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Physiological and Psychological Correlates of Sleep in HIV Infection

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Insomnia, a common problem associated with HIV disease, is most likely caused by a multitude of factors. This study investigated the correlations between a selected group of physiological and psychological factors and sleep quality in an HIV-infected population. A convenience sample of 79 ethnically diverse HIV-positive adults, ages 24 to 63, completed a number of questionnaires and released their laboratory records for CD4+ cell count and viral load information. Variables significantly related to sleep quality were HIV-related symptoms, total pain, fatigue, depression, state anxiety, and the number of adults in the household. Findings support the need for health care providers to consider factors that contribute to impaired sleep when developing effective care for HIV-infected individuals with sleep disturbance.

Keywords: *sleep quality; HIV*

Sleep disturbance is a common problem related to HIV disease. The prevalence of sleep disturbance in HIV-positive individuals

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has been reported from 73% (Rubinstein & Selwyn, 1998) to 100% (Hand, Phillips, Sowell, Rojas, & Becker, 2003) as measured by the Pittsburgh Sleep Quality Index (PSQI). Alterations in sleep have been shown to occur early during the disease while the person is still asymptomatic (Norman, Chediak, Kiel, & Cohn, 1990; Brown et al., 1990). These alterations in sleep continue to worsen across the disease course (Epstein et al., 1995). HIV-related sleep disturbance is uniquely important due to its contribution to fatigue, disability, and eventual unemployment. With these components of later stage illness, HIV-infected individuals experience deterioration in their quality of life and often must seek public funds for assistance (Darko, Mitler, & Henriksen, 1995). Although altered sleep is known to frequently accompany HIV infection, much of the etiology remains unknown. Understanding the characteristics and factors contributing to disturbed sleep in this population is essential for developing appropriate holistic interventions designed to promote better quality of sleep. The purpose of the present study is to determine the correlates of sleep quality in persons with HIV.

BACKGROUND

Although modest in quantity, there have been some recent reports regarding the prominent sleep changes in relation to HIV infection. Sleep disturbances have been reported to occur as an early symptom and may even serve as an early marker to the disease (Norman et al., 1992; White et al., 1995). The sleep changes become even more severe with advanced HIV infection (Darko et al., 1995; Norman et al., 1990; Rothenberg, Zozula, Funesti, & McAuliffe, 1990). The changes seen during the chronic asymptomatic phase of the illness include increased percentage slow wave sleep shifted to the latter part of the night, an increased number of shifts to Stage 1 sleep, a lower percentage of Stage 2 sleep, a decreased percentage of REM sleep, an increase in the number of REM periods, and a decrease in the mean duration of REM periods (Darko, McCutchan, Kripke, Gillin, & Golshan, 1992; Henriksen et al., 1995; Norman et al., 1990). Wheatley and Smith (1994) and Wiegand, Moller, Schreiber, Kreig, and Holsboer (1991) found a greater delay in sleep onset, earlier morning awakening, more

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frequent arousals and awakenings during the night, reduced total sleep time, and a poorer well-being on awakening. This progressive impairment of sleep quality is influenced by a multitude of physiological and psychological factors.

Numerous conflicting reports have appeared in the literature regarding the relation between CD4+ cell count and HIV-RNA viral load and sleep quality. It has been well documented that CD4+ cell count decreases, whereas viral load increases with the progression of HIV disease (Darko et al., 1995; Norman et al., 1990; Rothenberg et al., 1990). Many researchers believe that because quality of sleep worsens along the course of the disease, it may be related to CD4+ cell count and viral load as well. Some have found an inverse relationship between CD4+ cell counts and the frequency of sleep onset problems and sleep maintenance problems (Darko et al., 1992; Rothenberg et al., 1990). However, others have found no such relationship between sleep quality and CD4+ cell counts or viral load (Breitbart, McDonald, Rosenfeld, Monkman, & Passik, 1998; Lee, Portillo, & Miramontes, 2001; Nokes, Chediak, & Kendrew, 1999; Rubinstein & Selwyn, 1998).

