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Daniela Filipa Antunes Tavares

WHAT DO SLEEP DIARIES TELL US ABOUT PATIENTS DIAGNOSED WITH CHRONIC INSOMNIA? / O QUE NOS DIZEM OS DIÁRIOS DE SONO SOBRE PESSOAS DIAGNOSTICADAS COM INSÓNIA CRÓNICA?

Dissertation submitted in partial fulfilment of the requirements for the obtainment master's degree in Psychology, specialty in Clinical Psychology – sub-specialty Cognitive-Behavioural Interventions on Psychological and Health Disorders, supervised by Professor Ana Cardoso Allen Gomes, PhD, and presented to the Faculty of Psychology and Educational Sciences of the University of Coimbra.

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What do sleep diaries tell us about patients diagnosed with chronic insomnia? / O que nos dizem os diários de sono sobre pessoas diagnosticadas com insónia crónica?

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Resumo

A insónia tem-se tornado, cada vez mais, um problema dos tempos modernos, o que lhe confere relevância. Os diários do sono são ferramentas de reconhecida importância na avaliação e terapia da insónia, que nos permitem compreender os padrões de sono dos doentes a partir da sua perspetiva. Apesar disso, parecem ser muito pouco utilizados enquanto instrumentos centrais de investigação.

O objetivo do presente estudo é dar a conhecer, de uma forma mais compreensiva, os padrões de sono dos doentes com diagnóstico de Insónia, antes de serem submetidos a Terapia Cognitivo-Comportamental para esta perturbação (TCC-I), utilizando, para isso, o Diário de Sono.

A amostra incluiu 102 participantes (56.9% mulheres) diagnosticados com Perturbação de Insónia Crónica, medicados (44.1%) e não medicados para a Insónia, com idades compreendidas entre os 18 e os 85 anos (M = 48.90 ± 14.14). A média de duração da insónia era de 12.98 anos (DP = 11.13).

Em média, os participantes foram para a cama às 23h36m, acordaram 2.13 vezes, permaneceram 0h40m acordados durante a noite, acordaram às 7h23m, levantaram-se às 8h18m, e fizeram 0.42 sestas. O tempo total de sono foi de 6h14m, e o tempo total na cama de 8h40m, resultando numa eficiência de sono de 71.7%. Em mediana, demoraram 28 minutos a adormecer. A média dos padrões sono-vigília dos participantes foi mais tardia ao fim de semana, quando comparado com dias da semana. Foram encontradas diferenças significativas em vários padrões de sono, em função das variáveis sociodemográficas. Participantes medicados e não medicados não apresentaram diferenças nos seus padrões de sono. A qualidade do sono relatada ao acordar associou-se à hora de deitar, ao número de acordares e ao grau de repouso sentido.

Os resultados do presente estudo possibilitam uma melhor compreensão dos padrões de sono na insónia, antes do início da terapia, através da perspetiva do doente.

Palavras-chave: Diário de sono, padrão de sono, perturbação de insónia crónica, amostra clínica.

Abstract

Insomnia has become a greater problem in modern society. Sleep diaries are recognized as extremely important tools in the assessment of insomnia disorder and on the course of therapy, since they allow us to understand the sleep pattern from the patient's perspective. However, they have not assumed such a central role for research purposes.

In this study, we aim to better understand the sleep patterns of patients diagnosed with insomnia disorder at the base line, ie., before starting Cognitive-Behavioural Therapy (CBT-I), using the sleep diary.

The sample included 102 participants (56.9% women) diagnosed with chronic insomnia disorder, sleep medicated (44.1%) and non-medicated, with ages ranging from 18 to 85 years (M = 48.90 ± 14.14). The average duration of insomnia was of 12.98 years (SD = 11.13).

In mean, participants went to bed at around 23h36m, awaked 2.13 times per night, were awake 0h40m during the night, woke up at 7h23m, got up at 8h18m, and took 0.42 naps. The total sleep time was of 6h14m on average, and time in bed was 8h40m, resulting in a mean sleep efficiency of 71.7%. In median, they took 28 minutes to fall asleep.

The participants' mean sleep-wake patterns were later on weekends, when compared to weekdays. Several differences were found on sleep patterns by sociodemographic variables. Medicated and non-medicated participants did not seem to differ on sleep variables. Sleep quality was found to be associated, in general, with bedtime, the number of awakenings and the rest degree felt upon wake-time.

These results allow for a better comprehension of insomnia sleep-wake patterns, before treatment, from the perspective of the insomnia sufferer.

Key Words: Sleep diaries, sleep pattern, chronic insomnia disorder, clinical sample.

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Introduction

Insomnia is perhaps becoming the greatest sleep challenge our society faces. As society develops, busy lifestyles may put our sleep at risk, and therefore our health. Nowadays, longer work shifts are required, sometimes even nightshifts, activities are being delayed to post-labour hours and sleep restriction is even valued, in order to accomplish more, and this is creating a lifestyle that promotes insomnia (Clemente, 2006). According to the American Psychiatric Association (2013), the prevalence of insomnia is around 6-10% (but about 1/3 of the population has insomnia symptoms), being more prevalent amongst older adults and those who tend to report lower physical or psychological health (Morin, LeBlanc, Belanger, Ivers, Merette, & Savard, 2011).

Women also seem more prone to report insomnia complaints and to be less satisfied with their sleep (Leger, Guilleminault, Dreytus, Delahaye, & Paillard, 2000). Besides, divorced/separated individuals and widowers tend to be more prone to insomnia (Leger et al., 2000), as well as less educated individuals (Ohayon, Caulet, & Guilleminault, 1997).

With insomnia being such a relevant issue, there have been several attempts at classifying insomnia, similarly to other psychological disorders. In this study, we will focus on the Diagnostic and Statistical Manual – Fifth Edition (DSM-5) and the International Classification of Sleep Disorders – Third Edition (ICSD-3).

DSM-5 is the classification created by the American Psychiatric Association (APA) and covers all types of psychological disorders, and not only sleep-related disorders. According to this classification, insomnia is mainly characterized by a “dissatisfaction with sleep quantity or quality with complaints of difficulty initiating or maintaining sleep.” (American Psychiatric Association, 2013, p. 363).

ICSD-3 is a classification brought to the field by the American Academy of Sleep Medicine (AASM) and focuses specifically on sleep disorders. According to ICSD-3, insomnia is “a persistent difficulty with sleep initiation, duration, consolidation, or quality that occurs despite adequate opportunity and circumstances for sleep, and results in some form of daytime impairment” (American Academy of Sleep Medicine, 2014, p. 19).

In general lines, it is considered that one suffers from insomnia if sleep difficulties are present at least three nights per week, for at least a three-month period (American Psychiatric Association, 2013; American Academy of Sleep Medicine, 2014), but the subjective complaint is key to this diagnosis (American Academy of Sleep Medicine, 2014).

Insomnia has an impact on daytime functioning, with symptoms such as “fatigue, mood disturbances, cognitive deficits and physical illness” (Ong, Arnedt, & Gehrman, 2017, p. 787), thus affecting one’s quality of life and economic stability, by influencing one’s productivity at work (Gallup Organization, 1995; Rosekind, & Gregory, 2010). Although it has such negative effects in life, insomnia is still under reported, not being diagnosed as often as it should and, therefore, remains undertreated (Leger, & Poursain, 2005).

There are several objective (polysomnography and actigraphy) and subjective (sleep diaries and questionnaires) methods that allow us to evaluate insomnia, in addition to the most important, the clinical interview, which is key to a good evaluation and diagnosis of chronic insomnia (Riemann, Baglioni, Bassetti, Bjorvatn, Groselj, et al., 2017; Schutte-Rodin, Broch, Buysse, Dorsey, & Sateia, 2008). It should address medical, psychological and sleep history, as well as a complete evaluation of insomnia complaints, pre-sleep existing conditions, sleep schedules and daytime functioning and activities (Riemann et al., 2017; Schutte-Rodin et al., 2008).

The polysomnography (PSG) is not vital to evaluate chronic insomnia (Ong et al., 2017; Schutte-Rodin, et al., 2008), since it is done in a laboratory, the individual is in an unusual situation, which may affect its sleep (Campanini, Lopez-Garcia, Artalejo, González, Andrade, & Mesas, 2017), and one or two nights of assessment might not be enough (Ong et al., 2017). Besides, the information provided by polysomnography is not vital to the understanding of chronic insomnia, except in the case of paradoxical insomnia or suspicion of other sleep disorder (Riemann et al., 2017).

The actigraphy is done resorting to a small wrist-worn device that records movement (Vallières & Morin, 2003). It has been proven valid in several studies comparing actigraphy with PSG (Lichstein, Stone, Donaldson, Nau, Soeffing, Murray, Lester, & Aguillard, 2006; Vallières & Morin, 2003), albeit, when compared to PSG, it tends to underestimate total sleep time and to overestimate total wake time (Vallières & Morin, 2003). It is, nevertheless, recommended by the AASM in the evaluation of insomnia (Smith, McCrae, Cheung, Martin, Harrod, Heald, & Carden, 2018) and some authors suggest it should be used as a complement to the sleep diary (Vallières & Morin, 2003).

The sleep diary is of extreme importance in the evaluation of insomnia, since it is an "assessment and intervention tool that provides a daily recording of sleep from the patient's perspective" (Edinger, Leggett, Carney, & Manber, 2017, p. 814). It is recommended to be used before and during intervention and in case of relapse or follow-up, by AASM (Ong et al., 2017; Schutte-Rodin, et al., 2008). It has several advantages, such as practical utility (it is not intrusive nor expensive and it is very simple to use), clinical relevance (as they can be used in all sleep disorders and can provide information over a long period), validity and reliability (as compared to other means of assessing sleep disorders, such as PSG) and treatment relevance (as it is of extreme utility to and during therapy) (Campanini et al., 2017; Morin & Espie, 2003). But of course, sleep diaries have some disadvantages as well: patients may not adhere, may not complete the sleep diary correctly, and may become anxious about the monitorization (Ong et al., 2017). Nevertheless, it is essential to evaluate the patients' perceptions of a condition characterized by a subjective complaint.

Sleep diaries have been validated using objective methods (Campanini et al., 2017; Lichstein et al., 2006; McCrae, Rowe, Tierney, Dautovich, DeFinis, & McNamara, 2005; Sateia, Doghramji, Hauri, & Morin, 2000; Vallières & Morin, 2003; Means, Edinger, Glenn, & Fins, 2003). In some studies, the sleep diary was poorly correlated with actigraphy (Landry, Best, & Liu-Ambrose, 2015; McCrae et al., 2005), and others showed a moderate to good correlation (Kölling, Endler, Ferrauti, Meyer, & Kellmann, 2015). The agreement with PSG seems to be lower (Vallières & Morin, 2003). The low agreement between these methods may be due to the fact that they do not measure the exact same thing (Campanini et al., 2017), since this lack of agreement also seems to happen among good sleepers (Means et al., 2003).

Usually, sleep diaries, in patients with insomnia, tend to overestimate total awake time and to underestimate total sleep time. Overestimating the sleep latency and time spent awake after sleep onset, as well as underestimating total sleep time, seems to be a characteristic of insomnia sufferers (Fichten, Creti, Amsel, Bailes, & Libman, 2005; Means et al., 2003). There are several hypotheses in literature that seek to explain this misperception. Some hypothesize that it might be due to beliefs one might have about their sleep (Means et al., 2003), others propose that waiting for something to happen may result in a misperception of time (Tremblay, & Bastien, 2006), some mention that it might have something to do with motivational factors (Fichten et al., 2005), and others hypothesize it may be due to measurement techniques (during stage 2 of NREM sleep, the subject can still be aware of environmental stimuli, albeit the PSG records sleeping, giving them the sensation that they were vigil) (Fichten et al., 2005).

In this study, we will use a sleep diary that is an adaptation from 1993 Morin's sleep diary, performed by Clemente (2006), the Portuguese version of the Insomnia Severity Index (ISI; Morin, 1993; Clemente *et al.*, 2007, 2013 – which is also amongst the tools that have been recommended for insomnia assessment, e.g., Riemann at al., 2017), as well as the clinical interview.

