The relationship between Binge-watching, Compensatory Health Beliefs, and Sleep

Kira Oberschmidt

Bachelor thesis Psychology

Department of Psychology, Health & Technology

University of Twente

First supervisor: Dr. Peter ten Klooster

Second supervisor: Dr. Marcel Pieterse

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Abstract

Introduction: Binge-watching, watching more than two episodes of the same series in one sitting, is a relatively new phenomenon that followed the rise of online streaming services. There has not been much research into what causes binge-watching and what consequences might follow. A predictor of other binging behaviors is the so called Compensatory Health Beliefs Model and it is possible that this also plays a role in binge-watching behavior. Compensatory Health Beliefs (CHBs) influence sleep outcome, and binge-watching is a possible mediator in this relationship.

Method: 329 young adults participated in a cross-sectional survey study. The relationship between CHBs and sleep and the mediating effect of binge-watching was tested through mediation analysis. Other characteristics, of binge-watching were correlated to sleep outcome as well.

Results: The existing relationship between CHBs and sleep outcome does not seem to be influenced by binge-watching frequency. However, the CHBs on binge-watching that were developed for this study represent a possible relevant new subscale of the CHB questionnaire as it was the highest predictor of binge-watching frequency ($r= 0.244$, $p<0.01$). Of the binge-watching characteristics nighttime binge-watching negatively influenced sleep quantity ($t= -2.86$, $p<0.05$). Watching with others also had a negative effect on sleep quantity ($t= 2.43$, $p<0.05$). Specifically, watching with friends or a partner negatively influenced sleep quantity ($t= 2.40$, $p<0.05$).

Discussion: The Compensatory Health Beliefs on binge-watching are a good predictor of binge-watching frequency and correlate with the other CHBs. Therefore, the scale might be a good addition to the CHB scale in contexts where television watching is relevant. CHBs and binge-watching do not predict sleep outcome sufficiently. Binge-watching during nighttime can lead to lower sleep quantity. Watching with others, especially with a friend or partner led to a lower sleep quality. However, as binge-watching frequency did not correlate with sleep outcome it is questionable whether the correlation of the other factors with sleep is caused by the binge-watching behavior. Other predictors or confounders like character traits are possible.

Introduction

On-demand video streaming

'The age of broadcast TV will probably last until 2030' (J. Smith, 2014, p. §4), after that, series and movies will be consumed solely through the internet. At least that is what Reed Hastings, CEO of the American entertainment company Netflix, says. He explains his claim by comparing the invention of Netflix to the invention of cars; 'the horse was good until we had the car' (§4). While this might sound very optimistic, the general change in society which he senses is supported by research. According to the Dutch Central Bureau for Statistics (Centraal bureau voor de Statistiek, CBS) about 60% of the Dutch internet users watch TV or listen to the radio online (CBS, 2015). A primary reason for this is that watching series when it suits you best is more convenient than having to depend on the TV schedule. Another perceived advantage is the immense number of series and movies that are available on streaming and on-demand websites like Netflix, Hulu or the Dutch equivalent Videoland. The concept of those websites is very simple; users pay a small monthly fee to get access to thousands of movies and TV shows. More precisely, Hulu users were able to watch 7051 titles in total last year whereas Netflix offered a total of 5619 titles in 2016 (Lovely, 2016). Because of this significant difference with television, online services have been called TV-IV (instead of the older TV-III), hinting that video on demand websites take television watching to the next level (Jenner, 2016).

Characteristics of on-demand video streaming services

A consequence of the new possibilities is of course that people can watch more and more often. To take this general movement one step further, these websites have incorporated certain characteristics that make watching movies or episodes of series easier and more comfortable than watching regular television. As mentioned earlier, titles can be watched whenever this suits the viewer, no matter the time. Furthermore, it is very easy to continue watching a series as Netflix starts playing the next episode no longer than 10 seconds after one episode has ended. Through the use of search- and viewing algorithms, on-demand websites suggest series and movies that might fit within the liking of users. As Netflix started producing their own series (so called Netflix originals like *House of Cards* or *Orange is the New Black*) a new aspect of exclusivity began influencing viewing behavior as well.

Furthermore, there seems to be a difference in watching behavior when it comes to different series. This can be seen in a user research that Netflix conducted, which focused on how long sittings of certain series usually are. In this study Dwyer (2016) introduced the 'Binging Scale', which shows the series that people rush trough in one day and on the other hand those that viewers 'savor'. Another big difference with regular television is that in some cases a whole season airs on the same day, or a whole series is uploaded

all at once. This increases the temptation of watching more than the usual one episode per week. All of those features of new television lead to a more excessive watching behavior, which in turn prompted the introduction of the term 'binge-watching'.

Binge-watching

This concept of 'binge-watching' closely followed the rise of Netflix and others and has since then been declared word of the year 2015 by Collins dictionary (Collins Dictionary, 2015). While it is generally agreed upon that binge-watching means watching several episodes of a series in one sitting, there is some disagreement as to where 'normal' watching ends and 'binge-watching' begins. The most common definition used in research is one that was given by Netflix itself. In a survey they conducted in 2013, 73% of the respondents reported that they defined watching between 2 and 6 episodes at once as binge-watching (Spangler, 2013). Trouleau, Ashkan, Ding, and Eriksson (2016) on the other hand describe a difference between different watching behaviors and say that there are even different sub-classes of binge-watching. Other definitions put the focus on the sequential nature of watching series and less on the amount of episodes watched (Pierce-Grove, 2017). Pierce-Grove (2017) also mentions a problem with the term binge-watching itself, namely that 'binging' is usually associated with negative behavior like binge-eating or binge-drinking. Therefore, using the word *binge* in this context brings some 'moral judgments' to the table. Pittman and Sheehan (2015) raise the question whether users might prefer to use 'media marathon' as an alternative to 'binge-watching' because they think that the term might raise feelings of shame or guilt. This coincides with yet another, slightly different definition of binge-watching, given by Feeney (2014). He says that to binge-watch is 'to watch at least four episodes of a television program, typically a drama, in one sitting (bathroom breaks and quick kitchen snack runs excepted) through an on-demand service or DVDs, often at the expense of other perceived responsibilities in a way that can cause guilt' (Feeney, 2014, §18). Nonetheless most studies that looked at binge-watching have used definitions that are similar to Netflix's definition (Walton-Pattison, Dombrowski, & Presseau, 2016; West, 2013).

Consequences of binge-watching

Watching television has been linked to deterioration in healthy eating. Viewers consume snacks and unhealthy drinks, and sometimes adjust their normal eating schedule to television watching (Van Den Bulck, 2000). Related to this, television watching was also named as a factor that can lead to obesity (Boulos, Vikre, Oppenheimer, Chang, & Kanarek, 2012). As binge-watching is similar to television watching it is likely that it evokes some of the same effects. But it is not clear yet what the specific consequences of binge-watching are and in what way they differ from regular television watching.

While the abandonment of responsibilities that Feeney (2014) talks about in his article was not

spending enough time with family members, binge-watching might influence others parts of life just as much, for example sleeping, sporting or household tasks. Walton-Pattison et al. (2016) also conclude that an important aspect of binge-watching is that it undermines the pursuit of goals. This tendency can also be found in the media perspective on binge-watching, as Pierce-Grove (2017) has found. According to her, it is often assumed that binge-watching goes with at least some sacrifices of 'life'. She also concludes that during binge-watching 'All other responsibilities, activities, and social connections are abandoned, as are washing and dressing' (§ 2). Kroese et al. (2016) name television watching before bedtime as a reason for 'bedtime procrastination' or going to bed later than planned. Therefore, worse sleeping habits are another important consequence of binge-watching. This relationship will be looked at more closely later on. In that later part of the introduction, the consequences of a bad sleeping pattern will be discussed as well. Those consequences can be seen as indirect consequences of binge-watching. There are also some moral consequences like feeling judged, ashamed or guilty if one binge-watches (Pierce-Grove, 2017; Pittman & Sheehan, 2015). But if binge-watching seems to come with such negative consequences, why does the number of people who watch TV online continue to grow (CBS, 2015)?

