Short Sleep Duration and Correlates among Sero-positive HIV Patients in Nigeria, West Africa

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Authors’ contributions

This work was carried out in collaboration between all authors. Author ROS designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors LOO and SIL managed the literature searches. Author SAA analyzed of the study. Authors AGS and BSO wrote the discussion. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2015/19630

Editor(s):
(1) Mohammed Rachidi, Molecular Genetics of Human Diseases, French Polynesia, University Paris 7 Denis Diderot, Paris, France.
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Complete Peer review History: http://sciencedomain.org/review-history/10669

Received 20th June 2015
Accepted 24th July 2015
Published 24th August 2015

ABSTRACT

Introduction: Short sleep duration is a salient issue because it is a major public health concern and has more wide-reaching problems among HIV/AIDS patients. Short sleep duration was said to be associated with lower CD4 count, higher viral load values, depression, high blood pressure, high body mass index and disease progression. It was also documented that patients receiving

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efavirenz had shorter duration of deep sleep. Incidentally there is paucity of data in Nigeria to support these claims hence the need to investigate.

**Methods:** Four hundred HIV zero-positive patients were recruited at the HIV clinic of Kwara State Specialist Hospital, Sobi, Ilorin, after institutional ethical approval and informed consent was obtained. Blood pressure was measured. Classification of hypertension was made according to the seventh report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of high blood pressure (JNC-7). Body Mass Index was calculated as (kg/m$^2$). The Patient Health Questionnaire (PHQ-9) was administered to the respondents to screen for depressive symptoms. The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep duration. The respondents were categorized into four groups viz, sleeping more than 7 hours, 6-7 hours, 5-6 hours and less than 5 hours. Subjects with <5hrs are poor sleepers while those with >7hrs were good sleepers.

**Results:** Four hundred HIV-infected patients were recruited with a mean age of 39yrs (SD 9). Eighty four (21%) were male, while 316 (79%) were female. The mean body mass index was 22.0 (SD 4.6), mean present CD4 count was 339.0 (SD 180.6). One hundred and eighty three respondents (45.8%) slept less than 5 hours, while 58 (14.5%) sleep more than 7hours. Short sleep was commoner in the age group 31-40 73(39.9%), among the female 145(79.2%) and those that were married 103(56.7%), and those with non-formal education 84(45.9%). Traders 80(43.7%) had highest number than other occupation. Short sleepers of less than 5 hours were prone to high blood pressure; higher body mass index and depression. This was statistically significant. The lower the CD4 count, the more the short sleep duration observed among the respondents. Patients receiving HAART containing efavirenz had shorter duration of deep sleep.

**Conclusion:** Almost half of the respondents were poor sleepers with associated high blood pressure and increased body mass index (BMI). Both effects of the virus and antiretroviral drugs may cause short sleep duration. Health providers managing HIV positive patients, need to take complaints of short sleep duration seriously, because they can indicate an increased risk for low CD4 counts, high viral load, depression, high blood pressure and increase body mass index. There is the need for targeting efforts to improve short sleep duration for the majority of adults living with HIV/AIDS and tailoring appropriate interventions.

**Keywords:** Short sleep duration; HIV positive patients; Nigeria; West Africa.

1. **INTRODUCTION**

Sleep naturally restores body functions including immune system. Short sleep duration interferes with normal physical, mental and emotional functioning and had been reported in HIV-infected individuals since the 1980’s [1,2].

The amount of time spent sleeping is called sleep duration [3,4]. Short sleep is when sleep hours is less than or equal to 5 hours per night [5]. Short sleep duration (<5 hours) has been associated with lower reports of self-rated overall health than normal (>7hous) [6]. It has also been associated with low socioeconomic status [7]. National sleep foundation found out that adults need 7 – 9 hours of sleep [8].

Short sleep duration is common in HIV-infected patients [9]. These abnormalities are more frequent in subjects receiving efavirenz. Vivid dreams, difficulties in falling asleep, and/or numerous night awakenings are frequently reported by patients after beginning Efavirenz medication [10]. The first United States National Health and Nutrition Examination Survey (NHANES-1) reported that short sleep duration was associated with a 60% increased risk of hypertension [11]. Cross sectional studies from USA [12-15], France [16], Japan [17], Canada [18,19], Spain [20], Germany [21], and the United Kingdom [22] found significant association between short sleep and obesity. Short sleep was also found to be associated with lower CD4+ T-cell counts and higher viral load [23]. Our aim was to determine the prevalence of short sleep duration among HIV patient on HAART and to evaluate the associated factors.