Previous studies on insomnia have not focused primarily on the information given by the sleep diaries filled in during the assessment procedure (that is, to obtain the baseline of sleep patterns, prior to insomnia intervention), which is exactly the focus of this study. To the best of our knowledge, despite numerous studies on insomnia that used sleep diaries as part of the research protocol, no studies focused on studying sleep-wake patterns of insomnia sufferers were based specifically on sleep diaries. It seems, therefore, important to bring more knowledge to the field through a detailed analyses of sleep diaries, given the subjective nature of this disorder.

The main goal of this study is to acknowledge, in a comprehensive way, the daily sleep patterns of patients with insomnia before intervention (that is, at the baseline), using the sleep diary. Specifically, we aimed to assess differences between sociodemographic variables, as well as between medicated and non-medicated participants, on the sleep variables, and to understand which sleep diary variables are more related to perceived sleep quality in the morning. It was also aimed to assess the associations between the sleep diary variables and ISI total score, insomnia severity and clinical types.

Methods

Participants

The participants of this study were patients of the Sleep Medicine Centre, at Covões General Hospital of Central University Hospital of Coimbra (CHUC).

The inclusion criteria were the presence of chronic insomnia as described on DSM-5 and ICSD-3, and as assessed by clinical interview. The exclusion criteria were (1) the presence of another untreated sleep disorder, (2) being currently on psychotherapy, (3) the presence of life events that might influence the sleep results (such as pregnancy), and (4) having correctly completed at least 3 week nights and 1 weekend night of the sleep diary. Although they were required to complete the sleep diary for a period of one or two weeks, many patients filled some nights incorrectly or forgot to fill in some nights. Therefore, in order to have a more correct notion of their sleep patterns, we decided to select only patients that had correctly completed at least 4 nights, one of them being a weekend night.

The sample was composed of 102 participants (56.9% women), medicated (44.1%) and non-medicated. From the medicated ones, 32.6% took benzodiazepines, 4.7% non-benzodiazepine hypnotics, 20.9% anti-depressives, 27.9% neuroleptics, 2.3% took another type of sleep-aiding pills (e.g., antihistamines), 11.6 % took more than one type of sleeping pills. Medicated (M = 50.84, SD = 13.02) and non-medicated (M = 47.37, SD = 14.91) patients' age did not differ significantly ($p > .05$). 58.6% of women and 25.0% of men were medicated. A chi-square for independence (with Yates continuity correction) indicated a significant association between gender and medication (χ^2 (1, n = 102) = 10.15, p = .001, *phi* = .335).

The average age was of 48.90 years old (SD = 14.14), ranging from 18 to 85. Men were significantly older than women (t (100) = 2.953, p = .004, d = .590). Men's average age was of 53.48 (SD = 13.90), ranging from 23 to 74, and women's average age was of 45.43 (SD = 13.42), ranging from 18 to 85.

Median of education level of the sample corresponded to high school. Specifically, 21.8% had an elementary school education level, 14.9% had a middle school education level, 25.7% had a high school education level and 37.6% had a higher education level.

The participants of this study were in its majority married or cohabiting (71.6%). 19.6% were single, 6.9% divorced/separated and 2% widowers.

Concerning the professional status, 55.4% of participants were employed, 14.9% were unemployed, 20.8% were retired, 5.9% were students and 3% were on sick leave.

The average duration of insomnia was of 12.98 years (SD = 11.13), ranging from 1 to 52 years.

Considering the insomnia complaints described by the patients during the clinical interview, 9 participants (8.8%) reported difficulties on falling asleep, 18 (17.6%) reported difficulties on maintaining sleep, 38 (37.3%) reported both those difficulties, 5 (4.9%) reported early morning awakenings, 1 (1%) reported non-restorative sleep, and 31 (30.4%) reported mixed insomnia (a combination of either of the previous complaints).

Measures

Sleep diary

The patients completed a sleep diary (Morin, 1993; adapt. Pt: Clemente, 2006) every morning for at least a week, and until the next appointment. For this purpose, sleep diaries that had a minimum of 4 days/nights, fully and correctly filled, were considered, and for those cases when patients completed it for more than a week, we considered the first week completed. The sleep diary gives us information on the perceived quality of sleep and to what extent the participant felt rested in the morning, and monitors bedtime, lights out, sleep onset latency (SOL), number of awakenings after sleep onset, wake time after sleep onset (WASO), wake-up time and get up time.

Insomnia Severity Index (ISI)

ISI (Morin, 1993, adapt. Pt: Clemente, 2007, 2013) is a scale that evaluates subjective symptoms of insomnia and its consequences. It is composed of seven items that measure the severity of sleep difficulties, the satisfaction with one's sleep, the interference in one's daytime functioning, the impairments presumably caused by sleep problems, as well as the degree of concern and distress caused by those sleep difficulties. The items are rated according to a Likert scale that ranges from 0 to 4. The scores range from 0 to 28, and a higher score discloses a more severe problem (Bastien et al., 2001; Clemente, et al., 2017). In this study, the Portuguese version of ISI was used.

Cronbach's alpha was calculated to evaluate the reliability of ISI. The Cronbach's alpha value of the scale was of .69. This value may be due to the fact that ISI is a short and non-redundant scale.

Procedure

This project was integrated on a larger PhD project, conducted by Dr. Vanda Clemente, under the supervision of the current dissertation supervisor. Consent of CHUC's ethical commission was obtained.

The participants were evaluated on the first psychology appointment at the Sleep Medicine Centre, by a cognitive-behavioral therapy (CBT) psychologist and somnologist certificated by the European Sleep Research Society. For each patient, previous history and sleep complaints were explored. At the end of the appointment, the patients completed ISI and were asked to complete a sleep diary for a week period. The selected participants for the present study were the last 100 (dated from 2014 to 2019) of the collected total, fulfilling diagnostic criteria for insomnia according to ICSD-3 and insomnia disorder according to DSM-5.

Analytical approach

All sleep diary data were inserted onto Microsoft Excel. An Excel spreadsheet was used for each participant. The total, weekdays and weekend days means were calculated for each variable directly reported at the sleep diary. Using the details in the diaries, the researchers computed:

- "time in bed" (TIB): time span between bedtime and definitive rise time, excluding periods of out of bed and including pre-sleep activities performed in bed – e.g., reading, watching tv, surfing on the internet;
- "total sleep time" (TST): time span between sleep onset and sleep offset, removing total awaked time between the two points if applicable;
- sleep efficiency: this variable was calculated, *not* by dividing TST by TIB, but *instead* by dividing TST by the time occurred after the first attempt at sleeping, as suggested by Reed and Sacco (2016).

The data treated in Excel was then inserted onto IBM SPSS (Statistical Package for Social Sciences), version 22.0, as well as data collected from ISI.

Descriptive statistics analyses were performed in order to characterize the sample in terms of sociodemographic variables, like age, sex, marital status, in terms of sleep medication usage (medicated or non-medicated), and the type of medication used (e.g., benzodiazepine hypnotics, antidepressants, neuroleptics).

Kurtosis and skewness values were assessed to evaluate if the variables were normally distributed. Variables that had, simultaneously, kurtosis values < 8 and skewness values < 3, were considered normally distributed (Kline, 2005).

The means (median when normality assumptions were not respected), standard deviations, minimums and maximums of each sleep diary variable were calculated for total, weekdays and weekend days separately.

Sleep quality and rest degree were treated as numerical variables, albeit their Likert-type response format, since they are constituted by 5 levels (Jamieson, 2004).

Several bifactorial 2x2 mixed ANOVAs were performed, in order to assess the effects of sex (between-subjects factor) and of moment of the week (weekday/weekend, within-subjects factor), as well as interactive effects of these two variables, over sleep patterns. A Wilcoxon Signed Rank Test and a Mann-Whitney U test were used as non-parametric equivalents.

Person's correlation test was performed between age and sleep diary variables (Spearman's rho as a non-parametric alternative). Since the sex had, presumably, an effect on sleep variables (given that there were differences between sexes), a split file was done in order to evaluate a correlation between women and men's age and the sleep variables.

The age was correlated with sleep variables, but it was not possible to add it as a covariable, nor conduct ANCOVAs, because there were a significant differences ($p < .05$) between the age of groups on several variables (sex, educational level, marital status, professional status, and insomnia severity).

A series of two-way ANOVAs (with sex as a factor to detect interaction effects) were performed in order to evaluate differences between school degrees, professional status, marital status, and insomnia severity, on sleep variables. To evaluate differences between medicated and non-medicated participants, several ANCOVAs were performed, with age as a covariable. Posthoc comparisons were performed when there were 3 or more categories within an independent variable, to evaluate which categories differed from the others. For that, the homogeneity of variance was assessed. If that assumption was not violated, the chosen posthoc test was Tukey HSD (Pallant, 2010), in case it was, the chosen test was Games-Howell (Field, 2013).

The non-parametric equivalents used were Mann Whitney U test or Kruskal-Wallis test (if more than 3 categories on the independent variable). When non-parametric tests were performed, since the sex could not be added as a factor on those, analyses were repeated with a split file, in order to assess the influence of sex, being the results compared (Pallant, 2010). When Kruskal-Wallis was used, follow up Mann-Whitney U tests were performed in order to compare differences between groups (Pallant, 2010). For that, the Bonferroni adjustment was applied to the alpha values and the groups were compared two by two. Only a few comparisons were selected in order to maintain the alpha value at a reasonable value (Pallant, 2010). Afterwards, these procedures were repeated with a split file by sex.

A correlation was also performed to evaluate the relationship between insomnia duration, insomnia severity and the sleep diary variables. Finally, it was evaluated if there were differences between different insomnia types (classified based on the participants' complaints during the clinical interview) on the sleep diary variables.

The last set of analyses were performed to assess which sleep variables were related to perceived good quality sleep. First, Pearson's correlation coefficients (or Spearman's rho as non-parametric alternative) were computed between the sleep quality perceived by the participants in the morning and the other sleep variables. Then, multiple regression analyses were also performed to assess which sleep diary variables better predicted the perceived sleep quality and how much variance would be explained by sleep variables. The multicollinearity, normality and presence of outliers were also examined.

Correlations were evaluated according to their statistical significance and coefficients magnitude. It was considered that correlation coefficients between .1 and .29 corresponded to a low association, between .3 and .49 corresponded to a moderate association, and above .5 corresponded to a large association (Pallant, 2010). When *t*-tests were used, the effect size was also assessed with a Cohen's *d* test. Cohen's d standard deviation units between .2 and .49 corresponded to a small size effect, between .5 and .79 to a medium size effect and above .8 to a large effect (Cohen, 1988). When an ANOVA was used, the effect size was assessed with Eta Squared. It was considered that values of .01 corresponded to a small size effect, of .06 corresponded to a medium size effect and of .138 to a large effect (Tabachnick & Fidell, 2007).

Results

Preliminary Analyses

Preliminary analyses were conducted in order to check the normal distribution of the variables. All variables followed a normal distribution, except for “SOL (total)”, “SOL (weekend)” and “Number of naps (weekend)”.

Analyses were also performed to assess other assumptions relevant for the multiple regression analyses (linearity and homoscedasticity).

Sleep diary variables - overall, week and weekends - by sex and medication

On average, participants went to bed at 23h36m, awaked 2.13 times per night, spent 0h40m awake during the night, woke up at 7h23m, got up at 8h18m, and took 0.42 naps. The total sleep time was of 6h14m, and time in bed was of 8h40m, resulting in a mean sleep efficiency of 71.7%. In median, they took 28 minutes to fall asleep. All means are displayed in table 1.

Bifactorial 2x2 mixed ANOVAs were performed, in order to assess the effects of sex (between-subjects factor) and of moment of the week (weekday/weekend, within-subjects factor), as well as interactive effects of these two variables, over sleep patterns.

As to week/weekend comparisons, the differences were only statistically significant for wake-up, get up time and TIB. No significant interaction effects were found between sex and moment of the week on any of the sleep variables ($p > .05$).

On weekends, the participants went to bed significantly later than during the week (F (1,100) = 1.024, p = .314, η^2 = .012), woke up significantly later (F (1,100) = 11.680, p = .001, η^2 = .105), and also got up later (F (1,100) = 27.804, p = .000, η^2 = .218). The size effect on “bedtime” was small, on “wake-up time” was medium, and on “get up time” was large.

