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Sleep Disturbance and Depression as Barriers to Adherence

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This study examined the relationships among subjective sleep disturbance, depressive symptoms, and adherence to medications among HIV-infected women. HIV-infected women (N = 173) were recruited through community AIDS service organizations throughout South Carolina. Participants completed the Pittsburgh Sleep Quality Index (PSQI), the Centers for Epidemiological Studies Depression Scale (CES-D), and a modified version of the Adults AIDS Clinical Trials Group Adherence Baseline Questionnaire. Women who reported greater sleep disturbance also reported a higher level of depressive symptoms and reported poor adherence to their medication regimen. Depression helped to explain the relationship between sleep quality and adherence. Results indicate that assessment

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and management of sleep disturbance and depressive symptoms in women with HIV disease is important to promote medication adherence.

**Keywords:** sleep quality; HIV disease; women; depressive symptoms; medication adherence

Use of highly active antiretroviral therapy (HAART), careful monitoring of viral load, and better treatments for opportunistic infections have offered new hope for health and life to HIV-infected individuals. Treatment of HIV infection with HAART has been shown to suppress viral load to nondetectable levels in many patients (Montaner et al., 1998), reduce morbidity and mortality (Selik & Lindegren, 2003), reduce hospitalizations (Fleishman & Hellinger, 2003), and improve quality of life (Gill et al., 2002).

**PSYCHOSOCIAL BARRIERS TO MEDICATION ADHERENCE IN HIV DISEASE**

The problem is that nearly perfect adherence to a complex regimen of medications is necessary to achieve these benefits (Low-Beer, Yip, O'Shaughnessy, Hogg, & Montaner, 2000). Failure to adhere to HAART may result in treatment failure evidenced by rising viral load, development of drug-resistant strains of HIV, and disease progression (Gifford et al., 2000). Persons who do not maintain a 95% adherence rate to HAART are at high risk for treatment failure and adverse clinical outcomes (Gifford et al., 2000). It is estimated that as many as 80% of HIV-infected persons who have been treated with HAART now have drug-resistant strains of HIV (Richman et al., 2001).

Despite the efforts of health care professionals to encourage adherence, many HIV-infected individuals continue to miss doses, take lower doses than prescribed, or fail to take their medications as directed (Sankar, Luborsky, Schuman, & Roberts, 2002). Knowledge of possible barriers to adherence will facilitate the development of effective interventions for different segments of the population. Depression is recognized as a potential barrier to medication adherence (Starace et al., 2002), but the relationship of sleep disturbance with medication adherence has not been investigated fully.
A review of the literature supports the following theoretical framework. Sleep disturbance and depression may directly or indirectly affect adherence to antiretroviral medications (see Figure 1).

**THEORETICAL FRAMEWORK**

A review of the literature supports the following theoretical framework. Sleep disturbance and depression may directly or indirectly affect adherence to antiretroviral medications (see Figure 1).

**Adherence to Antiretroviral Medications**

Antiretroviral drugs can have enormous positive effects on the outcomes of HIV patients. HIV patients, however, must show a high level of adherence to HAART to suppress viral load and avoid production of resistant strains of the virus. Adherence to antiretroviral medications refers to the degree to which a patient takes antiretrovirals as prescribed by a health care practitioner. Adherence to HAART requires that the patient take the prescribed type and amount of medication, at the correct time, and with the appropriate dietary considerations. A recent study indicates that adherence rates greater than 95% are necessary to achieve maximum HIV-RNA viral suppression (Paterson et al., 2000).
Failure to adhere to medication regimens is the most frequent cause of virologic failure (Knobel et al., 2001), which is defined as an increase in the rate of viral replication and mutation following initiation of a protease inhibitor. Failure to adhere permits viral replication to continue (Gifford et al., 2000; Montaner et al., 1998) and mutant resistant strains of HIV to emerge (Gifford et al., 2000; Montaner et al., 1998). HIV-resistant strains can be transmitted horizontally (Salomon et al., 2000) from one individual to another or vertically (DeJose, Ramos, Alvarez, Jimenez, & Munoz-Fernandez, 2001) from an HIV-infected mother to her unborn child. An additional concern regarding suboptimal adherence is the development of cross-resistance to available medications. If an individual develops resistance to one antiretroviral, resistance to other drugs in that same class or other classes may develop, thus limiting future treatment options (Rousseau et al., 2001).

