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SLEEP QUALITY OF INSTITUTIONALIZED ELDERLY PEOPLE
STUDY DEVELOPED IN THE CONTEXT OF THE ICON PROJECT

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ABSTRACT

Objectives: (1) Characterize the sociodemographic and clinical profile of the sample; (2) to evaluate sleep quality perception and the average number of hours of sleep per day and (3) to analyze the relationship between sleep quality perception, cognitive functioning and psychopathological symptoms.

Methods: Cross-sectional and descriptive study, in which 442 elderly residents in Residential Structures for the Elderly of Beira Interior (Portugal) participated. For data collection, the Addenbrooke Cognitive Assessment and the Psychopathological Symptom Inventory were used.

Results: Participants had a mean age of 83.98 years (SD=8.06), 311 were women, and 254 participants had cognitive impairment. The average number of hours of sleep reported was 6.31 hours (SD=1.76) and most elders (71.1%) rated their sleep quality as positive. A statistically significant positive association was found between the average number of hours of sleep and perceived sleep quality, as well as a negative association between perceived sleep quality and the presence of psychopathological symptomatology.

Conclusion: The results of this study emphasize the importance of sleep quality for better well-being. We highlight the need for future studies to resort to more objective sleep evaluation measures, such as polysomnography.

Keywords: Aging; sleep; institutionalization; ICON.

INTRODUCTION

Sleeping is essential for the development and the physical and mental health of human beings throughout their entire life cycle, and shows certain specificities at different evolutionary stages, namely in old age[1-3]. Sleep disorders are seen as changes to sleep quality, sleep quantity and /or sleep patterns[4] and are increasingly common, leading to high levels of prescriptions for sedative, hypnotic and anxiolytic drugs, especially among the elderly[5].

Sleep disorders are associated with the decline of function, cognition and quality of life, as well as with a larger number of comorbidities and an exacerbation of certain diseases such as depression, anxiety and dementia[1,6-11].

The process of aging triggers a structural and physiological change in the architecture of sleep, which reflects the neuronal degeneration[1]. There is a decrease of the efficiency and total time of sleep, as well as of the slow-wave sleep. Conversely, there is an increase of nocturnal awakenings and sleep latency[1,2]. These changes result in an increase of daytime sleepiness and a consequent compromise of social life, a decrease in the level of independence for performing basic daily life activities, the onset of a cognitive deficit and, ultimately, a decrease of the quality of life[1,12].

To assess the sleep-wake cycle of the elderly, Ohayon and Vecchierini developed a study with more than one thousand subjects over 60 years of age. The authors observed that the average sleeping time per night was approximately 7 hours and recorded an average of daytime sleeping of 14 minutes, whereby male subjects slept more than female subjects during both the night time and daytime periods[13].

Although there is no decrease in the daily sleep necessities among the elderly, there is a decrease in the ability to maintain a sufficient quality and quantity of sleep[1,3,7]. Van Cauter et al. assessed a population of 149 healthy male subjects between 16 and 83 years of age, and concluded that between midlife (36-50 years old) and the eighth decade of life the total time of sleep diminished, on average, 27 minutes per decade[14].

The main reasons pointed out by literature for the decrease of adequate sleep quality and quantity are the presence of comorbidities, the use of pharmaceutical drugs that interfere with sleep, and changes of the circadian rhythm[7]. Among the relevant comorbidities are dementia, depression, cardiovascular diseases, pulmonary diseases and chronic pain[1,3,7,11,15]. Concerning the use of pharmaceutical drugs, the literature points out the presence of sleep changes resulting from the use of central nervous system stimulants, antidepressant, antihypertensive, antihistamine, corticosteroid and diuretic drugs[1,3,7,15].

In old age, sleep disorders are very common and an important risk factor for a person's health and quality of life[1-3,6,7,15]. In the case of elderly people residing in nursing homes, there's generally a set of factors that contribute to the increase or exacerbation of sleep--related problems and a further reduced sleep quality[15,16]. Some characteristics of nursing homes mentioned in the literature as potential sleep disturbing factors include nocturnal surveillance and hygiene care, noises, lights, excess of time spent in bed, decreased exposure to sunlight and a decrease of physical and social activity during the day, which induces excessive daytime sleepiness[12,15,16].

