Investigating anxiety, depression symptoms and quality of sleep during the COVID-19 pandemic: a cross-sectional study

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Abstract

This cross-sectional study investigates the correlations between mental health complaints and quality of sleep during the COVID-19 pandemic from late 2020 to early 2021. The findings show a statistically significant positive correlation between health complaints and quality of sleep, whereas an individual showing high distress and/or many negative symptoms of mental health complaints, their respective quality of sleep would also be bad. This would have consequences for the society, but especially for clinical practices, as the need for clinical treatment may increase. The overall effect of the pandemic situation needs to be assessed further and more deeply with a bigger sample. The study concludes with an observation of non-normal data distribution, that furthermore indicates a positive correlation between mental health complaints, in this case anxiety and/or depression and quality of sleep.

Introduction

The coronavirus (COVID-19), seems to have direct and indirect psychological and social consequences on the daily life routine of many individuals, which make them out of balance (Gupta et al. 2020). People working from home, in case, they did not lose their jobs entirely and social distancing becomes a hindrance in terms of social contact, and uncertainty whether one is to keep his occupation or for how long arises especially during this lockdown situation of 2020/2021.

Uncertainty about one's occupational status can also lead to psychological distress, for example anxiety, stress or depressive symptoms, especially in middle to low-income households, as the working place can be at risk during these times (Cenat et al., 2021). Around 12% of the European population experienced some form of depression during their lifetime, and around 14% experienced anxiety disorders while being the most prevalent mental health problem around the world (World Health Organization, 2015). These depressive and anxiety symptoms are enhanced and/or enabled by the ongoing COVID-19 situation, as a study by Rossi et al. (2020), found that the current lockdown situation increases negative affect and worsens symptoms such as anxiety and stress in the individual within Italy, Europe's hot spot for COVID-19 infections. Social distancing on top of the lockdown disrupts the daily routine of the individual which can also change the sleep patterns of people rather drastically which could also lead to negative effects on the individual (Morin et al., 2020).

One of the more obvious domains would be sleep (quality), especially not getting (good) enough sleep, as the prevalence of short sleep and insufficient sleep in the Netherlands, is 30.4% and 43.2% respectively (Kerkhof, 2017). As these events of uncertainty and non-routine mentioned above, hinder us from getting (good) enough sleep, dire consequences either

physically and/or psychologically may arise, such as mental health issues and or chronic physical conditions (Shochat, 2013).

First it needs to be described what constitutes a good quality of sleep and why it is important for the individual. Sleep is essential when it comes to our psychological and physical wellbeing. It helps the individual to cope with symptoms of distress, anxiety and worries (Morin et al. 2020). Growing evidence shows that sleep is regulating daily functions such as emotions, behavior and attention (Shochat, 2013). When referring to quality of sleep it is not merely assessed how long the individual was sleeping during a night, but also at what time he/she went to bed, how often his/her sleep got disrupted and how long it took the individual to finally fall asleep after going to bed (Moore and Meltzer, 2008). Factors like sleep disruption, sleep hygiene and the duration of the REM-sleep state are also indicators to be accounted for when measuring quality of sleep (LeBourgeouis 2005; Smyth, 1999). A study from Kanthermann (2020), found that sleeping behavior changed during the pandemic. That individuals would go to bed later, have more disruptions during their sleep and in the end sleep longer than before the pandemic, while at the same time having an overall worse quality of sleep. All these changes mentioned before are factors for a negative, unhealthy sleep behavior, as going to be in-time, having as less disruption as possible and not oversleeping are signs for a healthy sleep behavior (Kanthermann, 2020).

Without sleeping enough, while also not having a good quality of sleep, the vulnerability for mental health complaints is increased, which further enables anxiety and depression symptoms (Chaput, 2016). This highlights the many factors constitute a good quality of sleep and the direness to combine different complementary measures to create one coherent framework for more explicit research. Not getting enough sleep or not the right kind of sleep pattern can

have detrimental effects on human wellbeing (Smyth, 1999). Psychological as well as physiological chronic diseases can either be caused or catalyzed as a side effect of not getting a good quality of sleep, such as a decline in neurocognitive functioning of the individual (Shochat, 2013). This can be observed more in higher complexity tasks where creativity, problem-solving and computational speed may be needed, and not to such a degree when it comes to low complexity tasks, for example verbal memory, computational accuracy etc. (Shochat, 2013). Furthermore, sleep deprivation can lead to a loss of emotional stability and behavioral flexibility (Shochat, 2013).