Research has found links between various patient concerns and conditions including depressive symptoms and adherence. Depressed patients with varying diseases are less likely to be adherent to a treatment program and experience worse health outcomes (Leserman, 2003). Ickovics and colleagues (2001) found that HIV-infected female patients with symptoms of chronic depression were 2 times more likely to die than patients without depression and displayed a greater decline in CD4 cell count when compared to the patients without depressive symptoms (Chesney et al., 2000). A recent review by Leserman (2003) explored research from long-term longitudinal studies that demonstrated a relationship between depression and a faster progression from HIV to AIDS.

**Sleep Disturbance and Adherence**

The link between sleep dysfunction and depression has long been acknowledged (Adrien, 2002; Shaffery, Hoffman, & Armitage, 2003; Thase, 1999). Depression can lead to sleep disturbances and, conversely, sleep problems can produce depression. HAART is a complicated treatment program that requires great attention to the details of medication schedules and dietary restrictions (Liu et al., 2001; Miller & Hays, 2000). In addition to a demanding treatment schedule, the side effects of antiretrovirals can be harsh, requiring great personal motivation to continue treatment (Miller & Hays, 2000). Patient
adherence to the regime may be hampered by sleep disturbances related to depression that affect mental sharpness and attention to detail. The present study examined sleep disturbances as a possible barrier to adherence in HIV-infected individuals.

**Sleep and Depressive Symptoms**

Benca, Obermeyer, Thisted, and Gillin (1992) found sleep irregularity to be the most common clinical and physical sign of depression. There are two major forms of sleep disturbances in depressed persons: insomnia and rapid eye movement (REM) dysfunction (Adrien, 2002). A depressed person experiences a decrease in REM latency; that is to say the onset of REM sleep is accelerated. The outcome of this shift in sleep patterns is an increase in REM sleep and a decrease in slow wave sleep (SWS) that impairs sleep continuity (Cheeta, Ruigt, van Proosdij, & Willner, 1997). Abnormalities in when and how long REM and SWS occur are main characteristics of major depressive disorder (Shaffery, Sinton, Bissette, Roffwarg, & Marks, 2002). An increased cholinergic response is thought to be the cause of the increase and dysfunction in REM sleep in those who are depressed. The opposite effect, a decrease in REM sleep, is seen when serotonin agonists are given to depressed patients. Most antidepressants suppress REM sleep, and it is that action which is thought to relieve the symptoms of depression (Seifritz, 2001). A patient with depression’s symptoms will be improved following a night of sleep deprivation, which also acts to increase serotonin, and symptoms will reoccur after one night of uninhibited sleep (Seifritz, 2001). Insomnia may actually improve mood by increasing “serotoninergic neurotransmission” and may act as a compensatory mechanism for depressives. However, REM latency and increased REM pressure is pathologically related to depression and is a risk factor for developing the disorder (Adrien, 2002). Sleep deprivation can cause problems in all aspects of life and may affect a patient’s ability to recover from illness. The more severe depression becomes, the more normal sleep patterns are compromised (Riemann, Berger, & Voderholzer, 2001).

The link between depression and poor sleep quality has been shown in numerous studies (Adrien, 2002; Shaffery et al., 2003; Thase, 1999). As many as 90% of depressed patients also
experience poor sleep (Riemann et al., 2001). This poor quality nighttime sleep can inhibit daytime function and interfere with adherence to treatment programs (Thase, 1999). The relationship between depression and sleep dysfunction has often been studied as a direct link. Some studies have also found that persistent poor sleep can cause depression. A vicious cycle may unfortunately exist between sleep and depression.

