

Quality of sleep and quality of life in adolescents infected with human immunodeficiency virus

Qualidade do sono e qualidade de vida em adolescentes infectados pelo vírus da imunodeficiência humana

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ABSTRACT

Objectives: To assess sleep characteristics of adolescents infected by HIV, and to ascertain whether psychosocial aspects are associated to the quality of sleep. **Methods:** A cross-sectional study assessing 102 HIV-infected adolescents of both genders, aged between 10 and 20 years-old and 120 Controls. Data collection was performed by applying the Sleep Disturbance Scale for Children, the Epworth Sleepiness Scale, and the Pediatric Quality of Life Inventory. **Results:** A sleep disturbance prevalence of 77.4% was found in patients, and a 75% prevalence in controls, and there was correlation between quality of sleep and of life. HIV-infected adolescents scored higher for sleep breathing disorders and had higher prevalence of excessive daytime sleepiness. **Conclusions:** HIV-infected adolescents had similar quality of sleep compared to healthy adolescents. This may be explained by the steady improvements in daily living as a result of successful anti-retroviral therapy, and by the vulnerability that affects Brazilian adolescents living in major urban centers.

Key words: sleep, adolescents, HIV, quality of life, highly active anti-retroviral therapy.

RESUMO

Objetivos: Avaliar as características do sono de adolescentes infectados pelo HIV e estudar se os aspectos psicossociais estão associados à qualidade do sono. **Métodos:** Estudo transversal, que avaliou 102 adolescentes, com idades entre 10 e 20 anos, infectados pelo HIV, e 120 controles, de ambos os gêneros. Para a coleta de dados, aplicaram-se: a *Sleep Disturbance Scale for Children*, a *Epworth Sleepiness Scale*, e o *Pediatric Quality of Life Inventory*. **Resultados:** Verificou-se prevalência de distúrbios do sono em 77,4% dos pacientes e em 75% nos controles, e houve correlação entre qualidade do sono e de vida. Adolescentes HIV-positivos apresentaram maior pontuação nos distúrbios respiratórios do sono e maior prevalência de sonolência diurna excessiva. **Conclusões:** Adolescentes infectados pelo HIV apresentaram qualidade de sono semelhante à da população saudável. Isso provavelmente decorre pela melhora de suas condições de vida resultante do sucesso da terapia antirretroviral em pacientes HIV-positivos e pelas vulnerabilidades que afetam adolescentes brasileiros de grandes centros urbanos.

Palavras-Chave: sono, adolescentes, HIV, qualidade de vida, terapia antirretroviral de alta atividade.

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Sleep is a basic biological process, which is essential for healthy growth and development from intrauterine life. Sleep exhibits bidirectional interaction with the nervous, cardiovascular, respiratory, endocrine, and immune systems. Poor sleep quality is associated with higher risk for cognitive disturbances, low academic performance, behavioral disorders, accidents, as well as chronic conditions such as obesity¹. During adolescence, a phase characterized by marked physiological transformation such as puberty, and sociocultural changes such as forming of individuality, the physiology of sleep has specific features. It is generally accepted that the majority of adolescents need at least nine hours of sleep per day, although there is not a consensus about the definition of sleep needs^{1,2}. The main physiologic mechanism explaining this characteristic is a lag in phases, which is characterized by a delay in the sleep-wake cycle, marked by later sleeping and wake-up times¹. However, a significant proportion of adolescents has sleep disturbances, mainly caused by insufficient sleeping time, social interaction needs, inadequate school schedules, poor living conditions, and chronic diseases³⁻⁵.

Acquired immunodeficiency syndrome (Aids), caused by the human immunodeficiency virus (HIV), has represented a major challenge for global health over the past 30 years. Data from the Joint United Nations Programme on HIV/Aids (UNAIDS) reveals a high prevalence of HIV infection cases in the global population, with an estimation of 33 million people currently living with HIV/Aids. Of this group, 2.5 million comprise children under the age of 15⁶. In Brazil, 590,000 new cases of Aids were identified between 1980 and 2010, 30,000 involving individuals between 0 and 20 years-old⁷. Initially characterized as a high lethality disease, Aids became reclassified as a chronic one after the advent of highly active anti-retroviral therapy (HAART) 15 years ago, and sustainability of the treatment became the most critical issue concerning the disease. Health-related issues became focus of attention including quality of sleep, as well as psychosocial aspects such as quality of life. This pattern can be seen both in the international milieu as well as in the context of Pediatric Aids in Brazil^{8,9}.