De Bruin et al. (2017) found a growing body of evidence for positive effects on symptoms of psychopathology and other symptoms after manipulating sleep of respondents. Furthermore, he found that the symptoms of comorbid and/or independent psychological problems such as anxiety and pathology like for instance depression can be reduced by reducing insomnia (De Bruin et al. 2017). This may be an example for a counter measure against the negative effects of sleep difficulties as especially the "mediating role" of sleep during this period, needs to be assessed more thoroughly (Werneck, 2020).

Since a systematic review of descriptive statistics within a natural setting does not exist yet, the importance of researching this lockdown situation may become clear. Hence improvements in wellbeing, such as reducing anxiety and depression symptoms by reducing insomnia symptoms can be achieved (de Bruin et al. 2017). As this is a rather unexplored domain yet, any beneficial outcome for the individual's health would be desirable, hence researching deeper into the theme to create a bigger picture of the complexity of the relation between quality of sleep and mental health complaints such like anxiety and depressive episodes. This way a sophisticated means of improving health in the population could be contributed to, by creating a

framework for reliable sleep quality and mental health assessment, hence giving an overview of the effects of the lockdown on the individual, setting a starting point to tackle further.

Since, it was researched, that the pandemic causes changes and disruptions in the life of individuals and those in turn can have major implications for the sleep quality and mental health of the population, this study will try to establish a Dutch/German point of view in terms of the effects of the pandemic on the quality of sleep and mental health of mostly students, that are in their early twenties up to their early thirty years of life. A combined scale of anxiety, depression and sleep quality questionnaires will help shape a greater picture of the current situation. The results of these measures, in turn, can be used for widening the scope of data set right before the COVID-19 lockdown to emphasize the direness of the pandemic. The research question to be answered is: "*what constitutes the relationship between depression and/or anxiety symptoms and quality of sleep, during the COVID-19 pandemic of 2020?"*. The question at hand is more of correlational nature since causality cannot be accounted for without older data, since a cross-sectional data set is used. One point of comparison will be enabled by using the generally approved cut-off scores for each respective scale, in order, to check how the sample scored in relation to earlier samples. By assessing the Dutch/German sleep quality and mental health complaints of individuals in their early twenties, a baseline framework for upcoming studies and COVID-19 counter measures can be developed.

Methods

Participants

In total 111 individuals ranging from 18 to 34 years (on average 22.2 years) of age (27% male, 73% female), were asked to participate in the concurrent study. The target group consisted of people within the social environment of the researchers and were also found via Sona-systems, a University of Twente based crediting tool for students who contribute to scientific studies by participating. While most of them are from Germany or the Netherlands, there were a few representations of Austrian, Indian or Eastern European countries. Details of the description of the population are presented in Table 1.

Table 1. Description of the sample

	Category	N	%
Age (mean)	22.2 years (s.d. .57)	111	
Gender	Male	36	27%
	Female	81	73%
Nationality	Dutch	14	12.6%
	German	72	64.9%
	Other	25	22.5%

Procedure

The respondents were asked to fill out an online survey via Qualtrics and/or Sona system. The participants were asked for consent via the online questionnaire, that was created via Qualtrics and uploaded on Sona. The informed consent will be included in the Appendix A. Due to social distancing measures the contact was restricted to the virtual realm. After completing the questionnaires, the participants received a contact mail address where they can ask for further information about the progress and/or potential results of the study. No form of deception was used to keep respondents from being biased towards the questionnaires. All data was collected during the period from early October to late December 2020.

Materials

The survey administered during this study consists of seven questionnaires. Four questionnaires measure different forms of sleep quality or sleep problems, while the HADS measures anxiety and depression symptoms in individuals. When deciding how to measure such an intertwined problem, a framework to measure sleep quality both subjectively and objectively, has to be constructed by combining different scales. In this case, scales to assess the quality of sleep of the respondents in an objective as well as subjective fashion are needed. In addition to that, scales that measure depression and anxiety symptoms which consists of subjective estimates, were also added to the questionnaire to enable a correlational analysis between the factors. The cut-off scores to the scales will be shown below. The SRSQ consists of 9 items, the PSQI of 22 items (including the eight diary items). The ISI and the HADS consist of seven and 14 items, respectively. In total 53 items from four different scales were incorporated within this questionnaire.

