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THE INFLUENCE OF SLEEP DISORDERS ON CHILD DEVELOPMENT

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ABSTRACT: This study aimed to verify, in scientific publications, the influence of sleep disorders on child development. It is an integrative literature review, undertaken in December 2012 and March 2014 in the LILACS, Pubmed, CINAHL, Scopus and Cochrane databases, in the period of publication covering 2003 – March 2014, with the descriptors 'child development' and 'sleep disorders'. As the research sample, eight articles were selected from the SCOPUS database and three from PubMed. Two of these articles were indexed repeatedly in these two databases. As a result, the final sample had nine articles, published between 2007 and 2013; three are of the longitudinal type and six are literature reviews. The summary of the results indicates evidence of sleep disorders as possible influences on alterations in development, mainly, in the cognitive and behavioral aspects.
DESCRIPTORS: Sleep disorders; Nursing; Child; Child development.

A INFLUÊNCIA DOS DISTÚRBIOS DO SONO NO DESENVOLVIMENTO INFANTIL

RESUMO: Objetivou-se averiguar em publicações científicas a influência dos distúrbios do sono no desenvolvimento infantil. Revisão integrativa da literatura, realizada no mês de dezembro de 2012 e março de 2014 nas bases de dados: LILACS, Pubmed, CINAHL, Scopus e Cochrane, abrangendo o periodo de publicação de 2003 a março de 2014, com os descritores desenvolvimento infantil e distúrbios do sono. Como amostra da pesquisa, foram selecionados oito artigos constantes na base de dados SCOPUS e três na PubMed. Sendo dois desses artigos indexados repetidamente nas duas bases supracitadas. Dessa forma, resultou em uma amostra final de nove artigos publicados entre 2007 e 2013; três são do tipo longitudinal e seis são revisões de literatura. A síntese dos resultados aponta evidências do distúrbio de sono como possível influenciador em alterações no desenvolvimento, principalmente, no aspecto cognitivo e comportamental.
DESCRITORES: Transtornos do sono; Enfermagem; Criança; Desenvolvimento infantil.

LA INFLUENCIA DE LOS DISTURBIOS DEL SUEÑO EN EL DESARROLLO INFANTIL

RESUMEN: El propósito del estudio fue analizar la influencia de los disturbios del sueño en el desarrollo infantil en publicaciones científicas. Revisión integrativa de la literatura, realizada en diciembre de 2012 y marzo de 2014 en las bases de datos: LILACS, Pubmed, CINAHL, Scopus y Cochrane, abarcando el periodo de publicación de 2003 a marzo de 2014, con los descriptores desarrollo infantil y disturbios del sueño. Como muestra de la investigación, fueron seleccionados ocho artículos constantes en la base de datos SCOPUS y tres en la PubMed. Dos de eses artículos fueron indexados repetidamente en las dos bases mencionadas. De esa forma, la muestra final resultó en nueve artículos publicados entre 2007 y 2013; tres son del tipo longitudinal y seis son revisiones de literatura. La síntesis de los resultados apunta evidencias del disturbio de sueño como posible influenciador en alteraciones en el desarrollo, principalmente, en el aspecto cognitivo y de comportamiento.
DESCRIPTORES: Trastornos del sueño; Enfermería; Niño; Desarrollo infantil.

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INTRODUCTION

Sleep disorders result from problems related to sleep behavior in pediatric populations. They can be influenced, mainly, by social, cultural and family aspects, as well as by biological and psychological factors[1].

Due to the growing number of activities demanded by the child during the day, sleep disorders are becoming increasingly prevalent in the pediatric age range. Sleep deprivation can cause various pathologies, negatively affecting the child's feelings and motivation, creating cognitive changes such as a reduction of the level of alert, mood changes, such as irritability, and physiological changes, such as fatigue, among other symptoms[2-4].

The results of poor quality sleep can also include difficulties in concentrating, reduced response speed, loss of memory, concentration and performance, increase in the incidence of painful episodes, and reduced capacity for undertaking daily activities[5].

It is also noteworthy that sleep can be affected by the child's psycho-social context and, as a consequence of poor quality sleep, can influence neuromotor development (NMD). The bidirectional relationships between sleep and the child's psychosocial aspects constitute an important topic for professionals linked to child care. It is fundamental to identify factors which could facilitate the children's sleep, and which are sensitive to the impact of insufficient sleep on child development[6].

In the light of the potential psychological, emotional, social and organic problems that the child tends to develop if there are changes in the sleep/wake pattern, it is necessary to investigate possible signs in the behavior of the child which, if identified early, may prevent the establishment of the sleep disorders, through the work of the nurse, as the nurse is one of the professionals who undertake the attendance of the child and her family with the purpose of helping them in their basic human needs[7], which include the need for sleep and rest.

