	PASS (Bedewy & Gabriel, 2015)	*'Worry about results after examinations'*	.70 (.86/.86)	-
	Culture	SCAS-R (Wilson, 2013)	*'Building and maintaining relationships'*	.92 (.94/.99)	.88
	Social network	The Loneliness Scale (De Jong Gierveld, 1987)	*'I miss the company of others'*	.80-.90 (.93/.91)	.80-.90
Physical health	-	SF-36 (subscale general health perceptions) (Ware & Sherbourne, 1992)	*'I am excellent in health'*	.93 (.80/.75)	.78
		SF-36 (subscale vitality) (Ware & Sherbourne, 1992)	*'How often did you feel washed out?'*	.86 (.88/.85)	.82
		SF-36 (subscale role functioning physical) (Ware & Sherbourne, 1992)	*'Cut down the amount of time you spent on work or other activities'*	.84 (.83/.85)	.90
		AUDIT-C (Saunders et al., 1993)	*'How often do you have a drink containing alcohol?'*	.80 (.80/.70)	.80
Mental health	-	EK-10 (Kessler et al., 2002); Donker et al., 2010)	*'During the last 30 days, about how often did you feel nervous?'*	.87 (.90/.91)	.94
Academic performance	-	LASSI (subscale concentration) (Weinstein et al., 1987)	*'I find it hard to pay attention during lectures'*	.83 (.89/.75)	.78

Table 4: Student survey measurement scales and Cronbach's alphas per concept.

** Chronbach's alpha derived from literature.*
E = English version of the scale
` D = Dutch version of the scale
*** Cronbach's alphas measured in this study for the Dutch and English version of the survey. (English/Dutch)*

Concept	Factor	Measure	Item
Background variables - Age - Gender - Studying in Amsterdam - Living situation - Educational facility - Department - Current study year - Year start study	-	Open question Single choice question Single choice question Single choice question Single choice question Single choice question Single choice question Single choice question	*'What is your age?'* *'Are you male or female?'* *'Are you currently studying in Amsterdam?'* *'What is your living situation?* *'What educational facility are you attending?* *'At which department are you studying?'* *'What is your current year of study?'* *'In what year did you start studying?'*
Individual level	Sleep need	Open question	*'How many hours sleep do you think you need to function optimally?'*
Social level	Work	Single choice question Single choice question Single choice question Single choice question Single choice question Single choice question Single choice question	*'Do you have a paid job next to your study?'* *'Does your job require irregular working times?'* *'Do you work in the evening or at night?'* *'How many hours per week do you work besides your study?'* *'Do you have a volunteer job?'* *'Does your voluntary job requires irregular working times?'* *'Do you work as a volunteer in the evening or at night?'* *'How many hours per week do you work as a volunteer?'*
	Association	Single choice question Scale question	*'Are you a member of a student association?'* *'How much time do you spend at the student association per week?'*
	Social network	Scale question Scale question	*'What is the frequency of contact with friends?'* *'I am satisfied with my social network'*
	Culture	Single choice question Single choice question	*'What is your ethnic/cultural background?'* *'Are you an international or exchange student?'*
Physical health	-	Single choice question Open question Single choice question Open question Single choice question Scale question	*'Are you diagnosed with a sleeping disorder?'* *'What kind of sleeping disorder?'* *'Are you diagnosed with a sleeping-related disorder?'* *'What kind of sleeping-related disorder?'* *'Do you use drugs?'* *'How many times have you used the following substances?'*
Academic performance	-	Scale question Scale question Scale question Scale question	*'What is the average grade of the current academic year?'* *'What was the average grade of the past academic year?'* *'What was the grade of your last exam?'* *'How many credits (ECT) did you achieve in past academic year?'*

Table 5: Self-developed questions included in the questionnaire per concept.

4.4.2 EXPERT SURVEY

For the expert survey, the factor policy was examined according to domain II and domain III of The Policy Analytical Framework by CDC. The expert survey was held on a small-scale in order to explore policy options. It consisted of both closed and open questions to allow the respondents to express themselves more comprehensively on the topic. The respondents had to indicate the level of agreement to three statements to measure their opinion of the prevalence and severity of sleep problems among higher educational students and whether the respondent believed policy should be developed. Furthermore, respondents were asked to give their opinion on the two most suggested policy options in scientific literature. The first option was to shift the start of the lectures to later in the morning to allow students to obtain sufficient sleep. The second option concerned providing more attention to education of sleep in order to increase knowledge of sleep hygiene. Respondents had to assess both proposals on effectivity, feasibility, involvement, contribution and implementation according to The Policy Analytical Framework (CDC, 2013). Furthermore, respondents were allowed to suggest other options that may be potentially improve sleep of students. All questions in the expert survey were self-developed, since no scale was available to measure these specific concepts. The Expert Survey can be found in Appendix D.

4.5 Statistical analysis

Statistical analysis was performed by using IBM SPSS Statistics version 24.0. For the student survey, missing values and outliers caused by data collection errors were examined and excluded prior to analysis (Osborne & Overbay, 2004). Descriptive analysis was conducted to gain insight in frequencies, means and standard deviations of the characteristics of the samples. For the student survey, linear regression analysis was performed to determine the association between the factors in individual and social level and the association between sleep and mental, physical health and academic performance, after controlling for significant covariates. In the analysis between the individual and social factors and sleep, the factors in the individual and social level were the independent variables and sleep was the dependent variable. In the analysis between physical health, mental health and academic performance, sleep was the independent variable and physical health, mental health and academic performance were the dependent variables, with the exception of two variables, namely sleeping disorder and sleep-related disorder. Both students that completed and uncompleted the survey were included in the analysis. For each individual analysis, the number of students that were included is given. Backward-selection procedure was performed in order to determine the variables that predicted sleep problems. Multiple variables were examined on confounding during analysis. If the regression coefficient was altered by more than 10%, the variable was marked as an confounder in the association (Twisk, 2014). The output was interpreted by the regression coefficient, the standard error, the p-value and the 95% Confidence Interval (CI). An alpha value of 0.05 was considered as statistically significant. For the expert survey, data was analyzed through a content analysis to assess policy options in order to make recommendations toward solutions of sleep problems among higher educational students.

5. Results

In this section, the results of both surveys will be discussed. First, the results of the student survey will be reviewed. The associations between the factors in the individual and social level versus sleep will be described as well as the associations between sleep versus health and academic performance. Second, the results of the expert survey will be explained based on effectivity, feasibility, involvement and contribution and implementation.

5.1 Student survey

In this part, the results of the survey which was held among higher educational students in Amsterdam will be reviewed. First, an overview of the descriptive characteristics of the sample is presented. Second, the degree of sleep problems among this study population of higher educational students is shown. Third, the factors associated with sleep quality in the individual level and social level will be discussed. Fourth, the associations between sleep quality and physical health, mental health as well as academic performance will be reviewed. Both complete as well as incomplete surveys were included, for each individual analysis the included number of students is given.

5.1.1 Descriptive characteristics

The descriptive characteristics of the sample of higher educational students in this study are shown in Table 6. In total, 493 higher educational students filled out the survey of which 312 students completed the survey. Of these students, 450 students were Dutch and 43 students were international or exchange students. The average age of the participants was 22.2 years old, with a minimum of 16 and a maximum of 66 years old. Of the population, 43.4% was male and 56.6% was female. Most students lived with their parents (37.5%), followed by living with roommates/friends (31.4%) and alone (20.9%). The four respondents who answered other were living partly with their parents or partner and partly alone. Half of the students was attending the University of Amsterdam (50.1%) and were first year bachelor students (24.9%) or master students (27.4%).

Variable	All students
Age in years (SD)	22.2 (4.15)
Gender (n (%)	
- Male	214 (43.4)
- Female	279 (56.6)
Type of housing (n (%)	
- With my parents	185 (37.5)
- Alone	103 (20.9)
- With roommates/friends	155 (31.4)
- With my partner	46 (9.3)
- Other	4 (0.8)
Educational facility (n (%)	
- University of Amsterdam	247 (50.1)
- VU University	125 (25.4)
- University of Applied Sciences Amsterdam	120 (24.3)
- InHolland University of Applied Sciences	1 (0.2)

Year of study (n (%)	
- Bachelor 1st year	123 (24.9)
- Bachelor 2nd year	63 (12.8)
- Bachelor 3rd year	97 (19.7)
- Bachelor 4th year	56 (11.4)
- Pre-master	5 (1.0)
- Master	135 (27.4)
- PhD	1 (0.2)
- Other	13 (2.6)
Year start study (n (%)	
- < 2013	83 (16.8)
- 2013	69 (14.0)
- 2014	60 (12.2)
- 2015	85 (17.2)
- 2016	64 (13.0)
- 2017	132 (26.8)

Table 6: Descriptive characteristics of the student sample.

5.1.2 Sleep problems

The PSQI consisted of 7 components, namely subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, use of sleep medication, daytime dysfunction and sleep disturbances. Table 7 shows the global PSQI score, which is the sum of the 7 components. Of all students, 58.9% had a global PSQI score of larger than 5, which is indicative of poor sleep quality.

The average global PSQI score for all students was 6.78, with a minimum of 0 and a maximum of 18. For male students, the average score was 6.68 with a minimum of 1 and a maximum of 17. For female students, the average score was 7.21 with a minimum of 0 and maximum of 18.

5.1.3 Background variables

Table 7 shows the linear regression analysis for the association between the background variables and sleep quality, which was measured by the global PSQI score. As shown, none of the variables were significantly associated with the global PSQI score. The first background variable was gender (β =0.521, t = 1.643, n = 493). The corresponding p-value was .095, indicating no significant association between gender and sleep quality. No significant association was found between age and sleep (β = -0.025, t= -0.648, p = .517, n = 493). The background variable type of housing had a p-value of 0.865, reporting no significant association (β = 0.026, t = 0.170, n = 493). No significant association was found between study level and sleep quality (β = 0.234, t = 0.651, p = .515, n = 493). Last, current study year was not found having a significant association with sleep quality (β = -0.216, t = -1.694, p = .091, n = 493).

Variable	Regression Coefficient (β)	Std. Error	95% Confidence Interval (β)		R^2	F	P-value
			Lower	Upper			
Gender	0.531	0.323	-0.104	1.166	0.006	2.699	.101
Age	-0.025	0.039	-0.101	0.051	0.001	0.421	.517
Type of housing	0.026	0.153	-0.274	0.326	0.000	0.029	.865
Study facility							
- WO/HBO	0.243	0.373	-0.490	0.976	0.001	0.424	.515
Current study year	-0.216	0.128	-0.467	0.035	0.007	2.868	.091

Table 7: Linear regression analysis for the association between background variables and sleep.

5.1.4 Sleep factors – Individual level

Linear regression analysis was performed to test if the factors in the individual level significantly predicted poor sleep quality indicated by the global PSQI score. The factors in the individual level were: sleep need, sleep beliefs, behavior and psychology It was found that sleep need was significantly associated to the global PSQI score (β = -0.452, t = -2,606, p = .010, n = 456), as well as behavior (β = -0.073, t = 4.872, p<.000, n = 410) and psychology (β = 1.034, t = 3.188, p = .002, n = 370). The factor sleep beliefs was not found to be significantly associated with sleep quality (β=-0.073, t = 0.051, p = .959, n = 442). The sleep beliefs that were most frequently answered incorrect, meaning that the item had a different effect on sleep compared to the beliefs, by respondents were: getting up when it is difficult falling asleep (71.3% wrong versus 28.7% right), doing intense physical exercise before going to bed, (58.1% wrong versus 41.9% right), going to bed 2 h earlier than the habitual hour (42.5% wrong versus 57.5% right), smoking before falling asleep (43.7% wrong versus 56.3% right) and trying to fall asleep without having a sleep sensation (51.4% wrong versus 48.6% right). Table 8 shows the linear regression analysis for the association between the factors in the individual level and global PSQI score.

Variable	Regression Coefficient (β)	Std. Error	95% Confidence Interval (β)		R^2	F	P-value
			Lower	Upper			
Sleep need	-0.452	0.173	-0.793	-0.111	0.378	48.564	**.010**
Sleep beliefs	0.002	0.046	-0.089	0.094	0.365	45.893	.959
Behavior	-0.070	0.014	-0.099	-0.042	0.408	55.230	**.000**
Psychology	1.034	0.324	0.396	1.672	0.376	49.980	**.002**

Table 8: Linear regression analysis for the association between factors in the individual level and sleep.

5.1.5 Sleep factors – Social level

For the analysis of the factors in the social level in association with sleep quality, linear regression was performed. The factors in the social levels were work, social network, associations, study and culture. Having a paid job in general was not significant associated with sleep quality (β = 0.014, t = 0.044, p = .956, n = 370), as well as working irregular (β = 0.358, t = 1.055, p = .293, n = 244) and the number of hours per week (β = 0.231, t = 1.568, p = .118, n = 244). Working in the evening and/or night was significant associated with sleep quality (β = 0.420, t = 2.517, p = .013, n = 244). Having a voluntary job in general was not found to be significant in the association with sleep quality (β = -0.520, t = -1.264, p = .207, n = 370). Additionally, working irregular as volunteer (β = 0.267, t = 0.429, p = .670, n = 55), working as volunteer in the evening and/or night (β = 0.317, t = 0.963, p = .341, n = 55) and amount of hours per week working as volunteer (β = 0.237, t = 0.675, p = .503, n = 55) did not show significance in the association with sleep.

Loneliness measured by The Loneliness Scale was found to be significant in the association with sleep (β = 0.154, t = 3.198, p = .002, n = 352). Frequency of contact with friends (β = -0.150, t = 0.504, p = .615, n = 352), frequency of contact with family (β = -0.171, t = -1.136, p = .257, n = 352), frequency of contact with colleagues (β = 0.067, t = 0.538, p = .591, n = 352) and frequency with neighbors (β = -0.242, t = -1.401, p = .162, n = 352) were not found to be a significant predictor to poor sleep quality.

Being a member of a student or study association was not significantly associated with sleep quality (β = 0.330, t = 1.109, p = .268, n = 369) as well as the amount of hours spend per week on the association (β = 0.371, t = 1.470, p = .144, n = 171). The concept study, which was measured by academic stress was not found to be significant after controlling for experiencing stress in general and mental health (β = 0.003, t = 0.223, p = .824, n = 361).