Physical symptoms of HIV infection normally affect sleep with progression of the disease. The etiology of sleep disturbances can include symptoms such as pain, abdominal cramping, diarrhea, incontinence, itching, burning, fever, night sweats, cough and dyspnea (Lashley, 1999). Nokes and Kendrew (2001) found less overall symptom severity to be a correlate of better sleep quality. Specifically, pain contributes to the nonrestorative sleep experienced by persons with HIV disease (Gardner, Petrin, Collier, & Paauw, 1997). Phillips and Skelton (2001) found that greater pain was associated with poorer sleep quality and that acupuncture was effective in promoting better quality of sleep and the relief of pain.

Fatigue is a major complaint that affects quality of life in those infected with HIV (Justice, Rabeneck, Hays, Wu, & Bozzette, 1999; Nokes et al., 1999; Norman et al., 1992; Rubinstein & Selwyn, 1998; Sarna, Van Servellen, Padilla, & Brecht, 1999). Fatigue is also well represented in the literature as a correlate of inadequate sleep (Adinolfi, 2001). Paradoxically, Lee et al. (2001) found that a group of women with HIV who had less fatigue, took less time to fall asleep and had better sleep efficiency when compared with a high-fatigue HIV-

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infected group of women. Darko and associates (1992) found that sleep-disturbed participants were significantly more likely to feel fatigued throughout the day. Darko, Mitler, and Miller (1998) studied fatigue and sleep disturbance in 112 gay men and found that poor sleep and daytime fatigue were present during all stages of HIV disease.

Daytime sleepiness is a common physical symptom associated with fatigue. It occurs in the early stages of HIV as well and may even be a presenting symptom of the disease (Aldrich, Rogers, & Angell, 1988). Decreased nocturnal sleep quality associated with HIV disease may create feelings of sleepiness throughout the following day. Therefore, poor sleep quality has been found to correlate with daytime sleepiness (Darko et al., 1995; Nokes & Kendrew, 2001). The decrease in alertness that has been documented in participants with HIV infection is of particular importance due to resulting limitations in basic activities of daily living (Cleary et al., 1993).

HIV-infected individuals often contend with a number of psychological stressors causing symptoms of mental distress. The signs and symptoms of depression are similar in HIV-infected and noninfected patients, but patients with HIV infection may more frequently have sleep disturbances (Penzak, Reddy, & Grimsley, 2000). Many have found sleep to be significantly affected by depressive symptoms (Mock, Phillips, & Sowell, 2002; Nokes & Kendrew, 2001). Some researchers, however, have found it unlikely that sleep architectural changes are psychological in etiology. Darko and colleagues (1995) reported it unlikely that depression is associated with structural changes in sleep because they occur prior to any evident medical pathology. Norman and colleagues (1992) found that HIV-infected individuals with complaints of sleep difficulty exhibited greater levels of depression; however, in that study they still scored below the limit for mild depression.

In addition to heightened levels of depression, HIV-positive patients often have difficulties dealing with anxiety. High-anxiety participants take longer to fall asleep, have a smaller percentage of slow-wave sleep, and have more transitions into non-REM sleep (Fuller, Waters, Binks, & Anderson, 1997). Nokes and Kendrew (2001) found a less anxious personality and temporary mood state to be a correlate of better sleep quality. Others, however, have found that disruptions in quality of sleep

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cannot be explained by anxiety (Darko et al., 1995; Norman et al., 1990).

Environment can also negatively influence one's quality of sleep. Physical and social aspects of sleeping arrangements such as sleeping alone and sleeping in a noisy room have been studied in their relation to sleep quality (Nokes & Kendrew, 2001). The relationship between sleep and the number of additional people in the household, including adults and children, however, has not been considered.

The purpose of this study was to determine the correlates of HIV-associated aberrant quality of sleep. The PSQI, a premier instrument for sleep quality measurement, was used to determine overall sleep quality. We hypothesized that both physiological and psychological variables would relate to the disturbed sleep of HIV-infected patients. Once identified, these factors can be employed to create interventions tailored for the individual client.

METHOD

STUDY DESIGN

A descriptive correlational design was used to investigate physiological and psychological correlates of sleep quality in individuals with HIV disease.