Poor patient adherence will disrupt the most successful treatment regimen. Poorer health outcomes seen in depressed patients may be partially explained by the patient with depression’s propensity to poor adherence (Wing, Phelan, & Tate, 2002). A study by the Depression Guideline Panel concluded that only 40% of depressed patients adhere to completing the 9-month recommended antidepressant treatment (Wing et al., 2002). A meta-analysis by DiMatteo, Lepper, and Croghan (2000) of literature on depression and adherence concluded that the odds are 3 times greater for a person with depressive symptoms to be nonadherent than for a person with no depressive symptoms. Wing and colleagues (2002) offered several possible explanations for this relationship: patients with depression often feel hopeless and may believe no treatment will be successful, they are often socially isolated and do not experience social support important to adherence, they may have cognitive impairment that renders them less capable of understanding or complying with the prescription, and they often lack the energy needed to complete many simple tasks. This lack of energy could be a result of or be exacerbated by poor sleep quality.

Thase (1999) believes that early relief from patient insomnia can increase patient adherence to the treatment program and thus improve patient prognosis. As previously mentioned, insomnia is commonly treated in concert with depression. Treatment protocols for depressed patients with HIV need to include antidepressants that improve sleep quality (Thase, 1999). Depression may not be an existing condition in HIV patients but is often a result of the virus itself and “central nervous system brain involvement” (Cruess, Evans, et al., 2003, p. 307). Cruess and colleagues found that mood disorders are often “unrecognized and untreated” (Cruess, Evans, et al., 2003, p. 307). In a study of 2,864 HIV-positive patients, researchers found that one third were experiencing symptoms of major depression (Cruess, Evans, et al., 2003).
Summary

Adherence to a complex regimen of HAART has improved the health and quality of life of many HIV-infected individuals. Nearly perfect adherence is necessary to achieve the benefits of HAART. Sleep disturbance and depressive symptoms are frequent symptoms associated with HIV disease. Depressive symptoms are recognized barriers to medication adherence. Sleep disturbance is frequently associated with depressive symptoms. The relationships between sleep disturbance, depressive symptoms, and medication adherence need further exploration.

PURPOSE OF THE STUDY

The primary purpose was to describe the relationships among sleep disturbance, depressive symptoms, and adherence in women with HIV disease. The secondary purpose was to describe the role (mediating effect) of depressive symptoms in the relationship of sleep disturbance and medication adherence.

DESIGN

The cross-sectional data reported here represent the third interview of a longitudinal clinical trial designed to test the effects of a peer-counseling intervention on depressive symptoms, disease management, and quality of life of rural women with HIV disease.

SAMPLE

One hundred seventy-three women (62%) of the 278 HIV-infected women recruited at the beginning of the study participated in the third interview. The sample was recruited from 10 public health agencies and voluntary community-based HIV/AIDS organizations serving rural areas of the southeastern United States. The recruitment sites provide a range of HIV/AIDS-specific services, including HIV testing and counseling, early intervention, case management, and treatment of persons with HIV/AIDS.
Women who participated resided in rural areas or towns with a population less than 50,000. They were 18 years of age or older, either African American or Caucasian, and HIV infected. They spoke English and had no evidence of dementia. Because the intervention targeted depressive symptoms, women were included in the study if they scored 16 or higher on a measure of depressive symptoms (Radloff, 1977). A cut-off point of 16 or higher is significantly correlated with a clinical diagnosis of depression (Radloff, 1977).

The sample consisted of largely single (84%), African American women (90%) living alone with their children. Fifty-one percent reported annual household incomes of less than $5,000, with 80% less than $10,000. Half of the sample lived in a small town (51%) and half (49%) lived on rural routes. Participants ranged in age from 18 to 69 years, with a mean age of 39.3 ± 10 years. Forty percent of the women had not earned a high school diploma. Only a small number of women (25%) was employed either full- or part-time. Of the 174 women who provided information about their medications on the third questionnaire, 65 women (37.4%) were not taking any antiretroviral medication and 109 women (62.6%) were taking one or more antiretroviral medications. Four women (3.7%) were taking only one antiretroviral, 16 women (14.7%) were taking two antiretrovirals, and 89 participants (81.6%) were taking three or four antiretroviral drugs. Seven women (4%) were taking anxiolytics, 13 women (7%) were taking antidepressants, 3 women (2%) were taking a narcotic analgesic, and 1 woman was taking phenobarbital, an anticonvulsant medication with sedative properties.