Students with the Chinese ethnicity were significant associated with poor sleep quality (β = 7.128, t = 2.597, p = .010, n = 493) as well as students who indicated to be of another ethnicity than the mentioned options (β = 1.911, t = 2.501, p = .013, n = 449). Frequent mentioned other ethnicities were: German, Russian, Armenian, African, Iraqi and Polish. Last, cultural adaptation had no significance in the association with sleep (β = 0.055, t = 0.795, p = .453, n = 27). Table 9 shows the output of the linear regression analysis between the factors in the social level and sleep quality.

Variable	Regression Coefficient (β)	Std. Error	95% Confidence Interval (β)		R^2	F	P-value
			Lower	Upper			
Work							
- **Paid job (yes/no)**	0.014	0.311	-0.598	0.626	0.356	59.985	.965
▪ Irregular	0.358	0.340	-0.311	1,028	0.407	36.262	.293
▪ Evening/night	0.420	0.167	0.091	0.749	0.422	38.453	**.013**
▪ Amount of hours per week	0.231	0.148	-0.060	0.523	0.411	36.827	.118
- **Volunteer job (yes/no)**	-0.520	0.411	-1.328	0.289	0.368	46.521	.207
▪ Irregular	0.267	0.622	-0.986	1.520	0.530	16.567	.670
▪ Evening/night	0.317	0.329	-0.346	0.980	0.553	13.317	.341
▪ Amount of hours per week	0.237	0.351	-0.470	0.944	0.533	16.759	.503
Social network							
- **Loneliness**	0.154	0.048	0.059	0.249	0.384	49.915	**.002**
▪ Frequency of contact with friends	0.086	0.154	-0.249	0.420	0.375	39.890	.615
▪ Frequency of contact with family	-0.171	0.150	-0.466	0.125	0.387	40.227	.257
▪ Frequency of contact with colleagues	0.067	0.125	-0.179	0.313	0.385	39.901	.519
▪ Frequency of contact with neighbors	-0.242	0.173	-0.581	0.098	0.388	40.445	.162
Associations (yes/no)	0.330	0.297	-0.255	0.915	0.377	40.207	.268
▪ Amount of hours per week	0.371	0.252	-0.129	0.871	0.365	11.135	.144
Study	0.003	0.016	-0.027	0.034	0.384	39.803	.824
Ethnicity							
- Dutch	1.287	0.817	-0.320	2.893	0.401	55.230	.116
- Turkish	1.622	1.726	-1.775	5.018	0.401	55.230	.348
- Moroccan	0.496	1.046	-1.562	2.554	0.401	55.230	.636
- Surinam	2.411	1.355	-0.254	5.077	0.401	55.230	.076
- Antillean	1.182	2.750	-4.229	6.592	0.401	55.230	.668
- Indian	0.534	1.334	-2.090	3.159	0.401	55.230	.689
- Chinese	7.128	2.744	1.728	12.528	0.401	55.230	**.010**
- Other	1.911	0.764	0.408	3.415	0.401	55.230	**.013**
Culture	0.055	0.069	-0.108	0.217	0.382	2.699	.453

Table 9: Linear regression analysis for the association between factors in the social level and sleep.

5.1.6 HEALTH

In linear regression analysis of association between health and sleep, sleep was the independent variable and health the dependent variable, with the exception of three variables: sleeping disorder, sleep-related disorder and physical impairment. The output of the linear regression analysis is shown in Table 10. Having a sleeping disorder could not significantly predict poor sleep (β = 1.145, t = 1.058, p = .291, n = 351). Only 7 students were diagnosed with a sleeping disorder such as sleep apnea, insomnia and rhythmic movement disorder. Having a sleep-related disorder was significant in the association with sleep (β = 1.766, t = 3.044, p = .003, n = 351). In total, 24 students reported being diagnosed with a sleeping-related disorder. Most reported disorders related to sleep were: ADD, ADHD, diabetes, depression and anxiety disorder. Having an physical impairment was not a significant predictor of poor sleep (β = 0.008, t = -0.010, p = .992, n = 351). Poor sleep was not found to be a significant predictor of subjective perceived general health (β = -0.124, t = -0.629, p = .530, n = 349). Poor sleep was significantly associated with subjective perceived vitality (β = -1.792, t = -4.109, p<.000, n = 349). Sleep was not significant in the association with subjective perceived role limitations due to physical health (β = 0.005, t = 0.084, p = .993, n = 349). Poor sleep was found to be a significant predictor of poor mental health (β = 0.600, t = 5.209, p <.000, n = 347).

The variables drug use and alcohol use were tested in both directions. Drug use was a significant predictor of poor sleep quality (β = 0.763, t = 2.500, p = .013, n = 349), as well as poor sleep quality was a significant predictor of drug use (β = 0.016, t = 2.064, p = .040, n = 349). Most frequent mentioned drugs used by students were: weed/hash, XTC, MDMA, 4FMP, cocaine and amphetamines. Alcohol use was found not to be a significant predictor to sleep quality (β = 0.091, t = 1.404, p = .161, n = 310) as was poor sleep quality was not a significant predictor of alcohol use (β = 0.052, t = 1.024, p = .306, n = 310).

Variable	Regression Coefficient (β)	Std. Error	95% Confidence Interval (β)		R^2	F	P-value
			Lower	Upper			
Sleeping disorder	1.145	0.344	-0.985	3.276	0.367	46.332	.291
Sleep-related disorder	1.766	0.580	0.625	2.907	0.375	49.538	**.003**
Impairment	-0.008	0.854	-1.688	1.671	0.365	45.892	.992
General health	-0.124	0.196	-0.510	0.263	0.126	12.829	.530
Vitality	-1.792	0.436	-2.649	-0.933	0.392	42.576	**.000**
Role limitations due to physical health	0.069	0.819	-1.544	1.682	0.220	18.662	.993
Mental health	0.600	0.115	0.373	0.826	0.586	62.168	**.000**
Effect of drug use on sleep	0.763	0.305	0.163	1.364	0.377	48.351	**.013**
Effect of sleep on drug use	0.016	0.008	0.001	0.032	0.037	6.287	**.040**
Effect of alcohol use on sleep	0.091	0.065	-0.037	0.219	0.401	48.036	.161
Effect of sleep on alcohol use	0.052	0.051	-0.048	0.152	0.082	6.339	.306

Table 10: Linear regression analysis for the association between health and sleep.

5.1.7 Academic performance

The global PSQI score was a significant predictor for a lower average grade in current academic year (β = -0.050, t = -2.679, p = .008, n = 347). Additionally, poor sleep quality was found to be significant in the association between sleep and the grade of the last exam (β = -0.073, t = -2.663, p = .008, n = 347). Poor sleep quality did not significantly predict the average grade in previous academic year (β = -0.003, t = -0.232, p = .817, n = 254) and the amount of ECTS in last academic year (β = 0.024, t = 0.514, p = .607, n = 347). Last, sleep was found to be of significance in the association between sleep quality and concentration, which was measured by the LASSI sub-scale (β = -0.525, t = -4.250, p<.000, n = 312). The results of the linear regression analysis of association between sleep and academic performance is shown in Table 11.

Variable	Regression Coefficient (β)	Std. Error	95% Confidence Interval (β)		R^2	F	P-value
			Lower	Upper			
Grade current academic year	-0.050	0.019	-0.087	-0.013	0.122	7.289	**0.008**
Grade previous academic year	-0.003	0.015	-0.033	0.026	0.093	8.082	0.817
Grade last exam	-0.073	0.027	-0.127	-0.019	0.070	7.999	**0.008**
ECTS last academic year	0.024	0.046	-0.067	0.115	0.223	14.966	0.607
Concentration	-0.525	0.124	-0.768	-0.282	0.170	30.253	**0.000**

Table 11: Linear regression analysis for the association between sleep and academic performance.

5.2 Expert survey

The expert survey was held among a total of 24 experts who can advise on policy guidelines in order to improve sleep of students. First, the demographics of the experts and the problem statement will be discussed. Second, the problem statement of sleep problems among higher educational students according the experts will be reviewed. Third, the assessments of the two policies that are most proposed in scientific literature will be discussed. The first policy proposal was: schools / universities do not start around 9 o'clock in the morning, but the start times shift to 10 o'clock / 11 o'clock in the morning in order to allow students to sleep longer. The second policy proposal was: during education, more attention should be paid to education about sleep, and the links with health and performance, in order to increase the knowledge of sleep. Furthermore, possible policies options recommended by expert themselves will be examined.

5.2.1 Descriptive characteristics and problem statement

Variable	All experts
Age in years (SD)	46.29 (12.36)
Gender (n (%)	
- Male	6 (25.0)
- Female	18 (75.0)
Profession (n (%)	
- Student general practitioner	4 (16.7)
- Student psychologist	4 (16.7)
- Study advisor	9 (37.5)
- Student dean	5 (20.8)
- Researcher	1 (4.2)
- Other	1 (4.2)
Organization (n (%)	
- University of Amsterdam	14 (58.3)
- Vrije Universiteit Amsterdam	3 (12.5)
- University of Applied Sciences Amsterdam	5 (20.8)
- InHolland University of Applied Sciences	0 (0.0)
- Research institute	1 (4.2)
- Other	1 (4.2)

Table 12: Descriptive characteristics of the expert sample.

The average age of the respondents was 46 years old. Most experts were females (75.0%). Of the experts, 37.5% was study advisor, followed by student dean (20.8%), student general practitioner (16.7%) and student psychologist (16.7%). Most experts were working at the University of Amsterdam (58.3%).

The first questions were concerning the problem statements of sleeping problems among higher educational students and the frequency and causes of higher educational students with sleep problems the respondents experience during their profession. Furthermore, respondents were asked if there should be policy developed to improve sleep and the reason for their opinion.

The first statement was: “sleep problems can negatively influence the mental / physical health of students”. All respondents agreed to this statement. To the second statement: “students who experience sleep problems perform at the same level as students without sleep problems”, 4.2% of the respondents somewhat agreed to this statement, 25.0% neither agreed nor disagreed, 25.0% somewhat disagreed to this statement, 29.2% disagreed and 16.7% of the respondents strongly disagreed to this statement.

The last statement was: “sleep problems play a big role among students”, 4.2% of the respondents completely agreed to this statement, 29.2% agreed, 41.7% somewhat agreed, 20.8% neither agreed nor disagreed and 4.2% of the respondents did not agree to this statement.

Of all respondents, 4.2% indicated to often experience higher educational students with sleep problems during their profession, 54.2% regularly and 41.7% of the respondents encounter sometimes students with sleep problems. For the causes of sleep problems, respondents, 79.17% of the respondents indicated stress as an important cause. Other mentioned causes were: lack of rhythm and regularity (58.33%), alcohol and drug use (33.33%) and poor sleep hygiene, for example use of technology prior to sleep (29.17%).

To the statement: “there should be policy developed to improve the sleep of students”, 4.3% of the respondents strongly agreed, 13.0% agreed, 34.8% somewhat agreed, 34.8% neither agreed not disagreed, 4.3% somewhat disagreed and 8.7% of the respondents did not agree to this statement. The respondents gave as reason for their opinion: policy may be a bit exaggerated, but giving more information could be useful (42.86%) good to promote but difficult not to patronize (23.81%) and sleep problems is too personal to develop policy (19.0%).

5.2.2 General opinions regarding the proposals

To policy proposal 1 which concerned the shift of start times of schools, most respondents indicated not finding this proposal useful (57.89%). The reasons they gave for their opinion were: students will go to bed later, not a good preparation for later and not realistic. Of the respondents, 36.84% reported that this proposal could be beneficial because it fits more with the current life stage of students.

Towards policy proposal 2, which comprehended more education regarding sleep, most respondents (64.71%) reported to be more favorable than proposal 1. Reasons that were given were: informative, increases responsibility and prepares for life after student time. Of the respondents, 11.76% thought that proposal 2 would not be useful and that there are also other subjects that are important such as healthy food and playing sports and 5.88% thought it was patronizing.

5.2.3 Effectivity

More than half of the respondents (57.89%) reported not finding policy proposal 1 effective in improving sleep. The mentioned reasons against this proposal were: rhythm is important and this policy does not contribute to this, shifting of the problem, one hour more of sleep will not be effective. Some respondents (15.79%) were doubtful of the effectivity since students already do not start often at 9:00 o’clock in the morning. Of the respondents, 26.31% were slightly positive to the effectivity of this proposal if it also means that students will not finish their college day later when start times are shifted till later.

Of all respondents, 41.18% indicated that policy proposal 2 could be effective. Reasons for this opinion were: “by improving knowledge, people may change their behavior regarding sleep” and “awareness and reflection promote behavioral change”. A third of the respondents (35.29%) reported not finding proposal 2 effective since more knowledge does not necessarily lead to change in behavior and because sleep problems are often caused by more factors than behavior alone.

5.2.4 Feasibility

Of all respondents, 36.84% did not find proposal 1 feasible in practice since it means that university staff also need to work till later which will evoke a lot of resistance. Additionally, respondents mentioned that there is already a scarcity in educational spaces such as lecture rooms. Of the respondents, 31.58% reported policy proposal 1 to be feasible in practice since it is easy to organize and it only requires a new planning. The other respondents (31.58%) had no opinion regarding the feasibility of policy proposal 1.

Most respondents (70.59%) reported finding policy proposal 2 feasible in practice. According to the respondents, proposal 2 can easily be included in the curriculum and providing more information regarding sleep is not difficult to realize. Of the respondents, 17.65% indicated that there is no space in the curriculum for inclusion and that it is not the responsibility of the university. The rest of the respondents (11,76%) did not have an opinion regarding the feasibility of proposal 2.

5.2.5 Involvement

Actors who should be involved in order to implement proposal 1 according to the respondents were: universities (47.37%), students (26.31%), teachers (21.05%). For policy proposal 2, stakeholders that should be involved in order to implement the policy were: study advisors/deans (47.06%), student psychologists (29.41%), student general practitioners (23.53%) and education directors (29.41%).

5.2.6 Contribution and implementation

Most respondents did not know how the stakeholders could contribute to policy proposal 1 and how it should be structurally implemented (63.16%). The rest of the respondents reported that it should be implemented in the study schedules for the upcoming years.