In the specialized literature, only one study is available on this theme, it concerned about investigating sleep disturbance in a small population of children and adolescents with HIV infection, published during the pre-HAART era¹⁰, which was a time of greater morbidity and lethality of the disease. The transition for a chronic disease setting highlights the need for researching psychosocial issues, more related to integral aspects of adolescent health. The only systematic review available in the literature, although based only on adult studies, also stresses the importance of studying the relationship between HIV infection, social functioning, and quality of life¹¹. The importance of the relationship between quality of sleep and social and cultural issues has been demonstrated in recent reports

from Brazilian adolescents^{12,13}. Based on these assumptions, we hypothesized that the quality of sleep of HIV-infected Brazilian adolescents probably bears an association with social and cultural issues, specifically the quality of life, which can be measured by validated instruments¹⁴. The knowledge resulting from this approach may serve to guide interventions and may help to improve the well-being of this patient group. The aim of the present study was to assess the quality of sleep of HIV-infected adolescents compared to a healthy population and to analyze the association between sleep quality and the broad psychosocial variable of quality of life.

METHODS

Study model and setting

An analytical, observation-based study with a cross sectional design was carried out. The patient group comprised adolescents undergoing clinical treatment at the Pediatric Immunodeficiency Service of the Clínicas Hospital of the School of Medical Sciences of the State University of Campinas (HC-FCM–Unicamp), which is situated in Campinas – São Paulo State, interviewed from January, 2010, and March, 2011. The Control Group comprised students from the Moacyr Santos de Campos State School in Campinas, São Paulo state, who were interviewed between October and December, in 2010.

All patients older than 10 years of age, with clinically-confirmed diagnosis of HIV infection, according to criteria of the Brazilian Ministry of Health¹⁵, were included in the study. To be eligible for inclusion, patients had to be in regular follow-up (at least two visits per year), caregivers had to agree to their participation in the study, and they should have signed the free and informed consent term. The sole exclusion criterion for both patient and Control Groups was refusal to be interviewed after initial consent.

Of the 109 patients who met the inclusion criteria, 102 took part in the study, where seven individuals refused to participate. The Control Group comprised a random sample of 120 presumably healthy adolescents, who were students at the State School of the municipality of Campinas (São Paulo State), and whose parents/caregivers had agreed to their participation and signed the free and informed consent term. The study population comprised 649 pupils from the 6th to 12th years, and consisted of 341 girls and 308 boys, attending school during morning or afternoon periods.

All data collection was carried out by the main author. Given the low schooling of some of the participants, all the scales were administered to both adolescents and their caregivers by the interviewer, in order to avoid any problems in comprehending the instruments. The same procedure was adopted for the Control Group, with the exception of the

interview script, which was filled out and signed by the parents of the students without the presence of the researcher.

All participants answered the instruments in individual interviews lasting around 20 minutes each, conducted in closed rooms.

Data collection instruments

The data collection instruments used were: the Sleep Disturbance Scale for Children (SDSC)¹⁶, the Epworth Sleepiness Scale (ESS)¹⁷, and the Pediatric Quality of Life Inventory (PedsQL™ 4.0)¹⁴. They have recently been validated for use in Brazil¹⁸⁻²⁰.

The SDSC is a standardized, reliable instrument, used internationally for assessing the child and adolescent population. It consists of 26 questions on sleep-related behavior of children aged between 3 and 18 years. Total scores on the SDSC range from 26 to 130 points, distributed in modules: Difficulty in Initiating and Maintaining Sleep (DIMS), Sleep Breathing Disorders (SBD), Disorders of Arousal (DA), Sleep-Wake Transition Disorders (SWTD), Disorders of Excessive Somnolence (DOES), and Sleep Hyperhydrosis (SHY). Scores on the scale are inversely proportional to the quality of sleep. Adolescents who attained total score of SDSC higher than 39 were classified as having sleep disturbances. This cut-off value was chosen due to the good diagnostic accuracy demonstrated in the original Italian validation study, and due to the lack of a similar cut-off value in the Brazilian population¹⁶.

