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Sleep quality and health-related quality of life in HIV-infected African-American women of childbearing age

Kenneth D. Phillips[1], Richard L. Sowell[2], Mary Boyd[1], Wesley D. Dudgeon[3], Gregory A. Hand[3,4] & The Mind–Body Research Group[5]
[1]*College of Nursing, University of South Carolina, 1601 Green Street, Columbia, SC 29208, USA (E-mail: ken.phillips@sc.edu);* [2]*College of Health and Human Services, Kennesaw State University, Kennesaw, GA 30144-5591, USA;* [3]*Department of Exercise Science, Arnold School of Public Health, University of South Carolina, Columbia, SC, 29208, USA;* [4]*Departments of Pharmacology, Physiology, and Neuroscience, School of Medicine, University of South Carolina, Columbia, SC 29208, USA;* [5]*University of South Carolina, Columbia, SC 29208, USA*

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Abstract

A descriptive, correlational design was used to examine the associations of sleep quality and stage of illness with health-related quality of life (HRQOL) in HIV-infected African-American women. Participants were recruited from 12 health clinics and AIDS service organizations (ASO) in Georgia, North Carolina, and South Carolina. The sample consisted of 144 African-American women who ranged in age from 20 to 48 years ($m = 34.8$, SD = 6.8). The Pittsburgh Sleep Quality Index (PSQI) and the Medical Outcomes Short-Form Health Survey (SF-36) were administered. Participants were categorized as good sleepers (PSQI global score <7) or poor sleepers (PSQI global score ≥ 7) using the median global sleep quality score. Differences in HRQOL between good and poor sleepers, as measured by the SF-36, were tested using MANOVA. Good sleepers scored significantly higher ($p < 0.0001$) for each SF-36 quality of life dimension and the mental and physical health summary scores. Multiple regression analysis indicated that sleep quality is associated with HRQOL, independent of the individual's stage of illness, more so with mental HRQOL than with physical HRQOL. The results suggest that treatment for poor sleep quality should be a primary concern for the treatment of HIV infection and a means for improving HRQOL.

Key words: PSQI, SF-36, HIV/AIDS, Women, African-American, Sleep

Introduction

Sleep disturbance is a frequent symptom that is reported early in HIV disease and continues throughout the illness [1–5]. In research conducted in an urban HIV/AIDS clinic, Rubinstein and Selwyn [6] found that 73% of the respondents were classified as having a sleep disturbance using the Pittsburgh Sleep Quality Index (PSQI). In a more recent study conducted in the southeastern United States, all 79 (100%) HIV-infected individuals (HIV or AIDS) scored 5 or greater on the PSQI indicating significant sleep disturbance [7]. The high prevalence of sleep disturbance in this population makes this a significant quality of life issue worthy of further study.

Sleep disturbance has been shown to profoundly affect the physiological and psychological functioning of HIV-infected individuals [8]. In the *asymptomatic phase* of HIV disease, individuals often complain of difficulty falling asleep and staying asleep [8], and polysomnography demonstrates significant changes in sleep quality and sleep architecture as evidenced by increased slow-wave sleep, greater slow-wave sleep during the latter half of the sleep period, and altered NREM

and REM sleep cycles [2, 8–10]. In the *symptomatic phase*, HIV-infected individuals report greater difficulty falling asleep and greater daytime fatigue [8–10]. Decreased total slow-wave sleep, decreased sleep efficiency, increased arousals, and increased distortion in the NREM and REM sleep cycles are observed on the polysomnogram in this phase of HIV-infection [8–10]. Persons in the *terminal phase* of HIV disease report extreme sleep disruption, fatigue, lethargy, and difficulty in maintaining sleep. In this phase, slow wave sleep is diminished or absent, sleep efficiency is extremely low, and the NREM–REM sleep cycle is unrecognizable [11, 12]. All phases of HIV infection demonstrate significant changes in sleep quality and sleep architecture that lead to lower levels of functioning for HIV-infected individuals. Therefore, since sleep disturbance is under-diagnosed [6] and thus undertreated in HIV-infected individuals, it is a quality of life issue that is of great concern.

Sleep disturbance contributes significantly to morbidity, disability, and eventual unemployment in HIV-infected individuals [13], yet has received little attention by researchers [14]. Using the PSQI, Nokes and Kendrew [15] found that better sleep quality in HIV-infected women is associated with indicators of quality of life such as general well-being (HIV Assessment Tool, General Well-being Scale), less anxiety (Spielberger's State–Trait Anxiety Inventory), fewer depressive symptoms (Centers for Epidemiological Studies – Depression Scale), and less symptom severity (HIV Assessment Tool, Symptom Subscale). However, their study did not examine the relative differences in mental and physical HRQOL between good and poor sleepers at various stages of HIV disease.