The answers the respondents gave about contribution and implementation of proposal 2 were very diverse. Most mentioned options were: inclusion in the curriculum (29.41%) and via student services and training (23.53%). Other respondents indicated not knowing how it should be implemented or did not agree to the implementation of proposal 2 at all (21.43%).

5.2.7 Other policy proposals

Several other options to improve sleep among higher educational students were suggested by the respondents themselves besides the two policy proposals derived from literature. First, lowering study pressure of students by for example, abolishing the binding study advice in order to reduce stress. Second, extension of student health services and providing more attention to sleep in current services. Third, increasing awareness of the availability of student psychologists and student general practitioners. The last proposal recommended by the respondents was providing more education about the use and effects of drugs on mental and physical health.

6. Discussion

In this section, the main findings of this study will be summarized and possible links between the factors will be discussed first. Then, the outcomes presented in the results section will be compared to the currently existing scientific literature. Thereafter, both the strengths and limitations will be discussed, and suggestions for further scientific research and implications for practice will be made. Last, the conclusions of this study will be provided.

6.1 Main findings

This research aimed to obtain a better understanding of sleep problems among higher educational students by gaining insight into the associated factors and effects of sleep problems on health and academic performance in order to make recommendations for policy options. The main research question was: *What is the extent of sleep problems among students in higher education and what are recommendations to work toward solutions for these problems?* This main research question was divided into six sub-questions and were answered through the student survey and expert survey.

In the student survey, we have found that 58.9% of the higher educational students in this sample suffered from poor sleep quality as measured with the PSQI. Multiple factors have been significantly identified in the association with sleep. In the individual level, the factors significantly associated with poor sleep quality were: sleep need, behavior and psychology. In the social level, having a paid job in the evening/night and loneliness were the factors significantly associated with sleep. Furthermore, the Chinese ethnicity was found to be a significant predictor of poor sleep quality. In addition to these factors, having a sleep-related disorder was a significant predictor of poor sleep quality, whereas having a sleeping disorder was not found to be significant in association with sleep quality. Sleep quality was significantly associated with mental health, suggesting that students who have a poor sleep quality have a higher chance of poor mental health. By contrast, sleep was not significantly associated with physical health with the exception of vitality, which represented energy levels and fatigue, and drug use. Additionally, sleep was a significantly associated with academic performance in the current academic year and study concentration, suggesting that students experiencing poor sleep quality have a worse academic performance in the current academic year.

The link between these factors in association with sleep could be the high demands of social life in combination with study which students often experience. As mentioned before, the current society is more performance-oriented and this leads to a high pressure among students in order to meet all the demands which can be at the expense of sleep (Coveney, 2014; Dopmeijer, 2017). The desire of the perfect life of high grades, an excellent resume and a good social network makes students more afraid to fail (LSVB, 2017). Students often work in the evening/night in order to combine it with their study and it was expected that students also have to work more hours due to the abolition of the basic grant as a gift (SCP, 2013). Additionally, students also need to study and have the desire to engage in social activities with friends (Gubbels & Kappe, 2017). This leaves little time left for behavior that is supportive to sleep such as relaxing activities and regular bed- and wake-times. Altogether, this may result in an increase of stress as well as higher levels of fatigue which may increase the use of drugs such as methylphenidate in order to keep up with the ambitious study climate.

In the expert survey, two policy proposals were evaluated by experts who can advise on policy in order to improve sleep among students on the aspects: effectivity, feasibility, involvement, contribution and implementation. Most experts were more favorable to policy proposal 2: 'during education, more attention should be paid to education about sleep, and the links with health and performance, in order to increase the knowledge of sleep' on all aspects of the evaluation. According to the experts, the university may play an important role as a stakeholder in order to develop policy guidelines for the improvement of sleep among students. Experts themselves recommended multiple other options for policy such as: lowering study pressure and extension of student health services and providing more attention to sleep in current services. Moreover, it was recommended to increase awareness of the availability of student health services and providing more information on the use and effects of drugs on health.

It appears that effective communication between the stakeholders is of high importance. Education facilities can play an important role in reducing sleep problems among higher educational students through the implementation of the discussed policy guidelines. On the other hand, an important task of students themselves is to indicate the issues that they experience in order to identify the key areas of concern by which the problem can be countered.

6.2 Comparison to literature

In this study, 58.9% of higher educational students had a global PSQI score of larger than 5, which is indicative of poor sleep quality. Similar numbers were found in the study of van der Heijden et al. (2017), in which 54% of a sample of Dutch students indicated poor sleep quality. This is further supported by the study of Lund et al., (2010) in which 60% of the students originated from the United States were categorized as poor-quality sleepers and Cheng et al., (2012) who found a prevalence of poor sleep quality of 54.7% among Taiwanese students with a higher PSQI cutoff score of 6. Additionally, the study of Ji & Wang (2018) indicated a prevalence of poor sleep quality of 50.2% among Chinese students, with the PSQI cutoff score of 7.

The factor *behavior*, which represented sleep hygiene was found to be significant in the association with sleep. This is further supported by Herscher and Chervin (2014), in which students were found to show more behavior that has a negative effect on sleep compared to non-students. Moreover, it was found that individuals suffering from insomnia reported a poorer sleep hygiene that may exacerbate or maintain the sleeping problem (Jefferson, Drake, Scofield, Myers, McClure Roehrs & Roth, 2005). Additionally, in a previous study was found that sleep hygiene was an important predictor of sleep quality in adolescents (LeBourgeois, Giannotti, Cortesi, Wolfson, & Harsh, 2005). Therefore, the finding that the factor behavior was significantly associated with sleep quality is corresponding to previous literature.

Furthermore, *psychology*, which was defined by experiencing stress overload, was found to be a significant predictor of poor sleep quality. Åkerstedt (2006) and Almojali et al., (2017) found similar results regarding the effects of stress on sleep quality. This is further supported by Dusselier, Dunn, Wang, Shelley II & Whalen (2005) who stated that students who had more self-reported sleep difficulties also reported a higher frequency of stress overload. However, most of the studies examining the effects of stress overload on sleep are cross-sectional studies. Therefore, longitudinal research on the effects of high levels of stress on sleep quality is advised in order to examine this association more extensively.

Not of significance in the association with sleep quality was the factor *sleep beliefs*. However, reduction of dysfunctional beliefs and attitudes about sleep were significantly correlated with improvements of sleep efficiency according to the study of Morin, Blais & Savard (2002). Furthermore, sleep hygiene knowledge was found to be a significant predictor of the average grade in the current academic year in the study of van der Heijden et al. (2017), suggesting a small contribution of sleep hygiene knowledge on academic performance which may be mediated by sleep quality. An explanation of the difference between the significance of sleep beliefs and sleep behavior could be that sufficient knowledge of sleep hygiene does not necessarily translate into behavior that promotes sufficient sleep in higher educational students since a significant but weak association was found between sleep hygiene knowledge and actual practice of sleep hygiene (Brown et al., 2002). Another explanation could be that students do not have the opportunity to adopt healthy sleep behavior due to pressure and a high workload.

For the factor *work* in the social level, only having a paid job in the evening/night was found to be associated with poor sleep quality whereas working irregular and was not found to be significant in the association with sleep. This could be explained by the fact that students mostly work part-time besides their study and therefore, irregular working schedules have less effect on sleep compared to full-time workers. Additionally, the number of hours working per week was also not found to be significant in the association with sleep. This is a surprising finding which is contradictive to previous studies (Carskadon, 1990; Gau & Soong, 1995). It was indicated that mostly students with a low socio-economic status have to work besides their study because their parents cannot provide financial support and they tend to have a higher aversion to debt (SCP, 2013). In this sample, most students were working 16 hours or less besides their study and no information was available about their socio-economic status. Therefore, further research is required to investigate this factor in association with sleep. Moreover, having a voluntary job was not found to be associated with sleep quality at all. This could be due to that working as volunteer may not require demands compared to a paid job and the lack of financial dependency. Therefore, it may be experienced as less stressful. This is in line with the study of Lewig, Xanthopoulou, Bakker, Dollard, & Metzer (2007) where higher job demands were related to health problems, including problems regarding sleep.

For the factor *social network*, loneliness was found to be a significant predictors of sleep quality whereas the frequency of contacts was not found to be significant. Previous findings of the study De Jong Gierveld (1987) support this finding and it was theorized that loneliness is primarily determined through the personal evaluation of the social network by an individual rather than the frequency of contacts. Therefore, students with a high frequency of contacts can still experience feelings of loneliness which may have a negative effect on their sleep.

Being a member of an *association* was not found to be a significant predictor of poor sleep quality and therefore, not a significant factor in the association with sleep. An explanation could be that the associations in the Netherlands are different than those in the United States, where members are often living together houses on university campus. In the Netherlands, it is not required to be a member of a student association to live in student houses and the residents of student houses are often a mix of members and non-members.

Study related stress lost significance after controlling for significant covariates. This finding is contradictive to previous studies. Lund et al., (2010) investigated patterns and predictors of poor sleep quality and a high number of students indicated that academic stress had a negative impact on their sleep. Additionally, a study among employed workers concluded that stress at work was strongly associated with disturbed sleep and impaired awakening.

It was theorized that worrying about work during free time could be an important link in the association between stress and sleep (Åkerstedt, Knutsson, Westerholm, Theorell, Alfredsson & Kecklund, 2002). This surprising finding could be explained by that students who are experiencing more stress in general along with students having a poor mental health may be more prone to experiencing study related stress and therefore, the association between sleep and academic stress is mediated by these factors.

The final factor of the social level was *culture*. It was found that cultural adaptation was not a significant predictor of poor sleep quality among international students. However, having the Chinese ethnicity and students having another ethnicity than the listed categories in the survey were significantly associated with sleep. This corresponds to literature since particularly Asian students were found to experience more pressure from their family and this resulted in more academic stress and consequently more problems regarding sleep (Tan & Yates, 2011). However, further research is required since only 3 out of 43 international or exchange students were of the Chinese origin.

For the concept health, physical health in terms of impairment, role limitations and general health were not found to be significant in the association with sleep whereas vitality was an significant associated effect of poor sleep quality. This finding shows that poor sleep quality was associated with energy levels and fatigue in higher educational students which corresponds to previous studies (Léger, Scheuermaier, Philip, Paillard & Guilleminault, 2001). Additionally, having a sleep-related disorder was found to be significant in the association with sleep which is in line with literature (Schredl, Alm & Sobanski, 2007; Stein, Weiss & Hlavaty, 2012). Furthermore, having a sleeping disorder was not found to be a significant predictor of poor sleep quality. This is contradictive to literature (Thorpy, 2012). This difference in results may be explained through the lower expectations that sleep disorder patients may have of sleep due to the long-term nature of these disorders. Additionally, students who are diagnosed with sleep disorders may have developed practices in order to improve coping with poor sleep. Drug use was found to be significant in the association with sleep quality which corresponds to previous studies (Mahoney et al., 2014; Lund et al., 2010) whereas alcohol use was not significant which is contradictive to former research (Stein & Friedman, 2005; Singleton & Wolfson, 2009). An explanation could be that the use of alcohol reduces the sleep latency as well as it reduces sleep quality whereas the use of drug stimulants increases sleep latency and suppresses REM sleep (Herscher & Chervin, 2014).

Sleep quality was found to be a significant predictor of mental health. This is in line with previous research; a study among Japanese adolescents showed that worsening of the subjective sleep assessment was associated with a poorer mental health status (Kaneita et al., 2007). This is further supported by Liu et al., (2013) who found a positive relation between insufficient sleep and frequent mental distress.

For the concept academic performance, poor sleep was associated only with achievement in the current academic year and grade of the past exam and not to achievement in the past academic year. This is in line with the study of van der Heijden et al., (2017) who theorized that since sleep was only measured for the past month, achievement in the current academic year showed stronger associations compared to achievement in the past academic year. Furthermore, sleep quality was associated with study concentration which is also supported by the study of van der Heijden et al., (2017) and the study of Alapin, Fichten, Libman, Creti, Bailes & Wright, (2000).

In conclusion, for most factors similar results were found in previous studies whereas for some factors we found contradictive results. This illustrates that sleep is an complex phenomenon which is affected by many factors. In addition, there may be clusters of students who score high on multiple factors. For example, students experiencing poor mental health may also experiencing more feelings of loneliness and may have a higher use of drugs and alcohol. A cluster analysis is therefore recommended for further scientific research. Furthermore, there may be other factors of significance in the association with sleep which were not taken into account in this study. For example, individual stress coping mechanisms and personality traits such as introversion or extraversion may also be important factors affecting sleep (Killgore, Richards, Killgore, Kamimori & Balkin, 2007; van de Laar, Verbeek, Pevernagie, Aldenkamp & Overeem, 2010; Otsuka et al., 2017). Furthermore, the factors associated with sleep among students in higher education may also differ between countries due to external aspects such as cultural factors and national policy regarding healthcare and education. This may cause difficulty in the comparison to previous studies. However, universities are currently becoming more international as more students are studying abroad. Due to the input of different cultures, it is important to consider this increasing diversity of students when developing policy to improve sleep among this target group.

6.3 Strengths and limitations

This study had several strengths. First, due to the cross-sectional design of this study it was possible to investigate multiple factors associated with sleep as well as associated effects on health and academic performance in order to obtain a better understanding of sleep problems among higher educational students. Second, the factor sleep need was used as an covariate in the regression analysis between the factors and effects versus sleep in order to control for the fact that short sleep not necessarily indicate sleep problems, but may also demonstrate a reduced sleep need. In this way, the concept sleep was exclusively representing sleep insufficiency. Third, the student survey used mostly existing and validated scales to measure the concepts. In this way, the reliability and validity in this study was increased. Additionally, the reliability analysis showed strong reliability for most scales used in this study in order to measure associations between sleep versus the factors and effects. Fourth, both surveys were tested by 5 higher educational students and 1 senior researcher by means of a pilot study. Their feedback was used to improve the surveys and to confirm that the questions were understandable and well formulated.