The ESS is the most widely used instrument internationally for evaluating daytime sleepiness. It consists of eight items, which describe everyday situations that can lead to sleepiness. Each item is scored on a scale of zero to three points and scores greater than ten points indicate daytime sleepiness.

The PedsQL™ is a modular instrument designed for measuring or assessing quality of life in children and adolescents aged from 2 to 18 years. It was devised to assess quality of life by rating physical, mental, social, educational, and

psychosocial performance, as well as overall quality of life. The PedsQL score ranges from 0 to 100 points, and it is directly proportional to quality of life. Given the age group of the studied population, the child report version (8 to 12 years-old) and the adolescent one (13 to 18 years-old) were used in the present investigation.

Sociodemographic data were collected using a structured interview script.

This study was approved by the Research Ethics Committee of FCM from the Unicamp (report 633/2008).

Statistical analysis

Results obtained in the interviews were tabulated and analyzed using the Statistical Package for Social Sciences, version 16.0 (SPSS Inc., Chicago, IL, USA).

Statistical analyses were performed using the Mann-Whitney tests for associations between two continuous variables and for independent variables, Spearman's correlation coefficient (r_s) for associations between two continuous variables, and the χ^2 test for association between two categories. Associations with a probability of less than or equal to 5% ($p \leq 0.05$) were considered significant.

RESULTS

General characteristics of the study population

The main demographic and social characteristics of the study population (patients and controls) are shown in Table 1. Subjects in the Control Group were predominantly female ($p=0.005$).

Assessment of quality of sleep by the SDSC scale

Adopting a cut-off score of 39 for total SDSC score, 79 (77.4%) patients and 90 (75%) controls presented sleep disturbances. No statistically significant differences were observed between Patient and Control Groups ($p=0.67$). Given

Table 1. Distribution of demographic and social characteristics of patients and controls.

Characteristic	HIV (102)	Control (120)	p-value
Sex* (n%, %)	59 M (57.8%) – 43 F (42.2%)	47 M (39.2%) – 73 F (60.8%)	0.005 [#]
Age (years) [§]	14.59 (10.74–20.97)	14.58 (10.94–19.03)	0.78 [£]
Schooling (years) [§]	8 (1–13)	8.5 (6–12)	0.08 [£]
Monthly family income (dollars) [§]	777.78 (111.11–5000)	666.67 (277.78–3888.89)	0.082 [£]
Dwellers at domicile [§]	4 (2–18)	4 (2–14)	0.12 [£]
Own house (n%, %)	67 (69.1%) Yes – 30 (44.8%) No	Not applied	
Social benefits (n%, %)	65 (66.3%) Yes – 33 (33.7%) No	Not applied	
Caregiver relationship (n%, %)	52 (50.1%) blood relative 50 (49.0%) not blood relative	Not applied	
Age of caregiver, years [§]	42.89 (15.13–85.14)	Not applied	
Employment status of caregiver (n%, %)	49 (53.3%) working 43(46.7%) not working	Not applied	

* M: male; F: female; #: χ^2 test; £: Mann-Whitney test.

the high prevalence of sleep disturbances in the group of presumed healthy controls, sleep quality scores were analyzed using only their continuous distribution.

Results of the analysis of the differences between patients and controls in SDSC scores are provided in Table 2. The Patient Group had higher scores on “sleep breathing disorders” ($p=0.05$), but lower ones on the “disorders of arousal” category ($p=0.03$). No significant differences in total SDSC score was found between the two groups ($p=0.83$).

In the Patient Group, 65.7% of the subjects slept for eight hours or longer *versus* 55% ($p=0.38$) in the Control Group. Sleep latency time was less than 30 minutes in 90.2% of patients and in 88.3% of controls ($p=0.78$).

Assessment of daytime sleepiness by Epworth scale

Higher scores on the ESS were detected among the Patient Group, suggesting excessive daytime sleepiness, with median and extremes of 6 (0–17) *versus* 5 (0–14), a difference which reached statistical significance ($p=0.02$). In the Patient Group, 13.7% of adolescents had daytime sleepiness *versus* 5.8% of control subjects ($p=0.04$). A statistically significant correlation between total SDSC and Epworth scores was detected in both groups ($r_s=0.28$, $p=0.02$ in patients; $r_s=0.25$, $p=0.01$ in controls).