This study is integrated in the ICON (*Interdisciplinary Challenges On Neurodegeneration*) project and aims at studying the understanding that institutionalized elderly people have over the quality of their sleep. The main objectives are: assessing the understanding

of sleep quality and the average number of sleep hours per day among institutionalized elderly people and analysing the relationship between the understanding of sleep quality, cognitive function and psychopathological symptomatology.

METHODS

Research Design

This is a cross-sectional and descriptive study, integrated in the ICON project, developed at the Research Centre for Health Sciences of the University of Beira Interior (CICS-UBI), financed by the European Union – Centro 2020's "SR&TC Integrated Programmes" (CENTRO-01-0145-FEDER-000013).

Subjects

The study was comprised of 442 elderly people residing in nursing homes in Beira Interior, or frequenting nursing homes as a day care centre, integrating the *EBICohort* created in the scope of the ICON project.

For establishing the sample, the authors contacted all of the nursing homes located within a geographical limit of 15 km at the time of study development. Among the contacted institutions, 18 accepted to participate in the study. Upon establishing a cooperation protocol with the institutions, the project was presented to the subjects and/or respective legal representatives.

Procedures

For collecting data, the authors applied a protocol developed in the scope of the ICON project, duly authorized by the Ethics Committee at the University of Beira Interior on May 23, 2017, with reference no. CE-UBI-Pj-2017-012.

The study subjects or their legal representatives (where the subjects had cognitive deficits) signed the informed consent, which was also signed by the ICON project's coordinator and a witness.

Data were collected in individual interviews with subjects with no cognitive deficit or with subjects who, despite some cognitive deficit, were able to answer questions about their sleep. In the case of subjects whose cognitive deficit hampered their ability to answer questions, no data was collected concerning sleep time and their understanding of sleep quality.

Instruments

For this study, the ICON's assessment protocol was used to analyse the results from the clinical and social-demographic survey, the sleep-related questions, and the Addenbrooke's Cognitive Examination – Reviewed (ACE-R) and the Brief Symptom Inventory (BSI).

The subject's clinical and social-demographic data were collected from the institutions providing care. Concerning their sleep, the subjects were asked: "On average, how many hours do you sleep per day?" and "Generally speaking, how do you describe the quality of your sleep?", to which the subjects replied on a Likert-type scale from 1 ("Very bad") to 5 points ("Very good").

ACE-R is an individual test for cognitive screening, adapted and validated for the Portuguese population by Simões et al.[18]. This instrument assesses five cognitive domains: attention/orientation, memory, verbal fluency, language and visuospatial[17]. The sum of the sub-scores obtained in each domain amounts to a maximum of 100 points, and any higher scores correspond to a better cognitive function. Additionally, this instrument provides the score for MMSE (Mini Mental State Examination).

The BSI, as adapted for the Portuguese population by Canavarro[19], provides scores in none psychopathological dimensions and three Global Indexes[18]. With the BSI, individuals are asked to classify the frequency with which they experienced psychopathological symptoms during the past week, using a scale from 0 to 4 points in which zero corresponds to the absence of symptoms ("never") and four corresponds to the very frequent presence of symptoms ("many times").

For this study, and taking its objectives into account, the authors considered indexes related to the dimensions of depression and anxiety, as well as an index for positive symptoms, with a cut-off point of 1.7, established in Canavarro's validation studies[19].

Statistical analysis

Descriptive statistics techniques were used to characterize the sample. To test average equality between two scores, *Student's* parametric t-test was used whenever possible. The test's premises, namely the normality of distributions and the homogeneity of variances (homoscedasticity), were respectively analysed using the Kolmogorov-Smirnov test with Lilliefors' correction and the Levene test. Where the variance equality premise was breached, the Welch-Satterthwaite approximation was used. There distributions were abnormal, an approximated result was reached using the Central Limit Theorem. To assess the existence of association between the understanding of sleep quality (measured using only an ordinal scale) and the average number of sleep hours, the index of positive symptoms, the

index of depression and the index of anxiety, the Spearman ordinal correlation test was used.