SAMPLE

A sample of 79 HIV-infected persons was recruited from a community health care center in Columbia, South Carolina. Persons included in the study were documented to be HIV positive, 18 years of age or older, able to read or understand English at a sixth-grade level, and receiving at least partial health care services from the community health care center. No one was excluded on the basis of gender or ethnicity.

PROCEDURE

The Office for Research Protection at the University of South Carolina approved the study and its procedures prior to any data collection. The physicians at the community health center

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referred all potential study participants known to meet the study criteria. Research assistants signed a confidentiality statement and were specifically trained to provide full information concerning the research study prior to collecting all data. All participants' prior physical examinations and laboratory studies were assessed at the time of their medical appointments. All those interested in the study were directed to a large conference room, which provided privacy and comfort for completion of the required documents. After being fully informed of the nature and duration of the study by the research assistant, each participant was instructed to read and sign the informed consent statement. Participants were then asked to sign a consent form to allow their laboratory results (complete blood count, HIV-RNA viral load, and CD4+ T helper cell count) to be released to the researchers. Following informed consent, research assistants were available to assist each individual participant as necessary to complete a set of questionnaires. After the questionnaire's completion, payment of $20 was given to each participant.

INSTRUMENTS

Demographic data form. Participants were asked to report standard demographic variables such as age and race. HIV-related variables such as symptoms, route of infection, antiretroviral medications and hematinic medications (particularly iron and erythropoietin) were also assessed. Patients were also asked to rate their level of pain at the present time, their least amount of pain in the past 24 hours, their greatest amount of pain in the past 24 hours, and their average pain in the past 24 hours. The data from these four questions regarding pain were later summed to yield a total pain score.

PSQI. The PSQI is a subjective measure of the quality and patterns of sleep. The instrument contains 19 self-reported questions, which are combined to yield one total score and seven component scores. The seven component areas include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction over the past month. The total score of the PSQI was used to assess overall sleep quality. The

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total sleep quality score has a reported test-retest reliability of .85 and an internal consistency of .83. Concurrent polysomnography support the findings of the PSQI. Possible scores for the sleep quality scale range from 0 to 21, with a higher score indicating poorer sleep quality. A total score of greater than 5 shows moderate to severe difficulties in at least three areas, indicating an overall disturbance in sleep (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

HIV-Related Symptom Scale (HSS). The HSS was developed specifically for use in this study. This instrument comprises 19 questions regarding symptoms (i.e., fever, diarrhea, weight loss, white patches in the mouth, skin sores, other skin problems, fatigue) commonly experienced by HIV-infected individuals. Individuals were asked to rate each of the 19 symptoms on a scale of 1 (*no problem*) to 4 (*very much a problem*) regarding how much trouble each of the symptoms had been for them during the past month. Responses for each of the items were summed to give a total HIV-related symptom score. A higher score indicates a greater problem with HIV-related symptoms.

Revised Piper Fatigue Scale (RPFS). The RPFS is a questionnaire used to measure subjective fatigue. The RPFS contains 22 items, which are scaled from 0 (*no fatigue*) to 10 (*high fatigue*). There are also an additional five items, which are not scored and solely yield clinical information. The 22 numerically scaled items yield a total score, and four subscale scores including behavior/severity, affective meaning, sensory, and cognitive/mood dimensions of fatigue. The total fatigue score was used to measure subjective fatigue in this study. The RPFS has an internal consistency of .97. A higher score indicates greater fatigue (Piper et al., 1998).

Epworth Daytime Sleepiness Scale (ESS). The ESS is an eight-item questionnaire used to measure daytime sleepiness. Individuals were asked to rate on a scale from 0 to 3 how likely they are to doze off, or fall asleep, during specific situations. The total score of the ESS has a reported internal consistency of .88 and a test-retest reliability of .82. Possible scores range from 0 to 24. A higher score indicates greater daytime sleepiness (Johns, 1992).

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Perceived Stress Scale (PSS). The PSS is a 30-item instrument used to measure perceived stress. A total score was used in this study; however, seven subscales for perceived stress can also be obtained. Although the PSS can be used to collect data about general perceived stress, this study assessed recent perceived stress experienced during the past month. Participants were asked to rate each of the items on a scale of 1 (*almost never*) to 4 (*usually*). The PSS has a reported test-retest reliability of .82 for the general form; however, the recent form varied by a mean factor of 1.9 over 6 months. Internal consistencies were reported at greater than .90 for both the general and recent forms. A higher score indicates greater perceived stress (Levenstein et al., 1993).