However, certain limitations also have to be acknowledged in this study. First, the design of this study was cross-sectional research; for this reason, caution should be observed regarding statements on causality. Second, all concepts were measured by retrospective self-reports, which could have led to social desirability bias in the association between the factors and sleep as well as in the association between sleep versus health and academic performance (Grimm, 2010). Third, the Dutch version of the Sleep Beliefs Scale (Adan et al., 2006) showed in this study a lower reliability ($\alpha = 0.61$) compared to literature ($\alpha = 0.76$). Nevertheless, an alpha of above 0.60 can be considered as acceptable in explorative studies and research in social sciences (Hair, Black, Babin, Anderson & Tatham, 2006). Fourth, it was decided to only include students who are attending an education facility in Amsterdam since the SHS is part of section student healthcare of the University of Amsterdam. However, inclusion of students from other universities and universities of applied sciences would have increased the generalizability of this study.

Lastly, the Pittsburg Sleep Quality Index (Buysse et al., 1988) only provides an global PSQI score which can be used as an indicator for poor sleep quality. For this reason, this study focused more on the association between sleep quality and the associated factors and effects although the global PSQI score calculates sleep quantity and sleep quality separately as one of the components. However, the scores of each component are eventually summed to create the global score. Therefore, sleep quantity was measured in this study but it was embedded in the final global PSQI score.

6.4 Implications for further scientific research

Taken into account the strengths and limitations of this study, further research is recommended in order to obtain an in-depth understanding of the factors and effects associated with sleep quality. A longitudinal research design with a large sample of students is advised in order to investigate the causal and potential bidirectional relationships between poor sleep, the factors and effects. Furthermore, objective instruments can be used to measure sleep to eliminate bias in self-reported data. Moreover, it is recommended to study the factors and effects of sleep problems in a more diverse study population of higher educational students in order to increase generalization. Last, further research that measures both sleep quantity and sleep quality separately is required to establish the effects of these components independently in order to obtain a more comprehensive understanding.

6.5 Implications for practice

Based on the findings of this study in which sleep problems among higher educational students were studied and policy options were explored, recommendations in order to reduce sleep problems can be provided. The student survey showed that more than half of the students experience poor sleep quality which has negative self-reported effect on mental health and academic performance in the current academic year. The expert survey showed that most experts were more favorable regarding policy proposal 2. Therefore, this policy can be further examined in order to improve sleep among students. However, this policy is mainly focused on providing more information regarding sleep to increase knowledge. This study does not support this policy proposal since there was no significant association found between the factor sleep beliefs and sleep quality. Nevertheless, previous studies regarding the association of sleep hygiene knowledge showed a positive effect on sleep. This suggests that there are still opportunities for improvement regarding the knowledge of sleep hygiene.

Additionally, the factors associated in the individual and social level may be connected to the increasing performance pressure of the current society. Although the society itself may be complex to change, universities may play an important role in lowering pressure and providing students the needed guidance by giving more attention to the wellbeing of students. As recommended by the respondents in the expert survey, universities can contribute to the increase of the social awareness of the negative influence of performance pressure on the welfare of students and providing students, lecturers, and student counselors clear information about the possibilities for help and advice regarding psychosocial problems. Moreover, providing sufficient assistance for students at education facilities through student psychologists, student counselors, study advisors or external healthcare professionals by reducing waiting lists can ensure that issues regarding sleep are early recognized and exacerbation is prevented. These policy recommendations can be further examined and evaluated in order to target sleep problems among higher educational students.

6.6 Conclusions

In conclusion, sleep problems is a complex phenomenon which is influenced by multiple factors and has a negative effect on health and academic performance. The main research question of this study was: *What is the extent of sleep problems among students in higher education and what are recommendations to work toward solutions for these problems?* This study has identified several factors associated with poor sleep quality and associated self-reported effects as well recommendations toward solutions for sleep problems among students. It was found that almost 60% of higher educational students experience poor sleep quality. The factors significantly associated with sleep quality were: sleep need, behavior, psychology, having a paid job in the evening/night, loneliness and the Chinese ethnicity. Moreover, having a sleep-related disorder was significantly associated with poor sleep quality. Sleep quality showed significant association to self-reported effects on mental health and no significant association was found with self-reported effects on physical health with the exception of vitality and drug use. Last, poor sleep quality was a significant predictor for grades in the current academic year and grade of the last exam as well as study concentration.

According to the experts, the university may play an important role as a stakeholder in order to develop policy guidelines for the improvement of sleep among students. Policy proposal 2: during education, more attention should be paid to education about sleep, and the links with health and performance, in order to increase the knowledge of sleep, was found to be more favorable among the experts on the aspects effectivity, involvement and contribution and implementation. Lowering study pressure, increase awareness of student health services and extension of these services were other mentioned policy recommendations in order to improve sleep quality among higher educational students.

This study contributes to a better understanding of sleep problems among higher educational students and supports previous findings of factors associated with poor sleep quality as well as the self-reported effects of poor sleep quality on health and academic performance. Furthermore, this study has made several recommendations toward solutions for sleep problems of higher educational students. This obtained knowledge can be used in order to target sleep problems among students in higher education and by that improve health and academic performance.

7. Literature

Åkerstedt, T. (2006). Psychosocial stress and impaired sleep. Scandinavian journal of work, environment & health, 493-501.

Alapin, I., Fichten, C. S., Libman, E., Creti, L., Bailes, S., & Wright, J. (2000). How is good and poor sleep in older adults and college students related to daytime sleepiness, fatigue, and ability to concentrate?. Journal of psychosomatic research, 49(5), 381-390.

Al-Kandari, S., Alsalem, A., Al-Mutairi, S., Al-Lumai, D., Dawoud, A., & Moussa, M. (2017). Association between sleep hygiene awareness and practice with sleep quality among Kuwait University students. Sleep health, 3(5), 342-347.

Almojali, A. I., Almalki, S. A., Alothman, A. S., Masuadi, E. M., & Alaqeel, M. K. (2017). The prevalence and association of stress with sleep quality among medical students. Journal of epidemiology and global health, 7(3), 169-174.

Anderson, P. & Pulich, M. (2001) Managing workplace stress in a dynamic environment. The Healthcare Manager, 19(3), 1–10.

Assefa, S. Z., Diaz-Abad, M., Wickwire, E. M., & Scharf, S. M. (2015). The functions of sleep. AIMS Neuroscience, 2(3), 155-171.

Bedewy, D., & Gabriel, A. (2015). Examining perceptions of academic stress and its sources among university students: The Perception of Academic Stress Scale. Health psychology open, 2(2), 2055102915596714.

Bernert, R. A., & Joiner, T. E. (2007). Sleep disturbances and suicide risk: A review of the literature. Neuropsychiatric Disease and Treatment, 3(6), 735–43.

De Boer, T. (2017) Van succes-student naar stress-student; hoe groot is het probleem? Landelijke Studentenvakbond, 1–33. Accessed at August 5, 2018. Retrieved from: https://lsvb.nl/wp-content/uploads/2017/10/LSVb-2016-Onderzoeksrapport-mentale-gezondheid-van-studenten.pdf

Brandão, M. P., Pimentel, F. L., & Cardoso, M. F. (2011). Impact of academic exposure on health status of university students. Revista de Saúde Pública, 45(1), 49–58.

Brislin, R. W. (1970). Back-translation for cross-cultural research. Journal of cross-cultural psychology, 1(3), 185-216.

Brown FC & Buboltz WC (2002). Applying sleep research to university students: Recommendations for developing a student sleep education program. Journal of College Student Development 43(3):411-416.

Brown, F. C., Buboltz, W. C., & Soper, B. (2002). Relationship of sleep hygiene awareness, sleep hygiene practices, and sleep quality in university students. *Behavioral Medicine*, *28*(1), 33–38.

de Bruin, E. J., van Kampen, R. K., van Kooten, T., & Meijer, A. M. (2014). Psychometric properties and clinical relevance of the Adolescent Sleep Hygiene Scale in Dutch adolescents. Sleep medicine, 15(7), 789-797.

Bryant, P. A., Trinder, J., & Curtis, N. (2004). Sick and tired: does sleep have a vital role in the immune system? Nature Reviews Immunology, 4(6), 457–467.

Buboltz, W. C., Brown, F., & Soper, B. (2001). Sleep habits and patterns of college students: A preliminary study. Journal of the American College Health Association, 50(3), 131–135.

Burke, M., Marlow, C., & Lento, T. (2010, April). Social network activity and social well-being. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 1909-1912). ACM.

Buysse,D.J., Reynolds,C.F., Monk,T.H., Berman,S.R., & Kupfer,D.J. (1989). The Pittsburgh Sleep Quality Index (PSQI): A new instrument for psychiatric research and practice. Psychiatry Research, 28(2), 193-213.

Card, A. J. (2017). Moving Beyond the WHO Definition of Health: A New Perspective for an Aging World and the Emerging Era of Value-Based Care. World Medical & Health Policy, 9(1), 127-137.

Carskadon, M. A. (1990). Patterns of sleep and sleepiness in adolescents. Pediatrician, 17(1), 5-12.

Casement, M. D., Harrington, K. M., Miller, M. W., & Resick, P. A. (2012). Associations between Pittsburgh Sleep Quality Index factors and health outcomes in women with posttraumatic stress disorder. Sleep medicine, 13(6), 752-758.

Van Cauter, E., Spiegel, K., Tasali, E., & Leproult, R. (2008). Metabolic consequences of sleep and sleep loss. Sleep medicine, 9, S23-S28.

Centers for Disease Control and Prevention (2013). CDC's Policy Analytical Framework. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services.

Centraal Bureau voor Statistiek (2010). Verhuisgedrag van Jongeren. Accessed at March 13, 2018. Retrieved from: https://www.cbs.nl/nl-nl/achtergrond/2010/13/verhuisgedrag-van-jongeren

Chang, A. M., Aeschbach, D., Duffy, J. F., & Czeisler, C. A. (2015). Evening use of light-emitting eReaders negatively affects sleep, circadian timing, and next-morning alertness. Proceedings of the National Academy of Sciences, 112(4), 1232-1237.

Cheng, S. H., Shih, C. C., Lee, I. H., Hou, Y. W., Chen, K. C., Chen, K. T., ... & Yang, Y. C. (2012). A study on the sleep quality of incoming university students. Psychiatry research, 197(3), 270-274.

Chokroverty, S., & Ferini-Strambi, L. (2017). Oxford Textbook of Sleep Disorders. Oxford, UK. Accessed at February 23, 2018. Retrieved from: http://oxfordmedicine.com/view/10.1093/med/9780199682003.001.0001/med-9780199682003

Cohen, S., Kamarck, T., & Mermelstein, R. (1994). Perceived stress scale. Measuring stress: A guide for health and social scientists.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. Journal of health and social behavior, 385-396.

Colligan, T. W., & Higgins, E. M. (2006). Workplace stress: Etiology and consequences. Journal of workplace behavioral health, 21(2), 89-97.

Coveney, C. M. (2014). Managing sleep and wakefulness in a 24-hour world. Sociology of Health and Illness, 36(1), 123–136.

Cronbach, L.J. (1960). The essentials of psychological testing. New York: Harper & Row.

Curcio, G., Ferrara, M., & De Gennaro, L. (2006). Sleep loss, learning capacity and academic performance. Sleep Medicine Reviews, 10(5), 323–337.

Danner, F., & Phillips, B. (2008). Adolescent sleep, school start times, and teen motor vehicle crashes. Journal of clinical sleep medicine: JCSM: official publication of the American Academy of Sleep Medicine, 4(6), 533.

DeSantis, A. S., Diez Roux, A. V., Moore, K., Baron, K. G., Mujahid, M. S., & Nieto, F. J. (2013). Associations of Neighborhood Characteristics with Sleep Timing and Quality: The Multi-Ethnic Study of Atherosclerosis. Sleep, 36(10), 1543–1551.

Dijk, D. J. (2014). Daily variations in sleep: associated genes and effects on affect. Journal of sleep research, 23(6), 607-608.

Dijk, D.J. (2009). Regulation and functional correlates of slow wave sleep. Journal of Clinical Sleep Medicine, 5(2 Suppl), S6-15.

Dodd, L. J., Al-Nakeeb, Y., Nevill, A., & Forshaw, M. J. (2010). Lifestyle risk factors of students: a cluster analytical approach. Preventive medicine, 51(1), 73-77.

Donker, T., Comijs, H., Cuijpers, P., Terluin, B., Nolen, W., Zitman, F., & Penninx, B. (2010). The validity of the Dutch K10 and extended K10 screening scales for depressive and anxiety disorders. Psychiatry research, 176(1), 45-50.

Dopmeijer J. Factsheet Onderzoek Studieklimaat, gezondheid en studiesucces 2017; eerste resultaten. Windesheim. Accessed at August 28, 2018. Retrieved from: http://www.iso.nl/website/wp-content/uploads/2018/04/Factsheet_Onderzoek_Studieklimaat_april2018.pdf

van Dorsselaer S. & Goossens FX. Goossens (2015). Alcohol-, tabaks- en drugsgebruik door studenten. Trimbos Instituut. Accessed at March 17, 2018. Retrieved from: https://assets.trimbos.nl/docs/f5a4716f-a658-4a45-81ff-ac1682139a4e.pdf

Dusselier, L., Dunn, B., Wang, Y., Shelley iI, M. C., & Whalen, D. F. (2005). Personal, health, academic, and environmental predictors of stress for residence hall students. Journal of American college health, 54(1), 15-24.

Eckert D.J., Jordan A.S., Merchia P., Malhotra A. (2007). Central Sleep Apnea: Pathophysiology and Treatment. Chest; 131(2): 595–607.

Fleetham, J. A., & Fleming, J. A. E. (2014). Parasomnias. CMAJ : Canadian Medical Association Journal de l'Association Medicale Canadienne, 186(8), E273-80.

Galambos, N. L., Dalton, A. L., & Maggs, J. L. (2009). Losing sleep over it: Daily variation in sleep quantity and quality in Canadian students' first semester of university. Journal of research on adolescence, 19(4), 741-761.

Gau, S. F., & Soong, W. T. (1995). Sleep problems of junior high school students in Taipei. Sleep, 18(8), 667-673.

Gilbert, S. P., & Weaver, C. C. (2010). Sleep Quality and Academic Performance in University Students: A Wake-Up Call for College Psychologists. Journal of College Student Psychotherapy, 24(4), 295–306.