Determinants of binge-watching

To answer this question it is important to look at determining factors behind binge-watching. Pittman and Sheehan carried out a survey to trace a map of possible motives for binge-watching behavior (Pittman & Sheehan, 2015). According to their research there seem to be differences in motivations for different frequencies of binge-watching. Furthermore, the factor of planning to binge-watch in advance, so for example arranging to watch some episodes with a friend on Friday night, could also be linked to other motivational factors. They found engagement in the story of a series to be related to all viewing behaviors that they included. It seems that stories with complex storylines and interesting characters lead to a higher chance of viewers watching more than two episodes. Therefore, different types of series might increase the tendency to binge-watch. On the Netflix Binge-watching scale (Dwyer, 2016) the genre that seems least likely to be watched longer than two hours at once is 'Irreverent comedy', like *BoJack Horseman*, while people who watch shows categorized as thrillers, like *Breaking Bad*, seem to do this for sittings that last longer.

Another important explanation of binge-watching behavior seems to be the social aspect of watching a series with a partner or friend. In a Dutch survey, 36% of the participants reported that they prefer watching with another person, while roughly half of the participants said they rather watch alone (DVJ Insights, 2014). In this case the 'social drive' of making an appointment to watch television together with somebody is what might influence viewing behavior. A logical explanation for binge-watching would

also be that watching several different series created more room for this type of viewing behavior, as there are more episodes to choose from. Character traits that are known to significantly influence series watching behavior are passion and impulsivity, which have been linked to binge-eating and addictive behavior as well (Orosz, Vallerand, Bőthe, Tóth-Király, & Paskuj, 2016). Walton-Pattison et al. (2016) additionally found that outcome expectancy and intention also lead to a variance in binge-watching behavior.

Compensatory Health Beliefs

Binge-watching therefore seems to, at least in some ways, correspond with other binging-behavior, hence the name. A construct that has been used to explain other binging behaviors is the Compensatory Health Beliefs model. The term Compensatory Health Beliefs (CHBs) refers to beliefs that people activate to 'neutralize' bad behavior, by making up for it with positive, good actions (Rabia, Knäuper, & Miquelon, 2006). An important aspect is that both actions have to be volitional. When confronted with an unhealthy temptation the person in question might use one of three different strategies. First he might just choose to resist. This of course might feel difficult, for example in the case of smoking. In the case of binge-watching this strategy would mean not starting to watch a series, or only watching a limited amount each week. Another strategy is to adapt the beliefs about negative consequences, e.g. 'smoking is not too bad'. If a person is convinced that they learn something from the series they watch they could make use of this strategy by saying that watching television can teach you something, and is therefore not as bad. Lastly the person might choose to make use of Compensatory Health Beliefs. In this case he might tell himself 'it is okay that I smoke one cigarette now, because I will stop soon', or in the case of binge-watching 'I worked so hard today; it is okay to watch a few episodes now'. A characteristic of these beliefs is that they can be scientifically accurate, partially accurate, or inaccurate. So what is problematic about having and indulging in CHBs is that the behaviors performed often do not fully compensate for the negative behavior. Another problem with CHBs is that the positive behavior might not happen after all (Radtke, Scholz, Keller, Perren, & Hornung, 2013), e.g. the person eats an unhealthy lunch, but does not actually go for a run in the evening because it is raining.

This compensatory behavior seems relatable to a lot of people and it can therefore be said that activation of CHBs occurs a lot, especially if a person is confronted with a temptation (De Nooijer, Puijk-Hekman, & Van Assema, 2009). CHBs can be measured using a CHB scale (Rabia et al., 2006). While CHBs for different unhealthy behaviors can be measured and have been studied, the relationship between CHBs and binge-watching has yet to be looked at. To fill the knowledge gap that exists around the determinants for binge-watching, it is necessary to look at CHBs in this context.

Possible role of CHBs in binge-watching

As with other binging behavior Compensatory Health Beliefs about binge-watching might lead to an increase in the possibly negative behavior. If somebody convinces themselves that it is okay to binge-watch because the behavior will be made up for later by good behavior they will engage in more negative actions. But not only CHBs specific for binge-watching are relevant in this context. Other, already existing CHB scales about other health behaviors are possibly also related to binge-watching. The CHBs that are expected to affect binge-watching most are those on eating and sleeping behavior. If people believe that lack of sleep can be compensated by sleeping longer another day, they might use this as an excuse to binge-watch until late at night. This relationship could work both ways, bad sleeping behaviors might increase binge-watching through CHBs, but binge-watching might also lead to worse sleeping patterns. This relationship will be explained subsequently.

Sleeping behavior

It was indicated earlier that binge-watching might have an impact on more aspects of life than is visible at first. Television watching is one of the main factors influencing sleep duration (Basner et al., 2007). Because of the similarities between television watching and binge-watching it can be expected that binge-watching has a similar effect. This negative influence can work in two ways. First of all, people might postpone their usual bedtime in order to watch another episode of a series. In a US survey, more than half of the study population reported that they had at one point lost two to three hours of sleep to binge-watching that specific night, another 20% saying that they had lost four to five hours of sleeping time. 17% even lost what can be considered a full night's sleep (6 to 8 hours) to binge-watching (Chan, 2014). Kakinami et al. (2017) supported this finding, saying that television watching was related to higher odds of poor sleeping quality. Therefore, the fact that it is so easy to continue binge-watching is expected to negatively influence the sleeping pattern and behavior of viewers.

But even if people get themselves to stop watching there is another issue. Watching series with often complex strings of actions keeps the brain busy, so after a longer period of watching the brain is still very active, making it difficult to fall asleep (Hedger, 2016). This links to the general problem of screen time right before going to bed. A review by Losch (2015) shows that people who looked at a screen before they went to bed had more trouble falling asleep or were more sleepy during the day. Likewise insomnia has been linked to mobile phone usage right before going to bed (Fossum, Nordnes, Storemark, Bjorvatn, & Pallesen, 2014). This seems to be related to the blue light that is emitted from screens. To support this hypothesis, van der Lely et al. (2015) found that the impact of screen time and blue light on the circadian physiology can be harmful to sleep quality and daytime functioning in adolescents. These effects may be especially big in younger people who have yet to develop good sleeping habits and patterns, and need more

sleep in general (Rettner, 2011). It seems that both sleep quantity and quality are influenced by late night television watching.

Consequences of bad sleeping behavior

Our sleeping behavior is very important to our health and the consequences of getting too little or too light sleep are grave. According to Rettner (2011) 'Insufficient sleep in children is linked with poor academic performance, tardiness at school, motor vehicle accidents and depressed mood' (§ 7). Furthermore, sleep deprivation relates to a decrease in immune responses, and consequentially to poorer health and higher susceptibility for diseases (Irwin, 2015). Sleeping patterns have also been linked to other compulsive and binging behavior. For example it was found that gambling influences sleeping patterns negatively (Okunna, Rodriguez-Monguio, Smelson, Poudel, & Volberg, 2016). For excessive alcohol use or binge-drinking, the relationship has been looked at from another perspective. In this case, researchers have found that not sleeping well or sleeping too little might lead to more alcohol use (Miller et al., 2017). Bad sleeping patterns seem to relate to more binging behavior, possibly because CHBs are activated. Quick et al. (2016) found that students who slept less than 7 hours a night showed more binge-eating and worse eating behavior in general. Daytime sleepiness, which might follow a night of poor sleep quality, was also related to binge-eating (Kelly et al., 2016). If a person generally tends to make use of CHBs they might adapt them to more aspects of their life and therefore engage in more unhealthy behavior.