2. **METHODS**

This is a descriptive cross-sectional study conducted among 400 HIV/AIDS patients on Highly Active Anti Retroviral Therapy (HAART) attending the lentiviral clinic of Kwara State Specialist Hospital, Sobi, Ilorin from January to April 2015.
The sample size was estimated using the Leslie Kish’s Formular for estimate minimum sample size in health studies [24]. Pretesting was carried out at the Kwara State Civil Service Hospital, using 40 respondents (10% of the sample size) from the HIV clinic.

Institutional ethical approval was obtained. All concerted HIV positive patients above 18 years were recruited. Exclusion criteria include the use of illicit drugs or alcohol, and the presence of acute medical condition that could affect the patients sleep or ability to complete the questionnaire. Weekly, 50 patients were seen on HAART and systematic sampling of odd numbers was used in selecting 25 weekly until a total sample size of 400 was obtained. The patient demographic data was evaluated. Recent laboratory results for CD4 cell count, and current antiretroviral therapy, was obtained from their case records.

Two or more blood pressure measurement separated by a two-minute interval, with the patient either supine or seated, and after standing for at least 2 minutes. Verification in the contra lateral arm was done. The JNC classification was used thus;

Normal $<$120 Pre-hypertensive $120 – 139$

$<80$ 80 – 89

Stage 1 140 – 159 Stage 2 $>160$

90 - 99 100

Body weight was measured with subjects bare-footed and expressed in kilograms (kg) to the nearest 0.1 kg and the corresponding height expressed to the nearest centimeters. The international classification of body mass index (BMI) ($\text{kg/m}^2$) was used as follows; severe thinness $<$16.00, moderate thinness 16.00 – 16.99, mild thinness 17.00 – 18.49, normal range 18.50 – 24.99, pre-obese 25.00 – 29.99, obese class 1 30.00 – 34.99, obese class II 35.00 – 39.99, obese class III $\geq$40.00.

The patients Health Questionnaire (PHQ-9) is a brief, 9-items patients report depression assessment tool. It was specifically developed for use in primary care general medical settings. Psychometric evaluation of the PHQ-9 reveal a sensitivity ranging from 62% to 92% and specificity between 74% – 88%. Respondents who scored one and more were assessed clinically for depression. Scoring and level of depression was assessed viz: (1-4) Minimal depression, (5-9) Mild depression, (10-14) Moderate depression, (15-19) Moderately severe depression, and (20-27) Severe depression. Some direct depression care, such as care support, coordination, case management, and treatment was embarked on [25].

The Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep duration. Psychometric properties have demonstrated good reliability internal consistency 0.89, test retest reliability 0.85 and good construct validity for the English language version. The respondents were categorized into three groups namely: Sleeping more than 7 hours, 5-7 hours and less than 5 hours. Subjects with $<$5 hrs are poor sleepers while those with $>$7 hrs were good sleepers.

The data were analyzed using the epidemiological information (Epi-info) 2005 software package. The 2 by 2 contingency tables were used to carry out Chi-square test and to find out the level of significance and values less than 0.05 were regarded as statistically significant.

3. RESULTS

Table 1 shows the socio-demographic factors of the respondents. Four hundred HIV-infected patients were recruited with a mean age of 39yrs (SD 9). Eighty four (21%) were male, while 316 (89%) were female.

Table 2 shows the association between sleep duration and socio-demographic factor. One hundred and eighty three respondents (45.8%) slept $<$5 hours, while 58 (14.5%) sleep $>$7hours. A significant number of the respondents who sleep for $<$ 5 hours 149 (81.4%) had depression.

Fig. 1 shows the stages of hypertension among the respondents.

74% had normal blood pressure and 21% were in the pre-hypertensive stage while only 2% and 3% were in the stages 1 and 2 respectively.

Fig. 2 shows the sleep duration among the respondents. One hundred and eighty three (45.8%) were poor sleepers, while 58 (14.5%) were good sleeps.