The 0.05 value was assumed as a statistically significant level. The collected data were analysed using *Software Package for Social Sciences* (SPSS®), v. 25.0.

RESULTS

Clinical and social-demographic characterization

This study included 311 female (70.4%) and 131 male (29.6%) subjects, totalling 442 subjects. The average age is 83.98 years (SD=8.06), comprised between the minimum of 60 and the maximum of 105 years.

Concerning education, 135 (30.5%) subjects are illiterate, 148 (33.5%) completed the 4th grade, 12 (2.7%) completed the 6th grade, 5 (1.1%) completed the 9th grade, 3 (0.7%) completed the 12th grade and 6 (1.4%) completed higher education.

Concerning the subject's medication, the most frequent pharmacological classes are benzodiazepines (n=213; 48.2%), loop diuretics (n=173; 39.1%), antipsychotics (n=163; 36.9%) and angiotensin receptor blockers (n=150; 33.9%).

As to the number of pharmacological classes taken by each subject, it is observed that the majority of subjects takes drugs from four or more different pharmacological classes per day (n=236; 57.6%), and may take one or more drugs from each class concomitantly. It was not possible to collect data related to this parameter from 32 subjects.

As to the number of diagnoses, the majority of subjects (n=280; 67.8%) presents two or more health issues. The most frequent clinical diagnoses among the studied elderly are high blood pressure (n=273; 61.8%), dyslipidaemia (n=116; 26.2%), diabetes (n=110; 24.9%), non-Alzheimer dementias (n=105; 23.8%) and congestive heart failure (n=85; 19.2%). The less prevailing diseases are asthma and atherosclerosis (n=10; 2.3%).

Cognitive state characterization

The ACE-R was applied to 337 subjects. Among these, and according to ACE-R standards related to age and education, 254 (75.4%) are found to have cognitive deficits. An average score of 45.31 (SD=19.33) was obtained, varying between a minimum of 9 and a maximum of 93 points. The average score obtained for MMSE was 16.81 (SD=5.90).

Sleep characterization

The average number of sleep hours reported by the subjects is described in figure 1. It was not possible to collect data related to this parameter from 198 subjects.

The elderly's understanding of sleep quality is described in figure 2, but it was not possible to collect this information from 55 subjects. The majority of subjects (n=275; 71.1%) has a positive understanding of their sleep quality, that is, they consider the quality of their sleep as being "3 – reasonable", "4 – good" or "5 – very good".

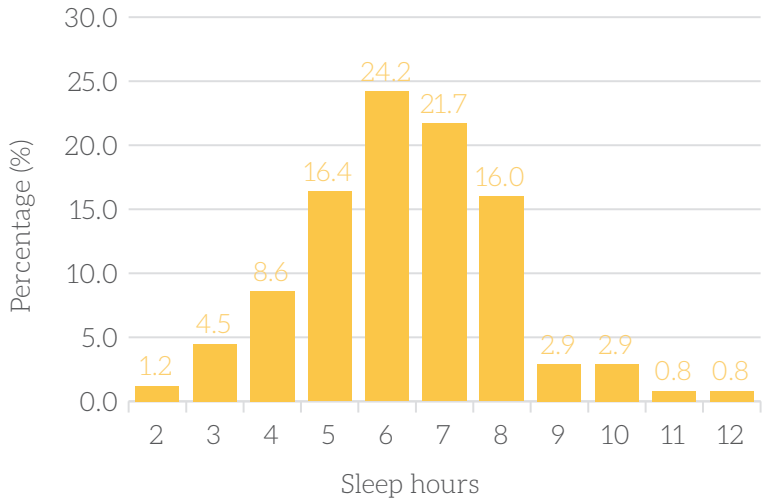

Figure 1 – Average number of subject sleep hours (N=244).