Research question and hypotheses

CHB research has mainly focused on unhealthy eating, smoking and alcohol drinking behavior, but not on unhealthy sleeping habits as a result of binge-watching. This research aims to fill part of that knowledge gap. Since there has not yet been any research on CHBs related to binge-watching, questions to look at this relationship will also be studied. This will also be done with regards to sleeping behavior. The research question that will be looked at is 'Do sleep- and binge-watching specific Compensatory Health Beliefs have a correlation with binge-watching frequency and how does binge-watching frequency affect the relationship between CHBs and sleeping behavior?' It is expected that people who have more CHBs about either binge-watching or sleeping behavior, or more CHBs in general, practice more binge-watching. Another hypothesis is that those who binge-watch more show worse sleeping patterns. A broad scheme of the expected mediation by binge-watching can be seen in figure 1. Secondly this study will take a closer look at characteristic factors of binge-watching that may influence sleep outcome, namely social drive, preferred genre of series, daytime versus nighttime binge-watching and amount of series that are watched. Social drive can be divided into two factors, namely whether the person mostly watches alone or with others, and who the usual watching partners are. The prediction is that socially driven binge-watching has fewer

negative consequences for sleeping behavior than watching alone, because of the earlier mentioned feeling of shame that arises from binge-watching. People might feel less inclined to show this behavior while with other people. When there is a watching partner there might still be a difference in binge-watching frequency, which in turn leads to less problematic sleep outcome. It is possible that with a partner or intimate friends one might be less ashamed of binge-watching behavior. Therefore, it is expected that there is a difference in watching partners based on the type of relationship. Series that emphasize a complex storyline, like dramas, are expected to have more impact on sleep outcome than lighter series, like comedies. It is assumed that nighttime binge-watching will influence sleeping quality and quantity more negatively than daytime binge-watching, as screen time before going to bed generally has a negative impact on sleep. Lastly people who watch more series concurrently are likely to engage in binge-watching more often and therefore have worse sleep outcome.
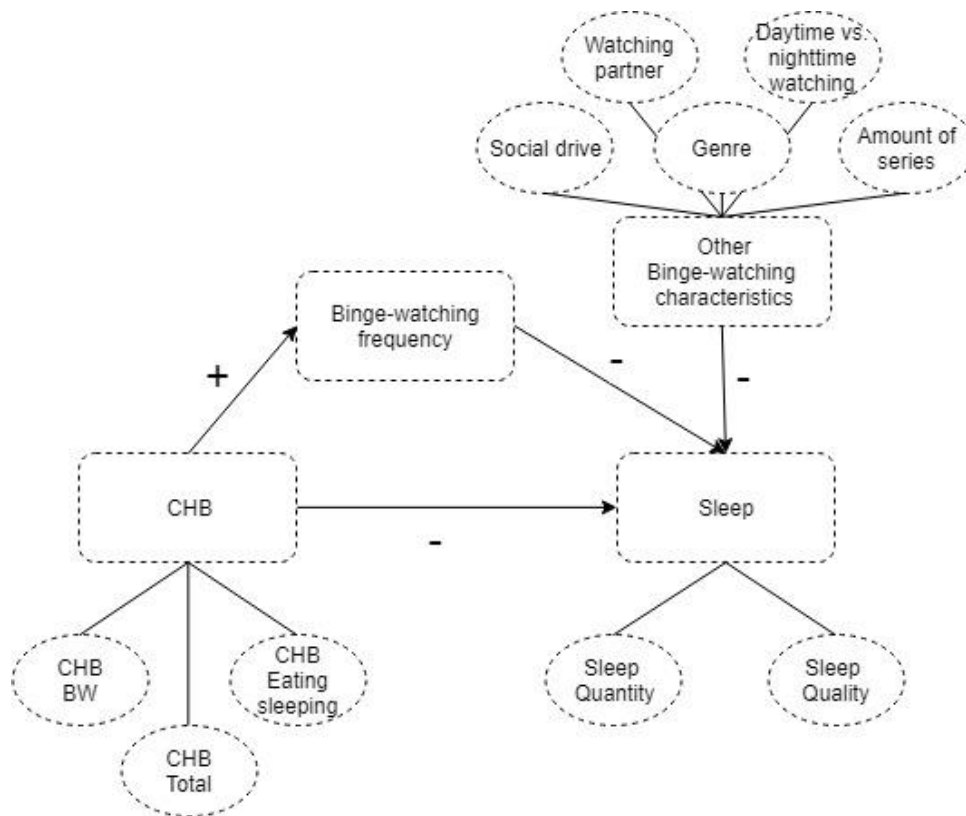
Figure 1. Scheme of the expected relationship between Compensatory Health Beliefs, Binge-watching and specific characteristics of binge-watching, and sleep.

Note: Square= main concept; circle= underlying concept. Broad categories per characteristic: Social drive= Alone, Both alone and with others, With others; Watching partner= Alone, Family, Friends, Partner, Roommates; Genre= Light series, More complex series; Daytime vs. Nighttime= Daytime watching, Both daytime and nighttime watching, Nighttime watching.

Method

Study Design

A cross-sectional correlational survey design was employed using Qualtrics Survey Software (www.qualtrics.com). The variables that were measured were CHBs, binge-watching behavior and sleep quality as well as quantity. Other researchers used the same survey to measure physical activity, height and weight. The whole survey was conducted in English.

Population

Between April 6 and April 24 2017, respondents were approached personally as well as through the test-person-system at the University of Twente (SONA). Additionally, social media like Facebook and WhatsApp were used to ask acquaintances of the researchers to participate in the study. In the SONA system, students of the studies psychology and communication sciences can sign up to participate in other students' research. The data of 329 participants was used in the study. Age of participants ranged from 17 to 33 years, with an average age of 20.88 (SD=2.25). 92 (28%) of those were male, the other 237 (72%) female. Most participants were students (N=297, 90.3%), some employed (N=21, 6.4%), a small group of 4 (1.2%) unemployed, and 7 (2.1%) participants named 'other' as their employment status. To check whether there was a significant difference between students and other participants with regards to sleep outcome a regression analyses on the effects of employment status on sleep was performed. The difference between groups was not significant and therefore both groups were included together in all further analyses.

Materials

The survey consisted of a battery of questionnaires. These questionnaires were the Compensatory Health beliefs scale and the Sleep questionnaire of the Medical Outcomes Scale (MOS) as well as the Walton-Pattison et al. (2016) variables for measuring binge-watching. Additional questions on different aspects of binge-watching were included as well, those will be explained later.

General Compensatory Health Beliefs were measured using the CHB scale which contains 17 items (Rabia et al., 2006). All items are scored on 5-point Likert scales. Thus, scores for the overall CHB scale range between 17 and 85. The scale can be divided into four subscales, namely 'substance use', 'eating/sleeping habits', 'stress', and 'weight regulation'. The CHB scale has been adapted for European countries like the Netherlands (De Nooijer et al., 2009) and Germany (Radtke et al., 2013). The internal consistency of the CHB scale is generally lower in European research than in the Canadian original version. More specifically, Rabia et al. (2006) found a Cronbach's alpha of 0.80 while the Cronbach's alpha was somewhere between 0.61 and 0.76 in the German study by Radtke et al. (2013) and 0.78 in the Netherlands (De Nooijer et al., 2009). For this population a Cronbach's alpha of 0.78 was found as well. The 'eating/sleeping' subscale was used

as a predictor of sleep outcome. In this population the Cronbach's alpha of this subscale was 0.62.

As there is not a scale about CHBs related to binge-watching questions were developed. This was done by looking at the existing scales and translating the items to be binge-watching related Compensatory Health Beliefs. Through this method eight questions were added. All questions can be found in Appendix A. Since these CHBs on binge-watching had been generated by the researcher it was necessary to look at their validity and whether different factors were measured. A factor analysis performed on those questions showed that in fact only one factor was measured. For all eight questions together a sufficiently high Cronbach's alpha of 0.83 was found. There was no item that would have led to a higher Cronbach's alpha if it had been excluded, so all items were kept.

Furthermore, questions about different aspects of the binge-watching behavior were added. Walton-Pattison et al. (2016) developed three questions to measure TV binge-watching behavior in the previous week. They do not however give a way to transform the answers into a clear score. Therefore, in this study, binge-watching frequency, or total number of episodes watched per week, was calculated by multiplying the amount of days that people watched more than two consecutive episodes with the amount of episodes that they watched. This quantity frequency measure approach was chosen because the definition of binge-watching in this research was linked to the amount of episodes watched rather than the time spent watching series. The questions by Walton-Pattison et al. (2016) were supplemented with related questions concerning the social context of binge-watching, preferred genre of series and daytime versus nighttime binge-watching.

Sleeping behavior was measured using the MOS sleep scale (Stewart & Ware, 1992). This scale can be used to measure six different dimensions of sleep quality ('initiation', 'maintenance', 'respiratory', 'adequacy', 'somnolence' and 'quantity') by asking participants to fill in 12 questions. Next to the sleep quantity (in hours) different sleep quality indexes can be calculated. M. T. Smith and Wegener (2003) have found that the Cronbach alpha was between 0.75 and 0.86 for different items and subscales.