Gillham, B. (2007). Developing a Questionnaire. London: Continuum.

Giri, P. A., Baviskar, M. P., & Phalke, D. B. (2013). Study of sleep habits and sleep problems among medical students of Pravara Institute of Medical Sciences Loni, Western Maharashtra, India. Annals of medical and health sciences research, 3(1), 51-54.

Grandner, M. a, Hale, L., Moore, M., & Patel, N. P. (2011). Mortality associated with short sleep duration: The evidence, the possible mechanism and the future. Sleep Med Rev, 14(3), 191–203.

Gray, D. E. (2013). Doing research in the real world. Sage, p 87-88.

Grimm, P. (2010). Social desirability bias. Wiley international encyclopedia of marketing.

Gubbels, N. & Kappe, F.R. (2017). Stress en bevlogenheid. Explorerend onderzoek naar de mate van stress en bevlogenheid bij studenten van Hogeschool Inholland. Lectoraat Studiesucces, Hogeschool Inholland.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). Multivariate data analysis 6th ed. Uppersaddle River: Pearson Prentice Hall.

Hale, L., Hill, T. D., & Burdette, A. M. (2010). Does sleep quality mediate the association between neighborhood disorder and self-rated physical health?. Preventive medicine, 51(3-4), 275-278.

van der Heijde, C. M., Vonk, P. & Meijman, F. J. (2013). Stoplichten. Projectresultaten Studentengezondheidstest 2012. Amsterdam: Bureau Studentenartsen/ UvA.

van der Heijde, C. M., Vonk, P., & Meijman, F. J. (2014). Stoplichten. Projectresultaten Studentengezondheidstest 2013-2014. Amsterdam: Bureau Studentenartsen/ UvA.

van der Heijde, C. M., Vonk, P., & Meijman, F. J. (2016). Stoplichten. Projectresultaten Studentengezondheidstest 2015-2016. Amsterdam: Bureau Studentenartsen/ UvA.

van der Heijden, K. B., Vermeulen, M. C. M., Donjacour, C. E. H. M., Gordijn, M. C. M., Hamburger, H. L., Meijer, A. M., Weysen, T. (2017). Chronic sleep reduction is associated with academic achievement and study concentration in higher education students. Journal of Sleep Research.

Hershner, S. D., & Chervin, R. D. (2014). Causes and consequences of sleepiness among college students. Nature and Science of Sleep, 6, 73–84.

Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., Adams Hillard, P. J. (2015). National sleep foundation's sleep time duration recommendations: Methodology and results summary. Sleep Health, 1(1), 40–43.

Colten, HR.; Altevogt, BM., editors. Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem. Washington, DC: National Academies Press; 2006. Extent and health consequences of chronic sleep loss and sleep disorders.

International Classification of Sleep Disorders – Third Edition. Darien, IL: American Academy of Sleep Medicine, 2014.

Interstedelijk Studenten Overleg (ISO) (2015). Sucstress: De stress om succes. Accessed at March 22, 2018. Retrieved from: https://www.iso.nl/website/wp-content/uploads/2015/01/1415-Sucstress.pdf

Irish, L. A., Kline, C. E., Gunn, H. E., Buysse, D. J., & Hall, M. H. (2015). The role of sleep hygiene in promoting public health: A review of empirical evidence. Sleep Medicine Reviews, 22, 23–36.

Jefferson, C. D., Drake, C. L., Scofield, H. M., Myers, E., McClure, T., Roehrs, T., & Roth, T. (2005). Sleep hygiene practices in a population-based sample of insomniacs. Sleep, 28(5), 611-615.

Ji A, Wang R (2018) Study on the Current Situation of College Students' Sleep Quality in China. J Sleep Disord Ther 7: 287.

De Jong Gierveld, J. (1987). Developing and testing a model of loneliness. Journal of Personality and Social Psychology, 53, 119-128.

Judd B.G., Sateia M.J. (2017). Classification of sleep disorders. Accessed at 14-2-2018. Retrieved from: https://www.uptodate.com/contents/classification-of-sleep-disorders

Kadam, P., & Bhalerao, S. (2010). Sample size calculation. International journal of Ayurveda research, 1(1), 55.

Kahn, M., Sheppes, G., & Sadeh, A. (2013). Sleep and emotions: bidirectional links and underlying mechanisms. International Journal of Psychophysiology, 89(2), 218-228.

Kaneita, Y., Ohida, T., Osaki, Y., Tanihata, T., Minowa, M., Suzuki, K., ... & Hayashi, K. (2007). Association between mental health status and sleep status among adolescents in Japan: a nationwide cross-sectional survey. The Journal of clinical psychiatry, 68(9), 1426-1435.

Kessler, R. C., Barker, P. R., Colpe, L. J., Epstein, J. F., Gfroerer, J. C., Hiripi, E., ... & Zaslavsky, A. M. (2003). Screening for serious mental illness in the general population. Archives of general psychiatry, 60(2), 184-189.

Khan, Z., & Trotti, L. M. (2015). Central disorders of hypersomnolence: Focus on the narcolepsies and idiopathic hypersomnia. Chest, 148(1), 262–273.

Khurshid, K. A. (2016). Bi-Directional Relationship Between Sleep Problems and Psychiatric Disorders. Psychiatric Annals, 46(7), 385-387.

Kierlin, L., Olmstead, R., Yokomizo, M., Nicassio, P., & Irwin, M. R. (2012). Diagnostic and Statistical Manual criteria for insomnia related impairment in daytime functioning: Polysomnographic correlates in older adults. Sleep medicine, 13(7), 958-960.

Killgore, W. D., Richards, J. M., Killgore, D. B., Kamimori, G. H., & Balkin, T. J. (2007). The trait of Introversion–Extraversion predicts vulnerability to sleep deprivation. Journal of sleep research, 16(4), 354-363.

Kim, E.-J., & Dimsdale, J. E. (2007). The Effect of Psychosocial Stress on Sleep: A Review of Polysomnographic Evidence. Behavioral Sleep Medicine, 5(4), 256–278.

Knufinke, M., Nieuwenhuys, A., Geurts, S. A., Coenen, A. M., & Kompier, M. A. (2018). Self-reported sleep quantity, quality and sleep hygiene in elite athletes. Journal of sleep research, 27(1), 78-85.

van de Laar, M., Verbeek, I., Pevernagie, D., Aldenkamp, A., & Overeem, S. (2010). The role of personality traits in insomnia. Sleep medicine reviews, 14(1), 61-68.

Lane, E. J., & Daugherty, T. K. (1999). Correlates of social alienation among college students. College Student Journal, 33(1), 7-7.

LeBourgeois, M. K., Giannotti, F., Cortesi, F., Wolfson, A. R., & Harsh, J. (2005). The relationship between reported sleep quality and sleep hygiene in Italian and American adolescents. Pediatrics, 115(Supplement 1), 257-265.

LeBourgeois, M. K., Hale, L., Chang, A. M., Akacem, L. D., Montgomery-Downs, H. E., & Buxton, O. M. (2017). Digital media and sleep in childhood and adolescence. Pediatrics, 140(Supplement 2), S92-S96.

Léger, D., Scheuermaier, K., Philip, P., Paillard, M., & Guilleminault, C. (2001). SF-36: evaluation of quality of life in severe and mild insomniacs compared with good sleepers. Psychosomatic medicine, 63(1), 49-55.

Levenson JC, Miller E, Hafer B, Reidell MF, Buysse DJ, Franzen PL (2006). Pilot Study of a Sleep Health Promotion Program for College Students. Sleep Health; 2(2): 167–174.

Lewig, K. A., Xanthopoulou, D., Bakker, A. B., Dollard, M. F., & Metzer, J. C. (2007). Burnout and connectedness among Australian volunteers: A test of the Job Demands–Resources model. Journal of vocational behavior, 71(3), 429-445.

Liu, X. (2004). Sleep and adolescent suicidal behavior. Sleep, 27(7), 1351–1358.

Liu, Y., Croft, J. B., Wheaton, A. G., Perry, G. S., Chapman, D. P., Strine, T. W., ... & Presley-Cantrell, L. (2013). Association between perceived insufficient sleep, frequent mental distress, obesity and chronic diseases among US adults, 2009 behavioral risk factor surveillance system. BMC public health, 13(1), 84.

Lowry, M., Dean, K., & Manders, K. (2010). The Link Between Sleep Quantity and Academic Performance for the College Student. Undergraduate Journal of Psychology, 3 (Spring 2010), 16–19.

Lund, H. G., Reider, B. D., Whiting, A. B., & Prichard, J. R. (2010). Sleep patterns and predictors of disturbed sleep in a large population of college students. Journal of adolescent health, 46(2), 124-132.

Mahoney, J. J., De La Garza, R., Jackson, B. J., Verrico, C. D., Ho, A., Iqbal, T., & Newton, T. F. (2014). The relationship between sleep and drug use characteristics in participants with cocaine or methamphetamine use disorders. Psychiatry research, 219(2), 367-371.

Malone, S. K. (2011). Early to bed, early to rise?: An exploration of adolescent sleep hygiene practices. Journal of School Nursing, 27(5), 348–354.

Matthews, T., Danese, A., Gregory, A. M., Caspi, A., Moffitt, T. E., & Arseneault, L. (2017). Sleeping with one eye open: Loneliness and sleep quality in young adults. Psychological Medicine, 47(12), 2177–2186.

Minges, K. E., & Redeker, N. S. (2016). Delayed school start times and adolescent sleep: a systematic review of the experimental evidence. Sleep medicine reviews, 28, 86-95.

Mori, S. (2000). Addressing the Mental Health Concerns of International Students. Journal of Counseling & Development, 78, 137–144.

Morin, C. M., Blais, F., & Savard, J. (2002). Are changes in beliefs and attitudes about sleep related to sleep improvements in the treatment of insomnia?. Behaviour Research and Therapy, 40(7), 741-752.

Nagai, M., Hoshide, S., & Kario, K. (2010). Sleep Duration as a Risk Factor for Cardiovascular Disease- a Review of the Recent Literature. Current Cardiology Reviews, 6(1), 54–61.

Nathaniel, W., Badr, M. S., Belenky, G., Bliwise, D. L., & Buxton, O. M. (2015). SLEEP - Recommended Amount of Sleep for a Healthy Adult: A Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society. Sleep, 38(6), 843–844.

NHG-Standaard Slaapproblemen en slaapmiddelen (2014). Knuistingh Neven A, Lucassen PLBJ, Bonsema K, Teunissen H, Verduijn MM, Bouma M Huisarts Wet;48(8):402-15.

NSWO. Nationale Slaapweek 21-26 Maart 2016. Accessed at March 16, 2018. Retrieved from: http://www.nswo.nl/userfiles/files/Persbericht%20NSWO%202016.pdf

O'Brien, M. C., McCoy, T. P., Rhodes, S. D., Wagoner, A., & Wolfson, M. (2008). Caffeinated cocktails: Energy drink consumption, high-risk drinking, and alcohol-related consequences among college students. Academic Emergency Medicine, 15(5), 453–460.

Ohayon, M. M. (2002). Epidemiology of insomnia: what we know and what we still need to learn. Sleep medicine reviews, 6(2), 97-111.

Osborne, J. W., & Overbay, A. (2004). The power of outliers (and why researchers should always check for them). Practical assessment, research & evaluation, 9(6), 1-12.

Otsuka, Y., Kaneita, Y., Itani, O., Nakagome, S., Jike, M., & Ohida, T. (2017). Relationship between stress coping and sleep disorders among the general Japanese population: a nationwide representative survey. Sleep medicine, 37, 38-45.

Owens, J. (2014). Insufficient Sleep in Adolescents and Young Adults: An Update on Causes and Consequences. Pediatrics, 134(3), e921–e932.

Owens, J. A., Belon, K., & Moss, P. (2010). Impact of delaying school start time on adolescent sleep, mood, and behavior. Archives of pediatrics & adolescent medicine, 164(7), 608-614.

Pilcher, J. J., Ginter, D. R., & Sadowsky, B. (1997). Sleep quality versus sleep quantity: relationships between sleep and measures of health, well-being and sleepiness in college students. Journal of psychosomatic research, 42(6), 583-596.

Pirrera, S., De Valck, E., & Cluydts, R. (2010). Nocturnal road traffic noise: A review on its assessment and consequences on sleep and health. Environment international, 36(5), 492-498.

Prather, A. A., & Leung, C. W. (2016). Association of Insufficient Sleep With Respiratory Infection Among Adults in the United States. JAMA Internal Medicine, 176(6), 850–2.

Primack, B. A., Shensa, A., Sidani, J. E., Whaite, E. O., yi Lin, L., Rosen, D., ... & Miller, E. (2017). Social media use and perceived social isolation among young adults in the US. American journal of preventive medicine, 53(1), 1-8.

Qualtrics, I. (2005). Qualtrics. com. Provo, UT, USA.

Rahmati, Z. (2015). The study of academic burnout in students with high and low level of self-efficacy. Procedia-Social and Behavioral Sciences, 171, 49-55.

ResearchNed. (2014). Monitor Beleidsmaatregelen 2014. Accessed at 14 March, 2018. Retrieved from: http://www.studentenmonitor.nl/rapporten/monitor-beleidsmaatregelen-2014.pdf

Riemann, D., Berger, M., & Voderholzer, U. (2001). Sleep and depression—results from psychobiological studies: an overview. Biological psychology, 57(1-3), 67-103.

Robotham, D., & Julian, C. (2006). Stress and the higher education student: a critical review of the literature. Journal of further and higher education, 30(02), 107-117.

Sabanayagam, C., & Shankar, A. (2010). Sleep duration and cardiovascular disease: Results from the National Health Interview Survey. Sleep, 33(8), 1037–1042.

Sateia, M. J. (2014). International classification of sleep disorders. Chest, 146(5), 1387-1394.

Saunders, J. B., Aasland, O. G., Babor, T. F., De la Fuente, J. R., & Grant, M. (1993). Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. Addiction, 88(6), 791-804.

Schredl, M., Alm, B., & Sobanski, E. (2007). Sleep quality in adult patients with attention deficit hyperactivity disorder (ADHD). European Archives of Psychiatry and Clinical Neuroscience, 257(3), 164-168.