In the light of this, the aim was to check, in scientific publications, the influence of sleep disorders on child development.

METHOD

The integrative review is one of the research methods used in evidence-based practice which allows the incorporation of support in clinical practice. The review has the aim of bringing together and summarising the results of studies on a theme, following the steps: identification of the problem; elaboration of the guiding question; establishment of the descriptors and of the criteria for inclusion and exclusion of the articles; sampling; definition of the information to be extracted from the studies; analysis and discussion of the results; summary of the knowledge evidenced in the articles, and presentation of the review[8]. The above-mentioned stages were used in this study, as in other review study[9].

The guiding question to respond to the research object was: Can the presence of sleep disorders cause some influence on child development? Articles were included which were: available electronically in full; published in English, Spanish or Portuguese in the period of 2003 – march 2014; complete publications with abstracts available and indexed in the following databases – Cumulative Index of Nursing and Allied Health Literature (CINAHL), Cochrane, Scopus, PubMed, and Latin American and Caribbean Health Sciences Literature (LILACS). The following were excluded: Letters to the Editor, Editorials, Experience Reports and Reflection Articles. It is emphasized that the period of publication was established with the aim of broadening the time period of publications available.

The terminology consulted in the Health Science Descriptors (DeCS) was used: child development and sleep disorders. The bibliographic search took place in December 2012 and in March 2014, with three evaluators. Based on the combining of the descriptors, 153 articles were found in CINAHL, 10 in LILACS, 824 in PubMed, 351 in the Cochrane Library and 1,390 in Scopus.

The process of evaluation was undertaken initially through the reading of all of the titles. If the topic was found to be included, the abstract was read, followed by reading the article in full, which was undertaken where there were reports referent to sleep disorders and child development. As the research sample,

the researchers selected eight articles found in the SCOPUS database, and three in PubMed. Two of these articles were indexed repeatedly in the two databases mentioned above. As a result, the final sample contained nine articles.

As a strategy for analyzing the knowledge, it was decided to extract the evidence related to sleep disorders and child development in the studies' results. The methodological information was presented descriptively, followed by the summary and discussion of the results.

The studies were classified in relation to the level of evidence which they presented: level I – the evidence is from a systematic review of controlled randomized studies or from systematic reviews of randomized clinical trials; level II – evidence derived from individual or observational systematic randomized reviews; level III – evidence obtained from non-randomized controlled cohort or follow-up studies; level IV – evidence arising from well-defined case-control studies, case studies, and longitudinal studies; level V – evidence originating from descriptive studies[10].

RESULTS

Based on the collection of data, nine articles were selected. According to the type of study, three are of the longitudinal type, and the other six are literature reviews. According to the level of evidence, three are Level IV and six are Level V[10]. All were internationally distributed in English; of these, three were published in periodicals in the pediatric area, four in the field of sleep medicine, and two in the area of medicine; of these, one was directed at respiratory physiology and the other at deficiencies in development and in intellectual function, as observed in Table 1.

Table 1 - Distribution of selected articles by journal, year of publication, author, type of study, objectives and results. Fortaleza, CE, 2014.

Journal/year/ author	Title	Study type	Objectives	Results
Pediatric Respiratory Reviews (Fauroux B, 2007)	What's new in pediatric sleep?	Literature Review	To discuss the relationship between Sleep Respiratory Disorders, inflammation and cardiovascular risk.	Snoring disorders in children are associated with dysfunction of the autonomic nervous system and with cardiovascular risks in adulthood.
Journal of Pediatric Psychology (Scher A et al., 2008)	Sleep difficulties in infants at risk for developmental delays: a longitudinal study	Longitudinal	To compare the sleep of children with the risk of NMD delays with those who do not have it.	The sleep scores were similar between the groups of the same age; in the groups without motor risks and with low risk, the sleep difficulties reduced with age. The motor skills are not related to the regulation of the sleep.
Official Journal of the European Pediatric Neurology Society (Jan JE et al., 2010)	Long-term sleep disturbances in children: a cause of neuronal loss	Literature Review	To present evidence on the sleep disorders and the effects on the brain.	Chronic sleep disorders negatively affect neurological development.
Sleep Medicine Journal (Piteo AM et al., 2011a)	Snoring and cognitive development in infancy	Longitudinal	To examine cognitive development in children who developed snoring in the first month of life and at six months of age.	Male children, and those who breastfed for a few days, are most affected by snoring; those who snored had lower scores in relation to cognitive development.