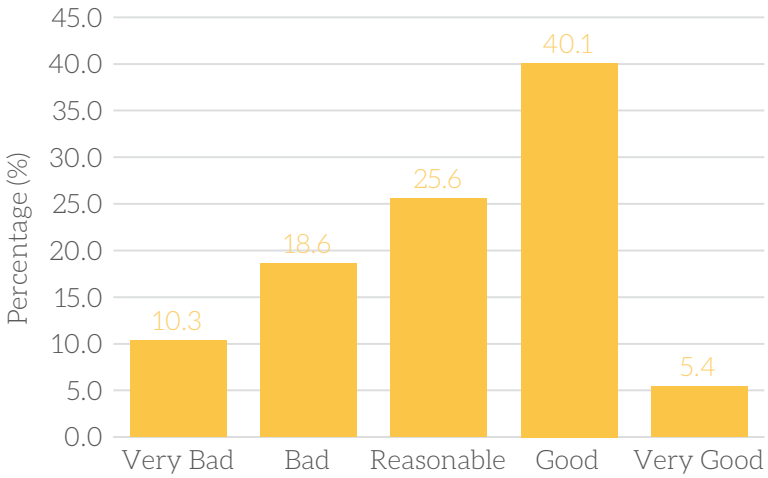

Figure 2 – Description of the subject's quality of sleep (N=387).

Association between cognitive state, psychopathological symptomatology and sleep

To assess whether the cognitive deficit and the understanding of sleep quality significantly affect the positive symptoms index, the depression index, the anxiety index and the number of sleep hours per night, tests were applied to obtain an average equality of two populations. The premises of the *Student's* parametric t-test, the normality of distributions and homoscedasticity, were respectively assessed using the Kolmogorov-Smirnov test with Lilliefors' correction and the Levene test.

With the Kolmogorov-Smirnov test, $p>0.05$ was obtained in the two groups referring to the cognitive deficit, except for the variables concerning the number of hours of sleep and the anxiety index in the group "with cognitive deficit", where $p=0.007$ and $p=0.001$ were respectively obtained. In the groups concerning the understanding of sleep quality, the authors reject the normality of distributions in the number of sleep hours and anxiety index variables among the group of individuals who assess the quality of their sleep as positive ($p=0.001$ in both cases). In these cases, as an alternative to the *Student's* t-test for average equality, an asymptotic result was used resulting from the Central Limit Theorem.

According to the Levene test's results, the premise of variable equality is not observed only for the total ACE-R variable among groups of individuals with and without cognitive deficit ($F=17.564$; $p<0.001$). In this situation, as an alternative to the *Student's* t-test for average equality, the Welch-Satterthwaite approximation was used.

It is observed that there is no difference between the elderly with and without cognitive deficit concerning the average number of sleep hours per night ($p=0.865$) and the subjects presenting cognitive deficit have higher averages in the positive symptom index (2.19± 0.46), in the depression index (1.19±0.83) and the ACE-R score (37.09±14.11).

The average sleep time of the elderly with a positive understanding of their sleep quality is higher than that of the elderly with a negative perception ($p<0.001$). The BSI's average depression, anxiety and positive symptom indexes are higher among the group of elderly that assess the quality of their sleep as negative ($p<0.001$ for all cases).

To assess the existence of association between the understanding of sleep quality (measured using only an ordinal scale) and the average number of sleep hours per night, the index of positive symptoms, the index of depression and the index of anxiety, the Spearman ordinal correlation test was used.

The authors observed a positive association between the average number of sleep hours per night and the understanding that subjects have of the quality of their sleep ($p<0.001$) as well as a negative association between the understanding of sleep quality and the positive symptom index, the anxiety index and the depression index. Therefore, a higher psychopathological symptomatology is associated with a more negative understanding of sleep quality.