In this survey the questions were asked as open questions due to an error. Therefore, answers that were given by participants had to be fit into the usual categories of the 6-point Likert scale used for the original survey by hand. This was not a problem in most cases, resulting in little or no missing values. However, there was one question ('How often during the past 4 weeks did you snore during your sleep?') with 76 missing values. Afterwards assigning categories to the answers the MOS scale had to be rescaled. This was done according to the rules given by Stewart and Ware (1992). The variable 'sleep quantity', as well as the longer of the two indexes, sleep quality index 2, was chosen as measures for sleeping behavior. This index consists of the mean score on 9 of the 12 items of the MOS sleep scale. Score can thus range from 1 to 6. The Cronbach's alpha of the index 2 in this population was 0.27.

Procedure

All participants completed the same questionnaire which was made in Qualtrics, an online survey software that allows researchers to design and administer questionnaires. The participants were asked to honestly fill in the questionnaire, consisting of 94 items. The estimated time to complete the questionnaire was 30 minutes. In practice the median of completion time was 15 minutes. In the beginning participants were given an explanation about the background and goal of the study. By continuing to fill in the survey the participant gave informed consent. The questionnaire consisted of headings with a short explanation of the kind of questions that were going to be asked, so that it was clear for the participants what was expected from them.

Ethical considerations

The study protocol was approved by the ethics committee at the University of Twente, faculty Behavioral and Management and Social Sciences (BMS), as request 17152. As mentioned earlier participants had to give informed consent in order to be able to start the survey. At the end of the survey they were given the right to exclude their data from the study. They could do so by contacting the researcher. All data was handled anonymously so there were no privacy violations. Participants did not have to give their name, and only had to fill in a standard number in order to receive test-person credits. An email address could be entered by choice if participants wished to be informed about the results of the study.

Analysis

Data analysis

Researchers were made aware of the fact that some participants had filled in the survey twice. It was possible to exclude duplicate data by filtering out SONA numbers that were entered twice, and only keeping data from the first participation. There were also 87 participants who did not complete the whole survey. These participants were excluded as well. This left a total of 329 respondents.

The genres of series that people watched were grouped into two categories for a broader overview of the effects on sleeping behavior. The categories 'Animation, Family ', 'Comedy ', 'Game-show, Reality-TV ', 'Music, Musical ', 'Romance ', 'Short' and 'Sport ' were seen as "lighter" programs while the other categories, 'Action, Adventure, Western', 'Biography, Documentary, News, Talk-show', 'Crime, Thriller, Horror', 'Drama ', 'History, War ' and 'Fantasy, Mystery, Sci-Fi' were thought to be more engaging. For the question 'Who do you usually watch series with' the category 'Other' had a frequency of 3 in all responses. During the analysis this category was counted as missing value because of the very low frequency of answers that also could not be added to any of the other answer categories logically.

For both the hours spent binge-watching and the amount of episodes watched a maximum amount of 15 was set, and any answer higher than 15 was seen as a missing value. In both cases this seemed like an unrealistically high amount. This resulted in 2 missing values in both cases.

Pearson correlation coefficients were calculated to investigate the relationship between all variables. For the influence of the binge-watching characteristics on sleep quality and quantity linear and multiple regression analysis was used. Mediation analysis was performed using the regression-based PROCESS function (Hayes, 2013) in SPSS to look at the mediation relationship explained above. Separate models were calculated for all independent variables. All models were calculated for both sleep quantity and quality as dependent variables. Any acceptable model should significantly explain all relationships within the model, including a mediation of the relationship between CHBs and sleep by binge-watching. Whenever the confidence interval of the beta value does not include 0 there is a mediation effect.

Results

Prevalence of binge-watching

Participants reported watching more than two episodes of a series on two days in the past week (SD= 1.89), on average. The average amount of episodes watched was 3.5 (SD= 1.83). The distribution of both variables can be seen in appendix B. Binge-watching frequency, or total number of episodes watched in the past week, varied a lot between participants, with around a third of participants that had a score of two or lower (32.8%), and some participants with scores between 30 and 42. The frequency of answers can be seen in table 1. For the frequency tables of the binge-watching characteristic variables, see appendix B.

Prevalence of sleep quality and quantity

The average of sleep quality in participants was 3.47 (SD= 0.41). For sleep quantity the average score of the population was 3.23 (SD= 1.00), which equals an average sleep time between seven and eight hours. Frequency tables for both variables can be found in appendix B.

CHBs and binge-watching

The best predictors of binge-watching frequency were the developed binge-watching related CHBs (r= 0.244, N= 320; p<0.01). Overall CHBs also showed a small but significant influence on binge-watching frequency (r= 0.113, N= 320; p<0.05).Unexpectedly a small correlation was found between binge-watching frequency and CHBs on substance use as well (r= 0.120, N= 320; p<0.05). The other correlations can be seen in table 2.

CHBs and sleep outcome

Only the CHBs on eating and sleeping behavior were found to have a low significant correlation with sleep quality (r= -0.114, N= 329; p<0.05). None of the other CHBs were significantly related to hours of sleep. The questions that were added for measuring Compensatory Health Beliefs on binge-watching were neither significantly related to sleep quality, nor to sleep quantity.

Tabel 1

Frequency of total number of episodes watched in the past week

		Frequency	Percent	Valid Percent	Cumulative Percent
			Binge-watching frequency		
Valid	,00	87	26.4	27.2	27.2
	2.00	18	5.5	5.6	32.8
	3.00	35	10.6	10.9	43.8
	4.00	21	6.4	6.6	50.3
	5.00	6	1.8	1.9	52.2
	6.00	27	8.2	8.4	60.6
	8.00	15	4.6	4.7	65.3
	9.00	16	4.9	5.0	70.3
	10.00	10	3.0	3.1	73.4
	11.00	1	0.3	0.3	73.8
	12.00	29	8.8	9.1	82.8
	14.00	2	0.6	0.6	83.4
	15.00	9	2.7	2.8	86.3
	16.00	7	2.1	2.2	88.4
	18.00	4	1.2	1.3	89.7
	20.00	11	3.3	3.4	93.1
	21.00	5	1.5	1.6	94.7
	24.00	3	0.9	0.9	95.6
	25.00	1	0.3	0.3	95.9
	28.00	4	1.2	1.3	97.2
	30.00	4	1.2	1.3	98.4
	32.00	1	0.3	0.3	98.8
	33.00	1	0.3	0.3	99.1
	35.00	2	0.6	0.6	99.7
	42.00	1	0.3	0.3	100.0
	Total	320	97.3	100.0	
Missing	System	9	2.7		
Total		329	100.0		

Table 2

Pearson correlation table of the variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1		0.357**	0.266**	0.284*	0.728**	0.120	0.270**	-0.103	0.006	-0.112	0.146**	0.115	-0.022	-0.081
2			0.338**	0.396**	0.745**	0.079	0.292**	-0.049	0.031	-0.046	0.123*	0.098	-0.114*	-0.097
3				0.135*	0.693**	0.084	0.335**	-0.083	-0.026	-0.057	-0.029	0.036	0.020	0.006
4					0.556**	-0.004	0.172**	0.000	-0.034	-0.064	0.085	-0.011	-0.079	-0.048
5						0.113*	0.402**	-0.096	-0.006	-0.103	0.113*	0.095	-0.060	-0.078
6							0.244**	-0.063	0.004	0.051	0.078	0.174**	-0.036	-0.035
7								-0.066	0.087	0.017	0.087	0.134*	-0.024	-0.013
8									0.498**	-0.022	-0.106	-0.028	0.133*	0.044
9										-0.091	-0.163**	0.006	0.132*	0.026
10											0.027	0.043	0.017	0.058
11												0.043	-0.049	-0.156**
12													-0.054	0.015
13														0.107

Note: 1-CHBs substance use; 2-CHBs eat sleep; 3-CHBs stress; 4-CHBs weight; 5-CHBs total; 6-Binge-watching frequency; 7-CHBs binge-watching; 8-Social drive; 9-Watching partner; 10-Genre; 11-Daytime vs. nighttime watching; 12-Amount of series; 13-Sleep quality; 14-Sleep quantity

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Binge-watching behavior and sleep outcome

Multiple regression analysis showed that all binge-watching related variables together did not form a significant model for explaining either sleep quality or quantity (F<4). However, some individual variables did predict part of the sleeping behavior. It is interesting to note that those variables in most cases did not have a significant influence in the multiple regression models, but did when tested alone. Daytime versus nighttime watching significantly influenced sleep quantity (t= -2.86, p<0.05). Whether people watched with other people or alone had a significant impact on sleep quality (t= 2.43, p<0.05). Who the participant watched together with influenced sleep quality as well (t= 2.40, p<0.05). Still, none of the variables seemed to significantly influence both sleeping quality and quantity. All linear regressions can be seen in table 3. The multiple regression models are shown in appendix C.