In a design similar to that of the present study, Manocchia et al. [16] examined the associations between sleep quality (Pittsburgh Sleep Quality Index) and HRQOL (Medical Outcomes Study SF-36) among 3484 chronically ill individuals. The participants in the study included groups with clinical depression, congestive heart failure, diabetes, recent myocardial infarction, hypertension, asthma, back problems, and arthritis. The findings clearly linked sleep quality with HRQOL (the mental component more so than the physical component) among chronically ill individuals. However, their sample did not include HIV-infected individuals, making the present study an important addition to the scientific knowledge about the associations between sleep quality and HRQOL. Given the recent increase in HIV diagnosis in young adult African-American women [17], and the lack of research regarding sleep and quality of life, the objectives of this analysis were to describe self-reported sleep quality, to examine the relationship between sleep quality and HRQOL, and to determine how much of the variance in HRQOL is explained by sleep quality in this population.

Methods

General

The data presented in this paper were collected during the fourth and final interview of a larger study that examined reproductive decision-making in HIV-infected women. Sleep quality was one of the several symptoms assessed in this study. A correlational design was used to study cross-sectional data collected from these HIV-infected women. Data were collected between 2000 and 2001 from participants recruited from 12 health clinics and AIDS Service Organizations (ASO) in Georgia, North Carolina, and South Carolina. Participants were eligible if they were HIV-seropositive, between the ages of 18 and 49, English speaking, and had no evidence of dementia. The exclusion of adults older than 50 years of age was considered appropriate for the present analysis because sleep quality remains stable in young adulthood, but changes after age 50 [18, 19]. Since the overall purpose of the study was to describe reproductive decision-making, women who were menopausal by self-report were excluded from participation.

Procedure

Prior to any data collection, the Institutional Review Board in the Office of Research Compliance at the University of South Carolina approved this study. Female research assistants, who were specifically trained for data collection and who were culturally sensitized to issues important to HIV-infected women, obtained informed consent and collected all data. Study interviews were conducted at mutually agreed upon sites that provided both

privacy and comfort. Research assistants read the questionnaires to all participants and recorded their answers verbatim. The interviews lasted approximately 2 h, and each subject was compensated US$ 40.00.

Instruments

Sleep quality

The 19 self-report items of the Pittsburgh Sleep Quality Index (PSQI) were used to measure sleep quality [20]. Seven component scores (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction) were obtained from the PSQI questions, with possible scores for each question ranging from 0 to 3. From the summation of these component scores, a global sleep quality score was derived. In a study of primary insomnia, using a global sleep score greater than 5 resulted in a sensitivity of 98.7% and a specificity of 84.4 in discriminating insomnia patients from control subjects [21]. The global score has demonstrated internal consistency with a Cronbach's alpha of 0.80 in patients with chronic insomnia [22] and a test–retest reliability of 0.87 in patients with primary insomnia [21]. Convergent and discriminant construct validity have been supported [22]. Possible global scores range from 0 to 21. A higher global score on the PSQI indicates poorer sleep quality. A global score of 5 or greater indicates severe difficulties in at least one component or moderate difficulties in three or more components of sleep quality [19]. In this study, the median score of 7 was used as the cutoff point to classify participants as good sleepers or poor sleepers. A median score of 7 or greater is a more conservative indicator of poor sleep quality. The instruments are further described in Table 1.

Health-related quality of life

HRQOL was measured using the Medical Outcomes Short-Form Health Survey (SF-36). The SF-36 was used instead of the Medical Outcomes Survey HIV (MOS-HIV) because the SF-36 has national normative values for comparison across studies and groups and it has fewer ceiling effects [23, 24]. A significant limitation of the MOS-HIV, and the reason for not using it in this study, is that it was developed during an era when HIV disease was an acute condition [25]. Now that HIV has become a chronic disease, the construct validity of some components of the MOS-HIV are questionable [26].

Table 1. Description of research instruments for the total sample

Scale	Potential range	Actual range	*M*	SD	α
Pittsburgh Sleep Quality Index	0–21	1–18	7.3	4.4	0.77
Bodily pain (BP)	19–63	20–62	50.7	10.8	0.87
General health (GH)	16–64	19–62	45.1	9.0	0.69
Mental health (MH)	7–65	15–64	45.4	12.2	0.85
Physical functioning (PF)	14–58	17–57	45.7	17.0	0.92
Role emotional (RE)	9–56	9–56	40.3	21.1	0.95
Role physical (RP)	17–57	18–57	45.9	16.0	0.93
Social functioning (SF)	13–57	13–57	46.8	11.2	0.74
Vitality (VT)	20–71	23–70	48.9	11.2	0.86
Physical component summary (PCS)	4–71	17–67	48.6	10.4	0.89
Mental component summary (MCS)	2–74	8–68	44.0	15.0	0.92

M – Mean; SD – Standard deviation; α – Cronbach's alpha.