Table 2. Distribution of variables from the SDSC scale for patients and controls.

Characteristic	HIV (102)	Control (120)	p-value
	Median (extremes)	Median (extremes)	
DIMS	12 (7–25)	12 (7–28)	0.10*
SBD	3 (3–15)	3 (3–11)	0.05*
DA	3 (3–8)	4 (3–9)	0.03*
SWTD	10 (6–18)	10 (2–18)	0.85*
DOES	11 (5–25)	10 (5–21)	0.83*
SHY	2 (2–10)	2 (2–10)	0.66*
Total	45 (29–73)	45 (27–76)	0.83*

SDSC: sleep disturbance scale for children; DIMS: difficulty in initiating and maintaining sleep; SBD: Sleep breathing disorders; DA: disorders of arousal; SWTD: sleep-wake transition disorders; DOES: disorders of excessive somnolence; SHY: sleep hyperhidrosis; *: Mann-Whitney’s test.

Table 3. Correlation between PedsQL™ 4.0 and Total SDSC scores in patient and control groups.

PedsQL Domains	HIV+ Group		Control Group	
	Total SDSC	p-value	Total SDSC	p-value
Physical	-0.33	0.001	-0.30	0.001
Emotional	-0.40	<0.001	-0.35	<0.001
Social	-0.40	<0.01	-0.16	0.087
School	-0.31	0.002	-0.25	0.005
Total	-0.46	<0.001	-0.37	<0.001

*: Spearman’s Correlation Coefficient (r_s); PedsQL: Pediatric Quality of Life Inventory; SDSC: sleep disturbance scale for children.

Assessment of association between quality of sleep and quality of life

Results of the analysis of correlation between SDSC and PedsQL™ 4.0 scores are summarized in Table 3. An overall inverse correlation was found between total SDSC scores and those on all domains of the PedsQL™ 4.0.

DISCUSSION

The results of this study revealed no difference in total sleep quality score or prevalence of sleep disturbance between HIV-infected and healthy adolescents. However, higher scores on the breathing module and lower scores on the disorders of arousal module were observed in the HIV-positive Group. To our knowledge, this study was the first in the literature to investigate the triad of sleep quality, quality of life and HIV infection, in an adolescent population.

Our data differ to those reported by the only study specifically assessing sleep disturbances in HIV-infected children. In the cited article, infected patients were found to have shorter sleep time and greater prevalence of sleep difficulties, nighttime awakening, and nightmares compared to normal controls¹⁰. The report in question employed different methods and included only 18 patients. In addition, since the study was published more than 11 years ago, it reports on the pre-HAART era. These characteristics hinder any comparisons with the present study.

In this study, the HIV-infected Group had significantly higher scores on the sleep disorders module of the SDSC. The majority of studies using the SDSC scale have identified an association between sleep breathing disorders and pathological conditions, a finding replicated in our HIV-infected population. In a study involving Brazilian children, a prevalence of sleep breathing disorders of 55% was found in a population seen at a clinical laboratory of a public pediatric hospital²¹. This prevalence was considered high compared to the international literature, a finding speculatively attributed by the authors to respiratory diseases secondary to environmental factors. In a study conducted in Italy, obese children and adolescents had a higher prevalence of sleep-disordered breathing and scores, which directly correlated with waist circumference²². In our population of HIV-infected adolescents, the prevalence of chronic respiratory symptoms, such as obstruction of the upper air ways or cough, were below 10% (data not shown). However, a study assessing the body composition in this Patient Group also found greater non-obesity-related waist circumference compared to healthy adolescents²³. The mechanism proposed to explain the presence of these symptoms was abnormalities in body fat distribution, whereby accumulated visceral fat can lead to diaphragm compression with additional effects on the chest and abdominal wall²².