TABLE 1.
Sleep diary variables on the whole sample, by sex, and medication presence/absence

	Total sample M (SD)	Men M (SD)	Women M (SD)	Medicated M (SD)	Non-medicated M (SD)
Bedtime (total)	23h36 (1h09)	23h36 (1h20)	23h37 (1h00)	23h28 (1h12)	23h42 (1h07)
(week)	23h35 (1h11)	23h33 (1h22)	23h37 (1h01)	23h28 (1h14)	23h41 (1h08)
(weekend)	23h39 (1h16)	23h41 (1h24)	23h38 (1h10)	23h33 (1h21)	23h44 (1h13)
SOL (total)	0h28[a]	0h29[a]	0h26[a]	0h29[a]	0h26[a]
(week)	0h34 (0h32)	0h36 (0h38)	0h32 (0h26)	0h34 (0h29)	0h34 (0h33)
(weekend)	0h24[a]	0h23[a]	0h23[a]	0h28[a]	0h23[a]
Nr. of awakenings (total)	2.13 (1.39)	1.97 (1.16)	2.25 (1.54)	2.15 (1.28)	2.12 (1.48)
(week)	2.16 (1.47)	1.95 (1.20)	2.32 (1.63)	2.19 (1.32)	2.14 (1.58)
(weekend)	2.07 (1.46)	2.00 (1.29)	2.12 (1.58)	2.07 (1.43)	2.07 (1.49)
WASO (total)	0h40 (0h33)	0h47 (0h38)	0h35 (0h29)	0h35 (0h30)	0h43 (0h35)
(week)	0h39 (0h33)	0h45 (0h37)	0h34 (0h29)	0h34 (0h28)	0h43 (0h36)
(weekend)	0h43 (0h49)	0h51 (0h50)	0h37 (0h48)	0h36 (0h44)	0h48 (0h52)
Wake-up time (total)	7h23 (1h34)	6h54 (1h26)	7h45 (1h34)	7h25 (1h28)	7h22 (1h38)
(week)	7h17 (1h33)	6h49 (1h26)	7h38 (1h34)	7h17 (1h30)	7h17 (1h37)
(weekend)	7h39 (1h46)	7h08 (1h43)	8h02 (1h44)	7h43 (1h36)	7h35 (1h55)
Get up time (total)	8h18 (1h10)	7h59 (1h07)	8h32 (1h10)	8h25 (1h05)	8h13 (1h14)
(week)	8h10 (1h13)	7h52 (1h11)	8h24 (1h13)	8h18 (1h07)	8h04 (1h18)
(weekend)	8h38 (1h19)	8h19 (1h22)	8h52 (1h14)	8h41 (1h10)	8h35 (1h26)
Rest degree (total)	2.85 (0.70)	3.12 (0.69)	2.65 (0.64)	2.83 (0.71)	2.87 (0.70)
(week)	2.83 (0.74)	3.10 (0.72)	2.63 (0.70)	2.80 (0.78)	2.85 (0.72)
(weekend)	2.89 (0.82)	3.18 (0.76)	2.67 (0.80)	2.87 (0.80)	2.91 (0.84)
Sleep quality (total)	3.01 (0.64)	3.16 (0.68)	2.89 (0.58)	2.95 (0.58)	3.05 (0.68)
(week)	3.03 (0.67)	3.18 (0.70)	2.91 (0.62)	2.98 (0.62)	3.06 (0.70)
(weekend)	2.98 (0.76)	3.19 (0.80)	2.84 (0.70)	2.89 (0.69)	3.06 (0.81)
Nr. of naps (total)	.42 (0.95)	.25 (0.72)	.55 (1.08)	.51 (0.97)	.35 (0.94)
(week)	.29 (0.70)	.18 (0.54)	.38 (0.79)	.36 (0.74)	.25 (0.66)
(weekend)	.00[a]	.00[a]	.00[a]	.00[a]	.00[a]
TST (total)	6h14 (1h25)	5h46 (1h15)	6h36 (1h26)	6h21 (1h24)	6h09 (1h25)
(week)	6h14 (1h12)	5h50 (1h19)	6h33 (1h23)	6h21 (1h22)	6h09 (1h25)
(weekend)	6h18 (1h49)	5h48 (1h36)	6h41 (1h53)	6h22 (1h49)	6h15 (1h50)
TIB (total)	8h40 (1h11)	8h24 (1h10)	8h52 (1h10)	8h52 (1h22)	8h31 (1h01)
(week)	8h34 (1h13)	8h18 (1h14)	8h46 (1h10)	8h49 (1h23)	8h23 (1h01)
(weekend)	8h57 (1h21)	8h38 (1h18)	9h12 (1h22)	9h07 (1h24)	8h49 (1h19)
SE (total)	71.7% (12.9)	68.5% (11.7)	74.1% (13.4)	71.3% (12.5)	72.0% (13.4)
(week)	72.2% (12.6)	69.3% (11.85)	74.4% (12.9)	71.7% (12.0)	72.6% (13.2)
(weekend)	70.2% (17.4)	66.8% (15.67)	72.9 % (18.2)	69.9% (17.1)	70.5% (17.7)

[a] Median. SE = Sleep Efficiency; SOL = Sleep onset latency. TIB = time in bed; TST = total sleep time; *WASO = Wakenings after sleep onset.*

Although participants slept an equivalent number of hours per night on weekends and weekdays (*F* (1,100) = .168, *p* = .683, η^2 = .002), they spent significantly more time in bed, on weekends (*F* (1,100) = 13.290, *p* = .000, η^2 = .117). The effect size on on "TIB" was medium. Participants also seemed to show lower sleep efficiency, less awakenings per night, feeling more rested in the morning and reported less perceived sleep quality on weekends, albeit these differences were not significant.

Regarding sex, significant differences were discovered on "wake-up time" (*F* (1, 100) = 7.849, *p* = .006, η^2 = .073), "get up time" (*F* (1,100) = 5.375, *p* = .022, η^2 = .051), "rest degree" (*F* (1,100) = 13.675, *p* = .000, η^2 = .120), "sleep quality" (*F* (1,100) = 5.828, *p* = .018, η^2 = .055), "TST" (*F* (1,100) = 7.506, *p* = .007, η^2 = .070), "TIB" (*F* (1,100) = 4.965, *p* = .028, η^2 = .047), and "sleep efficiency" (*F* (1, 100) = 4.250, *p* = .042, η^2 = .041). Overall, women woke up later, got up later, felt less rested, reported a lower sleep quality, slept more, spent more time in bed, and reported a higher sleep efficiency, when compared to men. The effect sizes were small to moderate.

A Wilcoxon Signed Rank test and a Mann-Whitney U test (non-parametric) were also performed. No differences were found. The Wilcoxon Signed Rank test was also repeated doing a split file by sex, in order to assess the effect of this variable on the results. There were no differences on either sex.

Several two-way ANCOVAs (with age as a covariable) were also performed to assess differences between sleep medicated and non-medicated participants on the sleep diary variables. No interaction between sex and medication nor between age and medication were found, nor any significant differences between medicated and non-medicated participants. A Mann-Whitney U test was performed for the non-normally distributed variables, but again no significant differences were discovered.

A Kruskal-Wallis test was also conducted (because the *n* of "non-benzodiazepine hypnotics" and "another type of sleeping-aid pills" was very small) to evaluate differences between different types of medication. It showed no differences between medication types ($p > .05$). The analysis was repeated with a split file by sex. A difference on weekdays sleep efficiency (*p* = .028) was found in women.

As posthoc, a follow-up Mann-Whitney U test was performed. Since only a comparison was done, the alpha value considered was of .05. Participants taking benzodiazepines differed from participants taking neuroleptics on weekdays sleep efficiency (p = .033). Participants who took neuroleptics had a higher sleep efficiency than those who took benzodiazepine hypnotics.

Age and sleep diary variables

Correlation coefficients between the sleep diary variables and men and women's age were computed (Table 2).

On total, weak correlations were found between age and total and weekdays bedtime, total and weekend days WASO, total, weekdays and weekend days wake-up time, total, weekdays and weekend days get up time, total and weekdays rest degree, total and weekend days TST, and total, weekdays, and weekend days sleep efficiency. No relationship was found when performing the Spearman's rho correlation.

As to men's age, the correlations were weak, being statistically significant when concerning total and weekdays number of awakenings, total and weekdays WASO, weekend wake-up time and get up time, rest degree on weekdays and TST on weekend.

Spearman's correlations were also determined for the variables that did not showed a normal distribution, but no significant correlation was found. Specifically, increasing age in men was associated with more nocturnal awakenings, more total and weekdays WASO, sooner wake and get up times, higher restfulness upon wake-up, and lower TST weekends.

As to women's age, only one parameter was significantly correlated to sleep diary variables, namely wake-up time on weekends, showing that increased age was associated with earlier wake-up times on weekends. Albeit its statistical significance, the correlation was weak. A Spearman's correlation was also performed for the variables that did not respect the normal distribution, but no correlations were found.

TABLE 2.
Correlations between age and each sleep diary variables (on each sex and total sample)

	r (total)	*p*	*r (men age)*	*p*	*r (women age)*	*p*
Bedtime (total)	-.211	.033*	-.217	.157	-.206	.120
(week)	-.228	.021*	-.207	.177	-.239	.071
(weekend)	-.177	.074	-.234	.126	-.141	.290
SOL (week)	-.034	.734	.009	.952	-.125	.349
Nr. of awakenings (total)	.081	.420	.328	.030*	-.009	.944
(week)	.056	.577	.355	.018*	-.051	.704
(weekend)	.102	.309	.213	.165	.059	.659
WASO (total)	.265	.007*	.408	.006**	.047	.727
(week)	.192	.053	.335	.018*	-.020	.880
(weekend)	.294	.003**	.447	.002**	.120	.370
Wake-up time (total)	-.312	.001**	-.265	.083	-.265	.083
(week)	-.278	.005**	-.208	.176	-.231	.082
(weekend)	-.345	.000**	-.339	.024*	-.260	.049*
Get up time (total)	-.284	.004**	-.188	.223	-.188	.223
(week)	-.214	.030*	-.067	.663	-.227	.086
(weekend)	-.356	.000**	-.368	.014*	-.258	.051
Rest degree (total)	.289	.003**	.211	.170	.229	.083
(week)	.328	.001**	.302	.046*	.243	.066
(weekend)	.149	.132	-.034	.827	.141	.290
Sleep quality (total)	.117	.242	-.002	.989	.199	.373
(week)	.123	.218	.009	.956	.128	.340
(weekend)	.118	.238	.011	.941	.098	.466
*Number of naps (*total)	-.146	.143	-.028	.854	-.151	.257
(week)	-.119	.232	.087	.573	-.178	.182
TST (total)	-.217	.028*	-.205	.183	-.068	.613
(week)	-.184	.063	-.169	.274	-.036	.786
(weekend)	-.253	.010*	-.321	.033*	-.085	.524
TIB (total)	-.037	.708	.084	.587	-.032	.810
(week)	.005	.959	.174	.259	-.033	.805
(weekend)	-.152	.125	-.149	.334	-.056	.676
SE (total)	-.217	.028*	-.287	.059	-.044	.724
(week)	-.197	.046*	-.246	.107	-.034	.800
SE (weekend)	-.211	.033*	-.271	.076	-.065	.628

$^{*}p < .05$; $^{**}p < .01$

Educational level and sleep diary variables

Several two-way ANOVAs were performed to evaluate differences between different education levels on the sleep variables. Four education levels were considered: elementary school education level (group 1), middle school education level (group 2), high school education level (group 3) and higher education level (group 4).

The "Sex" variable was also added to assess its interaction with the education level and a significant interaction effect was found on sleep efficiency on weekdays (F (3,92) = 2.968, p = .036, η^2 = .088). In order to assess the differences between sex on that variable, an ANOVA was rerun. The results showed that there was only a significant difference between educational levels on that variable in women. Significant differences were found between group 1 and 4 (4>1; p = .006).

Significant differences between education levels (see table 3) emerged on total, weekdays and weekend days bedtime, total, weekdays and weekend days wake-up time, weekend days get up time, on total and weekend days total sleep time, and on total and weekend days sleep efficiency. All effect sizes were medium, except on wake-up time (weekends) which was large.