Sleep quality

The Sleep Reduction Screening Questionnaire (SRSQ) with a good internal consistency of Cronbach's alpha .79, measures sleep reduction in the sleeping patterns of individuals, where higher sleep reduction implicates lower quality of sleep (van Maanen et al., 2014). Its goal is to assess chronic sleep reduction fast and reliably while incorporating nine items in total, such as "I am a person who does not get enough sleep" and are scored on a 3-point Likert scale such as "I agree", "Partly agree" or "Do not agree". Another example would be the question: "I have to struggle to stay awake in class", where the answers were either "Never", "Once in a while" or "Often". After reversing coding items, a total score was calculated by adding all scores of the nine items, resulting in a score from 9-27, with higher scores indicating more chronic sleep reduction. The cut-off score of the longer (20 item) version was set around 39.5, so the cut-off score of the short version would be around 17.8.

The Pittsburgh Sleep Quality Index (PSQ-I) is an effective tool to measure quality and patterns of sleep of adults. The respondent replies to seven areas of sleep using a 3-point Likert on 22 items, whereas a score of 3 indicates poor sleep quality (Smyth, 2012) An example of one of the 14 items is: "During the past month, how would you rate your sleep quality overall?". On this basis the respondent's answers could be used to indicate the sleep quality of the individual, where a higher score indicates high sleep reduction, hence indicating lower sleep quality. Its internal consistency is Cronbach's alpha .83.

Another extension of measuring sleep quality are the sleep related questions of the Pittsburgh Sleep Quality Index (PSQI; Monk et al., 1993) which in addition to general questions about sleep patterns asks about time estimates of time spent in bed, awake in bed or at which

times the respondent would usually wake up and/or go to bed. It needs to be stated that we refrained from using the questions that were related to alcohol and/or nicotine consumption as we are focusing on sleep quality which can be seen within the eight chosen items incorporated within the paper. The diary is showing reliability around Cronbach's alpha .56 to .81 on a 12-31 month retest delay. After adding up all seven components of the Pittsburgh Sleep Quality Index, a score higher than five is associated with moderate to severe sleep problems and a specialist may be contacted.

Insomnia

Another tool implemented in this study is the Insomnia Severity Index (ISI) by Charles Morin, 2020. It is designed to measure nature, severity and impact of insomnia in adults by using seven items that are answered via a Likert Scale from 0 (no problem) to 4 (very severe problem). Examples of items are "Difficulty falling asleep" or "Difficulty staying awake". These questions were all responded to while having the last two weeks as being of relevance when answering these questions. The eight items had four options, ranging from "None/Not at all" (0) to "Very much …" (3) regarding their respective context. Its internal consistency is around .90/.91 (Cronbach's alpha). The cut-off score of the ISI is 15, where a value higher than 15 is associated with moderate to severe insomnia. Subthreshold insomnia is reached by achieving a score between 8 and 14. What needs to be mentioned ist, that question 2 "Difficulties staying awake" should have been "Difficulties staying asleep", which might have cause problems later on , so the item will be removed since the possibility exists that respondents still interpreted it the way it was initially supposed to be even though it measures consequences of bad sleep instead of the actual quality of sleep as it is within this paper.

Depression and Anxiety

In addition to all the surveys directly related to sleep quality, the Hospital Anxiety and Depression Scale (HADS) is administered to measure stress and anxiety symptoms in the respondents. It is a reliable tool in detecting anxiety and depression within a medical setting (Zigmond & Snaith, 1983). The questionnaire consists of 14 items, seven for anxiety and seven for depression. For these two subscales, questions are answered on a 4-point Likert Scale ranging from "Not at all" (1) to "Most of the time" (4). A higher score on these items indicates a higher psychopathology. These two parts have a respective internal consistency of .87 for depression and .88 for anxiety (Cronbach's alpha). The sum-score of Cronbach's alpha is around .92. Cut-off scores for each respective subscale lie around eight or higher, resulting in a total cut-off of 16 or higher.