HIV-infected adolescents had higher prevalence of daytime sleepiness of 13.7% on the Epworth scale. Our results contrast with those of the only study on sleep disturbances in children with HIV, which, using parental reports and not a standardized scale, described the occurrence of daytime napping in 39% of the patients studied *versus* 13% in the Control Group, although this was not a statistically significant difference¹⁰. It is noteworthy, as stated above, that the design of this study is significantly different from ours, hampering further comparisons. The greater prevalence of daytime sleepiness in the Infected Group could be associated with a significantly higher score on the sleep breathing disorder component of the SDSC scale seen in the same group. Other pediatric studies, employing a modified version of the ESS for children, have reported similar findings, emphasizing the importance of the association between sleep breathing disturbances and daytime sleepiness^{24,25}.

Results of the present analysis of the association between sleep quality measured by the SDSC scale, and quality of life on the PedsQL scale, revealed a direct association between quality of sleep and quality of life in the HIV-infected Group. This association has been described in earlier international studies for a range of different clinical conditions, in which researchers had also applied the PedsQL scale. In a study performed in Holland, the authors reported that impaired sleep was a factor associated with lower quality of life scores in children with leukemia²⁶. A study analyzing the quality of sleep in adolescents undergoing anti-neoplastic chemotherapy observed significantly lower quality of life scores in this population among those groups that presented fatigue and sleep-wake disturbances²⁷. Employing different scales for assessing quality of life, this variable showed an association with sleep breathing disturbances in other clinical conditions, such as obesity and depression^{28,29}.

Our results also showed an association between quality of life and of sleep in the Control Group of presumably healthy subjects. No studies were found in the literature assessing the relationship among these variables in normal populations. It should be noted that the Control Group had a high prevalence of sleep disturbances (75%) compared to rates reported in international studies using the SDSC. Bruni et al., in an article presenting and validating the SDSC scale, reported sleep disturbances of 25% in healthy Italian children¹⁶ whereas a lower prevalence of 4.3% was reported for normal children in Malasia³⁰. Given the striking differences between cut-off levels for normality in different populations, we decided to adopt the criterion proposed by Bruni et al.¹⁶, because it was generated in a large (1,157 subjects) random sample of schoolchildren from socially diversified backgrounds. Ong et al.³⁰, in their work with Malayan children, used total SDSC scores from 92 siblings of epilepsy patients, a kind of sampling that does not represent the general population. Our

Control Group, which comes from a random sample of adolescents attending a public school, is comparable to the HIV-infected teenagers. However, both groups show low median *per capita* family incomes, suggesting high social vulnerability. In our evaluation, there is still the need to characterize normal SDSC cut-off rates from a representative sample of healthy Brazilian adolescents, comprehending a more diversified social background.

In an attempt to understand the similarity between both groups seen in the present study, we speculate that two main mechanisms are at play. HIV-infected adolescents have shown steady improvement in their conditions of life, as a result of progress made in anti-retroviral treatment. Such improvements have changed the course of Aids, from a fatal disease to chronic, controllable illness⁹. As to Brazil, the role of free universal access to treatment and integral care is noteworthy, including instruments of social support⁹. With regard to healthy adolescents, a number of recent studies carried out in Brazil have shown high prevalence of sleep disturbances in children and adolescents, associated with both clinical aspects and lifestyle, such as poor sleep hygiene and sleep deprivation^{12,13,21}. Additionally, the adolescents in the Control Group, drawn from users of public schools in large urban centers, had very similar social indicators to those infected by HIV, which could reflect comparable living conditions.

The present study had some limitations. A statistically significant predominance of females was evident in the Control Group, despite the random selection criteria used for sample selection. This difference may be explained by the predominance of females in the control population. However, no statistically significant difference between sex and sleep quality was detected. The main limitation of this study was the difficulty in defining a cut-off score for determining the prevalence of sleep disturbances. The extrapolation of the international parameter identified in middle-class Italian children results in fragilities inherent to the differences in social, economic, and cultural context of the populations¹⁶. However, this limitation was believed to be attenuated by comparison of the SDSC scores based on continuous values. We also consider that the using a Control Group with a similar social background to the population of adolescents living with HIV/AIDS enabled the role of the disease to be more accurately elucidated.

Based on these results, we have concluded that the sleep quality of Brazilian adolescents from a large urban center, whether healthy or infected by HIV, evidenced significant sleep deficits, problems which were directly related to quality of life indicators. This finding can contribute to future studies focusing on educational and environmental interventions, aiming at providing adolescents with better quality sleep, resulting in significant gains in both health and well-being.

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