In order to assess which groups of "education level" differed from another, posthoc tests were used. Since the homogeneity of variance was not violated, the Tukey HSD test was chosen (Pallant, 2010). On bedtime (total) there was a significant difference between groups 1 and 4 (4>1; p= .010). On bedtime (week), a significant difference was discovered between those with elementary school and those with a higher degree (elementary school level participants go to bed earlier). On bedtime (weekend) a significant difference was found between groups 1 and 4 (4>1; p = .008).

On wake-up time (total), significant differences were observed between groups 1 and 3 (p = .026), and between groups 1 and 4 (p = .003). Thus, participants with an elementary school education level wake-up earlier than those with a high school or higher education level. On wake-up time (week), a significant difference emerged between groups 1 and 4 (4>1; p = .012). On wake-up time (weekend) significant differences were found between groups 1 and 3 (3>1, p = .025), and groups 1 and 4 (4>1; p = .002).

On get up time (weekends) significant differences were discovered between groups 1 and 3 (3>1; p = .031) and groups 1 and 4 (4>1; p = .005).

On the total sleep efficiency, significant differences between groups 1 and 4 (p = .002), and between groups 2 and 4 (p = .047) were found. These differences mean that participants with a higher education level reported a higher sleep efficiency, when compared with those with elementary and middle school education level. On sleep efficiency (weekends significant differences between groups 1 and 4 (4>1; p = .009) and groups 2 and 4 (4>2; p = .039) were found.

TABLE 3.
Analyses of variance to assess differences between education levels on sleep diary variables, with sex added as a factor

		Elementary school level [1] M (SD)	Middle school level [2] M (SD)	High school level [3] M (SD)	Higher level [4] M (SD)	$F_{3,92}$	η^2
Bedtime (total)	Both	22h56m (0h42m)	23h33m (1h19m)	23h40m (1h13m)	23h56m (1h09m)	3.472**	.102
Bedtime (week)	Both	22h54m (0h42m)	23h32m (1h19m)	23h42m (1h18m)	23h54m (1h09m)	3.378*	.099
Bedtime (weekend)	Both	22h58m (0h51m)	23h35m (1h28m)	23h37m (1h09m)	24h04m (1h21m)	3.610**	.105
Wake-up time (total)	Both	6h29m (1h37m)	6h44m (1h19m)	7h41m (1h33m)	7h52m (1h23m)	5.016**	.141
Wake-up time (week)	Both	6h29m (1h28m)	6h37m (1h18m)	7h35m (1h28m)	7h43m (1h34m)	4.349**	.124
Wake-up time (weekends)	Both	6h33m (1h55m)	7h00 (1h33m)	7h56m (1h58m)	8h14m (1h19m)	4.914**	.138
Get up time (weekends)	Both	7h52m (1h09m)	8h09m (1h38m)	8h53m (1h09m)	9h02m (1h13m)	4.856**	.137
TST (total)	Both	5h43m (1h35m)	5h38m (1h02m)	6h24m (1h37m)	6h38m (1h10m)	2.905*	.087
TST (weekends)	Both	5h37m (1h58m)	5h29m (1h16m)	6h34m (2h07m)	6h51m (1h27m)	3.135*	.093
Sleep efficiency (total)	Both	64.8% (15.3%)	67.2% (13.2%)	72.5% (12.7%)	76.8% (9.5%)	5.290**	.133
Sleep efficiency (week)	Men	64.6% (11.6%)	70.9% (11.0%)	64.0% (9.7%)	75.1% (12.2%)	4.581**	.130
	Women	66.9% (17.6%)	57.8% (24.6%)	77.5% (10.0%)	77.1% (9.1%)		
	Both	65.7% (14.4%)	68.3% (14.5%)	73.4% (11.6%)	76.4% (10.1%)		
Sleep efficiency (weekends)	Both	63.0% (20.0%)	63.9% (16.2%)	70.4% (19.0%)	77.3% (11.8%)	4.362**	.125

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

For the non-normally distributed variables, a Kruskal-Wallis test was conducted. It showed that there were differences between school degrees on the SOL on weekends ($p = .021$). As posthoc, a U-Mann Whitney test was performed in order to assess which groups differed from each other. The only groups tested were 1 and 4. A significant difference was discovered between them (1>4; $p = .035$).

The Kruskal-Wallis test was repeated with a split file by sex. Differences were found between different education levels on total SOL (Gp 1, Md = 0h38m; Gp 2, Md = 0h32m; Gp 3, Md = 0h31m; Gp 4, Md = 0h19m) in women ($p < .05$) and on weekend days SOL (Gp 1, Md = 0h23m; Gp 2, Md = 0h30m; Gp 3, Md = 0h26m; Gp 4, Md = 0h17m) in men ($p < .05$).

Maintaining the split file, a follow up Mann-Whitney U test was performed to assess the differences between the groups (Pallant, 2010). The Bonferroni adjustment was applied to the alpha values and the groups were compared two by two. Only a few comparisons were selected to maintain the alpha value at a reasonable value (Pallant, 2010). Since it was intended to make two comparisons (between groups 1 and 4, and 2 and 4), when assessing differences on "SOL (total)", the alpha value (.05) was divided by 2. That way, the considered alpha value was of .025. At this alpha level, a significant difference was found between group 1 and group 4 ($p = .003$). The results show that women with an elementary education level took more time to fall asleep than did those with a higher level, on total.

Finally, the differences on "SOL (weekend)" were assessed. Two comparisons (between group 2 and 4 and 3 and 4) were calculated and significant differences between groups 2 and 4 ($p = .000$), and groups 3 and 4 ($p = .022$) were found. Men with a higher education seemed to take less time to fall asleep than did those with a middle school and high school education, on weekends.

Occupational status and sleep diary variables

Several two-way ANOVAs were done to evaluate differences between professional status on the sleep diary variables. The interaction between sex and professional status was assessed, and none was found to be statistically significant. The analyses only considered employed, unemployed and retired, since the *n* of "studying" and "on sick leave" were very small.

WASO (total) violated the homogeneity of variances assumption and so did WASO (week). Because of that, the alpha value considered for analyses concerning that variable was stringed to .01 (Pallant, 2010). No differences emerged on those variables.

Significant differences are displayed in table 4. The size effects were medium to large.

After assessing the homogeneity of variances (with Levene's test), and seeing that that assumption was not violated, a Tukey HSD test (Pallant, 2010) was performed. The results showed that employed participants reported less awakenings during the night on total (p = .008), weekdays (p = .016) and weekend days (p = .008), when compared to retired participants. Differences were found on "get up time (total)" between employed and unemployed participants (p = .011). Employed participants got up earlier. Differences were also discovered between employed and unemployed participants on "get up time (week)", being the employed the ones that got up earlier, as well (p = .009). On get up time (weekends) differences between employed and unemployed (p = 039) were found, being the employed ones, once again, that got up earlier.

TABLE 4.
Analyses of variance to assess differences between professional status on sleep diary variables, with sex as a factor

	Employed [1] M (SD)	Unemployed [2] M (SD)	Retired [3] M (SD)	$F_{4,95}$	p	η^2
Nr. of awakenings (total)	1.83 (1.21)	1.98 (1.24)	2.80 (1.35)	4.813	.010*	.101
Nr. of awakenings (week)	1.88 (1.25)	2.01 (1.41)	2.80 (1.41)	4.206	.018*	.089
Nr. of awakenings (weekend)	1.74 (1.27)	1.83 (1.24)	2.76 (1.40)	4.732	.011*	.099
Get up time (total)	7h58m (0h57m)	8h53m (1h25m)	8h12m (1h10m)	4.441	.015*	.094
Get up time (week)	7h48m (0h55m)	8h47m (1h37m)	8h09m (1h12m)	5.162	.008**	.107
Get up time (weekend)	8h22m (1h15m)	9h18m (1h23m)	8h22m (1h12m)	3.099	.050*	.067

$^*p < .05$; $^{**}p < .01$

In the Kruskal-Wallis tests ran to evaluate differences between professional status and the other sleep diary variables, no significant differences emerged, with nor without split file by sex.

Marital status and sleep diary variables

Several two-way ANOVAs were performed to assess differences between marital status on the sleep variables. Once again, “Sex” was added as a factor. The statistical relevant results concerning the differences between marital status on the sleep diary variables are shown in the table below (table 5). The analysis was only performed considering two groups (single and married/cohabiting), since the other groups had a very small *n*.

There were significant interactions on total bedtime (F (1,89) = 10.640, p = .002, η^2 = .108), weekdays bedtime (F (1,89) = 10.941, p = .001, η^2 = .109), and weekend days bedtime (F (1,89) = 10.640, p = .002, η^2 = .107), on total WASO (F (1,89) = 5.217, p = .025, η^2 = .055), weekdays WASO (F (1,89) = 4.180, p = .044, η^2 = .045), on total wake-up time (F (1,89) = 7.133, p = .009, η^2 = .074), weekdays wake-up time (F (1,89) = 6.142, p = .015, η^2 = .065), and weekend days wake-up time (F (1,89) = 6.687, p = .011, η^2 = .070), on total get up time (F (1,89) = 5.064, p = .027, η^2 = .054), and weekend days get up time (F (1,89) = 6.583, p = .012, η^2 = .069), on total sleep efficiency (F (1,89) = 4.668, p = .033, η^2 = .50), and on weekdays sleep efficiency (F (1,89) = 4.002, p = .048, η^2 = .043) between “Sex” and “Marital status”.

On “SOL (week)”, since the homogeneity of variance assumption was violated, a more stringed alpha value was set to .01 (Pallant, 2010). “Number of naps (week)” also violated that assumption, so the alpha value was also stringed. “Number of awakenings (weekend)” also violated the homogeneity of variances, and so did “TIB (weekend)”. No significant differences were discovered on these variables.

In both sexes, single participants got up later on weeknights (size effect from medium to large), and slept more on weekends (small size effect), than married/cohabiting ones.

Because of the interaction between sex and marital status, a split file by sex was done and a one-way ANOVA was conducted (Pallant, 2010).

Single and married/cohabiting women only differed on weekend days wake-up time (F (1,40) = 6.613, p = .013, η^2 = .119) and weekend days get up time (F (1,40) = 5.762, p = .020, η^2 = .105). Size effects were medium.

TABLE 5.
Comparing single and married/cohabiting participants on sleep diary variables using ANOVAs

		Single M (SD)	Married/Cohab. M (SD)	$F_{1,89}$	*p*	η^2
Bedtime (total)	Men	01h24 (1h06)	23h18 (1h11)			
	Women	23h39 (0h57)	23h39 (0h57)	12.404	.001**	.122
	Both	00h07 (1h16)	23h28 (1h05)			
(week)	Men	01h22 (1h02)	23h15 (1h13)			
	Women	23h44 (1h03)	23h40 (0h59)	12.306	.001**	.121
	Both	00h09 (1h15)	23h27 (1h07)			
(weekend)	Men	01h29 (1h21)	23h23 (1h14)			
	Women	23h32 (1h11)	23h40 (1h09)	8.311	.005**	.085
	Both	00h02 (1h28)	23h32 (1h12)			
WASO (total)	Men	0h12 (0h36)	0h53 (0h38)			
	Women	0h37 (0h23)	0h35 (0h32)	4.681	.033*	.050
	Both	0h30 (0h23)	0h44 (0h36)			
(week)	Men	0h13 (0h16)	0h51 (0h37)			
	Women	0h35 (0h31)	0h34 (0h31)	4.103	.048*	.043
	Both	0h29 (0h29)	0h43 (0h35)			
Wake-up time (total)	Men	9h08 (1h01)	6h29 (1h04)			
	Women	8h27 (1h31)	7h40 (1h18)	23.884	.000**	.212
	Both	8h37 (1h25)	7h04 (1h19)			
(week)	Men	8h52 (1h03)	6h25 (1h01)			
	Women	8h13 (1h39)	7h33 (1h22)	18.440	.000**	.172
	Both	8h23 (1h31)	6h59 (1h19)			
(weekend)	Men	9h49 (1h31)	6h40 (1h22)			
	Women	9h00 (1h26)	7h53 (1h23)	29.006	.000**	.246
	Both	9h12 (1h28)	7h16 (1h30)			
Get up time (total)	Men	9h14 (1h06)	7h35 (0h51)			
	Women	8h48 (1h21)	8h19 (1h09)	18.255	.000**	.170
	Both	9h09 (1h16)	8h03 (1h00)			
(week)	Both	8h54 (1h16)	7h57 (1h04)	12.108	.001**	.120
(weekend)	Men	10h24 (1h43)	7h57 (0h59)			
	Women	9h34 (1h25)	8h44 (1h00)	27.279	.000**	.235
	Both	9h46 (1h30)	8h20 (1h04)			
TST (weekend)	Both	7h07 (1h51)	6h09 (1h40)	4.034	.048*	.043
Sleep efficiency (total)	Men	80.4% (9.3)	66.6% (11.3)			
	Women	75.4% (12.4)	75.3 % (12.4)	4.837	.030*	.052
	Both	76.6% (11.6)	70.9% (11.8)			
(week)	Men	81.0% (10.8)	67.7% (11.5)			
	Women	75.8% (12.2)	75.2% (10.6)	4.802	.031*	.051
	Both	77.1% (11.8)	71.4% (11.6)			