Table 4 shows the association between present CD4 count and sleep duration. The lower the CD4 count, the more the short sleep duration. Those who sleep $<$ 5 hours had significantly low CD-4 count.
Table 1. Socio-demographic variables of the respondents

| Variables            | Frequency | (%)     |
|----------------------|-----------|---------|
| Age group            |           |         |
| ≤ 25                 | 28        | (7.0)   |
| 26 – 35              | 140       | (35.0)  |
| 36 – 45              | 148       | (37.0)  |
| 46 – 55              | 56        | (14.0)  |
| >55                  | 28        | (7.0)   |
| Total                | 400       | (100.0) |
| Sex                  |           |         |
| Male                 | 84        | (21.0)  |
| Female               | 316       | (79.0)  |
| Total                | 400       | (100.0) |
| Ethnicity            |           |         |
| Hausa                | 24        | (6.0)   |
| Yoruba               | 304       | (76.0)  |
| Others               | 72        | (18.0)  |
| Total                | 400       | (100.0) |
| Religion             |           |         |
| Christianity         | 76        | (19.0)  |
| Islam                | 324       | (81.0)  |
| Total                | 400       | (100.0) |
| Marital status       |           |         |
| Married              | 212       | (53.0)  |
| Single               | 32        | (8.0)   |
| Divorced             | 8         | (2.0)   |
| Separated            | 68        | (17.0)  |
| Widow                | 72        | (18.0)  |
| Widower              | 8         | (2.0)   |
| Total                | 400       | (100.0) |
| Educational level    |           |         |
| Non formal           | 168       | (42.0)  |
| Formal               | 232       | (58.0)  |
| Total                | 400       | (100.0) |
| Occupation           |           |         |
| Trader               | 188       | (47.0)  |
| Civil Servant        | 68        | (17.0)  |
| Self Employed        | 84        | (21.0)  |
| Unemployed           | 56        | (14.0)  |
| Student              | 4         | (1.0)   |
| Total                | 400       | (100.0) |
| Alcohol intake       |           |         |
| Never                | 60        | (15.0)  |
| Former               | 340       | (85.0)  |
| Total                | 400       | (100.0) |
| Smoking status       |           |         |
| Current              | 364       | (91.0)  |
| Never                | 20        | (5.0)   |
| Former               | 16        | (4.0)   |
| Total                | 400       | (100.0) |

Table 5 shows the association between Highly Active Anti Retroviral Therapy (HAART) and sleep duration. Patients receiving HAART containing efavirenz had shorter duration of deep sleep.

4. DISCUSSION

In this study, the prevalence of short sleep duration among the HIV positive patients was 45.8%, similar to 46% documented by Crum-Cianflone and co-workers [26] by the infectious diseases society of America, but lower than 59.4% reported by Adewole and co-workers [27] in Obafemi Awolowo Teaching Hospital, Ile-Ife, Nigeria.

The prominent age group with short sleep duration was 31-40 years, similar to 31-50 years reported by Bastos and colleagues [28]. Those with non-formal education had short sleep duration than those with formal education. Crum-Cianflone [26] found out that fewer years of education was associated with sleep duration.

Short sleepers of less than 5 hours were prone to high blood pressure. Recent data reported that short sleepers were at increased risk for hypertension [29-30]. Additionally, women who slept <7 hours were at increased risk of stroke [31]. Short sleepers were also prone to myocardial infarction [32].

Many studies had shown the relationship between short sleep duration and obesity [33,34]. Cross-sectional studies conducted in adults from Canada [35], France [36], Germany [37], Japan [38], UK [39], and USA [40], shown significant associations between short sleep and obesity. Short sleep duration was associated with increased weight gain and body mass index. This was similar to the longitudinal analysis observed where sleep duration of <7 hours were associated with increased risk of weight gain. Also similar to another study where the odds ratio for sleep duration predicting obesity was 0.50, and every extra hour increase of sleep duration was associated with a 50% reduction in risk of obesity [41]. Studies in France [42] and Canada [33] also attested to these.

There had been inconsistent reports on the relationship between CD4 cell count and poor sleep quality. Some studies [43,44] had not found any relationship whilst others had confirmed that sleep disturbances were independently related to immune status [45,46]. We noted a significant association between short sleep duration and lower CD4 count. The
immune system is directly linked to the psyche by a complex network of nerves, hormones, and neuropeptides. This network of specific physiological pathways allows immune function to have a direct impact on health especially sleep. On the contrary Crum-Cianflone and co-worker did not find any association between short sleep duration and HAART use.