**METHOD**

**PROCEDURES**

Women were recruited by female research assistants hired from the local area who received intensive training in recruitment and interviewing techniques. Following informed consent, women were interviewed individually either in their home or other mutually agreed on site where privacy and confidentiality could be maintained. All questions were read to the women and their responses were recorded. Interviews lasted
approximately 2 hours. Each woman was paid $30 for participating in the third interview. This study was approved by the Institutional Review Board of the University of South Carolina prior to any data collection.

**INSTRUMENTS**

**Sleep Quality**

Sleep quality was assessed by self-report in the direct face-to-face interview using the Pittsburgh Sleep Quality Index (PSQI). The instrument contains 19 self-report items and 5 items that are rated by a roommate or bed partner. As most of the women lived alone, the 5 items that are rated by a roommate or a bed partner were omitted. The 5 self-report items are never used in the calculation of the sleep quality score. The total score of the 19 self-report items of the PSQI was used to measure subjective sleep quality during the past month. In addition to the total score, seven component scores may be obtained. Possible total scores range from 0 to 21. The instrument has demonstrated reliability with a Cronbach’s alpha of .83. A higher total score indicates poorer sleep quality.

**Depressive Symptoms**

The Center for Epidemiologic Studies Depression Scale (CES-D) was used to measure depressive symptoms. The CES-D is a 20-item self-report, Likert-type instrument. Women were asked how often they experienced the symptom during the past week. Possible responses range from 0 (rarely or none of the time) to 3 (most or all of the time). The CES-D has high internal consistency (α = .90). Possible scores range from 0 to 60, with a higher score indicating greater depressive symptoms. A score of 16 or greater is consistent with a clinical diagnosis of depression.

**Adherence**

Adherence was assessed by self-report in the direct face-to-face interview using a modified version of the Adults AIDS Clinical Trials Group Adherence Baseline Questionnaire (Chesney et al., 2000; Chesney & Folkman, 1994). The women were given
a list of 14 commonly reported reasons for missing medications. For each possible reason, they were asked to rate on a 4-point, Likert-type scale how often they had missed a medication for that reason. Possible responses were 0 (never), 1 (rarely), 3 (sometimes), and 4 (often). A higher score indicated greater nonadherence. Internal consistency reliability of the scale for the sample was high (alpha = .95).

**DATA ANALYSIS**

Frequencies and percentages were calculated for the demographic variables. Analysis of variance was used to test whether sleep quality and depressive symptoms varied by demographic characteristics. Women were classified as good sleepers (PSQI score 5 or less) or as poor sleepers (PSQI score > 5) and as having mild depressive symptoms (CES-D score 8 to 15) or severe depressive symptoms (CES-D score 16 or greater). Reasons for missing medications were classified as never missed medications or missed medications for that reason. Chi-square and Fisher’s Exact Test were used to test the association of sleep quality and depressive symptoms with reasons for missing medication. A p-value less than .05 was established as the level of significance. The hypothesis that depressive symptoms mediate the relationship between sleep quality and adherence was tested using the four-step approach and criteria proposed by Baron and Kenny (1986). The following conditions must be met to establish mediation: (a) sleep quality must be significantly related to the mediator (depressive symptoms); (b) the mediator variable (depressive symptoms) must predict adherence; (c) when sleep quality and depressive symptoms are controlled, the previously significant relationship between the sleep quality and adherence becomes insignificant.

**FINDINGS**

**SLEEP QUALITY**

The global sleep quality score was 8.1 ± 3.9, indicating that this sample of women had significant sleep disturbance. Sleep quality varied by race and stage of illness. Sleep quality was
slightly better for African American than Caucasian women \( (p = .02) \), and poorer for HIV-infected women who were symptomatic and women who had progressed to AIDS than for those women who were asymptomatic \( (p = .0003) \).

**DEPRESSIVE SYMPTOMS**

The sample mean score for depressive symptoms was 24.1 ± 12.7. Depressive symptoms varied by education \( (p = .04) \) and whether or not a woman had a paying job \( (p = .02) \). Depressive symptoms were lower for women who had some college or technical training than women who were less educated and for women who were employed full- or part-time.