* $p < .05$; ** $p < .01$

In men, significant differences were discovered between marital status and total (*F* (1,40) = 14.170, *p* = .001, η^2 = .262), weekdays (*F* (1,40) = 13.726, *p* = .001, η^2 = .255), and weekend days (*F* (1,40) = 12.422, *p* = .001, η^2 =.237) bedtime, total (*F* (1,40) = 5.794, *p* = .021, η^2 = .127), and weekdays (*F* (1,40) = 5.067, *p* = .030, η^2 = .112) WASO, total (*F* (1,40) = 27.617, *p* = .000, η^2 = .408), weekdays (*F* (1,40) = 25.267, *p* = .000, η^2 = .387), and weekend days (*F* (1,40) = 22.736, *p* = .000, η^2 = .362) wake-up time, total (*F* (1,40) = 21.437, *p* = .000, η^2 = .349), and weekend days (*F* (1,40) = 22.661, *p* = .000, η^2 = .362) get up time, and total (*F* (1,40) = 6.833, *p* = .013, η^2 = .146), and weekdays (*F* (1,40) = 6.032, *p* = .018, η^2 = .131) sleep efficiency. Size effects were medium to large.

A Mann Whitney U test was performed for the other variables. No differences were found. This analysis was repeated using a split file, in order to assess sex effects that also showed no differences on either sex.

An independent samples *t*-test was conducted, to assess age differences between single and married/cohabiting participants. Significant differences were found (*t* (91) = -6.407, *p* = .000). Single participants' mean age was of 33.40 (SD = 11.26) and married/cohabiting participants' mean age was of 53.05 (SD = 12.38).

A split file was done to assess age differences on each sex. Single men (M = 29.80, SD = 7.86) were significantly younger than married/cohabiting men (M = 56.89, SD = 11.33; *t* (40) = 5.155, *p* = .000), and single women (M = 34.60, SD = 12.17) were also significantly younger than married/cohabiting women (M = 49.11, SD = 12.32; *t* (49) = -3.846, *p* = .000), though that difference is not as pronounced in women.

Sleep diary variables by insomnia severity, duration and type

Insomnia severity

Several two-way ANOVAs were conducted to assess differences between the severity of insomnia groups (measured by ISI) on the sleep variables. Statistically significant differences are displayed in table 6. The "absence" group was not considered, because the *n* was equal to 2, being, therefore, too small.

The "sex" variable was added as a factor and interaction effects were discovered on total (*F* (2,92) = 4.870, *p* = .010, η^2 = .096) and weekend days' (*F* (2,92) = 8.276, *p* = .000, η^2 = .152) sleep efficiency and on TST on weekends (*F* (2,92) = 5.333, *p* = .006, η^2 = .104).

The posthoc test showed that there was a significant difference between participants with sub-threshold and severe insomnia on total (p = .006) and weekdays (p = .003) rest degree, on total (p = .004) and weekdays (p = .002) sleep quality, and on total (p = .001) and weekdays' (p = .001) sleep efficiency, being a more severe insomnia associated with a lower sleep efficiency both on total and weekdays, when compared with the "subthreshold insomnia" group.

TABLE 6.

Analyses of variance to assess differences between different insomnia severities on sleep diary variables, with sex as a factor

		Sub-threshold insomnia [1] M (SD)	Moderate insomnia [2] M (SD)	Severe insomnia [3] M (SD)	$F_{2,92}$	p	η^2
Rest degree (total)	Both	3.14 (.66)	2.84 (.68)	2.54 (.68)	4.225	.018*	.084
(week)	Both	3.14 (.66)	2.83 (.74)	2.45 (.68)	4.585	.013*	.091
Sleep quality (total)	Both	3.30 (.61)	2.99 (.59)	2.70 (.68)	4.101	.020*	.082
(week)	Both	3.34 (.65)	3.00 (.63)	2.67 (.61)	4.743	.011*	.093
TST (weekend)	Men	6h05 (1h15)	5h34 (1h16)	5h56 (1h32)			
	Women	7h00 (1h09)	6h44 (1h14)	5h49 (1h40)	.653[a]	.523	.014
	Both	6h35 (1h16)	6h10 (1h23)	5h51 (1h35)			
Sleep efficiency (total)	Men	70.2% (9.7)	66.1% (12.4)	70.3% (10.4)			
	Women	82.8% (7.3)	76.6% (9.6)	61.8% (15.8)	4.303[a]	.016*	.086
	Both	77.2% (10.5)	71.5% (12.2)	63.9% (14.9)			
(week)	Both	77.9% (9.5)	71.7% (12.2)	64.9% (14.4)	5.179	.007**	.101
(weekend)	Men	72.3% (8.2)	67.0% (1.7)	67.5% (12.4)			
	Women	82.4% (8.1)	76.2% (10.0)	64.0% (15.3)	1.174[a]	.314	.025
	Both	77.9% (9.5)	71.7% (12.2)	64.9% (14.4)			

*p < .05; **p < .01

A split file by sex was done and several one-way ANOVAs were run. This set of analyses showed that differences between different insomnia severities on total and weekend days SE and weekend days TST were only significant in women (p < .05).

The posthoc tests showed that, in women, statistically significant differences were found on total and weekdays sleep quality, on total, weekdays and weekend days sleep efficiency and on TST (weekend), being all the differences between subthreshold and severe insomnia, and moderate and severe insomnia. Overall, women with subthreshold insomnia reported higher sleep quality on total and weekdays and higher sleep efficiency than those with severe insomnia ($p < .05$), and those with moderate insomnia reported higher sleep efficiency than those with severe insomnia on total, weekdays and weekend days ($p < .05$, 1>2>3). Regarding TST on weekends, differences emerged in women between the subthreshold and severe groups, as well as between moderate and severe groups ($p < .05$, 1>2>3).

No significant differences were found with the non-normally distributed variables ($p > .05$). The Kruskal-Wallis test was repeated with a split file and no differences were discovered.

Insomnia duration

Correlation coefficients were determined to evaluate the relationship between different insomnia durations and the sleep diary variables. The analyses were repeated with a split file, in order to control the effect of sex. No significant associations were found. Spearman correlations were also determined with and without split file, and no significant associations were discovered.

Sleep diary patterns by insomnia clinical types

Several two-way ANOVAs were conducted to evaluate differences between different insomnia types (as determined during the clinical interview) on sleep diary variables. “Sex” was added as a factor, in order to assess interaction effects. The “non-restorative sleep” group was excluded from analyses, because its *n* was 1. The insomnia types considered were “initial insomnia” (1), “middle insomnia” (2), “terminal insomnia” (3), “initial + middle insomnia” (4) and “mixed insomnia” (5). Sleep diary variables means for each group are displayed in table 7.

Interaction effects were found on “rest degree (total)” (F (3,92) = 3.169, $p = .028$, $\eta^2 = .094$), “rest degree (week)” (F (3,92) = 3.385, $p = .021$, $\eta^2 = .099$), “sleep quality (total)” (F (3,92) = 4.108, $p = .009$, $\eta^2 = .118$), and “sleep quality (week)” (F (3,92) =

3.999, p = .010, η^2 = .115). A split file by sex was done and the ANOVAs were repeated with post hoc tests, in order to check differences between insomnia clinical types on each sex. No differences were seen in women. In men, differences emerged on “rest degree (total)” (F (4,38) = 3.093, p = .027, η^2 = .246), “rest degree (week)” (F (4,38) = 2.900, p = .034, η^2 = .234), and “sleep quality (week)” (F (4,38) = 3.230, p = .022, η^2 = .254). All size effects were large.

Men displaying “initial and middle insomnia” (4) reported significantly lower restfulness degree than those with mixed insomnia (5), and lower sleep quality (total) than those with “initial insomnia” (1).

As to the main effects on the remaining sleep variables, statistically significant differences were seen between insomnia types on “bedtime (total)” (F (4,92) = 4.783, p = .002, η^2 = .172), “bedtime (week)” (F (4,92) = 5.114, p = .001, η^2 = .182), “bedtime (weekend)” (F (4,92) = 3.802, p = .007, η^2 = .142), “wake-up time (total)” (F (4,92) = 3.316, p = 0.014, η^2 = .126), “wake-up time (weekend)” (F (4,92) = 5.856, p = .000, η^2 = .203), “get up time (total)” (F (4,92) = 2.583, p = .042, η^2 = .101), “get up time (weekend)” (F (4,92) = 6.386, p = .000, η^2 = .217), and “sleep efficiency (total)” (F (4,92) = 2.566, p = .043, η^2 = .100). Size effects were medium to large.

Post hoc tests were then conducted to assess which insomnia types differed. On “bedtime (total)” differences were seen between participants with “initial insomnia” and participants with both “initial + middle insomnia” (1>4; p = .004), and between those with initial and mixed insomnia (1>5; p = .005). On “bedtime (week)”, differences were found between “initial insomnia” and “initial + middle insomnia” groups (1>4; p = .002), and between “initial insomnia” and “mixed insomnia” groups (1>5; p = .002). On “bedtime (weekend)”, differences emerged between participants with initial and initial + middle insomnia (1>4; p = .030), and between those with initial and mixed insomnia (1>5; p =.025).

On “wake-up time (total)”, differences were seen between the “initial insomnia” group and all other groups (5>1; 4>1; 3>1; 2>1; p < .05). On “wake-up time (week)” differences between participants with initial and terminal insomnia (3>1; p = .045), and between those with initial and mixed insomnia (5>1; p = .029) were discovered. On “wake-up time (weekend), differences were found between participants with initial insomnia and all other participants (5>1; 4>1; 3>1; 2>1; p < .05).