We noted that patients on efavirenz based HAART therapy had short sleep duration. Other earlier studies had also documented a correlation between high blood concentrations of efavirenz and poor sleep pattern [46,47]. Gallego et al. performed ambulatory electroencephalogram monitoring on HIV-infected subjects treated with efavirenz and documented that those receiving

### Table 2. Association between sleep duration, blood pressure, body mass index and depression among HIV positive patients

| Variables        | Sleep duration | Total | Chi-square | P-value |
|------------------|----------------|-------|------------|---------|
| Blood pressure   |                |       |            |         |
| Normal           | 133            | 117   | 46         | 296     | 4.165  | 0.654 |
| Border Line      | 40             | 34    | 10         | 84      |        |       |
| Stage 1          | 3              | 5     | 0          | 8       |        |       |
| Stage 2          | 7              | 3     | 2          | 12      |        |       |
| Total            | 183            | 159   | 58         | 400     |        |       |
| Body mass index  |                |       |            |         |
| Underweight      | 22             | 25    | 9          | 56      | 8.953  | 0.176 |
| Normal           | 141            | 112   | 35         | 288     |        |       |
| Over weight      | 5              | 6     | 5          | 16      |        |       |
| Obese            | 15             | 16    | 9          | 40      |        |       |
| Total            | 183            | 159   | 58         | 400     |        |       |
| Depression       |                |       |            |         |
| No depression    | 34             | 40    | 11         | 85      | 15.200 | 0.004 |
| Moderate depression | 99         | 101   | 31         | 231     |        |       |
| Severe depression | 50            | 18    | 16         | 84      |        |       |
| Total            | 183            | 159   | 58         | 400     |        |       |

![Fig. 1. Stages of hypertension among the respondents](image)
efavirenz had shorter duration of deep sleep. Also, efavirenz plasma levels were significantly higher in patients with insomnia [48]. It had been suggested that a direct inhibition of serotonergic hypothalamic pathways by efavirenz may explain this. This could be attributed to the presence of the defective CYP2B6 G516T variant allele known to be common in black Africans, which causes a variation in the rate of efavirenz metabolism thereby significantly increasing the likelihood of the occurrence of sleep disturbance. This contrast with the report of Crum-Cianflone [26], where no significant associations between those on efavirenz containing regimen was found.

In this study, short sleepers of less than 5 hours were prone to depression. This was similar to Crum-Cianflone [26] observation as well as other studies [49,50]. Sleep deprivation has effects on several domains of psychological health, including socialization, mood and stress. An increased stress response had been shown, including increased basal activity of neuroendocrine stress systems, elevations of the sympathetic nervous system, altered hypothalamic-pituitary-adrenal axis function, and increased stress reactivity [51].

![Sleep Duration](image)

**Fig. 2. Sleep duration among the respondents**

**Table 4. Association between present CD4 count and sleep duration among HIV positive patients**

| Variables | Present CD4 count | Total | Chi-square | P-value |
|-----------|-------------------|-------|------------|---------|
|           | <50               | 50-200| 201-500    | 500-999 |         |
| Duration  |                   |       |            |         |         |
| <5hrs     | 137               | 27    | 19         | 0       | 183     | 124.91 | < 0.001 |
| 5 - 7hrs  | 120               | 15    | 22         | 2       | 159     |        |         |
| >7hrs     | 6                 | 11    | 33         | 8       | 58      |        |         |
| Total     | 263               | 53    | 74         | 10      | 400     |        |         |
Table 5. Association between highly active antiretroviral therapy and sleep duration

| Haart            | Sleep duration | Total | Chi-square | P-value |
|------------------|----------------|-------|------------|---------|
|                  | < 5hours | 5-7 hours | >7hrs |         |
| AZT+3TC+NVP      | 64       | 60     | 15     | 139     | 16.676  | 0.034  |
| TDF+FTC+EFV      | 72       | 64     | 29     | 165     |         |        |
| TDF+FTC+NVP      | 47       | 29     | 12     | 88      |         |        |
| ABC+3TC+NVP      | 0        | 4      | 0      | 4       |         |        |
| AZT+3TC+LPVr     | 0        | 2      | 2      | 4       |         |        |
| Total            | 183      | 159    | 58     | 400     |         |        |

Hack and Mullinton [52], observed optimism-sociability declined in 15% of the respondents over consecutive days of sleep loss. One study investigated risky decision making following sleep deprivation [53] and found that not only was sleep deprivation associated with increased risky behavior.