**ADHERENCE**

Women were asked how long it had been since they had missed a dose of medication. Only 30% of the women reported never skipping or missing a dose of medication in more than 3 months. Thirty-five percent of the women had missed one or more medication doses during the past month.

**SLEEP QUALITY, DEPRESSIVE SYMPTOMS, AND ADHERENCE**

The primary purpose was analyzed using \( t \) tests, chi-square, and Fisher’s Exact Test to test the strength of association between sleep quality and adherence. A significant difference was found for the total medication adherence score between good sleepers (mean 2.0 ± 4.4) and poor sleepers (mean 6.8 ± 8.3; \( t_{df = 67} = -3.4, p = .001 \)). Chi-square and Fisher Exact tests of the individual items for reasons for missing medications demonstrated that poor sleepers were more likely than good sleepers to forget medications, want to avoid the side effects of medications, not want others to notice them taking their medication, have a change in their daily routine, fall asleep through the dose time, feel too sick or ill, feel depressed/overwhelmed, have problems with taking pills at specified times (with meals, on empty stomach, etc.), and run out of pills. No association was found between sleep quality and being away from home, being busy with other things, having too many pills to take, feeling that the drug was toxic or harmful, or feeling good (see Table 1).
Chi-square, \( t \) tests, and Fisher's Exact Tests were used to test the strength of association between depressive symptoms and adherence. A significant difference was found for the total medication adherence score between women with moderate depressive symptoms (mean 1.8 ± 3.9) and women with severe depressive symptoms (mean 6.1 ± 10.1; \( t_{(df = 123)} = -3.8, p = .0002 \)). Chi-square and Fisher's Exact Test of the individual reasons for missing medications revealed that women with severe depressive symptoms were more likely to perceive that they had too many medications to take or the drug was toxic or harmful, fall asleep through the dose time, feel sick or ill, feel depressed/overwhelmed, and have problems with taking pills at specified times (with meals, on an empty stomach, etc.) than women with mild symptoms. No association was detected between depressive symptoms and being away from home, being busy with other things, simply forgetting, not wanting others noticing them taking their medications, having a change in daily routine, running out of pills, or feeling good (see Table 2).

To examine the mediating effect of depressive symptoms in the model, the variables were examined using regression analysis procedures outlined by Baron and Kenny (1986). A mediator is a third variable that influences the relationship between a predictor (sleep quality) and an outcome (adherence) variable. The mediator helps explain how or why the relationship works. In other words, the mediator (depressive symptoms) provides additional information about the relationship of sleep quality and adherence. Sleep quality significantly predicted depressive symptoms \( (p < .0001) \) and adherence \( (p = .006) \). When sleep quality and depressive symptoms were regressed on reasons for missing medications, depressive symptoms remained a significant predictor of adherence \( (p = .032) \), but the direct relations of sleep quality to reasons for missing medications became nonsignificant \( (p = .0872) \). Removing the effects of depressive symptoms significantly reduced the relationship between sleep quality and reasons for missing medications.

**DISCUSSION**

Findings indicate that sleep quality and depression are related to antiretroviral medication adherence in a sample of
Table 1
Association of Sleep Quality With Reasons for Missing Medication