Data analysis

The data was collected via qualtrics and implemented in IBM SPSS 26. Furthermore, the data will be tested for normality and a correlational analysis will be executed in order to answer the research question at hand. Furthermore, the data set was tested for normality as this might have implications on the interpretation of the results. When the sample is not normally distributed it has to be accounted for whether the sample size is too small. After testing the data for Normality, a Spearman rank correlation is administered to assess the relationship between the scales.

Results

From 133 responses, 21 had to be excluded for not being replied to completely in the Qualtrics questionnaire. Table 2 shows that out of the four questionnaires analyzed within this research question, only the distribution of the Insomnia Severity Index was normal, since Shapiro-Wilk turned out to be not significant. The other data was almost normally distributed but still significantly different from a normal distributed sample. Because most of the variables were not normally distributed, the spearman rank correlation was used for further analyses of relations between the scales.

Table 2. Test of Normality for the PSQI, ISI, HADS, SRSQ.

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig.
PSQI	.133	111	.000	.943	111	.000*
ISI	.078	111	.090	.976	111	.038
HADSANX	.157	111	.000	.928	111	.000*
HADSDEP	.120	111	.000	.978	111	.067
SRSQ	.134	111	.000	.965	111	.005*
HADSTOTAL	.099	111	.010	.977	111	.054

$p < .05$*

All means with the exception of the ISI scored above the cut-off score indicating serious sleep problems. Means and standard deviations of the Sleep Reduction Screening Questionnaire, HADS depression, HADS anxiety, Insomnia Severity Index and the Pittsburgh Sleep Quality Index scales are listed below in Table 3. When comparing the means of the questionnaires, it can be stated, that the mean of the PSQI of 13.38 is almost two standard deviations above the cut-off score of 5, indicating severe sleep disruption and/or bad sleep quality. Furthermore, the ISI, with a mean score of 9.22, is around one standard deviation below the cut-off score of 15, which would indicate low to non-existent insomnia which will be investigated in more detail below. The HADS scores were higher than the cut-off scores listed above, meaning that the respondents showed a high level of distress during the measurement period, indicating severe anxiety/depressive problems. Finally, the SRSQ mean score of 18.15 is slightly above the cut-off score of 17.8, which would indicate moderate to severe sleep reduction of the respondent's sleep.

Table 3 Means and standard deviations of the respective questionnaires (PSQI, ISI, HADS, SRSQ).

	N	Minimum	Maximum	Mean (Std dev.)	Cut off-score	Std. Deviation
PSQI	111	7	23	13.38 (3.57)	5	3.57
ISI	111	0	23	9.22 (5.05)	15	5.05
HADSAN	111	4	21	11.84 (4.71)	8	4.71
HADSDEP	111	4	21	10.32 (4.59)	8	4.59
SRSQ	111	12	25	18.15 (2.89)	17.8	2.89
HADSTOTAL	111	8	41	22.15 (8.28)	16	8.29

As the ISI mean was the only score below the cut-off score, its frequencies and correlations with the HADS total score were explored in more depth. Table 4 shows the frequencies of the Insomnia Severity Index. Scores ranged from .00 (.9%) to 23 (.9%). With the scores of 7, 9 and 10 occuring the most frequent with being observed ten times each (9%). The score of 10, whilst being the highest of the three most prevalent scores still lies below the cut-off

score that would indicate high insomnia levels. Only subthreshold insomnia could be observed, as the cut-off score for moderate to severe insomnia is around 15.

Table 4. Frequencies of the Insomnia Severity Index (ISI).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	1	.9	.9	.9
	1.00	3	2.7	2.7	3.6
	2.00	7	6.3	6.3	9.9
	3.00	5	4.5	4.5	14.4
	4.00	6	5.4	5.4	19.8
	5.00	8	7.2	7.2	27.0
	6.00	4	3.6	3.6	30.6
	7.00	10	9.0	9.0	39.6
	8.00	7	6.3	6.3	45.9
	9.00	10	9.0	9.0	55.0
	10.00	10	9.0	9.0	64.0
	11.00	6	5.4	5.4	69.4
	12.00	4	3.6	3.6	73.0
	13.00	9	8.1	8.1	81.1
	14.00	3	2.7	2.7	83.8

15.00	2	1.8	1.8	85.6
16.00	6	5.4	5.4	91.0
17.00	3	2.7	2.7	93.7
18.00	4	3.6	3.6	97.3
20.00	1	.9	.9	98.2
22.00	1	.9	.9	99.1
23.00	1	.9	.9	100.0
Total	111	100.0	100.0	

A Spearman rank correlation was administered between the six variables (Table 5). Overall, it can be seen, that all scales correlated statistically significant and positive on an alpha level of .05. Correlation coefficients between .386 and .887 are listed in the Table below.