5. LIMITATION OF THE STUDY

There are few limitation of the study that may reduce the generation of our finding. Like all cross sectional study, it is difficult to establish casual association between dependent and independent variable. Further studies are required to determine the frequency of the genetic polymorphism affecting efavirenz metabolism in the African population. Also the regions in Africa where this detective gene exists need to be defined.

6. CONCLUSION

The results of this study indicate a significant reduction of deep sleep in HIV-infected individuals.

Efavirenz related neurologic effects especially short sleep duration may be explained by alterations in sleep architecture. EEG monitoring may be a helpful tool to detect objective sleep abnormalities in patients complaining of insomnia while receiving efavirenz. Further studies are required to determine the frequency of the genetic polymorphism affecting efavirenz metabolism in the African population. Also the regions in Africa where this detective gene exists need to be defined.

There is a dose-response relationship of short sleep duration and obesity and metabolic consequences. Short sleepers are prone to hypertension and depression.

It is recommended that health professionals make a systematic inclusion of questions regarding sleep when assessing patients with HIV/AIDS. This way, it will be possible to make an early identification of the sleep-related complaints and plan interventions that avoid or minimize the worsening of the complaints and subsequent deterioration of the quality of sleep, which will eventually affect the patients’ overall health and quality of life.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Norman SE, Resnick L, Cohn MA, Duara R, Herbst J, Berger JR, et al. Sleep disturbances in HIV-seropositive patients. Journal of the American Medical Association. 1988;260(7):922.
2. Wiegand M, Moller AA, Schreiber W, Krieg JC, Holsboer F. Alterations of nocturnal sleep in patients with HIV infection. Acta Neurologica Scandinavica. 1991;83(2):141-142.
3. Krueger PM, Friedman EM. Sleep duration in the United States: A cross-sectional population-based study. Am J Epidemiol. 2009;1:169(9):1052–1063.
4. Patel SR, Zhu X, Storfer-Isser A, Mehra R, Jenny NS, Tracy R, et al. Sleep duration and biomarkers of inflammation. Sleep. 2009;32(2):200–204.
5. Patel SR, Ayas NT, Malhotra MR. A prospective study of sleep duration and mortality risk in women. Sleep. 2004; 27:440-4.
6. Steptoe A, Peacey V, Wardle J. Sleep duration and health in young adults. Arch Intern Med. 2006;166(16):1689-1692.
7. Stamatakis KA, Kaplan GA, Roberts RE. Short sleep duration across income, education and race/ethnic groups: Population prevalence and growing disparities during 34 years of follow-up. Ann Epidemiol. 2007;17(12):948-955.

8. Institute of Medicine. Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem. Washington, DC: The National Academies Press; 2006.

9. Rubinstein M. High prevalence of insomnia in an outpatient population with HIV infection. J Acquir Immune Defic Syndr Hum Retrovirol. 1998;19:260-5.

10. Blanch J, Martínez E, Rousaud A. Preliminary data of a prospective study on neuropsychiatric side effects after initiation of efaviren. J Acquir Immune Defic Syndr. 2001;27:336-43.

11. Staessen JA, Thijis L, Fagard R, O’Brien ET, Clement D, de Leeuw PW et al. Predicting cardiovascular risk using conventional VS ambulatory blood pressure in older patients with systolic hypertension. Systolic hypertension in Europe Trial Investigators, JAMA. 1999;282:539-46.

12. Kripke DF, Garfinkel L, Wingard DL, Klauber MR, Marler MR. Mortality associated with sleep duration and insomnia. Arch Gen Psychiatry. 2002;59(2):131-136.

13. Littman AJ, Vitiello MV, Foster-Schubert K, Ulrich CM, Tworoger SS, Potter JD, et al. Sleep, ghrelin, leptin and changes in body weight during a 1-year moderate-intensity physical activity intervention. Int J Obes. 2007;31(3):466-475.

14. Patel SR, Ayas NT, Malhotra MR, White DP, Schernhammer ES, Speizer FE, et al. A prospective study of sleep duration and mortality risk in women. Sleep. 2004;27(3):440-444.