Sleep Medicine Journal (Piteo AM et al., 2011b)	Parental-reported snoring from the first month of life and cognitive development at 12 months of age	Longitudinal	To evaluate the relationship between the snoring and the development of children in the first year of life.	Children who started snoring in the first days of life have lower scores in relation to cognitive development, at 12 months of age, than healthy children.
Intellectual and Developmental Disabilities (Bonuck, Grant, 2012)	Sleep problems and early developmental delay: implications for early intervention programs	Literature Review	To review the evidence of the impact of sleep problems on children, with a view to early intervention.	Respiratory sleep disorders predispose to the risk of low school performance, behavioral impairment disorders, and disorders of difficulty in regulating emotion.
Sleep (Turnbull, Reid, Morton, 2013)	Behavioral sleep problems and their potential impact on developing executive function in children	Literature Review	To review the development of sleep and executive functions in childhood.	Sleep problems are most common in early childhood; the executive functions may be vulnerable to sleep problems, suggesting low self-regulation in the context of poor sleep and in the ability to carry out the executive functions.
Hippokratia (Urquhart, 2013)	Investigation and management of childhood sleep apnea	Literature Review	To describe the etiology, presentation and sequelae of obstructive sleep apnea syndrome.	Obstructive sleep apnea syndrome is associated with the anatomy of the airways; the effect on child development is negatively associated with cognitive and behavioral performance, lack of attention and hyperactivity.
Respiratory Physiology & Neurobiology (Muzumdar, Arens, 2013)	Physiological effects of obstructive sleep apnea syndrome in childhood	Literature Review	To discuss the origin of obstructive sleep apnea syndrome and its effects on the organs.	Obstructive sleep apnea may be related in childhood to high nasal resistance, as well as to craniofacial and soft tissue abnormalities; the physiological effects are neurobehavioral, cognitive, cardiovascular, and to do with the autonomic nervous system, inflammation and endothelial function.

According to the results, the following findings stand out, relating to the influence of sleep on child development. In a study undertaken with 142 children in Canada, the parents' perceptions relating to the sleep standards and habits of their babies were compared, using an adapted questionnaire, based on the Infant Sleep Questionnaire (ISQ), termed the Sleep-Q. This questionnaire presented different developmental risk indicators obtained through the Harris Infant Neuromotor Test (HINT), at four – six months and 10 – 12 months, and evidenced that the children with progress in the developmental milestones presented greater sleep difficulties[11]. Thus, the children who presented a high risk of delays and neuromotor impairments did not obtain scores which were very different from those children with low risk.

Of the nine articles identified, two were produced in the south of Australia, the first of which presented partial results, while the second showed the complete results of a longitudinal study[12-13].

In relation to the first study, in a control group of 88 children who never snored up to the age of six months, and of 16 who started snoring at birth through to 6 months, the Bayley Scales of Toddler Development Edition III were used, which provide estimates of four developmental domains (cognitive, language, motor and socio-emotional abilities) in conjunction with the parents in two periods, the first being from 0 – 3 months old, and the other at six months, during home visits. It was observed that among the children who snored, the majority were male and were breastfed for a shorter period. These also showed lower scores in relation to cognitive development, more disturbed sleep and a lower total duration of sleep during the night. As a result, the snoring, frequently, was associated with low developmental and cognitive scores, while the children who sleep more during the night and who had fewer nightwakings have higher scores for socio-emotional development[12].

In relation to the study's final results, the final sample was of 78 children in the control group and 13 in the group who presented snoring disorders. The children excluded from the groups were, respectively, due to losses (n=4) and to the starting of snoring (n=6) in the control group and, in relation to those who presented the disorder, related to the lack of frequency of snoring which began to become constant (n=3). The children's parents were interviewed a third time, in which the same scales as the first study were used, when the children were 12 months old. This again proved that children with snoring disorders in the first months of life have lower cognitive development scores than the control group. It is worth noting that of the sample of 13 children who snored, the prevalence (n=10) continued to be for boys, who had a lower socio-economic status and a shorter duration of breastfeeding[13].

A review undertaken in Canada, through studies on electrophysiology, structural and functional anatomy, genetics and biochemistry, indicated that the occurrence of chronic sleep disorders can impair full cerebral development, showing that the younger the children were when they presented chronic sleep disorders, the more these are deprived of full structural and functional development of the brain, due to the lack of neural stimulation, that occurs mainly during the period of sleep[14].

Another review, undertaken in France, which sought to discuss the results of polysomnographic characteristics, showed that the sleep respiratory disorders, as well as being related to the activation of the inflammatory system – specifically of leukotrienes - were also interlinked with dysfunction in the child's autonomic nervous system. In addition to this, it also evidenced susceptibility to vascular risks in adulthood[15]. The sleep disorders are more common in early childhood and the sleep problems can influence the performance of the child's executive functions, that is, the ability to self-regulate skills[16].