<table>
<thead>
<tr>
<th>Reason for Missing Medication</th>
<th>Total Sample</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never Missed</td>
<td>Missed Medications</td>
<td>Never Missed</td>
<td>Missed Medications</td>
<td>Never Missed</td>
<td>Missed Medications</td>
<td>p</td>
</tr>
<tr>
<td>Were away from home?</td>
<td>69</td>
<td>19</td>
<td>37</td>
<td>6</td>
<td>32</td>
<td>13</td>
<td>.0887(^a)</td>
</tr>
<tr>
<td>Were busy with other things?</td>
<td>71</td>
<td>18</td>
<td>38</td>
<td>6</td>
<td>33</td>
<td>12</td>
<td>.1260(^a)</td>
</tr>
<tr>
<td>Simply forgot?</td>
<td>63</td>
<td>25</td>
<td>38</td>
<td>5</td>
<td>25</td>
<td>20</td>
<td>*.0006(^a)</td>
</tr>
<tr>
<td>Had too many pills to take?</td>
<td>72</td>
<td>17</td>
<td>38</td>
<td>6</td>
<td>34</td>
<td>11</td>
<td>.1947(^a)</td>
</tr>
<tr>
<td>Wanted to avoid side effects?</td>
<td>73</td>
<td>16</td>
<td>40</td>
<td>4</td>
<td>38</td>
<td>12</td>
<td>*.0309(^a)</td>
</tr>
<tr>
<td>Did not want others to notice you taking medication?</td>
<td>82</td>
<td>7</td>
<td>44</td>
<td>0</td>
<td>38</td>
<td>7</td>
<td>*.0064(^a)</td>
</tr>
<tr>
<td>Had a change in daily routine?</td>
<td>69</td>
<td>20</td>
<td>38</td>
<td>6</td>
<td>31</td>
<td>14</td>
<td>*.0483(^a)</td>
</tr>
<tr>
<td>Felt like the drug was toxic/harmful?</td>
<td>79</td>
<td>10</td>
<td>41</td>
<td>3</td>
<td>38</td>
<td>7</td>
<td>.3148(^b)</td>
</tr>
<tr>
<td>Fell asleep/slept through dose time?</td>
<td>66</td>
<td>23</td>
<td>38</td>
<td>6</td>
<td>28</td>
<td>17</td>
<td>*.0093(^b)</td>
</tr>
<tr>
<td>Felt sick or ill?</td>
<td>69</td>
<td>20</td>
<td>40</td>
<td>4</td>
<td>29</td>
<td>16</td>
<td>*.0028(^b)</td>
</tr>
<tr>
<td>Felt depressed/overwhelmed?</td>
<td>70</td>
<td>19</td>
<td>41</td>
<td>3</td>
<td>29</td>
<td>16</td>
<td>*.0009(^b)</td>
</tr>
<tr>
<td>Had problem with taking pills at specified times (with meals, on empty stomach, etc.)?</td>
<td>72</td>
<td>17</td>
<td>42</td>
<td>2</td>
<td>30</td>
<td>15</td>
<td>*.0006(^b)</td>
</tr>
<tr>
<td>Ran out of pills?</td>
<td>71</td>
<td>18</td>
<td>39</td>
<td>5</td>
<td>32</td>
<td>13</td>
<td>*.0396(^b)</td>
</tr>
<tr>
<td>Felt good?</td>
<td>77</td>
<td>12</td>
<td>40</td>
<td>4</td>
<td>37</td>
<td>8</td>
<td>.2303(^b)</td>
</tr>
</tbody>
</table>

NOTE: Never missed = never missed a medication for this reason. Missed medication = missed a medication for this reason.
\(a\) = Chi-square.
\(b\) = Fisher's Exact Test.
\* = Statistically significant, \(p > .05\).
### Table 2