Low correlations between .3 and .5 can be observed between the HADS questionnaire and the sleep-related surveys. The highest correlations found are in-between the different sleep quality scales (.557- .697) and in-between the two subscale components of the HADS questionnaire including its total score (.585-.887).

The positive correlation between sleeping problems (bad sleep quality) and mental health symptoms in form of anxiety and depression answer the research question, what constitutes the relationship between mental health issues and sleep quality during the lockdown of late 2020 to early 2021.

Table 4 shows the frequencies of the Insomnia Severity Index. Scores ranged from .00 (.9%) to 23 (.9%). With the scores of 7, 9 and 10 occurring the most frequent with being

observed ten times each (9%). The score of 10, whilst being the highest of the three most prevalent scores still lies below the cut-off score that would indicate high insomnia levels.

Table 5. Spearman Rank Correlations of PSQI, ISI, HADS and SRSQ.

		PSQI	ISI	SRSQ	HADS A	HADS D	HADSTOTAL
PSQI	Correlation	1.000	.628**	.557**	.499**	.386**	.483**
ISI	Correlation	.628**	1.000	.697**	.516**	.438**	.526**
SRSQ	Correlation	.557**	.697**	1.000	.522**	.420**	.528**
HADSA	Correlation	.499**	.516**	.522**	1.000	.585**	.884**
HADSD	Correlation	.386**	.438**	.420*	.585**	1.000	.887**
HADSTOTAL	Correlation	.483**	.526**	.528**	.884**	.887**	1.000

*p < .05, **p < .01

As mentioned earlier, there occured a mistake with the Insomnia Severity Index, as item 2 „Difficulties staying asleep“, probably was misinterpreted by at least some respondents since it was presented in a wrong way (difficulties staying awake instead of staying asleep). Therefore the item will be removed and yet again correlated with the other scales to assess the impact of the wrong phrasing of item two. Below will be presented Table 6 with the correlations of Table 5.

As can be seen, correlation stayed positive and significant, with the overall correlation of the Insomnia Severity Index and the Hospital Anxiety and Depression Scale ranging from .411-.504. This correlation is low or moderate at best as the correlations between the Insomnia Severity Index and the Sleep Quality Scales (PSQI and SRSQ) ranges from .624-.673, being moderately higher. Correcting the scale showed no mentionable change in significance of the respective correlations.

Table 6. Spearman correlations of the corrected (ISIC) scores and the PSQI, SRSQ and HADS.

		PSQI	ISIC	SRSQ	HADSA	HADSD	HADSTOTAL
ISIC	Correlation	.624**	1.000	.673**	.504**	.411**	.504**

**p < .01

Discussion

The results of this study are interesting starting with the means. The means of all assessed scales were higher than the cut-off score that would indicate moderate to severe sleep problems or mental health problems. The HADS for instance reports severe mental health problems for the population, as well as the SRSQ and the PSQI scored around twice as high as means of the general population (Hinz et al. 2017).

Only the ISI scores would barely overscore subthreshold insomia (8-14). It was observed that for alle scales except the Insomnia Severity Index, the cut-off score was reached or even overscored by a fair margin. This is in conflict, with the means of the other scales since they all reported moderate to severe sleep problems, yet only 16.4 percent of the sample scored 15 or higher on the survey which would have indicated severe insomnia, hence indicating severe sleep problems.

After comparing HADS scores with earlier studies before COVID-19, it can be stated, that means were more than twice as high as in normative studies among a German sample before the pandemic, meaning that mental health problems were catalysed by this pandemic situation (Hinz and Brähler, 2011). The sample was used because the sample of this paper was mainly consisting of german students and/or people who have kept/lost their jobs during the pandemic. It was used to compare the actual pandemic data to a general estimation that was executed before the pandemic. Also, when comparing the results of this paper with the cut-off scores of the of the Insomnia Severity Scale it can be said, that a mean of 9 still indicates subthreshold insomnia even though it does not implicate clinical insomnia. The sample of Gerber et al. showed a mean of aroun 6.5 on the ISI, indicating no insomnia. The sample was chosen because the sample of this study consisted mainly of German students and Gerber et al. validated the German version of the ISI when comparing their results with other studies (Gerber et al. 2016). Even though the

mean age of the german population was above the mean of the concurrent study, it was still more comparable than that of an Indian or Lebanese population during the pandemic. The all German sample is used as an indicator of scores, regardless of age/occupations. The most important aspect is to compare scores of adolescents, students and workers from before and during the pandemic