The reliability and validity of the SF-36 have been supported extensively in prior research [27, 28], and the SF-36 has been used repeatedly in HIV-infected populations [29]. The SF-36 assesses eight domains of HRQOL: physical functioning due to physical health problems, role limitations due to physical problems, pain, general health perception, emotional well-being, role limitations due to emotional problems, social functioning, and vitality. Additionally, scores can be calculated for physical health (PCS) and mental health (MCS) components of HRQOL. A standardized algorithm is used to calculate the scores for the eight domains and two component summary scores of the SF-36 [28]. Scores for each of the eight domains and two dimensions of the SF-36 were transformed to norm-based scores with a mean of 50 and a standard deviation of 10. A higher score indicates a higher level of HRQOL in that domain or dimension [28].

HIV staging

The HIV-infected participants in this study were self-classified into one of three groups according to the 1993 Centers for Disease Control criteria. The participants were categorized by self-report as (1)

HIV-seropositive, asymptomatic ($n = 93$), (2) HIV-seropositive, symptomatic ($n = 34$), or (3) as having AIDS ($n = 17$). The HIV-seropositive, symptomatic participants and the participants with AIDS were collapsed into a HIV-seropositive, symptomatic group. Because of the low number of women with AIDS, symptomatic women and women with AIDS were collapsed into a single group.

Data analysis

Using SAS Version 8.0, scores for the PSQI [19] and the SF-36 [28] were computed using the standard scoring algorithms of the original authors. The mean global sleep quality score was used to categorize the participants as good sleepers (less than 7) or poor sleepers (7 or greater). The means and standard deviations of the total PSQI and each of the eight dimensions of HRQOL were calculated for the total sample, for participants who were asymptomatic, and for participants who were symptomatic.

In this cross-sectional design, it was considered important to test for group differences that might influence subjective sleep quality and HRQOL. Group comparisons were performed for employment status, stage of HIV disease (asymptomatic, symptomatic, or AIDS), annual household income, length of time since diagnosis, and partnership status (single or partnered) between good sleepers and poor sleepers. Participants were classified as single if they reported single, separated, or divorced on the demographic data form. Participants were classified as partnered if they reported married, common law, steady relationship, or partnered.

Differences in HRQOL (eight dimension scores and the two component summary scores) between good sleepers and poor sleepers were calculated using a multiple analysis of variance (MANOVA). Using Bonferroni's method, significance of the differences in HRQOL between good sleepers and poor sleepers was tested using Tukey's highest significant difference test at a significance level of $p < 0.005$ (0.05/10).

In these analyses, it was theoretically possible that sleep quality might be highly related to stage of illness. To avoid problems with multicollinearity, Pearson's r was used to calculate the correlations among the subscale scores of the PSQI, the subscale scores of the SF-36, and stage of illness. Using a bivariate correlation of 0.80 or above as the cutoff point for including two variables in the same analysis as recommended by Tabachnick and Fidell [30], we detected no multicollinearity between our two independent variables, sleep quality as measured by the global PSQI score and stage of illness. Finally, regression analysis was performed to examine the association between the sleep quality score (continuous variable) and HRQOL, while controlling for stage of illness. A significance level of $p < 0.005$ was used as the upper limit for statistical significance.

Results

Description of the sample

The sample consisted of 144 HIV-infected African-American women who were primarily single (68%) and between the ages of 20–48 years ($m = 34.8$, $SD = 6.8$). Most of the sample (68%) had no paying job and reported annual household incomes below US$ 10,000 (55%). Almost two-thirds of the women (65%) were asymptomatic. Most of the women who completed the antiretroviral medication form were taking antiretroviral medications (65%). Twenty-nine of the women did not complete the questions about antiretroviral medications, because they could not remember the names. The sample is further described in Table 2.