Table 3

Bivariate linear regression analysis outcome

Independent variable	Dependent variable	β	R square	F	t	p-value
Social drive	1	0.044	0.002	0.630	0.794	0.428
	2	0.133	0.018	5.883	2.425	0.016
Watching partner	1	0.026	0.001	0.225	0.474	0.636
	2	0.132	0.017	5.770	2.402	0.017
Genre	1	0.034	0.001	0.387	0.622	0.534
	2	0.053	0.003	0.905	0.951	0.342
Daytime vs. nighttime watching	1	-0.156	0.024	8.187	-2.861	0.004
	2	-0.049	0.002	0.772	-0.878	0.380
Amount of series	1	0.015	0.000	0.065	0.256	0.798
	2	-0.054	0.003	0.899	-0.948	0.344

Note: 1= Sleep quantity, 2= Sleep quality

Answer categories and scores: Social drive= Always alone (1); Mostly alone (2); Equally often alone and with others (3); Mostly with others (4); Always with others (5). Watching partner = Alone (1); Family (2); Friends (3); Partner (4); Roommates (5). Daytime vs. nighttime= During daytime (1); Equally often during daytime and nighttime (2); During nighttime (3). Genre= Light (1); More complex (2).

Mediation analysis

Different mediation analyses were performed. Independent variables were the total score of CHBs in the original scale, the sum of CHBs related to binge-watching and the sum of CHBs related to sleep. The mediator in all analyses was binge-watching frequency. Both sleep quantity and sleep quality were taken into account as dependent variables. The PROCESS function in SPSS was used for the analyses (Hayes, 2013). None of the tested models significantly explained the relationship between the three factors. As mentioned earlier the total CHB score as well as that of binge-watching CHBs influenced binge-watching frequency, while CHBs related to eating and sleeping had an influence on both sleep quantity and quality. A summary of all tested models can be found in appendix D.

Discussion

The goal of this cross-sectional correlation study was to look at the relationship between Compensatory Health Beliefs, binge-watching and sleep outcome in a population of 329 young adults.

The first finding of this study was that the developed questions about CHBs on binge-watching are the best predictor of binge-watching frequency and the new subscale also correlated with total CHB scores.

Secondly, there was no mediation of the relationship between CHBs and sleep outcome by binge-watching frequency. However, some paths of the model showed a significant relationship.

Lastly, characteristics of binge-watching and their relationship with sleep outcome were looked at. Watching during nighttime had a negative impact on sleep quantity. Watching with others in general and specifically watching with friends or a partner, negatively influenced sleep quality.

Compensatory Health Beliefs on binge-watching

The developed CHB scale on binge-watching related CHBs seems to be a good addition to the Compensatory Health Beliefs questionnaire. The scale was the variable with the highest correlation with binge-watching frequency and also showed correlations with the other subscales. Furthermore, the scale correlates with the sum of all other CHBs. Overall it seems like it can be valuable to add the developed questions to the existing CHB questionnaire. This could be useful to gain insight into CHBs about binge-watching as an additional, possibly unhealthy, behavior.

In the past several new subscales on CHBs about specific behavior like smoking (Radtke, Scholz, Keller, Knäuper, & Hornung, 2011) or glucose testing in diabetes patients (Rabiau, Knäuper, Nguyen, Sufrategui, & Polychronakos, 2009) have been developed. While these scales might be interesting to use in specific cases, the questions remains whether the CHB scale is not complete as it is. So these new binge-watching CHBs can best be seen as an optional scale to be added whenever this fits the context of the study. The same goes for the questions on binge-watching as well, as it is a specific behavior.

But in order for the new scale to be valuable in those cases it needs to be tested and validated again. Correlating results in a test-retest study including this new scale as well as the existing CHB scale can show how reliable the new questions are.

CHBs, binge-watching and sleep

Mediation analysis of different combinations of CHB, binge-watching and sleep outcome variables did not lead to a significant model of this relationship. Therefore, there seems to be no model where the effect of Compensatory Health Beliefs on sleep outcome is influenced by binge-watching frequency. Even though part of the binge-watching frequency can be explained through CHBs and other CHBs account for differences in sleeping outcome both relationships cannot be put into one model. While Chan (2014) found that binge-watching had a negative influence on sleep quantity and Kakinami et al. (2017) related binge-watching to poorer sleep quality, those findings were not supported in the current research. It is possible that the effect of binge-watching frequency on sleep outcome is less important than the actual time spent watching because series differ in length. However, as the most used definition of binge-watching remains independent of time it is more difficult to find a way to measure binge-watching in this case.

An issue that might have led to a distortion of the data was that the MOS sleep scale was administered as an open question survey. Afterwards the answers were arranged into the scores of the actual scale by the researcher. Although most answers could clearly be recoded into one of the categories, this led to some missing values, and to a very low reliability of the scale (Cronbach's alpha of 0.27). Therefore, it is actually surprising that correlations with sleep quality were found. This possibly resulted from the fact that mean scores were calculated for the index 2, so the impact of missing values was lower than it would have been in the case of a cumulative score. Still the data on sleep quantity can be seen as more reliable than that on sleep quality.

It can be hypothesized that students have a less strict schedule and can therefore take more time to binge-watch or compensate for consequences of this behavior. However, some of the students actually reported being stressed because of an exam and this stress influencing their sleep behavior but this cannot be generalized for all participants. It is therefore difficult to judge whether the timing of this study can be improved for this specific population.

As the data of this study does not indicate a possible correlation between binge-watching frequency and either sleep quantity or quality it is questionable if future research on the topic would add much, even if the MOS scale was administered correctly.

For the mediation analysis in general having access to longitudinal data could give more reliable results. In the case of this research, constructing a longitudinal study was not possible because of time restrictions. However, it would be interesting to look at differences in binge-watching and sleeping behavior

as well as possible changes in CHBs over a longer period of time.

The broader question of whether binge-watching is actually an unhealthy behavior, as other binging behaviors like binge-drinking or -eating are, still remains unanswered. In order to get a clear picture of this, more health outcomes need to be looked at. Sedentary behavior, mental and physical health as well as social functioning might be influenced by (aspects of) binge-watching. Possible starting points for future research are the other scales of the MOS (Stewart & Ware, 1992) like physical functioning, energy/fatigue or mental health.

Binge-watching characteristics and sleep outcome

In spite of the fact that binge-watching is not related to either sleep quantity or quality, there were several characteristics of binge-watching that could be linked to sleep outcome. Nighttime binge-watching leads to fewer hours actually slept. This relationship was as expected, with daytime watching influencing sleep quantity the least, and equally watching during daytime and nighttime having an effect in between those of daytime and nighttime watching. The findings are consistent with the studies by Losch (2015) and Hedger (2016) who link screen time in general, and specifically watching series before going to bed to participants having more trouble falling asleep and thus less sleep quantity. Contrary to expectation, mostly or always watching with others was linked to lower sleep quality. Especially participants that usually watched with a partner or friend showed lower scores on sleep quality, compared to those that watched with roommates, family, or alone. As the relationships with a partner and with friends are expected to be more intimate, this is not surprising. While these characteristics of viewing behavior make some difference in sleep outcome, the type and amount of series that one watches are not associated with sleep quantity or quality. Interestingly, neither of the significant factors correlated with binge-watching frequency. The expected correlation between binge-watching factors and sleep outcome partly relied on the theory that binge-watching in general influenced sleep outcome, and binge-watching frequency in this research did not. Therefore, it seems that some binge-watching characteristics have an impact on sleep outcome, regardless of whether the participant binge-watches a lot or not.