Therefore, still highlighting the direness of this situation and the interconnectedness between mental health and sleep behavior, as depression for example is often accompanied by sleep difficulties (insomnia) and some clinicians will not even diagnose depression in the absence of sleep complaints (Jindal & Thase 2004). Therefore, the two constructs are highly correlated, which is reflected within this study.

After executing the Spearman rank correlation analysis, it can be stated, that a positive correlation between depression and anxiety symptoms and quality of sleep was found, whereas a bad quality of sleep would be more likely to appear when also having many anxiety and/or depressive symptoms. This reflects the findings from Chaput (2016), where it is stated, that consequences of not getting good enough sleep can have detrimental effects on the mental health of individuals. Yet the causality is not clear, and it could also be the other way around, where mental health issues cause sleep quality problems.

Kanthermann (2020) found that the life of individuals would be influenced significantly by the situation and change people routines, especially during the pandemic situation. This significant change of people's life routines seems to be reflected in this doubling of HADS scores. Furthermore, this might highlight that not the sleep duration is of importance, as Insomnia did not score above a critical level, but more the quality of sleep, independent of the individual duration of sleep needed (Moore and Meltzer, 2008). Results of this study show low

to moderate correlations between the constructs quality of sleep and mental health problems (Anxiety and Depression). While the correlations were moderate at best, they still imply a significant decrease in mental health during the pandemic, highlighting the importance of treatment and/or other actions against the sleep problem situation.

As far as this study is concerned only low to moderate correlations were found, with no indication of which of the two measured constructs occurred first. Whether a bad sleep quality causes the depression and anxiety symptoms, or the other way around, needs to be investigated in more depth, potentially with a normally distributed sample including a factor analysis, exploring further what exactly caused the mental health and sleep quality problems. Although this might not be possible due to the non-normal situation we live in (Kanthermann, 2020). It has been researched that the pandemic changes the sleeping patterns of individuals so we cannot talk about normality as we were used to until this situation becomes the standard over a longer time period (Morin, 2020).

Assuming the results of this study are valid enough to be applied on the general population, the Sleep Reduction Sleep Quality Questionnaire and the Insomnia Severity Index still correlated the highest with the HADS sub and/or total scales. Therefore, implementing these in future research could prove to be useful for detecting moderate to severe sleep problems in individuals. The HADS proved to be a good indicator of mental health problems. Using it for future research is highly recommended.

Regarding the problem at hand of the Insomnia Scale not being scored above the cut-off for severe Insomnia cases, it is recommended to implement the corrected version in other samples to test whether the ISI is of use in such a situation, or whether other scales are more appropriate. By incorporating such wide scaled surveys, it should be warranted that the

measurements will not miss any important aspects of sleeping behavior as the Insomnia Scale does not seem to be as useful as it appeared to be in the beginning.

Strengths and Limitations

Strengths of the study are that the data seems to be actual and/or relevant as the collection was happening during the second big lockdown of 2020, so this data might have looked entirely different, if there were no social distancing measures taken since most individuals work from home now or may have lost their jobs entirely and stay at home most of the time (Kanthermann, 2020). One of the biggest strengths of the study would be that it confirmed that sleep duration does not equate to better sleep quality at all, as there are many different factors that influence the quality of sleep and its mental health implications for the individual (Chapet, 2016). As can be seen within the data of the PSQI, individuals spent more time spent in bed than before the pandemic, yet their overall sleep quality would become worse, the longer they stayed in bed (Moore and Meltzer, 2008). The strongest finding was the positive correlation between sleep problems and mental health symptoms.