Center for Epidemiological Studies Depression Scale (CES-D). The CES-D is a 20-item scale that measures depressive symptoms. The participants were asked to rate how often they had experienced a depressive symptom in each instance during the past week. The CES-D is a 4-point scale including 0 (*not at all to 1 day per week*), 1 (*1 to 2 days per week*), 2 (*3 to 4 days per week*), and 3 (*5 to 7 days per week*). Possible scores for this instrument range from 0 to 60. Internal consistencies for this instrument have been reported to range from .83 to .90. Concurrent and construct validity have been supported in a number of studies. A higher score indicates greater depressive symptoms (Radloff, 1977).

Spielberger's State-Trait Anxiety Inventory (STAI). The STAI is a 40-item instrument used to measure state anxiety (transitory) and trait anxiety (relatively stable anxiety proneness). There are 20 items each for the state and trait anxiety scales. Participants were asked to rate each of the 40 items on a scale of 1 (*not at all*) to 4 (*very much so*). The state anxiety scale is described as how the person is feeling at the present time. This portion of the STAI has internal consistencies ranging from .83 to .92, and test-retest reliabilities ranging from .16 to .92. The trait anxiety scale is described as a general inclination and a long-standing personality trait. This portion of the STAI has internal consistencies ranging from .86 to .92, and test-retest reliabilities ranging from .73 to .92. A higher score indicates greater anxiety (Spielberger, Gorsuch, & Lushene, 1983).

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Pain Visual Analog Scale (PVAS). Pain was measured using the PVAS (Clarke & Spear, 1964). The PVAS asks the participant to rate (a) present amount of pain, (b) least amount of pain in the past 24 hours, (c) greatest amount of pain in the past 24 hours, and (d) average amount of pain in the past 24 hours. Pain is ranked on a scale that ranges from 0 (*no pain*) to 10 (*the worst pain I have ever had*). Regardless of the particular scale used, subjective ratings of pain intensity are considered valid (McGuire, 1992). Test-retest reliability (r = .95, p < .001) has been demonstrated for visual analog scales that measure pain intensity (Revill, Robinson, Rosen, & Hogg, 1976). Visual analog scales may be more reliable in measuring changes in an individual's experience of pain than in comparing pain experience across groups, making them popular in studies of treatment outcomes (McGuire, 1992). Littman, Walker, and Schneider (1985) found a high degree of correlation (r = .89 to .93) between a visual analog scale, a verbal descriptor scale, and a verbal pain relief scale. Reliability of visual analog scales may be better to measure chronic pain in better educated individuals who do not have impaired motor coordination (McGuire, 1992).

Composites of 0 to 10 ratings, like the one described, maximize reliability in clinical settings where detecting changes of pain intensity in individuals is needed (Jensen, Turner, Romano, & Fisher, 1999).

DATA ANALYSIS

Statistical Analysis System Software Version 8.0 (SAS 8.0) was used to conduct the analyses. All data were entered by a research assistant and verified by an independent observer. Frequencies and percentages were calculated for each of the sociodemographic variables. The reliability of each instrument was tested using Cronbach's alpha reliability coefficient. Bivariate correlations were performed among the study variables using Pearson's coefficient of correlation. For this exploratory descriptive study, the level of statistical significance was established at an alpha of .05, and the statistical power was calculated to be .80 with medium effect size.

Variables that were significantly related to fatigue in the bivariate correlations (p < .05) were entered into a backward stepwise elimination model. Collinearity diagnostics were per-

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formed for the variables in the full model. Statistical power for the backward stepwise regression in this sample was calculated to be .80 with a medium effect size at a significance level of $p < .05$.

DESCRIPTION OF THE SAMPLE

The mean age of study participants was 39.9 years (range = 24 to 63 years). Most participants were female (54%) and African American (90%). All participants were HIV infected and were currently taking one or more antiretroviral medications. None reported taking erythropoietin or iron preparations other than that in a multiple vitamin. Ten participants were taking antidepressants, one was taking a short acting sedative hypnotic, and one was taking an anxiolytic. The sample is further described in Table 1.