Description of sleep quality

Nearly two-thirds (66%) of the sample scored 5 or greater on the PSQI, the cutoff point for sleep difficulties recommended by the author of the scale. Nearly one-half (47.2%) of the sample scored 7 or greater on the PSQI, making them more likely to have true sleep difficulties. The scores on the PSQI in this sample ranged from 1 to 18 (possible range = 0–21) with a mean of 7.3 ($SD = 4.4$). Frequencies, means, and standard deviations for the PSQI for the total sample, the asymptomatic sample, and the symptomatic sample are presented in Table 3. HIV-infected women who were symptomatic reported significantly poorer sleep quality ($t_{142} = 2.79$, $p = 0.0001$) than

Table 2. Demographic characteristics of the sample

Characteristic	Frequency	Percentage
Sleep quality		
Poor sleep quality (PSQI 7 or greater)	68	47.2
Good sleep quality (PSQI less than 7)	76	52.8
Employment status		
Paid job	57	39.9
No paid job	86	60.1
Missing	1	
Education		
<8 years	0	0.0
8 to <12 years	47	34.0
12 years	54	39.0
>12 to <16	27	19.6
16 years	9	6.4
>16 years	1	1.0
Missing	6	
Annual household income		
Less than US$ 5000	19	14.0
US$ 5000–US$ 9999	56	41.2
US$ 10,000 or greater	61	44.8
Missing	8	
Stage of illness		
Asymptomatic	93	64.6
Symptomatic	51	35.4
Time since diagnosis		
Less than 1 year	3	2.2
1 to <5 years	58	42.3
5 to <10 years	56	40.9
10 years or greater	20	14.6
Missing	7	
Partnership status		
Living with partner	39	27.1
Living without a partner	95	66.0
Other	10	6.9
Taking antiretroviral medications		
Yes	75	65.2
No	40	34.8
Missing	29	

PSQI – Pittsburgh Sleep Quality Index Total Score.

the HIV-infected women who were asymptomatic. Women who did not have paying jobs reported significantly poorer sleep quality ($t_{142} = 2.92$, $p = 0.004$) than women who did have paying jobs.

Subjective sleep quality was described as 'fairly bad' or 'very bad' by 23% of the total sample, 25% of the asymptomatic sample, and 21% of the symptomatic sample. Disorders of initiating sleep were seen from the observation that over half the sample (53%) reported that it required more than 15 min to fall asleep [20]. Half the sample (50%) reported that they had slept less than 7 h per night during the past month. Sleep efficiency [(the total number of hours of sleep) ÷ (total number of hours in bed) × 100] of greater than 85% is considered normal. Nearly one half (45.9%) of the participants in this study reported a habitual sleep efficiency of less than 85%. The use of sleeping medications was low considering the degree of disrupted sleep reported. Seventy-six percent of the sample had not used sleeping medications during the past month. Six percent of the participants reported using sleeping medication less than once per week during the month, 6% reported using sleeping medications once or twice per week, and 13% reported using sleeping medications three or more times per week. Over half the sample (52%) reported some degree of daytime dysfunction as a result of their sleeping problems (see Table 3).

Description of health-related quality of life

The HRQOL scores for the participants in this sample were compared to a normative sample of women in the United States using *t*-tests with pooled variances [28]. Asymptomatic participants who were good sleepers achieved higher HRQOL scores for the PCS than the women in the normative sample ($p < 0.001$), but no significant differences were observed for the MCS between asymptomatic good sleepers and the normative sample ($p < 0.001$). Asymptomatic participants who were poor sleepers scored lower on the MCS than the normative sample, but not on the PCS. Symptomatic good sleepers reported lower PCS ($p < 0.001$) than the normative sample, but no significant differences were observed in MCS for the good sleepers.

In the total sample, MCS did not differ on the basis of education ($F_{9,127} = 1.5$, $p = 0.15$), income ($F_{5,129} = 0.44$, $p = 0.12$), or the use of medications ($t_{77.3} = 1.6$, $p = 0.12$). Similarly, PCS did not differ for education ($F_{9,127} = 0.62$, $p = 0.78$), income ($F_{5,129} = 0.38$, $p = 0.86$), or the use of medications ($t_{78} = -1.7$ $p = 0.09$). However, both MCS ($t_{142} = 2.01$, $p = 0.047$) and PCS ($t_{142} = 3.54$, $p = 0.001$) were significantly higher for women who had paying jobs when compared to women who did not have paying jobs.

Table 3. Comparisons of sleep for symptomatic and asymptomatic HIV-infected women as measure by the PSQI self-report ($n = 144$)