TABLE 7.
Sleep diary variables comparisons between insomnia types groups

	Initial [1] M (SD)	Middle [2] M (SD)	Terminal [3] M (SD)	Initial+middle [4] M (SD)	Mixed [5] M (SD)
Bedtime (total)	24h49 (1h13)	23h52 (1h02)	23h44 (0h33)	23h25 (1h09)	23h24 (0h57)
(week)	24h56 (1h13)	23h49 (1h03)	23h48 (0h30)	23h23 (1h10)	23h23 (0h58)
(weekend)	24h48 (1h33)	24h00 (1h09)	23h36 (0h53)	23h29 (1h16)	23h25 (1h05)
SOL (total)	0h43[a]	0h11[a]	0h15[a]	0h33[a]	0h38[a]
(week)	0h47 (0h53)	0h16 (0h11)	0h22 (0h13)	0h37 (0h32)	0h40 (0h30)
(weekend)	0h58[a]	0h09[a]	0h10[a]	0h30[a]	0h23[a]
Nr. awakenings (total)	1.39 (1.32)	2.71 (1.91)	1.89 (1.16)	2.17 (1.18)	1.99 (1.28)
(week)	1.29 (1.27)	2.83 (2.05)	2.00 (1.22)	2.13 (1.17)	2.06 (1.42)
(weekend)	1.64 (1.80)	2.39 (1.73)	1.60 (1.14)	2.31 (1.42)	1.77 (1.26)
WASO (total)	0h17 (0h13)	0h41 (0h27)	0h52 (0h29)	0h46 (0h40)	0h38 (0h31)
(week)	0h15 (0h16)	0h39 (0h25)	0h50 (0h26)	0h43 (0h39)	0h38 (0h32)
(weekend)	0h21 (0h18)	0h44 (0h52)	0h57 (0h39)	0h52 (0h59)	0h36 (0h39)
Wake-up time (total)	9h06 (1h20)	7h19 (1h24)	6h34 (0h48)	7h26 (1h12)	7h03 (1h54)
(week)	8h46 (1h25)	7h12 (1h24)	6h25 (0h45)	7h18 (1h16)	7h04 (1h54)
(weekend)	9h59 (1h24)	7h32 (1h33)	6h56 (1h21)	7h45 (1h18)	7h01 (2h03)
Get up time (total)	9h27 (1h15)	8h04 (1h07)	7h35 (0h23)	8h21 (0h59)	8h12 (1h17)
(week)	9h06 (1h21)	8h00 (1h04)	7h30 (0h10)	8h10 (1h02)	8h11 (1h26)
(weekend)	10h24 (1h17)	8h13 (1h20)	7h47 (1h02)	8h48 (1h05)	8h21 (1h13)
Rest degree (total)	2.73 (.43)	2.70 (.64)	2.74 (.51)	2.77 (.68)	3.06 (.80)
(week)	2.64 (.61)	2.67 (.67)	2.72 (.44)	2.78 (.71)	3.02 (.86)
(weekend)	2.94 (.73)	2.69 (1.00)	2.80 (.76)	2.72 (.71)	3.16 (.78)
Sleep quality (total)	3.33 (.91)	2.91 (.60)	3.08 (.53)	2.91 (.59)	3.07 (.65)
(week)	3.42 (.87)	2.87 (.61)	3.04 (.57)	2.99 (.66)	3.04 (.66)
(weekend)	3.11 (1.11)	2.97 (.63)	3.20 (.45)	2.77 (.68)	3.15 (.79)
Nr. of naps (total)	.22 (.67)	.28 (.75)	.00 (.00)	.50 (1.06)	.48 (1.03)
(week)	.11 (.33)	.28 (.75)	.00 (.00)	.32 (.74)	.39 (.76)
(weekend)	.00[a]	.00[a]	.00[a]	.00[a]	.00[a]
TST (total)	6h57 (1h17)	6h16 (1h03)	5h45 (1h09)	6h13 (1h26)	6h04 (1h37)
(week)	6h41 (1h19)	6h16 (1h03)	6h09 (1h52)	6h16 (1h25)	6h02 (1h31)
(weekend)	7h37 (1h22)	6h15 (1h19)	6h17 (1h16)	6h03 (1h55)	6h11 (2h01)
TIB (total)	8h33 (1h28)	8h11 (0h36)	7h57 (0h42)	8h53 (1h21)	8h48 (1h09)
(week)	8h08 (1h24)	8h09 (0h35)	7h51 (0h38)	8h48 (1h26)	8h45 (1h07)
(weekend)	9h36 (1h45)	8h12 (0h49)	8h11 (1h02)	9h16 (1h19)	8h54 (1h25)
SE (total)	80.8% (7.8)	76.5% (11.8)	72.1% (9.3)	69.4% (12.8)	68.9% (14.0)
(week)	81.3% (9.8)	76.1% (11.7)	70.4% (11.9)	71.1% (12.3)	68.6% (13.3)
(weekend)	79.7% (6.7)	76.6% (15.7)	76.4% (9.4)	65.1% (18.7)	68.7% (17.9)

[a]Median

On “get up time (total), differences emerged between “initial insomnia” and “middle insomnia” groups (1>2; p = .024), between “initial insomnia” and “terminal insomnia” groups (1>3; p = .025), and between “initial insomnia” and “mixed insomnia” groups (1>5; p = .031). On “get up time (weekend)”, the differences were between participants with initial insomnia and all other groups (1>5; 1>2; 1>3; 1>2; $p < .05$).

Finally, on “time in bed (weekend)” differences between those with middle insomnia and those with initial + middle insomnia (4>2; p = .035) were discovered.

Kruskal-Wallis tests were performed to evaluate differences between different complaints on “SOL (total)” and “SOL (weekend)”. Significant differences were shown on both variables ($p < .05$). A follow-up Mann-Whitney U test was conducted to assess which types of complaints differed on these variables. Since two comparisons were conducted for each variable, the alpha value considered was of .025.

On “SOL (total)”, differences emerged between those with initial insomnia complaints and those with middle insomnia complaints (p = .005). Participants with initial insomnia complaints had a longer sleep onset latency mean, than did those with middle insomnia.

On “SOL (weekend)”, differences were found between the “initial insomnia” and “middle insomnia” groups (1>2; p = .005) and between “initial insomnia” and “terminal insomnia” groups (1>3; p = .007). Overall, participants with initial insomnia complaints were the ones who took longer to fall asleep.

Perceived sleep quality and sleep diary variables

Correlational analysis

Pearson’s correlation coefficients were determined (Spearman’s rho when the variables violated normality assumptions) in order to assess the relationship between the sleep quality participants perceived when they woke up and the other sleep variables, on total, weekdays and weekend days. No relationship with non-normally distributed variables emerged.

On general, significant correlations emerged between reported sleep quality and bedtime (r = .241, p = .015), number of awakenings per night (r = -.285, p = .004), and how rested the participant felt in the morning (r = .694, p = .000). Correlations were weak for bedtime and number of awakenings, and large for rest degree.

The test was repeated with a split file by sex, in order to assess differences between sexes. It showed that men's perceived sleep quality was significantly correlated with bedtime (r = .332, p = .028), and rest degree felt in the morning (r = .719, p = .000). On the other hand, women's sleep quality was significantly correlated with the number of awakenings during the night (r = -.344, p = .008), and the rest degree felt (r = .638, p =.000). Correlations were medium to large.

On weekdays, significant correlations emerged between the reported sleep quality and bedtime (r = .245, p = .013), number of awakenings during the night (r = -.339, p =.000), rest degree felt in the morning (r = .649, p = .000), and the time spent in bed (r = -.230, p = .020). Correlations were weak on bedtime and TIB, moderate on number of awakenings and large on rest degree.

Men's sleep quality was correlated with bedtime (r = .397, p = .008), WASO (r = -.306, p = .044), rest degree felt (r = .684, p = .000), and TIB (r = -.373, p = .013), on weekdays. Women's sleep quality was correlated with the number of awakenings during the night (r = -.417, p = .001), and the rest degree felt in the morning (r = .585, p = .000). Correlations were moderate to strong.

On weekends, significant correlations emerged between sleep quality and bedtime (r = .199, p = .045), number of awakenings during the night (r = -.226, p = .022), and rest degree felt (r = .679, p = .000). In men, sleep quality was correlated with the rest degree reported (r = .719, p = .000), and in women it was correlated with bedtime (r = .287, p = .029), and rest degree felt (r = .612, p = .000). Correlations were weak on bedtime and number of awakenings, and large on rest degree.

Hierarchical multiple regression analysis

A multiple regression analysis (table 8) was conducted, to assess which variable best predicted the perceived sleep quality and how much variance can be explained by the other sleep variables.

First, a block of sociodemographic variables (sex, age and educational level, by this order) was added, in order to control possible influences of those variables. Another block was added with the sleep diary variables.

The multicollinearity assumption was assessed for both blocks. A violation of this assumption was found, because the VIF value was above 10 on "bedtime (total)", "wake-up time (total)", "get up time (total)", "sleep efficiency (total)", "total sleep time (total)", and "time in bed (total)". As suggested by Pallant (2010), highly intercorrelated variables were eliminated from the model, namely "get up time (total)" and "total sleep time (total)". The multicollinearity assumption was assessed again and there were no violations.

Then, the normality was assessed by analysing the Normal Probability P-Plot (P-P). The variables were organized in a sensibly straight diagonal line, which means that the normality was not violated.

TABLE 8.

Summary of hierarchical regression analysis predicting sleep quality (total)

	B	SE	β	*t*	*p*	R^2	ΔR^2	ΔF	*p* Δ F
Step 1[a]						.054	.025	1.842	.145
Sex	-.262	.134	-.204	-1.956	.053				
Age	.004	.005	.092	.837	.405				
Educational level	.048	.059	.087	.803	.424				
Step 2[b]						.249	.146	2.566	.009
Bedtime (total)	1.908E-5	.000	.124	.499	.619				
Number of awakenings (total)	-.118	.046	-.257	-2.579	**.012**				
WASO (total)	-5.169E-6	.000	-.016	-.130	.897				
Wake-up time (total)	1.465E-5	.000	.129	.441	.660				
Number of naps (total)	-.060	.068	-.089	-.884	.379				
TIB (total)	.775	.863	.157	.898	.371				
SE (total)	-1.862E-5	.000	-.125	-.497	.621				

B = unstandardized beta coefficient; SE = standard error; β = standardized beta coefficient; $\Delta R^2 = R^2$ Change; Δ F = F Change; p ΔF = Sig. F Change

[a] Predictors: (constant), sex, age, educational level

[b] Predictors: (constant), bedtime (total), number of awakenings (total), WASO (total), wake-up time (total), number of naps (total), TIB (total), SE (total)

Finally, the presence of outliers was evaluated. First, the Mahalanobis distance was examined. Since there were 9 variables being tested, the maximum value of Mahalanobis distance should be 27.88, with values above that being considered outliers (Pearson & Harthy, 1958). One outlier was found (Mahalanobis distance value of 30.65), so it was excluded from the analysis. The presence of outliers was also assessed by looking at the Casewise Diagnostics table. Standard residuals under -3 or above +3 were considered outliers (Pallant, 2010). A standard residual of 3.590 was found, regarding case 62. Because of that, it was necessary to check Cook's distance, to evaluate if the outlier influenced the whole model (Pallant, 2010). Values under 1 indicate that there is no major problem (Tabanick & Fidel, 2007). The Cook's distance value was of .138, indicating no influence on the model in general, so the case was not excluded.

The analysis was then repeated. The variable "number of awakenings (total)" was responsible for a unique statistically significant contribution to predict "sleep quality (total)". Specifically, "number of awakenings (total)" was responsible for 4.7% of the variance in sleep quality. No other variables made unique contribution.

A multiple regression was conducted concerning *weekdays* (table 9). The same steps explained above were followed. The variables "sleep efficiency (week)", "total sleep time (week)", and "get up time (week)" were excluded because they were highly intercorrelated with other variables. After the removal of those variables from the analysis, no violations to the multicollinearity or to the normality assumption were found.

No outliers were found regarding the Mahalanobis distance. An outlier was, however, discovered when checking the standard residual value (std. residual = 3.588). The Cook's distance value was of .103, which showed no major problem, so the case was included on the analysis.

The only variable that made a unique significant contribution to predict "sleep quality (week)" was "number of awakenings (week)" ($p < .05$). The variable explained 6.2% of the variance on "sleep quality (week)".

TABLE 9.

Summary of hierarchical regression analysis predicting sleep quality (week)

	B	SE	β	*t*	*p*	R^2	ΔR^2	ΔF	*p* Δ F
Step 1[a]						.053	.023	1.786	.155
Sex	-.252	.140	-.188	-1.804	.074				
Age	.005	.005	.110	.997	.321				
Educational level	.061	.062	.106	.980	.330				
Step 2[b]						.252	.168	3.002	.003
Bedtime (week)	-5.259E-6	.000	-.033	-.178	.859				
SOL (week)	-1.720E-5	.000	-.049	-.473	.638				
Number of awakenings (week)	-.127	.045	-.279	-2.819	**.006**				
WASO (week)	-3.593E-5	.000	-.107	-1.013	.314				
Wake-up time (week)	3.606E-5	.000	.304	1.627	.107				
Number of naps (week)	-.111	.092	-.116	-1.205	.231				
TIB (week)	-4.865E-5	.000	-.318	-1.654	.102				

B = unstandardized beta coefficient; SE = standard error; β = standardized beta coefficient; Δ R^2 = R^2 Change; Δ F = F Change; p ΔF = Sig. F Change

[a] Predictors: (constant), sex, age, educational level

[b] Predictors: (constant), bedtime (week), SOL (week), number of awakenings (week), WASO (week), wake-up time (week), number of naps (week), TIB (week)

Lastly, a multiple regression analysis was run regarding *weekend* days (table 10).