DESCRIPTION OF SLEEP QUALITY

All participants reported pathological sleep disturbances as determined by a score of 5 or greater on the PSQI. The mean global score was 12.32 ± 3.93, whereas individual scores ranged from 5 to 21 on a possible scale of 0 to 21. However, the majority of the participants self-reported their sleep quality as fairly good and had a habitual sleep efficiency of greater than 85%. All participants had difficulties falling asleep during the past month. The sleep duration for 32% of the participants was reported at 5 to 6 hr per night. Sleep disturbances and daytime dysfunction were experienced by all of the participants during the past month. The use of sleeping medication was avoided by 53% of the participants. The results of the PSQI and its components are further described in Table 2.

BIVARIATE CORRELATIONS

Bivariate correlations were calculated among the study variables using Pearson's coefficient (Pearson's r) of correlation (see Table 3). Significant relationships were observed between quality of sleep and HIV-related symptoms ($r = .34$, $p = .002$), total pain ($r = .52$, $p < .0001$), fatigue ($r = .53$, $p < .0001$), depression ($r = .30$, $p = .009$), state anxiety ($r = .42$, $p = .0001$), trait anxiety ($r = .25$, $p = .028$), perceived stress ($r = .42$, $p = .0002$),

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Table 1
Demographic Characteristics of the Sample (n = 79)

Item	*n*	%
Gender		
Male	37	46.8
Female	42	53.2
Ethnicity		
African American	70	89.7
Caucasian	5	6.4
Hispanic	2	5.6
Other	1	1.3
Partnership status		
Single	64	82.0
Married or partnered	14	18.0
Number of adults		
0	11	15.7
1	25	35.7
2	21	30.0
3	7	10.0
4	5	7.1
13	1	1.4
Number of children		
0	19	41.3
1	12	26.1
2	9	19.6
3	4	8.7
4	1	2.2
5	1	2.2
Pain at present time		
None	37	46.8
A little	18	22.8
Moderate	18	22.8
Severe	5	6.3
Unbearable	1	1.3
Least amount of pain in past 24 hours		
None	35	44.3
A little	24	30.4
Moderate	17	21.5
Severe	2	2.5
Unbearable	1	1.3
Greatest amount of pain in past 24 hours		
None	34	43.0
A little	17	21.5
Moderate	12	15.2
Severe	14	17.8
Unbearable	2	2.5
Average pain in past 24 hours		
None	33	41.8
A little	17	21.5
Moderate	15	19.0
Severe	11	13.9
Unbearable	3	3.8

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Table 2
Statistical Description of Sleep as Measured by the Pittsburgh Sleep Quality Index (PSQI)

	Frequency	Percentage
Subjective sleep quality		
Very good	18	22.8
Fairly good	33	41.77
Fairly bad	18	22.78
Very bad	10	12.66
Sleep latency		
< 15 min, not during the past month	0	0
16 to 30 min, less than once per week	24	30.77
31 to 60 min, once or twice per week	28	35.90
> 60 min, three or more times per week	26	33.33
Sleep duration		
> 7 hours	18	23.68
6 to 7 hours		
5 to 6 hours	32	42.11
< 5 hours	17	22.37
Habitual sleep efficiency		
> 85%	27	42.86
75% to 85%	12	19.05
65% to 74%	10	15.87
< 65%	14	22.22
Sleep disturbances		
None	0	0
1 to 9	7	8.97
10 to 18	42	53.85
19 to 27	29	37.18
Use of sleeping medication		
Not during the past month	53	69.74
Less than once per week	5	6.58
Once or twice per week	4	5.26
Three or more times per week	14	18.42
Daytime dysfunction		
Never, no problem at all	0	0
One or two times per week, only a very slight problem	22	32.35
One to two times per week, somewhat of a problem	30	44.12
Three or more times per week, very big problem	16	23.53
	M	*SD*
Global sleep quality score	12.32	3.93

and number of adults in the household ($r = -.27$, $p = .025$). The relationships between poor sleep and daytime sleepiness (r =