Schlarb, A. A., Friedrich, A., & Claßen, M. (2017). Sleep problems in university students - An intervention. Neuropsychiatric Disease and Treatment, 13, 1989–2001.

Schmidt, E., & Simons, M. (2013). Psychische klachten onder studenten. Landelijke Studentenvakbond, 1–41. Accessed at March 17, 2018. Retrieved from: https://lsvb.nl/wp-content/uploads/2016/10/Onderzoeksrapport_Psychische_klachten.pdf

Scott-Sheldon LAJ, Carey KB, Carey MP (2008). Health Behavior and College Students: Does Greek Affiliation Matter? J Behav. Med; 31(1): 61–70.

Sexton-Radek, K., & Hartley, A. (2013). College Residential Sleep Environment. Psychological Reports, 113(3), 903–907.

Shepherd, D., Welch, D., Dirks, K. N., & McBride, D. (2013). Do quiet areas afford greater health-related quality of life than noisy areas?. International Journal of Environmental Research and Public Health, 10(4), 1284-1303.

Singleton, R. A., & Wolfson, A. R. (2009). Alcohol consumption, sleep, and academic performance among college students. Journal of Studies on Alcohol and Drugs, 70(3), 355-363.

Sociaal Cultureel Planbureau (2013). De studie waard. Accessed at March 13, 2018. Retrieved from: https://www.scp.nl/Publicaties/Alle_publicaties/Publicaties_2013/De_studie_waard

Stein, M. D., & Friedmann, P. D. (2006). Disturbed sleep and its relationship to alcohol use. Substance Abuse, 26(1), 1-13.

Stein, M. A., Weiss, M., & Hlavaty, L. (2012). ADHD treatments, sleep, and sleep problems: complex associations. Neurotherapeutics, 9(3), 509-517.

Stepanski, E. J., & Wyatt, J. K. (2003). Use of sleep hygiene in the treatment of insomnia. Sleep medicine reviews, 7(3), 215-225.

Steptoe, A., Peacey, V., Wardle, J., & Population, S. (2006). Sleep Duration and Health in Young Adults. Arch Intern Med, 166, 1689–1692.

Storfer-Isser, A., Lebourgeois, M. K., Harsh, J., Tompsett, C. J., & Redline, S. (2013). Psychometric properties of the adolescent sleep hygiene scale. Journal of sleep research, 22(6), 707-716.

Stošić, L., & Blagojević, L. (2011). Environmental noise and mental disturbances in urban population. Acta Med Median, 50(3), 34-39.

Taheri, S., Lin, L., Austin, D., Young, T., & Mignot, E. (2004). Short sleep duration is associated with reduced leptin, elevated ghrelin, and increased body mass index. PLoS medicine, 1(3), e62.

Tan, J. B., & Yates, S. (2011). Academic expectations as sources of stress in Asian students. Social Psychology of Education, 14(3), 389–407.

Tavernier, R., & Willoughby, T. (2014). Bidirectional associations between sleep (quality and duration) and psychosocial functioning across the university years. Developmental psychology, 50(3), 674.

Thacher, P. V. (2008). University students and the “All Nighter”: Correlates and patterns of students' engagement in a single night of total sleep deprivation. Behavioral sleep medicine, 6(1), 16-31.

Thomée, S., Härenstam, A., & Hagberg, M. (2011). Mobile phone use and stress, sleep disturbances, and symptoms of depression among young adults - A prospective cohort study. BMC Public Health, 11.

Thorpy, M. J. (2012). Classification of Sleep Disorders. Neurotherapeutics, 9(4), 687–701.

Twisk, J.W.R. (2014). Inleiding in de toegepaste biostatistiek. Maarssen: Elsevier gezondheidszorg. P 107 – 115.

U.S. Department of Education (2011).. How is Grade Point Average Calculated. National Assessment of Educational Progress. Accessed at July 23, 2018. Retrieved from: https://nces.ed.gov/nationsreportcard/hsts/howgpa.aspx

Valli Jayanthi, S., Balakrishnan, S., Lim Siok Ching, A., Aaqilah Abdul Latiff, N., & Nasirudeen, A. M. A. (2014). Factors Contributing to Academic Performance of Students in a Tertiary Institution in Singapore. American Journal of Educational Research, 2(9), 752–758.

Verschuren, P., Doorewaard, H. and Mellion, M. (2010). Designing a research project. The Hague: Eleven International Publishing House, p 161 – 169.

Vyazovskiy, V. V., & Delogu, A. (2014). NREM and REM sleep: Complementary roles in recovery after wakefulness. Neuroscientist, 20(3), 203–219.

Wang, D., Xing, X. H., & Wu, X. B. (2013). Healthy lifestyles of university students in China and influential factors. The Scientific World Journal, 2013.

Ware Jr, J. E., & Sherbourne, C. D. (1992). The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. Medical care, 473-483.

Weinstein, C. E., Schulte, A, & Palmer, D. (1987). LASSI: Learning and Study Strategies Inventory. Clearwater, FL: H& H Publishing.

Wheaton, A. G., Chapman, D. P., Croft, J. B., Chief, B., & Branch, S. (2016). School Start Times, Sleep, Behavioral, Health, and Academic. Outcomes: a review of the literature. J Sch Health, 86(5), 363–381.

Williams, S. J., Coveney, C. M., & Gabe, J. (2013). Medicalisation or customisation? Sleep, enterprise and enhancement in the 24/7 society. Social Science & Medicine, 79, 40-47.

Wilson, J. (2013). Exploring the past, present and future of cultural competency research: The revision and expansion of the sociocultural adaptation construct. Unpublished doctoral dissertation. Victoria University of Wellington.

Wing, Y. K., & Tsui, Y. Y. (2009). A study on the sleep patterns and problems of university business students in Hong Kong. Journal of American College Health, 58(2), 167–176.

World Health Organization (2014) Definition of mental health. Accessed at March 15, 2018. Retrieved from: http://www.who.int/features/factfiles/mental_health/en/

World Health Organization (2018). Definition of health. Accessed at March 15, 2018. Retrieved from: http://www.who.int/about/mission/en/

Wright, K. B. (2005). Researching Internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services. Journal of computer-mediated communication, 10(3), JCMC1034.

Zhu, L., & Zee, P. C. (2012). Circadian rhythm sleep disorders. Neurologic clinics, 30(4), 1167-1191.

Zochil, M. L., & Thorsteinsson, E. B. (2018). Exploring poor sleep, mental health, and help-seeking intention in university students. Australian Journal of Psychology, 70(1), 41-47.

Appendix A Recruitment of participants – Student survey

The invitation to participate in the student survey was distributed through e-mail and social media.

E-mail invitation to higher educational students in Amsterdam Facebook and e-mail.

For English see below!

Beste student,

Voor het onderzoek naar slaapproblemen onder studenten in het hoger onderwijs in Amsterdam zijn wij opzoek naar respondenten die een vragenlijst willen invullen. Met dit onderzoek willen wij slaapproblemen onder studenten in kaart brengen, om deze reden hopen wij dat zo veel mogelijk studenten willen meewerken om zo een zo representatief mogelijk beeld te krijgen. Om deze vragenlijst in te vullen hoef je geen slaapproblemen te hebben, ook studenten die geen last hebben kunnen meedoen. De tijd die nodig is om het in te vullen is afhankelijk van je gegeven antwoorden (gemiddeld 10-20 minuten).
Deelname aan dit onderzoek is op vrijwillige basis en is volledig anoniem. De resultaten van dit onderzoek zullen worden verwerkt in een onderzoeksrapport. Tevens maak je als deelnemer kans op een waardebon van Bol.com ter waarde van 20 euro.

Link naar het onderzoek: https://nlpsych.eu.qualtrics.com/jfe/form/SV_a8ywv8sJtlycwOF

Informatie onderzoek
De studententijd wordt vaak omgeschreven als de beste tijd van je leven. Echter, het is gebleken dat dit ten koste kan gaan van goede slaap. Uit wetenschappelijk onderzoek is gekomen dat studenten inderdaad een verhoogd risico hebben om last te hebben van slaapproblemen. Om deze reden is er een onderzoek gestart bij Bureau Studentenhuisartsen om de slaapproblemen van studenten in het hoger onderwijs in Amsterdam te onderzoeken. Het doel van dit onderzoek is in kaart te brengen hoeveel studenten slaapproblemen ervaren, wat de achterliggende oorzaken zijn en wat de effecten zijn op fysieke/mentale gezondheid en studieprestatie. Met dit onderzoek ontstaat er meer kennis over deze problematiek en kan er gekeken worden naar de mogelijkheden om beleid te ontwikkelen om het slapen van studenten te verbeteren.

Mocht je vragen of opmerkingen hebben, voel je vrij om contact op te nemen met mij.
Alvast bedankt voor het invullen van de vragenlijst!

Monique van Weeren
m.c.vanweeren@uva.nl
Huisartsen Oude Turfmarkt | Bureau Studentenartsen

Dear student,

For a research into sleep problems among students in higher education in Amsterdam, we are looking for respondents who want to fill out a questionnaire. With this research we want to investigate the extent of sleep problems among students. For this reason, we hope that as many students as possible want to participate in order to get a representative view. To fill in this questionnaire, you do not need to have sleeping problems, even students who don't have problems regarding their sleep can participate. The time required to participate depends on your answers (10-20 minutes on average). Participation in this research is voluntary and completely anonymous. The results of this research will be processed in a research report. As a participant, you will have a chance at winning one of the gift cards from Bol.com worth 20 euros.

Link to the survey: https://nlpsych.eu.qualtrics.com/jfe/form/SV_81wDECeLAHDOfCR

Research information
College days are often described as the best time of your life. However, it has been found that this can be at the expense of good sleep. Scientific research has shown that students indeed have a higher risk to suffer from sleep problems. For this reason, a study has been started at the Student Health Service to investigate the sleep problems of students in higher education in Amsterdam. The aim of this research is to investigate how many students experience sleep problems, what the underlying causes are and what the associated effects are on physical / mental health and study performance. With this research, more knowledge about this problem will be obtained and the possibilities to develop policies to improve the sleep of students can be examined.

If you have questions or comments, feel free to contact me.
Thanks in advance for filling out the questionnaire!

Monique van Weeren
m.c.vanweeren@uva.nl

Huisartsen Oude Turfmarkt | Bureau Studentenartsen

Invitation on social media

For English see below!

English below!

Lieve medestudenten,

De afgelopen tijd is de gezondheid van studenten veel in het nieuws geweest. Het is gebleken dat veel studenten een verhoogd risico hebben op zowel lichamelijke als geestelijke problemen. Om deze reden doe ik voor mijn master onderzoek naar slaapproblemen onder studenten in Amsterdam. Ik ga in kaart brengen hoe veel studenten slaapproblemen ervaren en wat de effecten zijn op lichamelijke, mentale gezondheid en academische prestatie. Met dit onderzoek kan er vervolgens gekeken worden of er mogelijkheden zijn om beleid te ontwikkelen om het slapen van studenten te verbeteren

Willen jullie mij helpen met mijn onderzoek door het invullen van mijn vragenlijst? Door het invullen maak je kans op een waardebon van Bol.com ter waarde van 20 euro!

Dit is de link: https://nlpsych.eu.qualtrics.com/jfe/form/SV_a8ywv8sJtlycwOF

Alvast bedankt!

Dear fellow students,

Recently, the health of students has been in the news a lot. It has been found that many students have an increased risk of both physical and mental problems. For this reason, I am currently performing a research into sleep problems among students in Amsterdam. I will explore how many students experience sleep problems and what the associated effects are on physical, mental health and academic performance. With this research, more knowledge of these problems will be obtained and it can be examined whether there are opportunities to develop policy to improve the sleep of students.

Do you want to help me with my research by completing my questionnaire? By filling in you can win a giftcard from Bol.com worth 20 euros!

This is the link: https://nlpsych.eu.qualtrics.com/jfe/form/SV_81wDECeLAHDOfCR

Thanks in advance!

The invitations to participate in the student survey were posted on the following Facebook pages:

- Personal page of the researcher
- MPA 2016-2018
- MPA VU Amsterdam 2017
- Health & Life Sciences
- Dames College Confetti 1937
- Unitas S.A.

Appendix B Recruitment of participants – Expert survey

The invitation to participate in the expert survey was distributed through e-mail.

Geachte heer/mevrouw,

Bureau Studentenartsen van de Universiteit van Amsterdam doet momenteel onderzoek om meer inzicht te krijgen in de omvang van slaapproblemen onder studenten in het hoger onderwijs in Amsterdam, en de factoren die bij kunnen dragen aan het ontwikkelen van slaapproblemen, waaronder studiestress, slaapgedrag en kennis van slaap (slaaphygiene). Tevens willen wij door middel van deze vragenlijst de mogelijkheden verkennen voor het ontwikkelen van beleid, om zo mogelijk de slaap van studenten te verbeteren.

Graag zou ik u als zorgverlener/onderzoeker willen vragen om deze vragenlijst in te vullen. Het invullen van de vragenlijst duurt maximaal 10 minuten. Deelname aan dit onderzoek is geheel op vrijwillige basis en is eenmalig. U kunt uw deelname ook op elk gewenst moment ongedaan maken. Deelname is anoniem, de data wordt alleen door de onderzoeker op groepsniveau verwerkt.

Link naar de vragenlijst: https://nlpsych.eu.qualtrics.com/jfe/form/SV_5gNc1dH24nAI0Qd

Onderzoeksinformatie

De gezondheid van studenten is de afgelopen tijd vaak in het nieuws gekomen. Uit diverse onderzoeken is gebleken dat studenten een verhoogd risico hebben op zowel mentale als fysieke klachten waaronder burn-out, depressie en vermoeidheid. Voorts is bekend dat een goede nachtrust belangrijk is voor gezondheid en studieprestaties en dat deze onder studenten wel eens vaker in het gedrang is. In het verleden was er niet zoveel aandacht voor deze verbanden, maar daar lijkt nu verandering in te komen.

De kennis die we graag willen opdoen van experts, zoals u, zal worden ingezet voor het mogelijk ontwikkelen van beleid om zo de goede nachtrust van studenten te bevorderen. Tijdens deze vragenlijst zal uw mening gevraagd worden over verschillende aspecten omtrent de ontwikkeling van beleid en word uw mening gevraagd over twee mogelijke oplossingen voor slaapproblemen voor studenten die zijn aangedragen in wetenschappelijke literatuur.