The same steps explained above were followed. The variables "sleep efficiency (weekend)" and "get up time (weekend)" were excluded because they were highly intercorrelated with other variables. After the removal of those variables from the analysis, no violations to the multicollinearity or to the normality assumption were found.

TABLE 10.

Summary of hierarchical regression analysis predicting sleep quality (weekend)

	B	SE	β	*t*	*p*	R^2	ΔR^2	ΔF	*p* Δ F
Step 1[a]						.058	.028	1.965	.124
Sex	-.335	.159	-.219	-2.105	**.038**				
Age	.004	.006	.076	.693	.490				
Educational level	.035	.071	.053	.495	.622				
Step 2[b]						.179	.097	2.184	.030
Bedtime (weekend)	3.212E-5	.000	.193	.922	.359				
Number of awakenings (weekend)	-.114	.053	-.218	-2.159	**.034**				
WASO (weekend)	9.611E-6	.000	.037	.289	.773				
Wake-up time (weekend)	4.685E-6	.000	.039	.170	.866				
TST (weekend)	2.753E-5	.000	.237	1.261	.211				
TIB (weekend)	-6.498E-6	.000	-.042	-.235	.814				

B = unstandardized beta coefficient; SE = standard error; β = standardized beta coefficient; $\Delta R^2 = R^2$ Change; Δ F = F Change; p ΔF = Sig. F Change

[a] Predictors: (constant), sex, age, educational level

[b] Predictors: (constant), bedtime (weekend), number of awakenings (weekend), WASO (weekend), wake-up time (weekend), TST (weekend), TIB (weekend)

Regarding the Mahalanobis distance, two cases had values above 26.13 (in this case, it was the value considered, since there were 8 variables being tested), and those two cases were considered outliers and excluded from the analysis. No outliers were discovered when checking the standard residual value.

The variables that made a unique contribution to predict “sleep quality (weekend)” were “sex” and “number of awakenings (weekend)” ($p < .05$). Specifically, sex was responsible for 4.3% of the variance on “sleep quality (weekend)” and “number of awakenings (weekend)” explained 2.2% of the variance.

Discussion

The present study aimed to acknowledge, comprehensively, the sleep patterns of patients suffering from chronic insomnia, at the baseline, using the sleep diary. In order to do that, differences on sleep variables by sociodemographic variables, as well as between medicated and non-medicated participants, were assessed. The possible relationships between the sleep diary variables and ISI's total score, insomnia duration and clinical types were also evaluated. Finally, we examined which sleep diary variables were more associated with sleep quality.

The participants in our study, on average, go to bed at 23h36m, have 2.13 awakenings during the night, spending 0h40m awake during the night, wake up at 7h23m, get up at 8h18m and take 0.42 naps per day. They take, in median, 28 minutes to fall asleep. The SOL is under 31 minutes (value used as quantitative criterion for insomnia) (Lichstein, Durrence, Taylor, Bush, & Riedel, 2003), but WASO is clearly above 31 minutes (established as quantitative criteria) (Lichstein et al., 2003).

In general, the total sleep time and the sleep efficiency of our sample is low. Both were expected, due to sleep difficulties inherent to insomnia. It is recommended for an adult to sleep between 7 and 9 hours, and for older adults to sleep 7-8 hours (Hirshkowitz, Whiton, Albert, Alessi, Bruni, DonCarlos, et al., 2015), whereas our participants slept, on average, 6h14m, i.e., 46 minutes below the recommended lower limit. Furthermore, our participants' sleep efficiency mean was of 71.7%, and optimally it should be higher than 90% (cf. Clemente, 2006). They also spend 8h40m in bed, a very long time when compared to their TST. It is necessary to interpret this data with caution, though, since sleep diaries do not necessarily faithfully reproduce insomniac's sleep patterns, given their tendency to overestimate WASO and underestimate TST.

A study with poor sleepers, using a sleep diary (Molzof et al., 2018), showed a SOL of approximately 37 minutes, 1.92 awakenings during the night, a WASO of approximately 46 minutes, a TST of approximately 7h05m, and an average sleep efficiency of 77.9%. In comparison to their sample, our participants have a lower SOL, report more awakenings, report a lower WASO, sleep less, and have a lower sleep efficiency.

In another study by Harvey and colleagues (2008), poor sleepers reported a SOL of approximately 27 minutes (very close to the SOL reported by the participants of our study), a WASO of approximately 20 minutes (far lower than our results), and a TST of 6h55m (50 minutes more than our findings).

Maich and colleagues (2016) used the consensus sleep diary and found a SOL of approximately 49 minutes, a WASO of around 51 minutes, a TST of roughly 6h18m and a sleep efficiency of 70%. Comparing to their results, our SOL and WASO was lower, our TST was very similar, and our sleep efficiency was slightly higher.

The differences between these studies' results and ours could be related to sociodemographic differences (e.g., mean age, sex ratio) between our sample and other studies' samples.

Regarding week and weekend days' sleep pattern differences, overall, patients with insomnia seem to show later sleep patterns on weekends, as is reported in literature concerning the general adult population (Carskadon & Dement, 2017; Sivertsen, Vedaa, Harvey, Glozier, Pallesen, Aarø, Lønning, & Hysing, 2018). In our sample, on weekends, participants wake up later, get up later, sleep the same number of hours and spend significantly more time in bed. Nevertheless, the participants report no differences on how rested they felt nor on the perceived sleep quality. The fact that the participants spend more time in bed on weekends could be due to the fact that they do not have to work, but it could also be a result of an attempt of catching up sleep by prolonging time in bed (Morin, Davidson, & Beaulieu-Bonneau, 2017).

In line with our results, previous studies (Baker & O'Brien, 2017; Karacan, Thornby, & William, 1983; Krishnan & Collop, 2006; Léger et al., 2000; Ohayon et al., 1997; Ohayon, Caulet, Priest, & Guilleminault, 1997) found differences between sexes, and a propensity for women to feel less rested, report a lower sleep quality, sleep more, spend more time in bed, and report higher sleep efficiency.

Our results also seem to be in line with previous studies (Barbosa, Miguel, Tufik, Sabino, Cendoroglo, & Pedrazzoli, 2016; Crowley, 2011) that showed a tendency towards morningness in older age, as well as an increase on the number of awakenings experienced during the night. We also found a tendency following the increasing age to spend more time awake during the night (probably a consequence of an increased number of awakenings), feel more rested upon waking up, sleep less, and have a lower sleep efficiency.

Our results found differences between sexes on the associations between age and sleep. Contrary to other studies (Punyahotra, Dennerstein, & Lehert, 1997; Owens & Matthews, 1998), in our study, men's age seems more associated with the sleep diary variables than did women's, which was not expected since women experience menopause, which affects sleep (Baker, & O'Brien, 2017).

According to our findings, higher age in men seems associated with more awakenings per night, more time awake after sleep onset on total and weekdays, earlier wake up and rise times on weekends, a lower feeling of restfulness upon waking up, and lower total sleep time on weekends. In women it was only found a tendency to wake up later on weekends with age.

The fact that older people tend to sleep poorly is no novelty and it is even considered a geriatric symptom (Barczi & Teodorescu, 2017). The illnesses that accompany older age (e.g., arthritis, gastroesophageal reflux disease) and medications taken to ease those illnesses could also have a part on these sleep difficulties (Barczi & Teodorescu, 2017; Foley, Ancoli-Israel, Britz, & Walsh, 2004).

Several studies have been showing that a lower education is highly associated with more sleep complaints (Bixler, Kales, Soldatos, Kales, & Healey, 1979; Kim, Uchiyama, Okawa, Liu, Ogihara, 2000). Grandner and colleagues (2010) also found that gender affects the relationship between education and sleep, being the relationship between lower education levels and poorer sleep stronger in men. In our study, we also find that those with lower education levels show more sleep complaints (longer SOL), less total sleep time, and lower sleep efficiency, being the complaints more prominent in men.

There could be several possible explanations for these results: 1) younger adults tend to have a higher education level, while older adults tend to have a lower one (this is due to the evolution of mandatory education in Portugal). Knowing these age-related changes, we hypothesize that some differences discovered on less educated insomniacs may reflect older ages; 2) a lower education level can be related to a lower socioeconomic status, which in turn can be linked to poorer living conditions (such as houses exposed to more noise or having to share a room with more people); 3) people with higher educational levels may have more optimal conditions to implement sleep hygiene rules; 4) people with higher education levels tend to have jobs with different schedules (tendentially, their jobs' starting time is later).

Regarding professional status, as found in literature (Grandner et al., 2010), our results show that employed participants tend to experience less awakenings during the night, when compared to the retired ones, and to get up earlier, when compared to the unemployed ones. This could be linked with the possible higher socioeconomic status of employed people.

Our results also seem to agree with other studies that show that marital status has an influence on sleep (Arber, 2012; Léger et al., 2000; Ohayon, 1996; Ohayon et al., 1997), albeit that difference is usually found on separated/divorced or widowed participants, that were not included on our analyses.

In agreement to the results of Arber (2012), differences by marital status were more prominent amongst men. In our sample, single men seem to go to bed later, spend more time awake after sleep onset (on total and weekdays), wake up later, get up later (on total and weekend days) and have higher sleep efficiency (on total and weekdays), than married/cohabiting men. Single women only differed from those married/cohabiting on weekend days wake up time (being the single women the ones who sleep until later).

There are several hypotheses to explain these results: 1) the results by marital status could be due to age differences between marital groups, at least in men (since single men are younger than those married/cohabiting); 2) the bed partner could disturb their sleep, by snoring or moving too much (Troxel, Robles, Hall, & Buysse, 2007); 3) there could be marital tension (Troxel, Braithwaite, Sandberg, & Holt-Lunstad, 2016).

Contrary to previous studies (Komada, Nomura, Kusumi, Nakashima, Okajima, Sasai, & Inoues, 2011; Pillai, Cheng, Kalmbach, Roehrs, Roth, & Drake, 2016), there seems to be no difference between sleep medicated and non-medicated participants on the sleep diary variables, meaning that both groups seem to report similar bedtimes, SOL, number of awakenings, WASO, wake-up and get up times, TST, TIB, rest degree and sleep quality. This could mean that medication has a limited effectiveness on the treatment of chronic insomnia and should not be the first line of treatment, nor used as the only treatment for this disorder (Sateia, Buysse, Krystal, Neubauer, & Heald, 2017).

There also seems to be a difference between participants taking benzodiazepine hypnotics and neuroleptics, on weekdays. Those who took benzodiazepines report lower sleep efficiency on weekdays. Other studies show a relationship between benzodiazepines and the estimated total sleep time, sleep onset latency and difficulty on getting back to sleep after nocturnal awakenings (Krska & MacLeod, 1995), but no differences on those variables were found, which could be related to the small size of some "medication type" groups in our study.

Overall, no link between different insomnia durations and sleep diary variables was discovered, which suggests that sleep characteristics and quality in insomnia participants may be somewhat independent of how long patients have been experiencing trouble sleeping. Maybe this is the reason why ICSD-3 makes no distinctions on what concerns the duration of chronic insomnia (≥3 months).

Regarding insomnia's severity, participants with more severe insomnia (ISI score) seem to rate their sleep as low quality on total and weekdays, as well as to sleep less on weekend days and to report lower sleep efficiency. These differences seem to only be found in women, though. This is not surprising, since it was expected for participants with more severe insomnia to show more sleep complaints. These results also support the notion that sleep patterns recorded by the patients in their sleep diaries are in accordance both with their ISI answers at the baseline assessment, and to the information they transmit orally during the initial clinical assessment session.

Finally, men seem to score higher on ISI when they don't feel rested in the morning and feel a low sleep quality. Women have higher scores when they go to bed earlier, spend more time in bed, have lower total sleep time on weekends, and have lower sleep efficiency. Once again, there is an agreement between the sleep patterns reported by the patients on their sleep diaries and the score obtained on ISI.

These results were expected since higher scores on ISI were predictably associated with poorer sleep in general. The fact that obtained scores tend to be higher when sleep efficiency is lower is not surprising, given that it was already reported by Bastien and colleagues (2001). The association of a higher score with earlier bedtimes could be related to participants going to bed earlier to try to sleep more, forcing themselves to sleep (but not being able to), which may result on a reduced sleep efficiency and reinforcement of their insomnia complaints, entering a vicious cycle (Clemente, 2006).