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Table 3
Bivariate Correlations With Sleep Using Pearson's r

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Sleep quality												
2. State anxiety	.42***											
3. Trait anxiety	.25*	.74****										
4. Depression	.30**	.68****	.78****									
5. Perceived stress	.41***	.77****	.80****	.80****								
6. Fatigue	.53***	.71****	.57***	.65****	.71****							
7. Daytime sleepiness	.19	.18	.22	.37***	.34**	.33**						
8. CD4 count	.05	–.06	.01	–.06	–.07	.06	–.27*					
9. Viral load	–.03	.21	.11	.21	.16	.25*	–.02	–.26*				
10. HIV-related symptoms	.34**	.52***	.48***	.49***	.54***	.61****	.35**	–.19	.16			
11. Number of adults in the home	–.27*	–.14	.03	–.07	.06	–.05	.13	–.17	.01	–.04		
12. Number of children in the home	–.10	–.10	–.14	–.13	.02	–.07	.07	.01	.23	.13	.08	
13. Total pain	.52***	.45***	.28**	.41***	.41***	.61****	.17	–.02	.17	.62****	–.14	.01

*$p < .05$. **$p < .01$. ***$p < .001$. ****$p < .0001$.

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.19), CD4+ count (r = .05), viral load (r = –.03), and number of children in the household (r = –.10) were not found to be significant.

BACKWARD STEPWISE REGRESSION

Subsequently, independent variables (state anxiety, trait anxiety, depression, fatigue, HIV-related symptoms, and stress) that demonstrated a significant association with the dependent variable (sleep quality) were entered into a backward stepwise elimination equation. In a five-step solution, only fatigue and total pain retained statistical significance and explained 34% of the variance in fatigue ($F_{2,70} < .0001$).

DISCUSSION

Both physiological and psychological variables were found to have an effect on sleep, though the greatest correlation to sleep quality was found among psychological factors. Results from the present study provide important insight regarding the correlates of sleep quality in a predominantly African American population of HIV-positive individuals. We did not screen participants for sleep disturbances as part of the inclusion criteria. With a range of 5 to 20 on the PSQI, however, 97% of the participants in our study reported pathological sleep disturbances as determined by a score of 5 or greater. Several physiological and psychological variables were investigated and found to associate with the participants' disturbed sleep.

The physiologic variables examined in this study included CD4+ count and HIV-RNA viral load, HIV-related symptoms, fatigue, and daytime sleepiness. CD4+ count and HIV-RNA viral load did not correlate with sleep quality. HIV-related symptoms, fatigue, and daytime sleepiness were significantly associated with sleep quality in the bivariate correlations. In the backward stepwise regression, only fatigue retained statistically significance association with sleep quality.

There have been a number of conflicting reports of sleep quality's association with CD4+ cell counts and viral load. Our data support the findings of Nokes and Kendrew (2001) and Lee and colleagues (2001), who have reported no relationship between these variables.

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HIV-related symptoms were found to be a significant correlate of sleep quality, however. As expected and found by many other researchers, symptoms such as fever, cough, and cramping can lead to discomfort and thus unrestful sleep (Nokes & Kendrew, 2001). It has even been suggested that clinicians may be most effective in restoring and promoting sleep through the management of HIV-related symptoms (Phillips, 1999).

Pain specifically was also found to be a significant correlate of sleep quality. Our finding in this study that total pain was significantly associated with sleep quality supports our previous findings (Phillips & Skelton, 2001) and those of La Spina, Porazzi, Maggiolo, Bottura, and Suter (2001).

Fatigue and daytime sleepiness were both found to correlate with sleep quality. These findings are similar to those reported in HIV-infected women (Lee et al., 2001) and gay men (Darko et al., 1998). Although a causal relationship cannot be assumed, it seems logical that disruptive sleep may lead to fatigue and thus daytime sleepiness.