Weaknesses of the study are that there cannot be made sophisticated statements about whether anxiety and depression affect quality of sleep negatively or vice-versa, as the nature of this thesis is restricted to cross-sectionalistic means. Also the failure of the third item of the ISI score could have been easily avoided, which may have changed the data. All that can be taken from it, ist that it seems as if there is a definite positive correlation between the two, as when for example anxiety and/or depression symptoms are high, problems in sleep quality are also high. This can also be the other way around, where low anxiety and/or depression correlates with a good quality of sleep. Also, from the initial 133 responses, 21 had to be excluded for not being

replied to completely in the Qualtrics questionnaire. This further weakened the overall sample size and its possible validity. Whether the results are just the product of chance, has to be researched further, by widening the sample size and/or adding this sample to another one to have more confidence in the interpretation.

Conclusions and recommendations

All in all, it can be stated that a low to moderate positive correlation between the two constructs anxiety/depression and quality of sleep was found. Thus. indicating that sleep problems would occur more often when also having mental health issues such as depression and/or anxiety or vice-versa. While this needs to be researched in more depth, as the long-term effects of the concurrent pandemic cannot be fully explored until after the pandemic and will need to be frequently actualized to paint a bigger picture for potential new arising pandemics in the future, recommendations for clinical practice can be made.

As can be taken from this study, individuals experience a mentionable increase in mental health complaints, so even when causality cannot be observed immediately, interventions or therapy session dedicated to treat mental health issues would be of importance. Seeking out a clinician when scoring above the cut-off score would be advised. Furthermore, treating individuals sleep problems could also turn out to be beneficial, and eradicate mental health issues as a by-product of the process. Groot and De Bruin's experimental study from March 2020, found that treating Insomnia in individuals with comorbid disorders proved to be effective, and that having comorbid disorders would not be a contradiction that would hinder beneficial results for the individual, since the pandemic has remarkable effects on the populations mental health and applying treatment tackling these effects on mental health would be of importance. So,

treating sleep quality problems and mental health issues simultaneously would be the most promising way to recover pre-pandemic states of (mental) health.

The current situation and/or data set does not allow to indicate any form of causality. Also, potential confounding variables were not accounted for within this paper. In order, to find any form of causality more variables need to be included within the analysis, since the pandemic situation, especially during the lockdown, is new and therefore rather unexplored, with its entire implication for humankind having to be assessed more thoroughly to be able to say something about the effects on the individual and society with confidence.

This whole pandemic situation that will prolong for potentially another year will have massive implications for mental health and therefore the sleep quality of individuals, so these phenomena should be assessed more deeply during the full course of the pandemic to say more about the normality of the findings and to research more what intervention/treatment will turn out to be most beneficial.

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Appendix A

Informed Consent:

Dear respondent,
we are measuring sleep quality and stress/anxiety symptoms, especially during the COVID-lockdown. Please only go further if you are okay with giving your data. All data will be anonymized and be treated confidentially. You can at any time quit the study and withdraw your information.

When you have any questions regarding the study contact us @ l.steffen@student.utwente.nl or e.chouseinoglouorhusseinoglu@student.utwente.nl

Questionnaire:

What is your country of origin?

- The Netherlands
- Germany
- Other

How old are you?

Please indicate your gender

- Male
- Female
- Other

PSQI: The first questions are about your usual bed- and sleep-times on weekdays (not in weekends) over the past month. If you don't know the exact answers, please indicate your best estimate.

Over the past month, on weekdays:

At what time did you usually get into bed ? (e.g. 22:40)

hours (e.g. 22 for 10pm)

minutes (0-59)

After getting into bed, at what time did you usually turn off the light to go to sleep? (e.g. 23:10)

hours (e.g. 22 for 10pm)

minutes (0-59)

How long (in minutes) did it usually take you to fall asleep? (e.g. 15)

How long (in minutes) were you usually awake during the night (after first falling asleep but before waking up for the last time in the morning)? (e.g. 5)

At what time did you usually wake up in the morning? (e.g. 07:50)

hours (e.g. 7 for 7am)

minutes (0-59)

At what time did you usually get up in the morning? (e.g. 08:00)

hours (e.g. 7 for 7am)

minutes (0-59)

How many hours of actual sleep do you get at night? (This might be different than the number of hours you spent in bed) (e.g. 7.5)

During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes?

- Not during the past month (0)
- Less than once a week (1)

- Once or twice a week (2)
- Three or more times a week (3)

During the past month, how often have you had trouble sleeping because you wake up in the middle of the night or early morning?