Characteristic	Total sample		Asymptomatic		Symptomatic	
	n	%	*n*	%	*n*	%
Subjective sleep quality						
Very good	44	30.6	10	19.6	34	36.6
Fairly good	67	46.5	28	54.9	39	41.9
Fairly bad	20	13.9	8	15.7	12	12.9
Very bad	13	9.0	5	9.8	8	8.6
Sleep latency						
Less than 15 minutes, not during the past month	68	47.2	19	37.2	49	52.6
16–30 min, less than once per week	38	26.4	16	31.4	22	23.7
31–60 min, once or twice per week	38	26.4	16	31.4	22	23.7
>60 min, three or more times per week	0	0	0	0	0	0
Sleep duration						
>7 h	71	49.6	22	43.1	49	53.3
6–7 h	37	25.9	9	17.7	28	30.4
5–6 h	11	7.7	5	9.8	6	6.5
<5 h	24	16.8	15	29.4	9	9.8
Habitual sleep efficiency						
>85%	66	45.9	19	37.3	47	50.6
75%–84%	35	24.3	12	23.5	23	24.7
65%–74%	15	10.4	4	7.8	11	11.8
<65%	28	19.4	16	31.4	12	12.9
Sleep disturbances						
None	22	15.3	7	13.8	15	16.0
1–9	67	46.5	17	33.3	50	53.8
10–18	39	27.1	17	33.3	22	23.7
19–27	16	11.1	10	19.6	6	6.5
Use of sleeping medications						
Not during the past month	109	75.7	38	74.5	71	76.3
Less than once per week	8	5.6	4	7.8	4	4.3
Once or twice per week	9	6.2	4	7.8	5	5.4
Three or more times per week	18	12.5	5	9.9	13	14.0
Daytime dysfunction						
Never, no problem at all	69	47.9	22	43.1	47	50.5
One or two times per week, only a very slight problem	49	34.0	16	31.4	33	35.5
One or two times per week, somewhat of a problem	23	16.0	13	25.5	10	10.8
Three or more times per week, very big problem	3	2.1	0	0	3	3.2
	M	SD	*M*	SD	*M*	SD
Global sleep quality score	7.3	4.4	6.5	4.2	8.6	4.4

n – number; % – Percent of total respondents; *M* – Mean; SD – Standard deviation.

Differences in HRQOL between good and poor sleepers

Poor sleepers reported significantly lower HRQOL scores for each of the eight dimensions and the two summary scores of HRQOL than the good sleepers in the total sample. The eight dimension scores ranged from 5.2 points (42.7 ± 9.1 vs. 47.9 ± 8.1 for general health) to 16.8 points (32.4 ± 22.5 vs. 49.2 ± 15.3 for role emotional) lower for poor sleepers in the total sample. The MCS was 12.7 points lower (38.0 ± 15.7 vs. 50.7 ± 17.0, $p < 0.0001$) and the PCS was 6 points lower (45.8 ± 10.6 vs. 51.8 ± 9.4, $p = 0.0005$) for the poor sleepers than for the good sleepers.

Table 4. Summary table of differences in HRQOL between good sleepers and poor sleepers for the total sample and by stage of illness

			PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Norms US women		Mean	48.7	49.1	49.1	49.4	48.7	49.1	49.0	48.8	48.8	48.9
		SD	10.6	10.3	10.3	10.2	10.2	10.5	10.5	10.5	10.7	10.9
Total sample		Mean	45.7	45.9	50.7	45.1	48.9	46.8	40.3	45.4	48.6	44.0
		SD	10.4	16.0	10.8	9.0	11.2	11.2	21.1	12.2	10.4	15.0
Total sample	Good sleepers (n = 68)	Mean	49.8	51.8	55.1	47.9	53.6	51.6	49.2	50.4	51.8	50.7
		SD	9.3	12.1	9.4	8.1	10.0	8.1	15.3	8.8	9.4	17.0
	Poor sleepers (n = 76)	Mean	42.1	40.6	46.7	42.7	44.6	42.5	32.4	40.9	45.8	38.0
		SD	10.0	17.2	10.5	9.1	10.5	11.8	22.5	13.1	10.6	15.7
		Mean difference	7.7	11.2	8.4	5.2	9.0	9.1	16.8	9.5	6.0	12.7
		F	22.9	19.9	25.4	12.8	27.8	28.7	27.2	25.5	12.7	30.5
		df	(1,141)	(1,142)	(1,141)	(1,142)	(1,142)	(1,142)	(1,142)	(1,142)	(1,141)	(1,141)
		Significance	< 0.0001	< 0.0001	< 0.0001	0.0005	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0005	< 0.0001
Asympto-matic	Good sleepers (n = 54)	Mean	51.2	54.7	57.0	49.1	56.2	53.4	49.3	51.9	54.0	51.4
		SD	8.4	7.3	7.5	7.2	8.4	7.1	15.0	8.5	6.1	11.0
	Poor sleepers (n = 39)	Mean	44.6	44.0	48.0	45.4	45.5	43.3	30.4	41.4	49.4	36.7
		SD	9.5	17.0	10.8	8.9	10.2	11.4	22.4	12.6	10.1	15.7
		Mean difference	6.6	10.7	9.0	3.7	10.7	10.1	18.9	10.5	4.6	14.7
		F	12.5	16.9	22.3	4.8	30.4	28.0	23.7	22.6	7.5	28.5
		df	(1,91)	(1,91)	(1,91)	(1,91)	(1,91)	(1,91)	(1,91)	(1,91)	(1,91)	(1,91)
		Significance	0.0006	< 0.0001	< 0.0001	0.0310	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0075	< 0.0001
Sympto-matic	Good sleepers (n = 14)	Mean	44.4	40.8	47.6	43.2	43.9	44.8	49.2	44.9	42.5	47.6
		SD	10.7	19.4	12.5	9.7	9.6	8.6	16.9	7.8	14.4	10.6
	Poor sleepers (n = 37)	Mean	45.3	37.0	45.4	39.8	43.7	41.7	34.4	40.3	42.0	39.5
		SD	9.9	16.9	10.1	8.6	10.9	12.3	22.7	13.8	9.8	15.8
		Mean difference	−0.9	3.8	2.2	3.4	0.2	3.1	14.8	4.6	0.5	8.1
		F	2.4	0.5	0.4	1.4	0.0	0.8	4.9	1.4	0.0	3.0
		df	(1,49)	(1,49)	(1,48)	(1,49)	(1,49)	(1,49)	(1,49)	(1,49)	(1,48)	(1,48)
		Significance	0.1261	0.4988	0.5260	0.2388	0.9527	0.3901	0.0320	0.2475	0.8716	0.0916