15. Hasler G, Buysse DJ, Klaghofer R, Gamma A, Ajdacic V, Eich D, et al. The association between short sleep duration and obesity in young adults: A 13-year prospective study. Sleep. 2004;27(4):661-666.

16. Locard E, Mamelle N, Billette A, Miginiac M, Munoz F, Rey S. Risk factors of obesity in a five year old population. Parental versus environmental factors. Int J Obes Relat Metab Disord. 1992;16(10):721–729.

17. Shigeta H, Shigeta M, Nakazawa A, Nakamura N, Yoshikawa T. Lifestyle, obesity, and insulin resistance. Diabetes Care. 2001;24(3):608.

18. Chaput JP, Despres JP, Bouchard C, Tremblay A. The association between sleep duration and weight gain in adults: A 6-year prospective study from the Quebec Family Study. Sleep. 2008;31(4):517–523.

19. Chaput JP, Despres JP, Bouchard C, Tremblay A. Short sleep duration is associated with reduced leptin levels and increased adiposity: Results from the Quebec family study. Obesity (Silver Spring). 2007;15(1):253–261.

20. Vioque J, Torres A, Quiles J. Time spent watching television, sleep duration and obesity in adults living in Valencia, Spain. Int J Obes Relat Metab Disord. 2000;24(12):1683-1688.

21. Von Kries R, Toschke AM, Wurmser H, Sauerwald T, Koteitzko B. Reduced risk for overweight and obesity in 5- and 6-year-old children by duration of sleep—a cross-sectional study. Int J Obes Relat Metab Disord. 2002;26(5):710–716.

22. Reilly JJ, Armstrong D, Dorosty AR, Emmett PM, Ness A, Rogers I, et al. Early life risk factors for obesity in childhood: Cohort study. BMJ. 2005;330(7504) 1357.

23. Kathryn AL, Caryl G, Carmen JP, Traci C, Harvey D, Clive RP, et al. Types of Sleep Problems in Adults Living with HIV/AIDS. Journal of Clinical Sleep Medicine. J Clin Sleep Med. 2012;8(1):67-65.

24. Fisher AA, Laing JE, Stoeckel JE, Townsend JW. Handbook for Family Planning Operation Research Design, 2nd ed. New York; Population Council. 1998;43-45.

25. Kroonenke K, Spitzer RL, Williams B. The Patient Health Questionnaire 2: Validity of a Two-Item Depression Screener. Medical care. 2003;41:1284-94.

26. Crum-Cianflone NF, Roediger MP, Moore DJ. Prevalence and factors associated with sleep disturbances among early-treated HIV-infected persons. Clinical Infectious Diseases. 2012;54(10):1485-1494.

27. Adewole T, Kuteyi A, Bello I. Sleep disorders and sleep quality among adults patients presenting at General Outpatient Department in Ille Ife, Nigeria – A preliminary report. 2013;12:50-64.