Mocht u vragen of opmerkingen hebben, dan kunt u contact met mij opnemen via onderstaand e-mail adres.

Met vriendelijke groet,

Monique van Weeren
m.c.vanweeren@uva.nl

Claudia van der Heijde, sr onderzoeker
c.m.vanderheijde@uva.nl

Peter Vonk, directeur Studentenartsen
p.vonk@uva.nl

Appendix C Student survey

English version of the survey

Dear student,

College days are often described as the best time of your life. However, this often happens at the expense of good sleep. Several scientific studies have shown that indeed many students suffer from sleep problems. For this reason, I am doing research at the Student Health Service into factors and effects of sleeping problems among students in higher education in Amsterdam.

The aim of this research is to investigate the extent of sleeping problems, the factors and the associated effects on physical / mental health and academic performance. With this study, more knowledge about this problem will be obtained and the possibilities to develop policies to improve the sleep of students can be examined.

I would like to ask you to help me in my research by filling in the questionnaire. Even if you are not experiencing any sleep problems, you are still welcome to fill in the survey. The time it will take you to fill in the questionnaire depends on your answers (on average 10 to 20 minutes).

You can choose whether you want to participate in this questionnaire or not. Participation is voluntarily and one-time. You are also free to cancel your participation at any time. Participating is completely confidential and your answers will be processed anonymously on a group level, and only by the researcher. There will be several bol.com gift cards to the value of 20 euros randomly distributed among all participants. If you want to make a chance at winning one of the gift cards, you need to fill in your e-mail address at the end of the questionnaire.

If you have any questions regarding the survey, do not hesitate to contact me.

Thank you in advance for filing out the questionnaire!

Monique van Weeren,
m.c.vanweeren@uva.nl

Huisartsen Oude Turfmarkt | Bureau Studentenartsen

Section A: Demographic characteristics

Are you currently studying in Amsterdam?

- ○ Yes
- ○ No

What is your age?

[ ] years old.

Are you … ?

- ○ Male
- ○ Female

What is your living situation?

- I live with my parents
- I live on my own
- I live with roommates/friends
- I live with my partner
- Other : …

What educational facility are you attending?

- University of Amsterdam
- VU University
- University of Applied Sciences Amsterdam
- Inholland University of Applied Sciences
- Other …

At which department are you studying?

In case respondent studied at University of Amsterdam.

- Economics and Business
- Faculty of Dentistry (ACTA)
- Faculty of Humanities
- Faculty of Law
- Faculty of Medicine (AMC)
- Faculty of Science
- Faculty of Social and Behavioral Sciences

In case respondent studied at VU Amsterdam.

- Faculty of Dentistry (ACTA)
- Faculty of Behavioral and Movement Sciences
- Faculty of Humanities
- Faculty of Law
- Faculty of Medicine (VUmc)
- School of Business and Economics
- Faculty of Science
- Faculty of Social Science
- Faculty of Theology

In case respondent studied at University of Applied Sciences Amsterdam.

- Faculty of Sports and Nutrition
- Faculty of Business and Economics
- Faculty of Health
- Faculty of Applied Social Sciences and Law
- Faculty of Digital Media and Creative Industries
- Faculty of Education
- Faculty of Technology

In case respondent studied at Inholland University of Applied Science

- Creative Business
- Education & Innovation
- Business, Finance & Law
- Engineering, Design & Computing
- Agri, Food & Life Sciences
- Health, Sports & Social Work

What is your current year of study?

- Bachelor 1st year
- Bachelor 2nd year
- Bachelor 3rd year
- Bachelor 4th year
- Pre-master
- Master
- PhD
- Other: …

In what year did you start studying?

- < 2013
- 2013
- 2014
- 2015
- 2016
- 2017

Section B: Sleep quantity and quality

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.

Sleep quantity

When have you usually gone to bed?

How long (in minutes) has it taken you to fall asleep each night?

What time have you usually gotten up in the morning?

How many hours of actual sleep did you get at night?

How many hours were you in bed?

Sleep quality

During the past month, how often have you had trouble sleeping because you	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
A. Cannot get to sleep within 30 minutes	○	○	○	○
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. Have bad dreams	○	○	○	○
I. Have pain	○	○	○	○

During the past month, how often have you had trouble sleeping because you	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
J. Other reason (s), please describe, including how often you have had trouble sleeping because of this reason (s):	○	○	○	○

	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
During the past month, how often have you taken medicine (prescribed or “over the counter”) to help you sleep?	○	○	○	○
During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?	○	○	○	○
During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?	○	○	○	○

During the past month, how would you rate your sleep quality overall?

- ○ Very good
- ○ Fairly good
- ○ Fairly bad
- ○ Very bad

(The Pittsburgh Sleep Quality Index (PSQI))

Section C-1: Sleep factors - Individual level

Sleep need

How many hours of sleep do you think you need to function optimally?

[ ]

Sleep beliefs

For the following list of behaviors, please indicate whether you believe they produce a positive effect, a negative effect, or neither effect on sleep. Please do not make reference to how they influence your sleep in particular, but to the effects you think these behaviors have on people in general. Please answer ALL the statements by checking the appropriate box, even if you are not completely sure of the answer.

	Positive effect	Neither effect	Negative effect
Drinking alcohol in the evening	○	○	○
Drinking coffee or other substances with caffeine after dinner	○	○	○
Doing intense physical exercise before going to bed	○	○	○
Taking a long nap during the day	○	○	○
Going to bed and waking up always at the same hour	○	○	○
Thinking about one's engagements for the next day before falling asleep	○	○	○
Using sleep medication regularly	○	○	○
Smoking before falling asleep	○	○	○
Diverting one's attention and relaxing before bedtime	○	○	○
Going to bed 2h later than the habitual hour	○	○	○
Going to bed with an empty stomach	○	○	○
Using the bed for eating, calling on the phone, studying and other non-sleeping activities	○	○	○
Trying to fall asleep without having a sleep sensation	○	○	○
Studying or working intensely until late night	○	○	○
Getting up when it is difficult to fall asleep	○	○	○
Going to bed 2h earlier than the habitual hour	○	○	○
Going to bed immediately after eating	○	○	○
Being worried about the impossibility of getting enough sleep	○	○	○
Sleeping in a quiet and dark room	○	○	○

Recovering lost sleep by sleeping for a long time	○	○	○

(The Sleep Beliefs Scale)

Behavior

Using the choices below, circle how often the following things have happened during the past month.

	Never	Once in awhile	Sometimes	Quite often	Often	Always
After 6:00 pm, I have drinks with caffeine	○	○	○	○	○	○
During the hour before bedtime, I am very active	○	○	○	○	○	○
During the hour before bedtime, I drink >4 glasses of water	○	○	○	○	○	○
I go to bed with a stomachache	○	○	○	○	○	○
I go to bed feeling hungry	○	○	○	○	○	○
During the hour before bedtime, I do things that make me feel very awake	○	○	○	○	○	○
I go to bed and do things in my bed that keep me awake	○	○	○	○	○	○
I use my bed for things other than sleep	○	○	○	○	○	○
I go to bed and think about things I need to do	○	○	○	○	○	○
I go to bed and replay the day's events over and over in my mind	○	○	○	○	○	○
I check my clock several times during the night	○	○	○	○	○	○
During the 1 h before bedtime, things happen that make me feel strong emotions	○	○	○	○	○	○
I go to bed feeling upset	○	○	○	○	○	○
I go to bed and worry about things at home or at school	○	○	○	○	○	○
During the day, I take a nap that lasts >1 h	○	○	○	○	○	○
After 6:00 pm, I take a nap	○	○	○	○	○	○
I fall asleep while listening to loud music	○	○	○	○	○	○
I fall asleep while watching TV	○	○	○	○	○	○
I fall asleep in a brightly lit room	○	○	○	○	○	○
I fall asleep in a room that feels too hot or too cold	○	○	○	○	○	○
I fall asleep in one place and then move to another place during the night	○	○	○	○	○	○

During the school week, I stay up more than 1 h past my usual bedtime	○	○	○	○	○	○
On weekends, I stay up more than 1 h past my usual bedtime	○	○	○	○	○	○
On weekends, I sleep in more than 1 h past my usual wake time	○	○	○	○	○	○

(Adolescent Sleep Hygiene Scale revised (ASHSr))

Psychology – Stress

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

	Never	Almost never	Sometimes	Fairly often	Very often
In the last month, how often have you been upset because of something that happened unexpectedly?	○	○	○	○	○
In the last month, how often have you felt that you were unable to control the important things in your life?	○	○	○	○	○
In the last month, how often have you felt nervous and “stressed”?	○	○	○	○	○
In the last month, how often have you felt confident about your ability to handle your personal problems?	○	○	○	○	○
In the last month, how often have you felt that things were going your way?	○	○	○	○	○
In the last month, how often have you found that you could not cope with all the things that you had to do?	○	○	○	○	○
In the last month, how often have you been able to control irritations in your life?	○	○	○	○	○
In the last month, how often have you felt that you were on top of things?	○	○	○	○	○
In the last month, how often have you been angered because of things that were outside of your control?	○	○	○	○	○
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	○	○	○	○	○

(Perceived stress scale-10)

Section C-2: Sleep factors – Social level

Work

Do you have a paid job next to your study?

- Yes
- No

In case respondent is having a paid job.
Does your job require irregular working times?

- Yes
- No

In case respondent is having a paid job.
Do you work in the evening or at night?

- Yes, in the evening
- Yes, at night
- Both in the evening and at night
- No

In case respondent is having a paid job.
How many hours per week do you work besides your study?

- 0-4 hours
- 4-8 hours
- 8-16 hours
- 16-24 hours
- 24 > hours

Do you have a volunteer job?

- Yes
- No

In case respondent is working as a volunteer.
Does your voluntary job requires irregular working times?

- Yes
- No

Do you work as a volunteer in the evening or at night?

- Yes, in the evening
- Yes, at night
- Both in the evening and at night
- No

In case respondent is having a volunteer job.
How many hours per week do you work as a volunteer?

- 0-4 hours
- 4-8 hours
- 8-16 hours
- 16-24 hours
- 24 > hours

Association

Are you a member of a student association?

- Yes
- No

In case respondent is member of a student association.

How much time do you spend at the student association per week?

- Less than one day
- 1 day
- 2-3 days
- 4 or more days

Study Stress

Please rate your perception about the following statements in contributing to academic stresses.

	Strongly disagree				Strongly agree
I am confident that I will be a successful student	○	○	○	○	○
I am confident that I will be a successful in my future career	○	○	○	○	○
I can make academic decisions easily	○	○	○	○	○
The time allocated to classes and academic work is enough	○	○	○	○	○
I have enough time to relax after work	○	○	○	○	○
My teachers are critical of my academic performance	○	○	○	○	○
I fear failing courses this year	○	○	○	○	○
I think that my worry about examinations is weakness of character	○	○	○	○	○
Teachers have unrealistic expectations of me	○	○	○	○	○
The size of the curriculum (workload) is excessive	○	○	○	○	○
I believe that the amount of work assignment is too much	○	○	○	○	○
Am unable to catch up if getting behind the work	○	○	○	○	○
The unrealistic expectations of my parents stresses me out	○	○	○	○	○
Competition with my peers for grades is quite intense	○	○	○	○	○
The examination questions are usually difficult	○	○	○	○	○
Examination time is short to complete the answers	○	○	○	○	○
Examination times are very stressful to me out	○	○	○	○	○

Even if I pass my exams, am worried about getting a job	○	○	○	○	○

(Perceptions of Academic Stress Scale)

Social network

The following questions are about your social network and your personal satisfaction with your social network.

	Never	Sometimes	Regularly	Often	Very often
What is the frequency of contact with friends?	○	○	○	○	○
What is the frequency of contacts with family?	○	○	○	○	○
What is the frequency of contact with colleagues?	○	○	○	○	○
What is the frequency of contact with neighbors?	○	○	○	○	○

Please indicate for each of the following statements, the extent to which they apply to your situation.

	Yes!	Yes	More or less	No	No!
There is always someone I can talk to about my day-to-day problems	○	○	○	○	○
I miss having a really close friend	○	○	○	○	○
I experience a general sense of emptiness	○	○	○	○	○
There are plenty of people I can lean on when I have problems	○	○	○	○	○
I miss the pleasure of the company of others	○	○	○	○	○
I find my circle of friends and acquaintances too limited	○	○	○	○	○
There are many people I can trust completely	○	○	○	○	○
There are enough people I feel close to	○	○	○	○	○
I miss having people around me	○	○	○	○	○
I often feel rejected	○	○	○	○	○
I can call on my friends whenever I need them	○	○	○	○	○

(The Loneliness Scale)

Culture

The following questions are about your cultural background.

What is your ethnic/cultural background? (more answers possible)

- Dutch
- Turkish
- Moroccan
- Surinam
- Antillean
- Indian
- Chinese
- Other: …

Are you an international or exchange student?

- Yes
- No

In case respondent is an international or exchange student.
Living in a new culture often involves learning new skills and behaviors. Thinking about life in your home country, please rate your competence at each of the following behaviors.

	Not competent at all	Somewhat competent	Competent	Highly competent	Extremely competent
Interacting at social events	○	○	○	○	○
Interacting with members of the opposite sex	○	○	○	○	○
Accurately interpreting and responding to other people's gestures and facial expressions	○	○	○	○	○
Varying the rate of my speaking in a culturally appropriate manner	○	○	○	○	○
Building and maintaining relationships	○	○	○	○	○
Changing my behavior to suit social norms, rules, attitudes, beliefs, and customs	○	○	○	○	○
Accurately interpreting and responding to other people's emotions	○	○	○	○	○
Managing my academic/work responsibilities	○	○	○	○	○
Working effectively with other students/work colleagues	○	○	○	○	○
Gaining feedback from other students/work colleagues to help improve my performance	○	○	○	○	○

Expressing my ideas to other students/work colleagues in a culturally appropriate manner	○	○	○	○	○
Maintaining my hobbies and interests	○	○	○	○	○
Obtaining community services I require	○	○	○	○	○
Dealing with the bureaucracy	○	○	○	○	○
Attending or participating in community activities	○	○	○	○	○
Adapting to the noise level in my neighborhood	○	○	○	○	○
Finding my way around	○	○	○	○	○
Adapting to the population density	○	○	○	○	○
Adapting to the pace of life	○	○	○	○	○
Understanding and speaking Dutch	○	○	○	○	○
Reading and writing Dutch	○	○	○	○	○

(Socio-Cultural Adaption Scale-R)

Section D: Physical health

Are you diagnosed with a sleeping disorder?