PF – physical functioning; RP – role physical; BP – bodily pain; GH – general health; VT – vitality; SF – social functioning; RE – role emotional; MCS – mental component score; PCS – physical component score; F – F value; df – degrees of freedom; SD – standard deviation; n – number.

Likewise, poor sleepers who were HIV-infected but asymptomatic generally reported significantly lower HRQOL scores than the good sleepers who were asymptomatic. The eight dimension scores ranged from 3.7 points (45.4 ± 8.9 vs. 49.1 ± 7.2 for general health) to 18.9 points (30.4 ± 22.4 vs. 49.3 ± 15.0 for role emotional) lower for poor sleepers who were HIV-infected, but asymptomatic. The scores for the eight dimensions of HRQOL of the poor sleepers were all significantly lower ($p < 0.005$) than for the poor sleepers, except for general health ($p = 0.031$). The MCS was 14.7 points lower (36.7 ± 15.7 vs. 51.4 ± 11.0, $p < 0.0001$) and the PCS was 4.6 points lower (49.4 ± 10.1 vs. 54.0 ± 6.1, $p = 0.0005$) for the poor sleepers than for the good sleepers.

In contrast, for the women with symptomatic HIV disease, no statistically significant differences ($p<0.005$) were observed for any of the eight dimension scores or the two summary scores of HRQOL between poor sleepers and the good sleepers.

Sleep quality and HRQOL controlling for stage of illness and employment

Controlling for stage of illness and whether or not the woman had a paying job, global sleep quality explained significant levels of variance in bodily pain (21%), mental health (18%), physical functioning (8%), role physical (6%), social functioning (16%), and vitality (14%) dimensions of HRQOL. Stage of illness explained significant levels of variance in the general health (8%), physical functioning (7%), and role physical (10%) dimensions of HRQOL. Sleep quality accounted for 20% of the variance in the MCS, but none of the variance in the PCS. In contrast, stage of illness accounted for 14% of the variance in the PCS, but none of the variance in the MCS. Whether or not the woman had a paying job accounted for a significant amount of the variance in physical functioning (11%), however, none of the other seven dimensions or two component scores of HRQOL explained any variance (see Table 5).

Relationships among the components of sleep quality and HRQOL

Relationships among the seven components of sleep quality, the PCS, and the MCS were assessed

Table 5. Regression analysis of the association between sleep quality and health-related quality of life controlling for stage of illness and employment ($n = 144$)