- Not during the past month (0)
- Less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

During the past month, how often have you had trouble sleeping because you have to get up to use the bathroom?

- Not during the past month (0)
- Less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

During the past month, how often have you had trouble sleeping because you cannot breathe comfortably?

- Not during the past month (0)
- Less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

During the past month, how often have you had trouble sleeping because you cough or snore loudly?

- Not during the past month (0)
- Less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

During the past month, how often have you had trouble sleeping because you feel too cold?

- Not during the past month (0)

- Less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

During the past month, how often have you had trouble sleeping because you feel too hot?

- Not during the past month (0)
- Less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

During the past month, how often have you had trouble sleeping because you have bad dreams?

- Not during the past month (0)
- Less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

During the past month, how often have you had trouble sleeping because you have pain?

- Not during the past month (0)
- Less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

Other reason(s), please describe, including how often you have trouble sleeping because of this reason(s)

- Click to write Choice 1
- Not during the past month (0)
- Less than once a week (1)
- Once or twice a week (2)

- Three or more times a week (3)

During the past month, how often have you taken prescribed medicine (prescribed or "over-the-counter") to help you sleep?

- Not during the past month (0)
- Less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

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

- Not during the past month (0)
- Less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

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

- Not during the past month (0)
- less than once a week (1)
- Once or twice a week (2)
- Three or more times a week (3)

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

- Very good (0)
- Fairly good (1)
- Fairly bad (2)
- Very bad (3)

Do you have trouble getting up in the morning?

- No
- Sometimes

- Yes

Do you feel sleepy during the day?

- No
- Sometimes
- Yes

Are you immediately wide awake when you wake up?

- No
- Sometimes
- Yes

When I am in class for a while I have trouble keeping my eyes open

- No
- Sometimes
- Yes

Do you have enough energy during the day to do everything?

- No
- Sometimes
- Yes

I am active during the day

- Agree
- Partly agree
- Do not agree

I have to struggle to stay awake in class

- Never
- Once in a while
- Often

I don't feel like going to class because I feel too tired.

- This never happens
- This happens once a week
- This happens twice or more often a week

I am a person who does not get enough sleep

- Agree
- Partly agree
- Do not agree

For each question, please indicate the option that best describes your answer.
Please rate the CURRENT (i.e. LAST 2 WEEKS) SEVERITY of symptoms of sleep problem(s).

Over the past 2 weeks I have had:

Difficulty falling asleep

- None (0)
- Mild (1)
- Moderate (2)
- Severe (3)
- Very severe (4)

Difficulty staying awake

- None (0)
- Mild (1)
- Moderate (2)
- Severe (3)
- Very severe (4)

Problems waking up too early

- None (0)
- Mild (1)

- Moderate (2)
- Severe (3)
- Very severe (4)

How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?

- Very satisfied (0)
- Satisfied (1)
- Moderately satisfied (2)
- Dissatisfied (3)
- Very dissatisfied (4)

How NOTICEABLE to others do you think your sleep problems in terms of impairing the quality of your life?

- Not at all noticeable (0)
- A little (1)
- Somewhat (2)
- Much (3)
- Very much noticeable (4)

How WORRIED/DISTRESSED are you about your current sleep problem?

- Not at all worried (0)
- A little (1)
- Somewhat (2)
- Much (3)
- Very much worried (4)

To what extent do you consider your sleep problem to INTERFERE with your daily functioning CURRENTLY?

- Not at all Interfering (0)
- A little (1)
- Somewhat (2)

- Much (3)
- Very much worried (4)
- For each sentence, mark the number that describes how often it applies to you during the last week. There are no right or wrong answers. Please work quickly, without bothering to check your answers, and do not skip any question.

	Not at all	Occasionally	A lot of time	Most of the time
1. You feel tense or "wound up"				
2. You still enjoy the things you used to enjoy				
3. You get sort of frightened feelings as if something awful is about to happen				
4. You can laugh and see the funny side of things				
5. Worrying thoughts go through your mind				
6. You feel cheerful				
7. You can sit at ease and feel relaxed				
8. You feel as you are slowed down				
9. You get a frightened feeling like "butterflies" in the stomach				
10. You have lost interest in your appearance				
11. You feel restless as you have to be on the move				

12, You look forward with enjoyment to things				
13. You get a sudden feeling of panic				
14. You can enjoy a good book, radio or TV program				