Sleep apnea related to the anatomy of the airways is a disorder commonly related in the literature. One review study undertaken in the United Kingdom showed that this disorder leads to changes in the child's development in aspects related to cognition and hyperactivity, as well as predisposing them to cardiovascular problems in adulthood. The study also showed that the main diagnostic tests are polysomnography, limited channel polysomnography and oximetry[17].

A review undertaken in the United States showed that children's predisposition for obstructive respiratory sleep disorders may be related to high nasal resistance, rigidity of certain soft tissues, and the size of the adenoids and soft palate. The presence of any of these problems

can directly influence the neurobehavioral and neurocognitive functions, as well as behaviour and attention, mood and sleep, and risks to the cardiovascular system, such as hypertension and cardiac dysfunction, as well as changes in the autonomic nervous system, inflammatory dysfunctions and the endothelial function[18].

In the review undertaken in Canada, it was possible to identify that the sleep disorders can occur at any age, but that they affect children more seriously, due to the brain being in constant development at this stage, causing greater generalized deterioration of the neuronal functions, memory and learning. Interventions are necessary in order to avoid sleep problems in children, principally relating to difficulties in initiating and maintaining sleep, with a view to preventing developmental problems and comorbidities[19].

DISCUSSION

The results of the articles selected are little conclusive regarding the influence of sleep disorders on child development. However, they indicate that factors related to an inadequate sleep/wake pattern can influence cognitive functioning, as well as the structural and functional development of the brain, principally when they occur during critical periods of child development, evidenced by the increase in difficulty in learning, memorizing, creativity, attention, and in the cognitive and motor functions.

In the United Kingdom, one longitudinal study showed, through the analysis of questionnaires administered to the parents of 13,467 children, that the presence of sleep respiratory disorders and sleep behavioral problems affects the cognitive, behavioral and language functions[20].

One investigation with 212 preschool age children indicated that the children who snored and had fragmented sleep had lower scores for language, cognitive, social and daily life skills, and lower general development in relation to the children in the control group. However, no significant correlation was found between sleep duration and the results of the development tests using the Ankara Developmental Screening Inventory (ADSI) and Peabody Picture Vocabulary Test (PBT) instruments[21].

Besides alterations in mental development, the respiratory sleep disorders were associated with behavioral difficulties, with 40% and 60% in children aged four and seven years old, respectively, in a follow-up survey of combined symptoms lasting six months to 69 months, in over 11,000 children[22].

Neuroimaging studies on the metabolism and cerebral activation following sleep deprivation have shown associations between sleep and the regulation of emotion, given that participants deprived of sleep for 35 hours show a greater response from the amygdala to negative emotional stimuli, when compared with a group which has not been deprived of sleep. It was also observed that the participants who were deprived of sleep presented weaker functional connectivity between the amygdala and the medial prefrontal cortex, suggesting a lower capacity for moderating emotional responses[23].

Remaining on this subject, there is much to be investigated regarding any and all underlying physiological mechanisms, which may associate sleep disorders with their impact on behavioral, social and emotional development[24]. However, in a study undertaken in Canada, with 27 healthy children aged between 12 – 36 months old, measurements of higher levels of cortisol were associated with fragmented sleep, as well as with emotionally negative and introspective behavior[25].

In relation to snoring and sex, in one study undertaken in São Paulo investigating the clinical profile of children aged between one and 12 years old with indication for the surgical removal of palatine tonsils resulting, mainly, from obstructive sleep apnea syndrome, a slight male predominance was perceived in the age range 0 to 8 years old recommended for surgery due to snoring, which is inverted among 10 to 12-year-olds[26].

It seems to be the case that children with symptoms of habitual snoring or apnea have an increased risk of daytime sleep and changes in learning and behavior, which can cause poor school performance[27]. This corroborates a study undertaken with 40 blind children in São Paulo, in which a greater prevalence of excessive daytime sleepiness was observed, occurring in 39% of the children between two and six years of age[28].

CONCLUSION

In the nine studies selected, evidence was ascertained, indicating the presence of sleep disorder as a possible influence in the changes in development, mainly in the cognitive and behavioral aspects. The data showed that respiratory sleep disorder, which was mentioned most in the studies, is one of the main causative factors of cognitive changes in the child, hindering the undertaking of activities of daily living, including in school and in coexistence with parents and family members.

Among the respiratory sleep disorders, snoring was identified as the main cause of inadequate sleep and increases in the frequency of nightwakings, and consequently affects mental development related to the child's cognitive, emotional and social aspects. However, evidence was not found for the influence of sleep disorders on motor development.

It was observed that the quantity of publications on the issue of sleep disorders and child development remains scarce and with a low level of evidence. However, it is highlighted that the search for publications available free of charge was one of the limitations on acquiring further studies on this issue.

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