- ○ Yes
- ○ No

In case respondent has been diagnosed with a sleeping disorder.
What kind of sleeping disorder?

Are you diagnosed with a sleep-related disorder? (such as ADHD)

- ○ Yes
- ○ No

Do you suffer from an impairment?

- ○ Yes
- ○ No

In case respondent suffers from an impairment
What kind of impairment

How often do you drink alcohol?

- ○ Never
- ○ Monthly or less
- ○ 2 to 4 times a month
- ○ 2 to 3 times a week
- ○ 4 or more times a week

In case respondent is drinking alcohol.
How many units do you drink on a typical day when you are drinking?

- 1 or 2 drinks
- 3 or 4 drinks
- 5 or 6 drinks
- 7 to 9 drinks
- 10 or more drinks

In case respondent is drinking alcohol.
How often have you had 6 or more drinks on a single occasion in the last year?

- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily

(AUDIT-C)

Do you use drugs?

- Never
- Sometimes
- Regularly
- Often
- Very often

In case respondent is using drugs.
How many times have you used the following substances?

	Never	Less than yearly	Yearly	Every six months	Every other month	Monthly	Weekly	Daily
Hash/weed	○	○	○	○	○	○	○	○
XTC	○	○	○	○	○	○	○	○
MDMA	○	○	○	○	○	○	○	○
4FMP	○	○	○	○	○	○	○	○
Cocaine	○	○	○	○	○	○	○	○
Amphetamine (Speed/pep)	○	○	○	○	○	○	○	○
Ketamine	○	○	○	○	○	○	○	○
LSD	○	○	○	○	○	○	○	○
Opiates	○	○	○	○	○	○	○	○
Truffles	○	○	○	○	○	○	○	○
Mushrooms	○	○	○	○	○	○	○	○
Phenylethylamine (o.g. 2C-B, 2C-E)	○	○	○	○	○	○	○	○
Ritalin/Methylphenidate: prescription	○	○	○	○	○	○	○	○
Ritalin/Methylphenidate: non-prescription	○	○	○	○	○	○	○	○
Poppers	○	○	○	○	○	○	○	○
Crack cocaine	○	○	○	○	○	○	○	○
Methamphetamine	○	○	○	○	○	○	○	○

Heroin	○	○	○	○	○	○	○	○
Other:	○	○	○	○	○	○	○	○

How true or false is each of the following statements for you.

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
I seem to get sick a little easier than other people	○	○	○	○	○
I am as healthy as anybody I know	○	○	○	○	○
I expect my health to get worse	○	○	○	○	○
My health is excellent	○	○	○	○	○

(SF-36 – general health perceptions)

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	Yes	No
Cut down the amount of time you spent on work or other activities	○	○
Accomplished less than you would like	○	○
Were limited in the kind of work or other activities	○	○
Had difficulty performing the work or other activities (for example, it took extra effort)	○	○

(SF-36 - role limitations due to physical problems)

The following questions concern how you felt in the past 4 weeks.

	Hardly ever	Sometimes	Frequently	Often	Almost always
Did you feel high-spirited?	○	○	○	○	○
Did you feel energetic?	○	○	○	○	○
Did you feel washed out?	○	○	○	○	○
Did you feel tired?	○	○	○	○	○

(SF-36 – vitality)

In general, would you say your health is:

- ○ Excellent
- ○ Very good
- ○ Good
- ○ Fair
- ○ Poor

(SF-36 – general health perceptions)

Section E: Mental health

These questions concern how you have been feeling over the past 30 days. Tick a box below each question that best represents how you have been.

	None of the time	A little of the time	Some of the time	Most of the time	All of the time
During the last 30 days, about how often did you feel nervous?	○	○	○	○	○
During the last 30 days, about how often did you feel hopeless?	○	○	○	○	○
During the last 30 days, about how often did you feel restless or fidgety?	○	○	○	○	○
During the last 30 days, about how often did you feel so sad that nothing could cheer you up?	○	○	○	○	○
During the last 30 days, about how often did you feel that everything was an effort?	○	○	○	○	○

	Never	Sometimes	Regularly	Often	Very often
In the past month, did you have a spell or attack when all of a sudden you felt frightened, anxious or very uneasy, or all of a sudden experienced physical symptoms?	○	○	○	○	○
In the past month, did you have an unreasonably strong fear of being in a crowd, leaving home alone, standing in a queue or traveling on buses, cars and trains?	○	○	○	○	○
In the past month, did you have a strong fear of doing things in front of others, like speaking in public, eating in public, writing while someone watches?	○	○	○	○	○
In the past month, have you felt most of the time worried and anxious?	○	○	○	○	○
Do you use medication for anxiety, depression, tension or stress at this moment?	○	○	○	○	○

(EK-10)

Section F: Academic performance

The following questions are questions regarding the academic performance and study concentration.

	1	2	3	4	5	6	7	8	9	10
What is the average grade of the current academic year? (2017-2018)	○	○	○	○	○	○	○	○	○	○
What was the average grade of the past academic year?	○	○	○	○	○	○	○	○	○	○

(2016-2017)										
What was the grade of your last exam?	○	○	○	○	○	○	○	○	○	○

	0-10	10-20	20-30	30-40	40-50	50-60
How many credits (ECT) did you achieve in past academic year? (2016-2017)	○	○	○	○	○	○

	Not at all typical of me	Not very typical of me	Somewhat typical of me	Fairly typical of me	Very much typical of me
I find it hard to pay attention during lectures	○	○	○	○	○
I am distracted from my studies very easily	○	○	○	○	○
My mind wanders a lot when I study	○	○	○	○	○
I find that during lectures, I think of other things and don't really listen to what is being said	○	○	○	○	○
Problems outside of school cause me to neglect my schoolwork	○	○	○	○	○
I am unable to concentrate well because of restlessness or moodiness	○	○	○	○	○
I do not understand some course material because I do not listen carefully	○	○	○	○	○
I concentrate fully when studying	○	○	○	○	○

(LASSI – Concentration Scale)

This is the end of the survey. Thank you for participation. If you have any comments you can leave them in the box below:

Please fill in your e-mail address in case you want to make a chance at winning one of the Bol.com gift cards.

Thank you for your time spent taking the survey! Your response have been recorded

Appendix D Expert Survey

De gezondheid van studenten is de afgelopen tijd vaak in het nieuws ten sprake gekomen. Uit onderzoek is gebleken dat studenten een verhoogd risico hebben op zowel mentale als fysieke klachten waaronder burn-out, depressie en vermoeidheid.

Om deze gezondheidsproblemen van studenten beter in kaart te brengen is er een onderzoek gestart bij Bureau Studentenartsen van de Universiteit van Amsterdam naar slaapproblemen. Tijdens dit onderzoek zal de omvang van slaapproblemen onder studenten in het hoger onderwijs in Amsterdam onderzocht worden. Tevens zal er gekeken worden naar eventuele factoren die bij kunnen dragen aan het ontwikkelen van slaapproblemen, waaronder studiestress, slaapgedrag en kennis van slaap. Daarnaast zal er gekeken worden of slaap geassocieerd is met fysieke/mentale gezondheid en studieprestatie.

Echter, de slaap van studenten wordt niet verbeterd door het alleen in kaart te brengen. Deze vragenlijst dient als een verkenning voor het mogelijk ontwikkelen van beleid om zo de slaap van studenten te bevorderen. Tijdens deze vragenlijst zal uw mening gevraagd worden over verschillende aspecten omtrent de ontwikkeling van beleid en word uw mening gevraagd over twee mogelijke beleidsvoorstellen die zijn aangedragen in wetenschappelijke literatuur. Tevens is het mogelijk om zelf mogelijke voorstellen voor beleid aan te bevelen.

Graag zou ik u als zorgverlener/onderzoeker willen vragen om deze vragenlijst in te vullen. Het invullen van de vragenlijst duurt maximaal 10 minuten. Deelname aan dit onderzoek is geheel op vrijwillige basis en is eenmalig. U kunt uw deelname ook op elk gewenst moment ongedaan maken. Deelname is anoniem, de data wordt alleen door de onderzoeker op groepsniveau verwerkt.

Mocht u vragen of opmerkingen hebben, dan kunt u contact met mij opnemen via het onderstaande e-mail adres.

Alvast bedankt voor het invullen van de vragenlijst!

Monique van Weeren

m.c.vanweeren@uva.nl

Huisartsen Oude Turfmarkt | Bureau Studentenartsen

Section A: Demographics

Bent u … ?

- ○ Man
- ○ Vrouw
- ○ Anders

Wat is uw leeftijd?

[ ] jaar oud

Wat is uw beroep?

- Studentenhuisarts
- Studentenpsycholoog
- Studie adviseur
- Onderzoeker
- Anders: …

Ingeval de respondent studentenhuisarts, studentenpsycholoog of studieadviseur is
Voor welke organisatie werkt u?

- Universiteit van Amsterdam
- Vrije Universiteit Amsterdam
- Amsterdam University College
- Hogeschool van Amsterdam
- InHolland
- Anders: …

Ingeval de respondent onderzoeker is
Voor welk onderzoeksinstituut werkt u?

Section B: Problem statement

Geef aan in hoeverre u het eens bent met de volgende stellingen.

'Slaapproblemen kan de mentale/fysieke gezondheid van studenten negatief beïnvloeden'.

- Helemaal mee eens
- Mee eens
- Enigszins mee eens
- Noch eens noch oneens
- Enigszins mee oneens
- Mee oneens
- Helemaal mee oneens

'Studenten die slaapproblemen ervaren presteren op hetzelfde niveau als studenten zonder slaapproblemen'.

- Helemaal mee eens
- Mee eens
- Enigszins mee eens
- Noch eens noch oneens
- Enigszins mee oneens
- Mee oneens
- Helemaal mee oneens

'Slaapproblemen speelt een grote rol onder studenten'.

- Helemaal mee eens
- Mee eens
- Enigszins mee eens
- Noch eens noch oneens
- Enigszins mee oneens
- Mee oneens
- Helemaal mee oneens

Hoe vaak ziet u studenten met slaapproblemen tijdens uw werk?

- Vaak
- Regelmatig
- Soms
- Zelden
- Nooit

Wat is, naar uw mening, de oorzaak van slaapproblemen onder studenten?

Section C: Policy

Geef aan in hoeverre u het eens bent met de volgende stelling:

'Er moet beleid ontwikkeld worden om de slaap van studenten te verbeteren'.

- Helemaal mee eens
- Mee eens
- Enigszins mee eens
- Noch eens noch oneens
- Enigszins mee oneens
- Mee oneens
- Helemaal mee oneens

Waarom bent u van mening dat er wel/geen beleid ontwikkeld moet worden?

Ingeval respondent het er mee eens is dat er beleid ontwikkeld moet worden
Wie zou er bij deze beleidsontwikkeling betrokken moeten worden?

Ingeval respondent het er mee eens is dat er beleid ontwikkeld moet worden
Hoe zouden de verschillende partijen kunnen bijdragen het verbeteren van slaap onder studenten?

Ingeval respondent het er mee eens is dat er beleid ontwikkeld moet worden
Hoe zou dit beleid er volgens u uit moeten komen zien?

Wetenschappelijke onderzoekers hebben verschillende voorstellen gedaan voor mogelijke beleidsontwikkeling om het slapen van studenten te verbeteren. Hieronder staan de twee meest voorkomende voorstellen die zijn aangedragen in wetenschappelijke literatuur. Beantwoord voor elk voorstel de bijbehorende vragen.

Beleidsvoorstel 1:

Scholen/universiteiten beginnen niet meer rond 9 uur 's ochtends maar verschuiven de start tijden naar 10 uur/half 11 's ochtends om op deze manier de slaap van studenten te bevorderen.

Wat is uw mening over beleidsvoorstel 1?

Denkt u dat beleidsvoorstel 1 effectief is tegen slaapproblemen bij studenten?

Denkt u dat beleidsvoorstel 1 uitvoerbaar is in de praktijk?

Wie zou betrokken moeten worden bij het ontwikkelen en uitvoeren van beleidsvoorstel 1?

Op welke manier zou beleidsvoorstel 1 op structurele wijze geïmplementeerd kunnen worden?

Beleidsvoorstel 2:

Er moet tijdens onderwijs meer aandacht komen voor educatie omtrent slaap om zo de kennis van slaap te vergroten.

Wat is uw mening over beleidsvoorstel 2?

Denkt u dat beleidsvoorstel 2 effectief is tegen slaapproblemen bij studenten?

Denkt u dat beleidsvoorstel 2 uitvoerbaar is in de praktijk?

Wie zou betrokken moeten worden bij het ontwikkelen en uitvoeren van beleidsvoorstel 2?

Op welke manier zou beleidsvoorstel 2 op structurele wijze geïmplementeerd kunnen worden?

Heeft u zelf nog een ander beleidsvoorstel dat de slaap van studenten zou kunnen verbeteren?

- Ja
- Nee

Ingeval respondent nog een ander beleidsvoorstel heeft dat de slaap van studenten zou kunnen verbeteren.

Hoe zou dit beleid er volgens u uit moeten komen zien?

Ingeval respondent nog een ander beleidsvoorstel heeft dat de slaap van studenten zou kunnen verbeteren.
Wie zou er bij dit beleid betrokken moeten worden?

Ingeval respondent nog een ander beleidsvoorstel heeft dat de slaap van studenten zou kunnen verbeteren.
Hoe zouden de verschillende partijen kunnen bijdragen aan het verbeteren van slaap onder studenten bij dit beleid?

Dit is het einde van de vragenlijst. Bedankt voor uw deelname. Als u nog vragen of opmerkingen heeft dan kunt u deze hieronder achterlaten.

Bedankt voor uw tijd om aan deze enquête deel te nemen. Uw antwoord is geregistreerd.