However, there are possible confounders or predictors of those relationships that were not measured in this study. It is probable that any night-time behavior will influence sleep quantity, not only binge-watching during night-time. Cognitive aspects, personality traits and other possible predictors of binge-watching behavior other than CHBs were not looked at in this research. Adding those factors in a future research and adjusting outcomes for different personality groups could lead to a more accurate, parsimonious model that predicts binge-watching behavior. Allen, Magee, and Vella (2016) looked at the relationship between the Big Five and sleep quality and found that openness to experience negatively influenced the sleep quality of participants. It would be interesting to develop and test a model of this

relationship and including binge-watching as a possible mediator.

This second part of the research was set up as a more exploratory study to see what aspects future research might need to look at in more detail. It seems that two of the factors of binge-watching that were taken into account in this study do not play a role in influencing sleep outcome. However, with some alterations, the basis of this study can be used in the future. Firstly, the genre of series was split into two broad categories. While there was not a significant difference between both groups this might have been caused by the broad division into only two groups. In future research, it might be interesting to look at this relationship more specifically. Making more and smaller groups or looking at other genres of series altogether could lead to different and more significant results. Besides, the amount of series that participants watched varied a lot between participants, but there was only a small amount of participants that actually watched a lot of different series so it is difficult to base results on this group. It could be interesting to look at this relationship in a group of people that generally watch more series.

Furthermore, not all aspects that might be of interest concerning the topic of binge-watching were looked at. To explore which factors are important, qualitative research might be more useful than a quantitative study like this one. In the case of this research those factors were not the primary topic which explains the choice of study design. However, this study has shown that it could be very interesting to investigate binge-watching characteristics further. By asking people that participate in binge-watching about possible factors and consequences, new insights might be gained. Thereafter another quantitative study can measure the effects of those factors.

General outcomes of binge-watching and sleep

The average amount of episodes watched in the last session of binge-watching of this study's participants was 3.5, which is more than one episode above the session average of 2.3 that Feeney (2014) reports for a general American and Canadian population. This difference may stem from the fact that most participants in this study were students, who have a more flexible schedule than a fulltime worker. Daily internet use in the group of Dutch adolescents between 12 and 25 years was 94% in 2014 while the average in the general population is 90% (CBS, 2015). Roughly two thirds of internet users watch television or listen to the radio online, making it one of the most popular online activities. Therefore, it is plausible that adolescents spent more time (binge-) watching television online.

According to Spoormaker (2006) the average sleep time in the Netherlands is 7 hours and 20 minutes. This was about the same in the study population. Sleep quality in this population was also roughly the same as the average of the baseline score reported by Hays, Martin, Sesti, and Spritzer (2005) for an American population. It is thus interesting to note that while this adolescent population does spent more time watching series than an average population, there is no significant difference in sleep outcome.

A population characteristic that was not taken into account in this research was the living situation of participants. It is possible that living in student housing with roommates influences sleeping and binge-watching behavior differently than living at home or alone does. Adding this as a variable and comparing data between groups might show that there are stronger correlations than were found in this study.

All in all binge-watching frequency is influenced by Compensatory Health Beliefs in general and CHBs about binge-watching in specific. However, binge-watching might not be an unhealthy behavior after all, at least when it comes to the impact on sleep outcome. There are binge-watching characteristics other than binge-watching frequency that influence sleep quality or quantity. Specifically watching during nighttime and watching with others, especially friends or a partner had a negative effect on sleep outcome. However, there are still possible predictors and confounders that have not been looked at with regards to binge-watching, and the topic generally seems like a very fruitful field for future research.

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Appendix A – Survey questions

General questions

What is your age?

What is your gender?

❍ Male (1)
❍ Female (2)

Employment status

❍ Student (1)
❍ Employed (2)
❍ Unemployed (3)
❍ Other (4)

Compensatory Health beliefs scale

In the following part, please state how much you agree with the statements.

	Not at all (1)	A little (2)	Somewhat (3)	Quite a bit (4)	Very much (5)
The effects of regularly drinking alcohol can be made up for by eating healthy (1)	❍	❍	❍	❍	❍
It is alright to drink a lot of alcohol as long as one drinks lots of water to flush it (2)	❍	❍	❍	❍	❍
Smoking from time to time is OK if one eats healthy (3)	❍	❍	❍	❍	❍
The effects of drinking coffee can be balanced by drinking equal amounts of water (4)	❍	❍	❍	❍	❍
The effects of drinking too much alcohol during the weekend can be made up for by not drinking during the week (5)	❍	❍	❍	❍	❍
Smoking can be compensated for by exercising (6)	❍	❍	❍	❍	❍

In the following part, please state how much you agree with the statements.

	Not at all (1)	A little (2)	Somewhat (3)	Quite a bit (4)	Very much (5)
Too little sleep during the week can be compensated for by sleeping in on the weekends (1)	○	○	○	○	○
It is OK to go to bed late if one can sleep longer the next morning (only the number of hours counts) (2)	○	○	○	○	○
It is OK to skip breakfast if one eats more during lunch or dinner (3)	○	○	○	○	○
Eating whatever one wants in the evening is OK if one did not eat during the entire day (4)	○	○	○	○	○

In the following part, please state how much you agree with the statements.

	Not at all (1)	A little (3)	Somewhat (4)	Quite a bit (5)	Very much (6)
Stress during the week can be made up for by relaxing on the weekend (1)	○	○	○	○	○
A stressful day can be compensated for by relaxing in front of the TV (2)	○	○	○	○	○
The bad effects of stress can be made up for by exercising (3)	○	○	○	○	○
Sleep compensates for stress (4)	○	○	○	○	○

In the following part, please state how much you agree with the statements.

	Not at all (1)	A little (2)	Somewhat (3)	Quite a bit (4)	Very much (5)
Eating dessert can be made up for by skipping the main dish (1)	○	○	○	○	○
Using artificial sweeteners compensates for extra calories (2)	○	○	○	○	○
Breaking a diet today may be compensated for by starting a new diet tomorrow (3)	○	○	○	○	○

Binge-watching

In the following part, please state how much you agree with the statements.

	Not at all (1)	A little (2)	Somewhat (3)	Quite a bit (4)	Very much (5)
It's okay to watch multiple episodes of a series if I worked hard that day (1)	❍	❍	❍	❍	❍
A night/evening of watching multiple episodes of a series can be compensated by not watching television another night (2)	❍	❍	❍	❍	❍
I can compensate a night of watching multiple episodes of a series if I study extra hard tomorrow (3)	❍	❍	❍	❍	❍
After a good work-out I deserve to watch multiple episodes of a series (4)	❍	❍	❍	❍	❍
If I eat healthy it's okay to watch multiple episodes of a series (5)	❍	❍	❍	❍	❍
After I studied for a long while I can treat myself by watching multiple episodes of a series (6)	❍	❍	❍	❍	❍
A day of much television watching can be	❍	❍	❍	❍	❍

made up for by exercising more the next day (7)					
A day of much television watching can be made up for eating less unhealthy food (8)	○	○	○	○	○

The following questions are about television watching as well as on-demand streaming websites. An example of such a website is Netflix. Please answer the questions with regards to watching series online.

In the past 7 days, on how many days did you watch more than two episodes of the same TV series in the same sitting (one immediately after the other)?

- ○ 0 days (1)
- ○ 1 day (2)
- ○ 2 days (3)
- ○ 3 days (4)
- ○ 4 days (5)
- ○ 5 days (6)
- ○ 6 days (7)
- ○ 7 days (8)

Thinking of the last time you watched more than two consecutive episodes of the same TV show in the same sitting, how many consecutive episodes of the same TV show(one after the other) did you watch?

Thinking of the last time your watched more than two consecutive episodes of the same TV show in the same sitting, how many hours did you spend watching the TV show? (in hours, rounded to nearest half hour)

How do you usually watch series?