Dependent variable	Independent variables	β weight	SEB	Model r^2	Partial r^2	p
Bodily pain	Sleep quality	−1.13	0.18	0.29	0.21	< 0.0001
	Paying job	1.57	1.63		0.01	0.3386
	Stage of illness	−2.29	1.14		0.03	0.0468
General health	Sleep quality	−0.31	0.17	0.16	0.02	0.0612
	Paying job	2.25	1.47		0.02	0.1288
	Stage of illness	−3.65	1.03		0.08	0.0005
Mental health	Sleep quality	−1.16	0.21	0.25	0.18	< 0.0001
	Paying job	3.69	1.89		0.03	0.0527
	Stage of illness	−1.49	1.32		0.01	0.2614
Physical functioning	Sleep quality	−0.61	0.17	0.31	0.08	0.0006
	Paying job	6.52	1.54		0.11	< 0.0001
	Stage of illness	−3.61	1.08		0.07	< 0.0010
Role emotional	Sleep quality	−1.99	0.39	0.18	0.16	< 0.0001
	Paying job	1.68	3.43		0.00	0.6239
	Stage of illness	−0.03	2.40		0.00	0.9912
Role physical	Sleep quality	−0.86	0.29	0.21	0.06	0.0030
	Paying job	3.04	2.54		0.01	0.2332
	Stage of illness	−7.04	1.78		0.10	< 0.0001
Social functioning	Sleep quality	−1.00	0.20	0.24	0.16	< 0.0001
	Paying job	2.24	1.74		0.01	0.2010
	Stage of illness	−2.46	1.22		0.03	0.0462
Vitality	Sleep quality	−0.92	0.19	0.26	0.14	< 0.0001
	Paying job	3.61	1.71		0.03	0.0373
	Stage of illness	−2.95	1.21		0.04	0.0156
Physical summary score	Sleep quality	−0.36	0.18	0.25	0.03	0.0506
	Paying job	3.93	1.62		0.04	0.0166
	Stage of illness	−5.43	1.14		0.14	< 0.0001
Mental summary score	Sleep quality	−1.59	0.27	0.23	0.20	< 0.0001
	Paying job	1.72	2.36		0.00	0.4693
	Stage of illness	0.01	1.66		0.00	0.9929

p value < 0.005 is significant.

using Pearson's r. At $p < 0.005$, the physical component score was significantly related to sleep efficiency ($r = -0.35$), sleep disturbances ($r = -0.31$), and daytime dysfunction ($r = -0.26$). The MCS was significantly related to subjective sleep quality ($r = -0.47$), sleep disturbances ($r = -0.42$), and daytime dysfunction ($r = -0.67$).

Discussion

The objectives of these analyses were to describe self-reported sleep quality, to examine the relationship between sleep quality and HRQOL, and to determine how much of the variance in HRQOL is explained by sleep quality in young adult, asymptomatic and symptomatic HIV-infected, African-American women. We found a high prevalence of poor sleep quality in this sample of HIV-infected African-American women. Our findings clearly demonstrate an association between sleep quality and HRQOL for the total sample of HIV-infected African-American women and for women who were asymptomatic. For the women who were symptomatic, no significant differences were observed between good sleepers and poor sleepers for any dimension of HRQOL or for the PCS or the MCS.

Almost two-thirds (66%) of the HIV-infected African-American women participating in our study reported a PSQI global score of 5 or greater, and almost one-half (47%) reported a PSQI global score of 7 or greater. These findings are consistent with those of previous studies reporting a high incidence of sleep disturbance in HIV-infected individuals [1, 3, 6]. Although objectively measured sleep disturbances have been shown to begin early in HIV infection [31], our findings support the contention that increased incidence and severity of disturbances in sleep occur with the progression of HIV disease. This is consistent with the findings of other researchers who found increased sleep disturbances in symptomatic HIV-infected individuals [8, 10, 32]. These findings are of particular importance in HIV disease, because a number of researchers have demonstrated an adverse effect of sleep deprivation on immunity in healthy individuals [33–41] and in HIV disease [13, 42–45]. Cruess and colleagues [42] have reported that psychological distress also may impact the immune system of an HIV-infected individual through its effects on sleep quality.

For the total sample, HRQOL was significantly lower for the poor sleepers on each of the eight domain scores and on the physical and mental component scores. As previously mentioned, the differences for the eight dimension scores ranged between 5.2 and 16.8 points lower for the poor sleepers in the total sample, and from 3.7 to 18.9 points lower in the asymptomatic sample. As Manocchia and colleagues [16] point out, a five-point difference between the good sleepers and poor sleepers on the PCS and MCS components of the SF-36 is equal to half a standard deviation, indicating a clinically significant difference in HRQOL.

In the total sample, mean HRQOL scores for women who were good sleepers were equal to or significantly higher than that of a normative sample of US women in the general population [28] for all dimensions except for the general health and role emotional dimensions. This attests to the important relationship between sleep and HRQOL. Even in conditions of chronic disease, such as HIV, those who sleep well are able to maintain a normal HRQOL.

The PCS and MCS were comparable to those of US women in the general population. For women in the total sample who were poor sleepers, the mean scores for all eight dimensions of HRQOL and the PCS and MCS scores as measured by the SF-36 were significantly lower than the mean scores for US women in the general population. Women who were good sleepers in the asymptomatic sample reported HRQOL scores that were equal to or slightly higher than for women in the normative sample and poor sleepers reported lower HRQOL for all dimensions and the two summary scores. In the symptomatic sample, all the HRQOL scores were lower for good and poor sleepers than the scores reported by women in the normative sample.