The psychological variables included in this study were depression, state and trait anxiety, and perceived stress. Depression, trait and state anxiety, and perceived stress were found to correlate with sleep quality in our HIV-infected sample. These findings are supported by many studies that have found that depressed and anxious HIV-infected individuals take longer to fall asleep, have more awakenings, and have less transitions into non-REM sleep (Fuller et al., 1997; Nokes & Kendrew, 2001; Penzak et al., 2000). In accordance with these reports, stress management interventions, such as relaxation therapy, may prove helpful in aiding the disturbed sleep of these individuals. However, some researchers believe that sleep disturbances are not simply psychological in etiology (Darko et al., 1995; Norman et al., 1992).

The final variables studied concerned the sleeping environment of our participants. Both the number of children and the number of adults in the household were assessed for their relationship to sleep quality in our HIV-infected participants. Although there have been no other studies that have examined these variables, our results suggest that only the number of adults is significantly related to sleep quality. A possible reason for this negative correlation may be that our participants were more likely to live with adults rather than children. Another

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possible reason for the observed increase in sleep quality may be that additional adults in the household serve as a support system for the infected individual. In future studies, it would be interesting to ask participants if, and in what manner, other people in the household contribute to their poor quality of sleep.

There are several limitations of this study that should be considered in future research. The cross-sectional design employed here limits our ability to distinguish a causal relationship among any of the investigated factors. There is a possibility that some other variable or variables may have affected the association of sleep quality with a measured correlate. Some of these variables may include specific antiretroviral drugs, caffeine intake, tobacco, and alcohol use, all of which may contribute to poorer sleep quality (Mock et al., 2002). These factors should be examined in future studies. Future work should also examine sleep quality's relationship to cytokines such as TNFα and IL-1. It has been proposed that cytokines act directly on somnogenic neural networks to alter sleep (Darko et al., 1995). Finally, the use of a convenience sample limits generalization to other groups. However, our sample of predominantly middle-aged African American females residing in the southeastern United States is one of the fastest growing groups in the HIV-infected population. In addition, this group of participants has been neglected in prior studies regarding sleep disturbance (Breitbart et al., 1998). Therefore, our findings provide useful information regarding sleep in this population.

Through effective antiretroviral treatment, HIV illness has been transformed from a fatal illness into a chronic condition (Centers for Disease Control and Prevention [CDC], 2001). HIV-infected individuals are living longer, and there is a new need to consider quality of life in these patients. Sleep quality is a significant determinant of health-related quality of life in this population (Phillips, Sowell, Boyd, & Hand, in review. Disturbed sleep may contribute to increased morbidity and disability in individuals with HIV disease and therefore deserves more attention in the research. Disturbed sleep, however, continues to be underdiagnosed and therefore undertreated in these individuals. The findings of this study support the need for holistic interventions and treatment of specific symptoms that contrib-

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ute to sleep disturbances so common in people infected with HIV disease.

CLINICAL IMPLICATIONS

Although 97% of the men and women in this sample reported poor sleep quality, only one person was taking any prescribed sedative or nonprescribed medication to help them sleep. In light of sleep quality's impact on quality of life, health care practitioners must anticipate and offer treatment for poor sleep quality. Both pharmacological and nonpharmacological therapies for sleep disturbances can be beneficial to HIV-infected persons.

Sleep hygiene is a nonpharmacological therapy that frequently diminishes simple sleep disturbances, such as insomnia. Zarcone (2000) describes several factors important in sleep hygiene. The first factor includes circadian rhythm and the propensity to sleep during the day. Methods such as nap avoidance, regular exercise, and taking hot baths before bed may improve timing of the sleep-wake cycle. Drug use is another factor that can greatly impede high-quality sleep. Clients with HIV/AIDS take a variety of medications, and virtually every drug that passes the blood-brain barrier can affect sleep (Roehrs & Roth, 1997). Caffeine, ethanol, and nicotine can also fragment sleep and should be limited before bedtime or given up entirely. A final class of sleep hygiene is arousal in the sleep setting. Methods such as using the bedroom only for sleep, keeping the clock out of sight, and practicing a bedtime ritual may minimize psychological stressors or habits related to nocturnal wakefulness. Health care providers should collect information about the precipitating and perpetuating factors affecting sleep-wake patterns in the HIV-infected individual. Once a sleeping problem is established, the patient will need a treatment plan based on the individual's clinical, mental, social, and environmental situations (Lacks & Morin, 1992).

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