- ○ Always alone (1)
- ○ Mostly alone (2)
- ○ Equally often alone as with others (3)
- ○ Mostly with others (4)
- ○ Always with others (5)

Who do you usually watch series with

- ○ I watch alone (1)
- ○ With family (2)
- ○ With friends (3)
- ○ With a partner (4)
- ○ With roommates (5)
- ○ Other (6)

What genre of series do you watch most

- ○ Action, Adventure, Western (1)
- ○ Animation, Family (2)

○ Biography, Documentary, News, Talk-show (3)
○ Comedy (4)
○ Crime, Thriller, Horror (5)
○ Drama (6)
○ Game-show, Reality-TV (7)
○ History, War (8)
○ Music, Musical (9)
○ Fantasy, Mystery, Sci-Fi (10)
○ Romance (11)
○ Short (12)
○ Sport (13)

When do you usually watch series?

○ During daytime (1)
○ Equally often during daytime and nighttime (2)
○ During nighttime (between 12 and 8am) (3)

How many different series do you watch regularly?

MOS sleep scale

How long did it usually take for you to fall asleep during the past 4 weeks?

On the average, how many hours did you sleep each night during the past 4 weeks?

How often during the past 4 weeks did you feel that your sleep was not quiet (moving restlessly, feeling tense, speaking, etc.) while sleeping?

How often during the past 4 weeks did you get enough sleep to feel rested upon waking in the morning?

How often during the past 4 weeks did you awaken short of breath or with a headache?

How often during the past 4 weeks did you feel drowsy or sleepy during the day?

How often during the past 4 weeks did you have trouble falling asleep?

How often during the past 4 weeks did you awaken during your sleep time and have trouble falling asleep again?

How often during the past 4 weeks did you have trouble staying awaken during the day?

How often during the past 4 weeks did you snore during your sleep?

How often during the past 4 weeks did you take naps (5 minutes or longer) during the day?

How often during the past 4 weeks did you get the amount of sleep you needed?

Appendix B – Frequency tables

Frequency of the amount of days of binge-watching in the past week

In the past 7 days, on how many days did you watch more than two episodes of the same TV series in the same sitting (one immediately after the other)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 days	86	26,1	26,1	26,1
	1 day	77	23,4	23,4	49,5
	2 days	50	15,2	15,2	64,7
	3 days	47	14,3	14,3	79,0
	4 days	34	10,3	10,3	89,4
	5 days	17	5,2	5,2	94,5
	6 days	4	1,2	1,2	95,7
	7 days	14	4,3	4,3	100,0
	Total	329	100,0	100,0	

Frequency of the amount of episodes watched

Thinking of the last time you watched more than two consecutive episodes of the same TV show in the same sitting, how many consecutive episodes of the same TV show (one after the other) did you watch?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	12	3,6	3,8	3,8
	1	2	,6	,6	4,4
	2	60	18,2	18,9	23,3
	3	121	36,8	38,2	61,5
	4	67	20,4	21,1	82,6
	5	32	9,7	10,1	92,7
	6	9	2,7	2,8	95,6
	7	1	,3	,3	95,9
	8	4	1,2	1,3	97,2
	10	5	1,5	1,6	98,7
	11	2	,6	,6	99,4
	12	1	,3	,3	99,7
	14	1	,3	,3	100,0
	Total	317	96,4	100,0	
Missing	20	1	,3		
	33	1	,3		
	System	10	3,0		
	Total	12	3,6		
Total		329	100,0		

Frequency of the binge-watching frequency

BW_freq

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	,00	87	26,4	27,2	27,2
	2,00	18	5,5	5,6	32,8
	3,00	35	10,6	10,9	43,8
	4,00	21	6,4	6,6	50,3
	5,00	6	1,8	1,9	52,2
	6,00	27	8,2	8,4	60,6
	8,00	15	4,6	4,7	65,3
	9,00	16	4,9	5,0	70,3
	10,00	10	3,0	3,1	73,4
	11,00	1	,3	,3	73,8
	12,00	29	8,8	9,1	82,8
	14,00	2	,6	,6	83,4
	15,00	9	2,7	2,8	86,3
	16,00	7	2,1	2,2	88,4
	18,00	4	1,2	1,3	89,7
	20,00	11	3,3	3,4	93,1
	21,00	5	1,5	1,6	94,7
	24,00	3	,9	,9	95,6
	25,00	1	,3	,3	95,9
	28,00	4	1,2	1,3	97,2
	30,00	4	1,2	1,3	98,4
	32,00	1	,3	,3	98,8
	33,00	1	,3	,3	99,1
	35,00	2	,6	,6	99,7
	42,00	1	,3	,3	100,0
	Total	320	97,3	100,0	
Missing	System	9	2,7		
Total		329	100,0		

Frequency of social drive

How do you usually watch series?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Always alone	41	12,5	12,5	12,5
	Mostly alone	172	52,3	52,3	64,7
	Equally often alone as with others	66	20,1	20,1	84,8
	Mostly with others	42	12,8	12,8	97,6
	Always with others	8	2,4	2,4	100,0
	Total	329	100,0	100,0	

Frequency of watching partner

Who do you usually watch series with?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I watch alone	115	35,0	35,3	35,3
	With family	21	6,4	6,4	41,7
	With friends	58	17,6	17,8	59,5
	With a partner	98	29,8	30,1	89,6
	With roommates	34	10,3	10,4	100,0
	Total	326	99,1	100,0	
Missing	Other	3	,9		
Total		329	100,0		

Frequency of daytime vs. nighttime watching

When do you usually watch series?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	During daytime	127	38,6	38,6	38,6
	Equally often during daytime and nighttime	162	49,2	49,2	87,8
	During nighttime (between 12 and 8am)	40	12,2	12,2	100,0
	Total	329	100,0	100,0	

Frequency of amount of series

How many different series do you watch regularly?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	,00	17	5,2	5,4	5,4
	,00	5	1,5	1,6	7,1
	,01	1	,3	,3	7,4
	1,00	52	15,8	16,7	24,0
	2,00	104	31,6	33,3	57,4
	3,00	75	22,8	24,0	81,4
	4,00	16	4,9	5,1	86,5
	5,00	20	6,1	6,4	92,9
	6,00	7	2,1	2,2	95,2
	7,00	2	,6	,6	95,8
	8,00	5	1,5	1,6	97,4
	9,00	3	,9	1,0	98,4
	11,00	1	,3	,3	98,7
	15,00	2	,6	,6	99,4
	18,00	1	,3	,3	99,7
	22,00	1	,3	,3	100,0
	Total	312	94,8	100,0	
Missing	System	17	5,2		
Total		329	100,0		

Frequency of genre

1=Light; 2=Heavy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	102	31,0	31,0	31,0
	2	227	69,0	69,0	100,0
	Total	329	100,0	100,0	

Frequency of sleep quality

MOS_index_2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2,33	4	1,2	1,2	1,2
	2,44	3	,9	,9	2,1
	2,56	1	,3	,3	2,4
	2,67	4	1,2	1,2	3,6
	2,78	11	3,3	3,3	7,0
	2,89	8	2,4	2,4	9,4
	3,00	14	4,3	4,3	13,7
	3,11	34	10,3	10,3	24,0
	3,22	31	9,4	9,4	33,4
	3,33	26	7,9	7,9	41,3
	3,44	32	9,7	9,7	51,1
	3,56	33	10,0	10,0	61,1
	3,67	35	10,6	10,6	71,7
	3,78	29	8,8	8,8	80,5
	3,89	30	9,1	9,1	89,7
	4,00	13	4,0	4,0	93,6
	4,11	13	4,0	4,0	97,6
	4,22	4	1,2	1,2	98,8
	4,33	1	,3	,3	99,1
	4,44	2	,6	,6	99,7
	4,56	1	,3	,3	100,0
	Total	329	100,0	100,0	

Frequency of sleep quality

Frequency of sleep quantity

On the average, how many hours did you sleep each night during the past 4 weeks?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5h	14	4,3	4,3	4,3
	6h	62	18,8	18,8	23,1
	7h	118	35,9	35,9	59,0
	8h	108	32,8	32,8	91,8
	9h	24	7,3	7,3	99,1
	10h+	3	,9	,9	100,0
	Total	329	100,0	100,0	

Frequency of sleep quantity

Appendix C – Output multiple regression model

Multiple regression model sleep quantity

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,179[a]	,032	,016	1,003

a. Predictors: (Constant), How many different series do you watch regularly?, Who do you usually watch series with, 1=Light; 2=Heavy, When do you usually watch series?, How do you usually watch series?