Stage of illness accounted for significant variance in the general health, physical functioning, and role physical dimensions of HRQOL. Stage of illness also was associated with the physical component of HRQOL, but not with the mental component. These findings that stage of illness was associated with all measures of physical health were as expected, given that physical health declines as HIV disease progresses.

In the total sample, statistically significant differences were observed for all eight dimensions of HRQOL and for the two summary scores. In the asymptomatic sample, statistically significant differences were observed for the MCS and all eight dimensions of HRQOL except general health. This relationship suggests that it may be possible to improve both sleep and HRQOL in this stage of HIV disease. In the symptomatic sample, no statistically significant differences in HRQOL were observed between the good sleepers and the poor sleepers. The absence of a difference between groups in the symptomatic stage of HIV disease may be explained in that the physical decrements of this stage may supercede the effects of sleep on HRQOL.

In the regression analyses, it was demonstrated that sleep quality explained more of the variance in HRQOL than stage of illness. These results suggest that finding ways to improve sleep quality for these individuals may significantly improve their quality of life. Although, it should be noted that this correlational study does not establish that sleep problems cause the decreases observed in HRQOL.

Our finding that good sleepers report a higher mental HRQOL suggests that improving sleep quality may help to improve mental HRQOL. This may be important for a number of reasons. Recent evidence has suggested that better mental HRQOL is associated with greater adherence to combined antiretroviral therapy (CART) [46, 47]. Mental health status has been shown to influence an HIV-infected person's choice of healthy or unhealthy behaviors and [48–50], and improving mental health status has been shown to increase self-care and health promoting behaviors [48–50].

The findings of our study are limited in several ways. The sample consisted of HIV-infected women, all of whom were African-American and many of whom were from a lower socioeconomic status. All participants came from one geographic region, the southeastern United States. A more heterogeneous sample would allow for group comparisons. The participants consisted primarily of HIV-infected women who were asymptomatic, and because there were so few women who had progressed to AIDS, the symptomatic women and those with AIDS were collapsed into a single group for data analysis. This resulted in a very crude measure of stage of illness. A purposive sample that included a greater number of persons who had progressed to AIDS would allow comparisons between good sleepers and poor sleepers in this group. This study did not adequately address the effects of antiretroviral medications on sleep in this population. In a larger sample, researchers could tease out the effects of specific antiretroviral medications and combinations of antiretroviral medications on sleep quality and HRQOL. It is possible that the women provided socially desirable answers to items on the questionnaires, and social desirability was not measured in this study. Depression was not screened for, and thus not controlled for, so it is possible that depression status could have affected the mental health aspects of the SF-36.

Nevertheless, this study provides important insights concerning sleep disturbances and HRQOL in a segment of the population in which HIV infection is growing exponentially. Current statistics show that African-American women of reproductive age have one of the highest rates of new HIV diagnosis. Additionally in this geographic area, this group may be particularly at risk for having more limited-access to medical treatment and for receiving fewer health care services. Therefore, the examination of HRQOL and HIV-related symptoms in this group of women may be particularly important if these women are to receive quality health care.

Research implications

This manuscript presents research findings from a correlational study, thus cause and effect cannot be inferred. Scientifically rigorous studies must be done on sleep and HIV to justify clinical recommendations. A replication of the current study that more precisely controls for stage of illness, takes depression into account as a confounding variable, and measures sleep objectively (polysomnography) in addition to subjectively would be an important next step. It is likely that some aspects of the sleep of HIV-infected individuals are particularly amenable to pharmacological and/or behavioral therapies, such as sleep hygiene or relaxation therapy, and that perhaps other aspects of sleep are less amenable to such therapies. Randomized clinical trials examining such hypotheses are necessary to

make clinical recommendations based on sound science.

Conclusion

Knowledge concerning the high incidence of sleep disturbance in HIV-infected African-American women and the adverse effect such disturbances can have on HRQOL provides new direction to health care practitioners in providing these women with quality health care. Many of the women in this study were poor and received HIV-related heath care through Medicaid and Ryan White funded clinics. It is important for practitioners treating women in these publicly supported clinics to emphasize assessment and treatment of sleep disturbance along with current efforts to provide early diagnosis, effective combination antiretroviral therapy, and prophylactic treatment of opportunistic infections. The findings of this study support a growing body of knowledge that underscores the importance of addressing quality of life issues in the treatment of women with HIV infection. Further, research that tests interventions to reduce sleep disturbances in this population is needed.

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Address for correspondence: Kenneth D. Phillips, College of Nursing, University of South Carolina, 1601 Green Street, Columbia, SC 29208, USA
Phone: +1-803-777-7635; Fax: +1-803-777-0550
E-mail: ken.phillips@sc.edu