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Sleep Disorders Related to Circadian Rhythm in People with Visual Impairment: Integrative Review

REVIEW

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Abstract

Objective: to analyze the scientific production on sleep disorders and circadian rhythmicity in blind people.

Method: Integrative review of articles published in Portuguese, English and Spanish on the basis of PUBMED, CINAHL, SCOPUS and LILACS electronic data, using the descriptors *"Sleep Disorders"* OR *"Sleep"*,*"Blindness"* OR *"Visually Impaired"*.

Results: 8 articles were selected.The circadian rhythm sleep disorders and clinical manifestations identified were categorized according to the International Classification of Sleep Disorders (ICSD-3) of 2014.

Discussion: It was verified the prevalence of sleep disorders in people with visual impairment, such as: increased latency of sleep, reduced sleep time, excessive daytime sleepiness and fragmented sleep.

Conclusion: Knowing sleep disorders and circadian rhythmicity of people with visual impairment is required for premeditation of care plans that safely regulate the sleep-wake cycle in these individuals.

Keywords
Sleep disorders; Sleep; Blindness; People with Visual Impairment.

Introduction

The main problem associated with blindness is the lack of vision. However, a secondary factor that may have a major impact on the health and well-being of people with visual impairment (PDV) is the disruption of their sleep-wake cycle [1].

Sleep, like all physiological functions, follows a rhythm called circadian, characterized in periods of 24 hours ± 4 hours. Environmental stimuli like light-dark cycles, temperature, and especially the presence of light, known collectively as "*zeitgebers*", can influence the circadian rhythms [2].

The absence of light stimulation of the biological clock results in loss of synchronization between the rhythm of 24-hour normal sleep and the light/dark cycle. When individuals are kept in constant darkness and temporal isolation, the biological clock reverts to its endogenous frequency with a rhythm of free course, which is usually greater than 24 hours [3].

Most PDV, at higher levels, show circadian rhythm disorders of sleep-wake cycle by the inability to perceive the presence of light to synchronize their circadian clock with the external day-night cycle [1,3].

The International Classification of Sleep Disorders (ICSD-3) attests to that fact, saying that more than half of totally blind individuals have non-standard 24-hour circadian rhythm and 50% to 80% of blind people present sleep disorder [4]. The situation worsens even more when we consider the difficulties of access to reference health services and, therefore, the delay in the diagnosis of disorders [4, 5].

In a postal survey of 29,815, where 10% of these subjects presented visual impairment, it was found that 95% of them had disorder of the sleep-wake cycle with interference in their daily activities [6]. As noted in another survey, conducted with 1,073 blind people, sleep patterns had changed, compared to non-blind people [7]. In a comparative study, among people with no light perception, 83% of them had at least one sleep problem, such as difficulty of sleeping, nighttime awakenings, decreased sleep duration and daytime sleepiness, compared with 57% in the control group [8].

On the basis of the above, the following guiding question emerged: What are the main circadian rhythm sleep disorders in visually impaired people?

With a view to contemplate such questioning, the proposal of this research was to synthesize the knowledge produced in the literature on sleep disorders in PDV.

Method

It is a study of integrative review (IR), related to sleep disorders affecting visually impaired people. The development of this review followed a methodological frame of reference, which proposes six steps for its development, namely: 1) elaboration of the guiding question, 2) search and sampling in the literature, 3) categorization, 4) critical analysis of included studies, 5) discussion of results, and 6) summary of the integrative review [9].

In this context, a revised protocol was previously prepared to guide the development of research and achievement in all six suggested steps. There were steps in the protocol: the issue of identification, purpose, selection of guiding question, sample selection for the study through the search strategy in the database using controlled descriptors, elaboration of criteria for inclusion and exclusion in the study, results categorization, evaluation of the studies included in the review and synthesis of knowledge.

The main question that supported the development of the research was: What are the main circadian rhythm sleep disorders in visually impaired people? For the selection of the sample of the study, a survey of texts was carried out in these electronic databases: PUBMED (National Library of Medicine and National Institutes of Health], CINAHL (Cumulative Index to Nursing and Allied Health Literature), SCOPUS and LILACS (Latin American and Caribbean Literature in Health Sciences) in April and May 2014, in which the indexed descriptors were used: *MeSH"sleep disorders"* (1st) OR *"sleep"* (2nd); *"blindness"* (3rd) OR *"visually impaired persons"* (4th).

These descriptors permitted four crossings [#], which were inserted respectively in all selected da-

tabase. They are: #1) *"sleep disorders" AND "blindness"*; #2) *"sleep disorders" AND "visually impaired persons"*; #3) *"sleep" AND "blindness"*; #4) *"sleep" AND "visually impaired persons"*.

Each database was accessed by two researchers, simultaneously, in separate computers without communication, in order to ensure the most accurate selection and the highest number of articles relevant to the search. Regarding the timeframe, all publications available in each database were collected until May 2014, without previous limit, by the intention to provide a wider catchment of articles relating the object of study.