DISCUSSION

The elderly people who participated in this study report an average of 6.31 hours of sleep per night. This information agrees with the Ohayon and Vecchierini study, which indicated an average of 7 hours of night time sleep among the studied population[13]. This result is also supported by studies indicating that ageing triggers a natural change process in the architecture of sleep, with a consequent decrease in the total sleep time[1,2].

The positive understanding that the majority of the study's elderly has of their sleep quality does not corroborate the literature indicating that sleep problems are a frequent grievance among the elder population[1,19]. Considering that the assessed population is institutionalized, a more negative understanding of sleep quality would be expected, given that according to current literature the elderly residing in nursing homes generally present a set of factors that contribute to an increase and/or worsening of sleep problems and a further reduced sleep quality. However, given the positive description of sleep quality by the assessed elderly, it should be considered whether these risk factors are minimized at the nursing homes where they reside. Another possible factor that may justify this positive understanding may be the fact that, as previously mentioned, the decrease in the number of sleep hours is a natural process of ageing[1,2]. Therefore, the elderly have not felt that their sleep has less quality just because they are sleeping an average of 6 hours per night.

On the other hand, Ohayon and his collaborators concluded that the cognitive deficit is associated with 6 of less hours of sleep per night[13]. Considering that the average number of sleep hours among the elderly included in this paper corresponds to the average number of hours mentioned in the study, there could be a relationship with the high prevalence of cognitive deficit in the sample. However, this study did now find differences between subjects with and without cognitive deficit.

Concerning the psychopathological symptomatology, this study's subjects with cognitive deficit present higher levels of depression. This information corroborates other studies stating that cognitive compromise is associated with depression among the elderly in a bidirectional relationship[20,21]. The high values obtained in this study's positive symptom index and depression index are an indicator of possible psychopathological symptomatology. However, the subjects' diagnoses do not mention the psychopathology framing expected by the BSI values. Therefore, the results raise the possibility that this type of symptomatology is not being assessed.

This study observed that the higher scores in the depression and anxiety dimension indexes are associated with a more negative understanding of sleep quality. These results corroborate the observations of Maglione et al. that depressive symptoms are associated with a negative self-understanding of sleep quality[9]. Following this idea, several studies mention that sleep problems are associated with and/or worsen depressive and anxious states[7,8,10].

As to the average number of sleep hours per night, the subjects who assess the quality of their sleep as negative sleep fewer hours, which agrees with the literature stating that there is no decrease in the daily sleep necessities among the elderly, despite the decrease in the ability to maintain a sufficient quality and quantity of sleep[1,3,7].

Concerning the understanding of sleep quality among the institutionalized elderly, a more negative understanding would be expected. The characteristics of the studied population are pointed out by literature as potentially disruptive of sleep, namely: a high prevalence of cognitive deficit, psychopathological symptomatology, multidrug administration and a combination of morbidities[1,7-11].

CONCLUSION

This paper highlights the relevance of sleep quality and its relationship with psychopathological symptomatology among institutionalized elderly people. This group presents several pathologies, comorbidities and a high consumption of pharmaceutical drugs and consequent drug interactions that may interfere with sleep quality.

The results alert to a high presence of cognitive deficit and emotional pathological symptoms among the subjects – institutionalized elderly people. The promotion of sleep quality presents itself as a way to improve the general and emotional state of this specific population.

As a limitation to this study, the authors highlight the fact that the collection of data was done based on the subjective assessment and the self-reporting by the elderly people. This prevented the collection of data related to the elderly with severe cognitive deficit and may raise questions as to the validity of the data collected related to the subjects with mild to moderate deficit. For future studies, the authors suggest the use of objective sleep assessment measures, such as polysomnography. Other limitations include the sample's specificity, for the fact that it is comprised of elderly people residing in nursing homes of a very specific area of Portugal, and the limitations inherent to the generalization of the results to the whole population of institutionalized elderly. Consequently, it will be possible to more adequately study the important relationship between sleep and cognitive function and psychological well-being in order to promote the quality of life of institutionalized elderly people.

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