28. Bastos FI, Swarcwald CL. AIDS e pauperizacao: Principais conceitos e evidencias empiricas. Cad Saude Publica. 2000;16(Supl. 1):65-76.
29. Gottlieb DJ, Redline S, Nieto FJ, Baldwin CM, Newman AB, Resnick HE, et al. Association of usual sleep duration with hypertension: The Sleep Heart Health Study. Sleep. 2006;29(8):1009-1014.
30. Gangwisch JE, Heymsfield SB, Boden-Albala B, Bujs RM, Kreier F, Pickering TG et al. Short sleep duration as a risk factor for hypertension: Analyses of the first National Health and Nutrition Examination Survey. Hypertension. 2006;47(5):833-839.
31. Chen JC, Brunner RL, Ren H, Wasserman-Smoller RS, Larson JC, Levine DW, et al. Sleep duration and risk of ischemic stroke in postmenopausal women. Stroke; 2008.
32. Meisinger C, Heier M, Lowel H, Schneider A, Doring A. Sleep duration and sleep complaints and risk of myocardial infarction in middle-aged men and women from the general population: The MONICA/KORA Augsburg cohort study. Sleep. 2007;30(9):1121-1127.
33. Chaput JP, Despres JP, Bouchard C, Tremblay A. Association of sleep duration with type 2 diabetes and impaired glucose tolerance. Diabetologia. 2007;50(11):2296-2304.
34. Knutson KL, Spiegel K, Penev P, Van Cauter E. The metabolic consequences of sleep deprivation. Sleep Med Rev. 2007;11(3):163-178.
35. Cappuccio FP, Taggart FM, Kandala NB, Currie A, Peile E, Stranges S, et al. Meta-analysis of short sleep duration and obesity in children and adults. Sleep. 2008;31(5):619-626.
36. Locard E, Mamelle N, Billette A, Miginiac M, Munoz F, Rey S et al. Risk factors of obesity in a five year old population. Parental versus environmental factors. Int J Obes Relat Metab Disord. 1992;16(10):721-729.
37. Von Kries R, Toschke AM, Wurmser H, Sauerwald T, Koletzko B. Reduced risk for overweight and obesity in 5- and 6-year-old children by duration of sleep—a cross-sectional study. Int J Obes Relat Metab Disord. 2002;26(5):710-716.
38. Shigeta H, Shigeta M, Nakazawa A, Nakamura N, Yoshikawa T. Lifestyle, obesity and insulin resistance. Diabetes Care. 2002 26(5):710-716.
39. Reilly JJ, Armstrong J, Dorosty AR, Emmett PM, Ness A, Rogers I, et al. Early life risk factors for obesity in childhood: cohort study. BMJ. 2005;330(7504):1357.
40. Kripke DF, Garfinkel L, Wingard DL, Klauber MR, Marler MR. Mortality associated with sleep duration and insomnia. Arch Gen Psychiatry. 2002;59(2):131-136.
41. Hasler G, Buyse DJ, Klagofer R, Gamma A, Ajdacic V, Eich D, et al. The association between short sleep duration and obesity in young adults: A 13-year prospective study. Sleep. 2004;27(4):661-666.
42. Locard E, Mamelle N, Billette A, Miginiac M, Munoz F, Rey S, et al. Risk factors of obesity in a five year old population. Parental versus environmental factors. Int J Obes Relat Metab Disord. 1992;16(10):721-729.
43. Perkins DO, Leserman J, Stern R A. Somatic symptoms and HIV infection: Relationship to depressive symptoms and indicators of HIV disease. The American Journal of Psychiatry. 1995;152(12):1776-1781.
44. Cohen FL, Ferrans C E, Vizgirda V, Kunkle V, Cloninger L. Sleep in men and women infected with human immunodeficiency virus. Holistic Nursing Practice. 1996;10(4):33-43.
45. Crueiss DG, Antoni MH, Gonzalez J. Sleep disturbance mediates the association between psychological distress and immune status among HIV-positive men and women on combination antiretroviral therapy. Journal of Psychosomatic Research. 2003;54(3):185-189.
46. Seay JS, McIntosh R, Fekete EM, Fletcher MA, Kumar M, Schneiderman N, et al. Self-reported sleep disturbance is associated with lower CD4 count and 24-h urinary dopamine levels in ethnic minority women living with HIV. Psychoneuro Endocrinology. 2013;38(11):2647-2653.
47. Núñez M, González de Requena D, Gallego L, Jiménez-Nácher I, González-Lahoz J, Soriano V et al. Higher efavirenz plasma levels correlate with development of insomnia. Journal of Acquired Immune Deficiency Syndromes. 2001;28(1):399-400.
48. Gallego L, Barreiro P, Del Río R. Analyzing sleep abnormalities in HIV-infected patients treated with efavirenz. Clinical Infectious Diseases. 2004;38(3):430-432.
49. Dinges DF. The state of sleep deprivation: From functional biology to functional consequences. Sleep Med Rev. 2006; 10(5):303-305.
50. American Academy of Sleep Medicine. International Classification of Sleep Disorders. 2. Westchester, IL: Author; 2005.
51. Meerlo P, Sgoifo A, Suchecki D. Restricted and disrupted sleep: Effects on autonomic function, neuroendocrine stress systems and stress responsivity. Sleep Med Rev. 2008;12(3):197-210.
52. Haack M, Mullington JM. Sustained sleep restriction reduces emotional and physical well-being. Pain. 2005;119(1-3):56-64.
53. Killgore WD, Balkin TJ, Wesenten NJ. Impaired decision making following 46h of sleep deprivation. J Sleep Res. 2006; 15(1):7-13.

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