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10,114	5	2,023	2,009	,077[b]
	Residual	305,109	303	1,007		
	Total	315,223	308			

a. Dependent Variable: On the average, how many hours did you sleep each night during the past 4 weeks?

b. Predictors: (Constant), How many different series do you watch regularly?, Who do you usually watch series with, 1=Light; 2=Heavy, When do you usually watch series?, How do you usually watch series?

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	3,450	,319		10,829	,000
	1=Light; 2=Heavy	,136	,125	,062	1,088	,277
	How do you usually watch series?	-,007	,071	-,007	-,103	,918
	Who do you usually watch series with	,000	,046	-,001	-,009	,993
	When do you usually watch series?	-,260	,087	-,171	-2,985	,003
	How many different series do you watch regularly?	,008	,023	,019	,329	,742

a. Dependent Variable: On the average, how many hours did you sleep each night during the past 4 weeks?

Multiple regression model sleep quality

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,197[a]	,039	,023	,40068

a. Predictors: (Constant), How many different series do you watch regularly?, Who do you usually watch series with, 1=Light; 2=Heavy, When do you usually watch series?, How do you usually watch series?

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1,963	5	,393	2,446	,034[b]
	Residual	48,646	303	,161		
	Total	50,609	308			

a. Dependent Variable: MOS_i2

b. Predictors: (Constant), How many different series do you watch regularly?, Who do you usually watch series with, 1=Light; 2=Heavy, When do you usually watch series?, How do you usually watch series?

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3,234	,127		25,421	,000
	1=Light; 2=Heavy	,063	,050	,071	1,264	,207
	How do you usually watch series?	,042	,028	,096	1,475	,141
	Who do you usually watch series with	,029	,018	,104	1,591	,113
	When do you usually watch series?	-,011	,035	-,018	-,321	,749
	How many different series do you watch regularly?	-,009	,009	-,055	-,967	,334

a. Dependent Variable: MOS_i2

Appendix D - Output mediation analysis

Model of CHB total, binge-watching frequency and sleep quantity

```
Outcome: BW_freq

Model Summary
          R        R-sq         MSE           F         df1         df2           p
      ,1128       ,0127     62,5063      4,0953      1,0000    318,0000       ,0438

Model
             coeff          se           t           p        LLCI        ULCI
constant     3,0260      2,1306      1,4203       ,1565     -1,1658      7,2177
CHB_t         ,1051       ,0519      2,0237       ,0438       ,0029       ,2072


************************************************************************
Outcome: MOS_2

Model Summary
          R        R-sq         MSE           F         df1         df2           p
      ,0955       ,0091      1,0013      1,4588      2,0000    317,0000       ,2341

Model
             coeff          se           t           p        LLCI        ULCI
constant     3,6732       ,2705     13,5784       ,0000      3,1410      4,2054
BW_freq      -,0031       ,0071      -,4348       ,6640      -,0171       ,0109
CHB_t        -,0105       ,0066     -1,5922       ,1123      -,0235       ,0025
```

Model of CHBs on binge-watching, binge-watching frequency and sleep quantity

```
Outcome: BW_freq

Model Summary
          R        R-sq         MSE           F         df1         df2           p
      ,2436       ,0593     59,5549     20,0574      1,0000    318,0000       ,0000

Model
             coeff          se           t           p        LLCI        ULCI
constant      ,1599      1,6395       ,0975       ,9224     -3,0658      3,3855
CHB_BW_t      ,3139       ,0701      4,4785       ,0000       ,1760       ,4518


************************************************************************
Outcome: MOS_2

Model Summary
          R        R-sq         MSE           F         df1         df2           p
      ,0375       ,0014      1,0091       ,2236      2,0000    317,0000       ,7998

Model
             coeff          se           t           p        LLCI        ULCI
constant     3,3116       ,2134     15,5168       ,0000      2,8917      3,7315
BW_freq      -,0039       ,0073      -,5340       ,5937      -,0183       ,0105
CHB_BW_t     -,0024       ,0094      -,2603       ,7948      -,0210       ,0161
```

Model of CHBs on eating and sleeping, binge-watching frequency and sleep quantity

```
Outcome: BW_freq

Model Summary
          R          R-sq          MSE            F           df1           df2             p
      ,0791         ,0063      62,9154       2,0011        1,0000      318,0000         ,1582

Model
               coeff           se            t            p          LLCI          ULCI
constant      5,3143       1,4342       3,7053        ,0002        2,4925        8,1360
CHB_ES_t       ,2078        ,1469       1,4146        ,1582        -,0812         ,4969

*************************************************************************
Outcome: MOS_2

Model Summary
          R          R-sq          MSE            F           df1           df2             p
      ,1174         ,0138        ,9966       2,2165        2,0000      317,0000         ,1107

Model
               coeff           se            t            p          LLCI          ULCI
constant      3,5981        ,1844      19,5159        ,0000        3,2354        3,9608
BW_freq       -,0032        ,0071       -,4587        ,6467        -,0171         ,0106
CHB_ES_t      -,0373        ,0185      -2,0122        ,0450        -,0738        -,0008
```

Model of CHB total, binge-watching frequency and sleep quality

```
Outcome: BW_freq

Model Summary
          R          R-sq          MSE            F           df1           df2             p
      ,1128         ,0127      62,5063       4,0953        1,0000      318,0000         ,0438

Model
               coeff           se            t            p          LLCI          ULCI
constant      3,0260       2,1306       1,4203        ,1565       -1,1658        7,2177
CHB_t          ,1051        ,0519       2,0237        ,0438         ,0029         ,2072

*************************************************************************
Outcome: MOS_i2

Model Summary
          R          R-sq          MSE            F           df1           df2             p
      ,0677         ,0046        ,1688        ,7298        2,0000      317,0000         ,4828

Model
               coeff           se            t            p          LLCI          ULCI
constant      3,5853        ,1111      32,2804        ,0000        3,3668        3,8039
BW_freq       -,0015        ,0029       -,5247        ,6002        -,0073         ,0042
CHB_t         -,0028        ,0027      -1,0221        ,3075        -,0081         ,0026
```

Model of CHBs on binge-watching, binge-watching frequency and sleep quality
```
Outcome: BW_freq

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,2436      ,0593    59,5549    20,0574     1,0000   318,0000      ,0000

Model
              coeff         se          t          p       LLCI       ULCI
constant      ,1599     1,6395      ,0975      ,9224    -3,0658     3,3855
CHB_BW_t      ,3139      ,0701     4,4785      ,0000      ,1760      ,4518

**************************************************************************
Outcome: MOS_i2

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,0373      ,0014      ,1693      ,2212     2,0000   317,0000      ,8017

Model
              coeff         se          t          p       LLCI       ULCI
constant     3,4902      ,0874    39,9221      ,0000     3,3182     3,6623
BW_freq      -,0017      ,0030     -,5822      ,5608     -,0076      ,0041

CHB_BW_t     -,0007      ,0039     -,1701      ,8651     -,0082      ,0069
```

Model of CHBs on eating and sleeping, binge-watching frequency and sleep quality
```
Outcome: BW_freq

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,0791      ,0063    62,9154     2,0011     1,0000   318,0000      ,1582

Model
              coeff         se          t          p       LLCI       ULCI
constant     5,3143     1,4342     3,7053      ,0002     2,4925     8,1360
CHB_ES_t      ,2078      ,1469     1,4146      ,1582     -,0812      ,4969

**************************************************************************
Outcome: MOS_i2

Model Summary
          R       R-sq        MSE          F        df1        df2          p
      ,1161      ,0135      ,1673     2,1656     2,0000   317,0000      ,1164

Model
              coeff         se          t          p       LLCI       ULCI
constant     3,6126      ,0755    47,8267      ,0000     3,4640     3,7613
BW_freq      -,0014      ,0029     -,4885      ,6255     -,0071      ,0043
CHB_ES_t     -,0150      ,0076    -1,9780      ,0488     -,0300     -,0001
```