The publication inclusion criteria in this integrative review were: complete original articles available free of charge in selected databases, discussing sleep disorders for PDV, available in English, Spanish or Portuguese. These exclusion criteria were applied: articles in the form of editorials, letters to the editor, expert opinion or revisions.

Results

During the research 551 articles were identified in four databases cited, through the crossings, of which: #1: 214 articles (SCOPUS=206; CINAHL=8; PUBMED=0; LILACS=0); #2: 8 articles (SCOPUS=6; CINAHL=0; PUBMED=2; LILACS=0); #3: 317 articles (SCOPUS=308; CINAHL=5; PUBMED=3; LILACS=1); #4: 12 articles (SCOPUS=12; CINAHL=0; PUBMED=0; LILACS=0).

Repeated articles were considered a single time. Upon completion of the initial data collection phase, and applying the inclusion and exclusion criteria, by reading each article, the sample consisted of eight articles.

In **Table 1**, 8 articles are presented, composing the final sample of this study. During the analysis of completely texts, a significant predominance of studies by choosing the research design of cross-sectional type was noticeable.

As for sleep disorders and their clinical manifestations, presented in the studies, there was a categorization according to the International Classification

Table 1. Characterization of the articles by article reference, methodological design and objectives.

ID	Article reference	Delineation	Objectives
A	Mindell JA, De Marco CM. Sleep problems of young blind children. J of Visual Imp&Blind. 1997 Jan-Feb; 91[1]:33-7.	Transversal	Investigate the habits and sleeping patterns of blind children.
B	Tabandeh H, Lockley SW, Buttery R, Skene DJ, Defrance R, Arendt J, Bird AC. Disturbance of Sleep in Blindness. Am J Ophthalmol. 1998 Nov; 126[5]:707–712.	Transversal	Determine the prevalence of sleep disorders in blind individuals and examine the relationship between the sleep disorder and the characteristics of visual loss
C	Leger D, Prevot E, Philip P, Yence C, Labaye N, Paillard M, Guilleminault C. Sleep disorders in children with blindness. Ann Neurol. 1999; 46[4]:648–651.	Transversal	Evaluate the frequency and type of sleep disorders in blind children
D	Leger D, Guilleminault C, Defrance R, Domont A, Paillard M. Prevalence of sleep/wake disorders in persons with blindness. Clinical Science. 1999 Aug; 97[2]:193–199.	Transversal	Evaluate the frequency and type of sleep disorders in blind individuals
E	Vervloed MPJ, Hoevenaars E, Maas A. Behavioral treatment of sleep problems in a child with a visual impairment. J Advanced Nursing. 2003 Dec;52[5]:546-553.	Case study	Describe the behavioral treatment of sleep problems in a child with visual impairment.

ID	Article reference	Delineation	Objectives
F	Das A, Sasmal NK, Deb RK, Bera NK, Sanyal D, Chatterjee SS, Bhaduri G. A Study of Sleeping Disorders in Blind Patients. J indiano Med Assoc. 2006 Nov; 104[11]:619-626.	Transversal	Evaluate sleep disorders in blind patients with no light perception.
G	Adeoti A. Disorders of the Sleep-Wake Cycle in Blindness. West African J of Med. 2010 May-June; 29[3]:163-168.	Transversal	To determine the prevalence, types and severity of sleep-wake disorders in blind people and their relationship to the degree and cause of blindness.
H	Warman GR, Pawley MD, Bolton C, Cheeseman JF, Fernando AT, Arendt J, Wirz-Justice A. Circadian-Related Sleep Disorders and Sleep Medication Use in the New Zealand Blind Population: An Observational Prevalence Survey. PLoS One. 2011 Jul; 6[7]:281-297.	Transversal	Determine the prevalence of self-reported sleep disorders with the use of medication for sleep and use of melatonin in blind population in New Zealand

of Sleep Disorders (ICSD-3) from 2014, which were classified in circadian rhythm disorder of two types: irregular sleep-wake rhythm and sleep-wake without 24-hour standard.

As noted, **Table 2** shows the types of sleep disorders and their categorization according to the International Classification of Sleep Disorders (ICSD-3).

Table 2. Circadian rhythm sleep disorders according to the ICDS-3 for PDV.

Type	Average	Median
Sleep-Wake Irregular Rhythm	Excessive Daytime sleepiness	5 Articles A, B, F, G, H
	Fragmented Sleep (Nocturnal awakenings	4 Articles A, B, D, G
	Non-restorative sleep (Sleep of bad quality	3 Articles B, C, D
	Insomnia	2 Articles F,H
Sleep-Wake without 24-hour pattern type	Increased Sleep Latency	6 Articles B, C, D, E, G, H
	Reduced sleeping time	6 Articles A, B, C, D, G, H
	Excessive Daytime sleepiness	5 Articles A, B, F, G, H
	Insomnia	2 Articles F, H

Discussion

According to ICSD-3, the circadian rhythm sleep disorders are changes of the maintenance time, mechanisms of haul or misalignment between the endogenous circadian rhythm and the external environment [4]. Of the selected articles for review, 87,5% [7 articles] used in their methodological design group of blind people with no light perception compared to control groups and/or groups of visually impaired people with light perception. The higher the degree of severity of visual impairment, the greater were sleep disorders, and the prevalence of sleep disorders was higher in blind people with no light perception compared to blind people with light perception and control (people without any visual impairment) [1, 5, 12, 13, 14, 16].