There seems to be an agreement, to some extent, between the insomnia complaints participants reported during the clinical interview and the sleep diary variables. Overall, participants identified with initial insomnia at the clinical interview tend to go to bed later (men), take more time to fall asleep, wake up later, and get up later, according to the sleep diary. This is not surprising, since those with initial insomnia 1) typically have longer SOL, 2) usually go to bed later, in order to try to reduce their SOL, and 3) try to extend time in bed in the morning, to extend sleep time. On weekends, those with terminal insomnia complaints are the ones who get up later, as would be expected.

Finally, those diagnosed with middle insomnia are the ones who, according to their sleep diaries, have a higher average of number of awakenings, closely followed by those with initial and middle insomnia, something also to be expected. Once again, these findings support the congruence between the sleep diaries data and the information reported by the patients during the clinical interview.

Lastly, sleep quality correlates and predictors were examined. Men's perceived sleep quality seems to be better when they go to bed later and feel more rested waking up. On the other hand, women's sleep quality seems to be better when the number of awakenings during the night is lower and they feel more rested in the morning.

Harvey and colleagues (2008) tried to evaluate the subjective meaning of sleep quality and the fact that the feeling of restfulness seems so highly associated with the perceived sleep quality could be explained by their findings. According to the participants of their study, sleep quality can be defined by "tiredness on waking and throughout the day, feeling rested and restored on waking, and the number of awakenings they experienced in the night" (Harvey et al., 2008, p. 383). Thus, it seems that perceived sleep quality and restfulness in the morning could be somewhat perceived as synonyms.

The set of hierarchical multiple regression analyses revealed that the only sleep variable (rest degree was excluded) that shows a unique contribution to predict sleep quality in this study is the number of awakenings during the night. Interestingly, the relationship between sleep continuity and perceived sleep quality is also found in literature (Åkerstedt, 2008; Åkerstedt, Hume, Minors, & Waterhouse, 1994).

As expected (albeit not necessarily obvious for the layman), sleep duration is neither related to, nor predicts, sleep quality perception.

As a strength of this study, we must point the fact that, to the best of our knowledge, there are no other studies addressing insomnia sufferers' sleep-wake patterns focusing specifically on sleep diaries as the main research tool. Being insomnia a disorder with such a subjective component, obtaining daily sleep patterns descriptions from the patients' point of view seems of extreme importance. Besides, this study's sample is clinical, in a strict sense, that is, it only includes insomnia patients diagnosed with the gold standard in insomnia assessment, i.e., the clinical interview (cf. e.g. Riemann et al., 2017), which we also consider a major strength. Compared to other studies that used sleep diaries, the *n* of our sample is large, something we also consider a strength.

There are, of course, limitations to this study. One of the limitations is the small *n* of some groups (e.g., divorced/separated, widowed, students), that limited some analyses and some results found. The fact that the sleep diary is a subjective evaluation method could also be a limitation in certain aspects, since it could be subject to many influences (like mood and personality influences). Another limitation is the absence of a control group to compare with our clinical sample. That could bring further knowledge to the field and would provide important data.

Conclusion

In summary, the sleep diary SOL of our sample was marginally below the expected cut-off point (below 31 minutes), the number of awakenings was somewhat above what was found in literature, the WASO was in accordance to what was anticipated (above 31 minutes), the total sleep time was lower than what is recommended for adults, which was also foreseeable due to sleep difficulties reported by the participants of this study, TIB is somewhat high, especially when considering TST, and sleep efficiency is below the normal cut point, again not surprising considering the sleep disorder of the participants.

Our results show that insomnia sufferers tend to have later weekend days sleep-wake patterns, when compared to weekdays. An influence of sex in sleep was found, seen by the differences observed between women and men, being women the ones who wake up and get up later, sleep more and spend more time in bed and had higher sleep efficiency. In spite of sleeping more and having higher sleep efficiency, women feel less rested in the morning and perceive their sleep as low quality. Sex differences in insomnia participants seem to be in line with the ones found in non-insomnia samples.

A relationship between age and sleep was also found, as expected, even though men's age was surprisingly more related with sleep on our sample.

Lower education seems to be associated with poorer sleep, as well as being unemployed or retired. Married/cohabiting men also seem to have poorer sleep.

The fact that sleep medicated and non-medicated patients do not seem to show any difference on their sleep seems surprising. At the same time, the absence of differences seems to be in line with the notion that medication has limited effectiveness for chronic insomnia treatment in general.

ISI's severity was related with sleep diary variables. The more severe the insomnia, the poorer the rest degree, sleep quality and sleep efficiency and the lesser the sleep time on weekends reported in the diaries. Men's high scores seem to be associated to a low feeling of restfulness and a lower perceived sleep quality, while women's higher scores seem associated with earlier bedtimes, longer TIB, lower sleep efficiency and less TST on weekends. These results are not surprising, since earlier bedtimes and longer TIB could result in lower sleep efficiency.

Finally, higher sleep quality perception in men seems to be related to later bedtimes and feeling more rested in the morning. In women, higher sleep quality seems to be related to less awakenings during the night and a higher rest degree felt in the morning. Interestingly, and as expected, sleep duration is neither related to, nor predicted sleep quality perception at wake time.

Future research could compare a clinical sample to a control group, for a better comprehension of subjective sleep patterns. Future studies could also evaluate which sleep variables better predicted the restfulness upon waking up.

Since chronic insomnia is a disorder essentially characterized by subjective complaints, diary data seem of great relevance to completely portraying sleep in insomnia patients and, therefore, we believe further investigations should focus to a greater extent on this very important tool.

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Appendix: works emerging from the current dissertation

Works emerging from the current dissertation:

Poster presentation:

Tavares, D., Clemente, V., Serra, J., & Allen Gomes, A. (2019, September). *What do sleep diaries tell us about patients diagnosed with Chronic Insomnia?*. World Sleep 2019. September 20-25, Vancouver, Canada.

[Note: hosted by the World Sleep Society and the Canadian Sleep Society, cf. https://worldsleepcongress.com/worldsleep2019]

Abstract Publication (accepted):

Tavares, D., Clemente, V., Serra, J., & Allen Gomes, A. (in press). What do sleep diaries tell us about patients diagnosed with Chronic Insomnia? *Sleep Medicine (Suppl)*. [Journal information: ISSN 1389-9457. Indexed in Scopus, PubMed/Medline, Science Citation Index, Neuroscience Citation Index, etc].

Cf. provisory abstract publication in the next page.

Appendix 1: Provisory abstract publication

Insomnia
Board #097 : Poster session 1
WHAT DO SLEEP DIARIES TELL US ABOUT PATIENTS DIAGNOSED WITH CHRONIC INSOMNIA?

D. Tavares[1], V. Clemente[2,3], J. Serra[2], A. Allen Gomes[3,4]
[1]Faculty of Psychology and Educational Sciences, University of Coimbra, [2]Sleep Medicine Centre, Coimbra University Hospital Centre (CHUC), [3]Center for Research in Neuropsychology and Cognitive and Behavioral Intervention (CINEICC) [FPCE-UC], [4]Faculty of Psychology and Educational Sciences., University of Coimbra, Coimbra, Portugal

Introduction: The Sleep Diary is a very important tool that allows clinicians to assess insomnia from a patient's perspective (Edinger *et al.*, 2016) and is recommended before and during CBT-i by the AASM (Schutte-Rodin, et al., 2008). Despite its importance, the sleep diary is not widely used on research. Our aim was to analyse the sleep patterns of insomnia patients during the initial consultations at a Sleep Centre (referred to the clinical psychology somnologist), as reported by them on sleep diaries.
Materials and Methods: It was used a clinical sample of 103 participants (45.4% women; 18-85 years old, M=49.04 ± 14.14) meeting ICSD-3 and DSM-5 criteria for Chronic Insomnia Disorder, as assessed by clinical interview conducted by a sleep medicine specialist, having insomnia for 1-45 years (M=12.90±11.10), 43.7% medicated, referred to a Sleep Medicine Centre of a Central University Hospital (outpatients considered: 2015-present). Patients displaying untreated comorbid sleep disorder were excluded. Participants completed the Sleep Diary's (Morin, 1993; adapt. Pt: Clemente, 2006) as part of routine clinical assessment procedures, before starting CBT-I. Only diaries displaying complete data for a minimum of 4 nights (3 weeknights and 1 weekend night) were considered, and the analyses included a maximum of 7 nights (5 weeknights and 2 weekend nights).
Results: Mean sleep-wake patterns were later on weekends than weekdays, albeit that difference was only significant for "wake up time" and "rise time": 4 minutes for "bedtime" (23h38m±1h10m; 23h34m±1h15m; p=.301); ~22 minutes for "wake up time" (7h38m± 1h46m; 7h17m±1h33m; p< .05); and ~27 minutes for "rise time" (8h37m±1h19m; 8h09m±1h13m, p< .05). Total sleep time was 6h10m±1h30m on weekdays and 6h14m±1h24m (p=.613) on weekends, time in bed was 8h34m±1h12m on weekdays and 8h56m±1h21m on weekends (p< .05). Sleep efficiency was 71.5% on weekdays and 69.6% on weekends. In median, participants took 27 minutes to fall asleep. In mean, they awaked 2 times per night, rated their sleep as "average" in terms of quality and felt "tired" in the morning. Men's age was associated with higher number of awakenings per night (r=.328, p< .05), more time awake after sleep onset (r=.408, p< .05), earlier wake up (r= -.339, p< .05) and rise times (r= -.368, p< .05) on weekends, and lower total sleep time on weekends (r= -.321, p < .05). Women's age was correlated with weekends earlier wake up time (r= -.260, p< .05). When age's effect was controlled for, women felt less rested in the morning, slept more, awaked later on weekdays and spent more time in bed on weekends (p< .05), as compared to men. Finally, there were no significant difference between sleep medicated and non-medicated patients' sleep diaries.
Conclusions: Since chronic insomnia is a disorder characterized by subjective complaints, diary data seem of great relevance to completely portraying sleep in insomnia patients.
Acknowledgements: We are grateful to all patients who participated in this study. Presentation-related expenses partially supported by the FTC Research Unit CINEICC [FPCEUP]

Appendix 2: Acceptance letter

Assunto **Abstract Poster Board Number - World Sleep 2019**
Remetente World Sleep Society <info@worldsleepsociety.org>
Para a.allen.gomes@fpce.uc.pt <a.allen.gomes@fpce.uc.pt>
Data 2019-09-10 21:17

Greetings Ana Allen Gomes,

Your abstract titled **"What do Sleep Diaries tell us about patients diagnosed with Chronic Insomnia?"** number **A-1055-0007-01760** has been assigned to the following session and poster board:

- **P1 - Sunday: Sunday, September 22, 2019, from 4:30 PM to 6:00 PM in Ballroom B - Board #097**

Presenting: Authors must be present by posters for scheduled 45-minute time (details below) within assigned 90-minute Poster Abstract Session.

Hanging Posters: For Poster Sessions 1, 2 and 3, poster abstracts must be posted on boards between 8:00am-10:30am.

Removing Posters: Posters must be removed from boards within one hour of poster session's close. Poster Session 1, remove posters between 6:00pm-7:00pm. Poster Sessions 2 & 3, remove posters between 7:00pm-8:00pm.

Poster Abstract Presentation Schedule

Poster Abstracts will be posted in Vancouver Convention Centre West on Level 1 in Ballroom B. The Poster Hall at World Sleep 2019 will be accessible from 8:00am until 8:00pm during the regular congress dates.

Each poster session is 90-minutes, broken into two 45-minute presenting windows. For odd numbered poster boards, presenting authors must be present near poster the first 45-minutes of the poster session. For even numbered poster boards, presenting authors must be present near poster the last 45-minutes of the poster session.

Sunday, September 22, 2019

Poster 1 (P1) 4:30pm-6:00pm

Odd # posters present: 4:30pm-5:15pm

Even # posters present: 5:15pm-6:00pm

Abstract changes can be made between August 15 and September 25, 2019 by logging into the author's online abstract submission account. Abstracts will be published in a supplement of *Sleep Medicine* Journal and available online in December 2019.