The results of this study show the prevalence of circadian rhythm sleep disorders for PDV, according to the data presented by the ICSD-3 which states the prevalence of such changes of 50% to 80% in these individuals [6].

Sleep latency increased, reduced sleep time and excessive daytime sleepiness were the most addressed sleep standard clinical manifestations, possibly because these are striking symptoms of the circadian cycle of sleep disorders. Therefore, the use of medicinal therapies for sleeping was the most common conduct, as an alternative to improving sleep pattern in the PDV [1, 13, 14].

After reading and searching data in the selected articles, changes of circadian rhythm sleep disorders for PDV were evident, of which two types of circadian rhythm sleep disorders are noteworthy: type 1 - Sleep- Wake Irregular Rhythm and type 2 - Sleep- Wake without 24-hour standard, which will be presented below [17].

Sleep-Wake Irregular Rhythm Type

This category presents clinical manifestations of sleep pattern that characterize the circadian rhythm sleep disorder of sleep-wake irregular rhythm type, according to ICDS-3 from 2014, which corresponds to the lack of a clearly defined circadian rhythm, whose sleep-wakefulness standard is desynchronized. Individuals may exhibit symptoms such as fragmented sleep, insomnia and excessive daytime sleepiness [4].

Four clinical manifestations were exposed in the selected articles: excessive daytime sleepiness, fragmented sleep [nocturnal awakenings], non-restorative sleep (bad quality of sleep) and insomnia [1, 2, 8, 11, 12].

The excessive daytime sleepiness and fragmented sleep were the most common clinical manifestations. It is worth mentioning that such findings corroborate with other studies that say that individuals with circadian rhythm disorder in sleep of irregular sleep-wake rhythm type feature, as main symptoms, fragmented sleep and excessive daytime sleepiness [3, 4, 14].

In this regard, it is noted that both the dysfunction of the central processes responsible for the generation of circadian rhythm, as well as decreasing exposure to external synchronizing agents, or *"zeitgebers"*, such as light, common for PDV, play a role in the development and maintenance of the irregular sleep-wake rhythm, in order to cause insomnia and impaired sleep quality, clinical manifestations presented in the articles [3, 13, 15].

Sleep-Wake without 24-hour pattern type

According to ICDS-3, the 24-hour sleep-wake disturbance type, or of free course, is defined by history of insomnia, increased sleep latency, excessive daytime drowsiness and sleep time decreased, related to abnormal synchronization between the 24-hour light-dark cycle and the endogenous circadian rhythm of sleep-wakefulness. It is characterized by symptoms of sleep that occur due to the greater length of the circadian timing system which features a period around 25 hours [4, 15].

Sleep latency increased [difficulty falling asleep within 30 minutes of being bedridden], along with reduced sleeping time [sleeping later and awakening earlier], were the most verified manifestations of clinical sleep pattern beyond excessive daytime sleepiness and insomnia [2, 3, 12]. Such events can be explained due to the desynchronization of the light-dark cycle for PDV, especially to those who do not have light perception by the absence of the light stimulus. The circadian cycle of blind individuals without light perception has only endogenous stimuli as reference, resulting in free running of the biological clock greater than 24 hours [6, 11, 13].

According to studies, it is clear that blind people, especially those whose light perception is absent, have sleep disorders characterized by a biological clock of free course, around 25.14 hours, reduced sleep time [less than five hours per night]; and sleep latency increased by 35 minutes later compared with other individuals with light perception [1, 10, 11].

Conclusion

The characterization of the major sleep disorders and their clinical manifestations in PDV is required for targeting care plans that govern, safely, the sleep-wake cycle in these individuals.

A high occurrence of circadian rhythm sleep disorders for PDV was verified, and that the greater the severity of blindness, such disorders are becoming increasingly prevalent, especially to those who

do not have light perception. The cyclical changes in the pattern of sleep and irregular sleep pattern are common changes in these individuals.

Such disturbances may create social, familiar and working problems, making it difficult for the person to maintain relationships and responsibilities, which contributes to the isolation of these individuals.

We see the need for the production of knowledge in this subject, which manages scientific evidence and subsidizes the best knowledge of care, with respect to sleep disorders in PDV, as well as studies that address safe therapeutic interventions for this population.

Thus, we suggest that further studies are conducted on the theme, especially studies that gsenerate strong evidence, in order to support clinical practice.

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