**Association of Depressive Symptoms With Reasons for Missing Medications**

<table>
<thead>
<tr>
<th>Reason for Missing Medication</th>
<th>Total Sample</th>
<th>Mild Depression</th>
<th>Severe Depression</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never Missed</td>
<td>Missed Medications</td>
<td>Never Missed</td>
<td>Missed Medications</td>
</tr>
<tr>
<td>Were away from home?</td>
<td>94</td>
<td>30</td>
<td>33</td>
<td>7</td>
</tr>
<tr>
<td>Were busy with other things?</td>
<td>97</td>
<td>28</td>
<td>35</td>
<td>6</td>
</tr>
<tr>
<td>Simply forgot?</td>
<td>89</td>
<td>35</td>
<td>31</td>
<td>9</td>
</tr>
<tr>
<td>Had too many pills to take?</td>
<td>104</td>
<td>21</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Wanted to avoid side effects?</td>
<td>106</td>
<td>19</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Did not want others to notice you taking medication?</td>
<td>113</td>
<td>12</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Had a change in daily routine?</td>
<td>110</td>
<td>15</td>
<td>40</td>
<td>1</td>
</tr>
<tr>
<td>Felt like the drug was toxic/harmful?</td>
<td>91</td>
<td>34</td>
<td>35</td>
<td>6</td>
</tr>
<tr>
<td>Fell asleep/slept through dose time?</td>
<td>99</td>
<td>26</td>
<td>39</td>
<td>2</td>
</tr>
<tr>
<td>Felt sick or ill?</td>
<td>99</td>
<td>26</td>
<td>41</td>
<td>0</td>
</tr>
<tr>
<td>Felt depressed/overwhelmed?</td>
<td>99</td>
<td>26</td>
<td>41</td>
<td>0</td>
</tr>
<tr>
<td>Had problem with taking pills at specified times (with meals, on empty stomach, etc.)?</td>
<td>101</td>
<td>23</td>
<td>38</td>
<td>3</td>
</tr>
<tr>
<td>Ran out of pills?</td>
<td>100</td>
<td>25</td>
<td>36</td>
<td>5</td>
</tr>
<tr>
<td>Felt good?</td>
<td>107</td>
<td>17</td>
<td>38</td>
<td>3</td>
</tr>
</tbody>
</table>

**NOTE:** Never missed = never missed a medication for this reason. Missed medication = missed a medication for this reason.

a. = Chi-square.

b. = Fisher's Exact Test.

* = Statistically significant, p > .05.
low-income, HIV-infected women living in the rural southeastern United States. The findings further suggest that whether sleep quality adversely affects an HIV-infected woman’s medication adherence may depend on whether she is experiencing depressive symptoms. To our knowledge, this is the first study that examined the effects of depressive symptoms on disturbed sleep and medication adherence.

We found a high prevalence of sleep disturbance in these women. Almost two thirds of the sample reported a sleep score greater than 5, meaning that almost two thirds of the women suffer severe sleep disturbance. This is consistent with the findings of others who have reported a high prevalence of sleep disturbance in HIV disease (Hand, Phillips, Sowell, Rojas, & Becker, 2003; Rubinstein & Selwyn, 1998). Sleep disturbance is of particular importance in HIV disease because of the demonstrated adverse effect of sleep deprivation on immunity in healthy individuals (Dinges, Douglas, Hamarman, Zaugg, & Kapoor, 1995; Irwin, 2002) and in HIV disease (Cruess, Antoni, et al., 2003).

We also found a high prevalence of depressive symptoms in this population. The prevalence of depression is almost twice as high for HIV-infected women than for HIV-infected men (Ickovics et al., 2001). Depression has been shown to be associated with HIV disease progression (Leserman, 2003) and increased morbidity and mortality (Ickovics et al., 2001). Depression has been related to alterations in natural killer cells and T suppressor cells (CD8+), two groups of cells that are important in suppressing HIV disease progression.

Despite the high levels of depression, anxiety, and sleep disturbance, pharmacological interventions for these conditions were relatively low. This may indicate that these conditions are underreported and/or undertreated by HIV-infected women.

LIMITATIONS

Several issues limit the results of the study. Our sample included only women from one geographic region of the United States. The measure of adherence was self-report, and true adherence levels are often underestimated when self-reported (Melbourne et al., 1999; Miller & Hays, 2000). No questions were asked to assess the use of over-the-counter sleeping medications or street drugs. Many factors related to sleep quality,
such as caffeine intake and sleeping environment, were not assessed and limit the findings of this study.

This study is limited by the fact that women who scored less than 16 on the CES-D at baseline were excluded from participation. Most of the women who presented for participation scored greater than 16 on the CES-D, indicating a high prevalence of clinical depression in this population. It would be interesting in a replication of this study to include women who were not depressed.

Finally, the results of multiple comparisons are reported. There is a high risk of making a Type 1 error (i.e., incorrectly declaring a difference between two groups, when a real difference does not exist). Therefore, the relationships reported in this study should be confirmed in a separate study.

**CLINICAL IMPLICATIONS**

The results of this study point to the great need to incorporate nursing interventions to reduce depression and improve sleep quality when implementing a plan to improve adherence to HIV antiretroviral therapy. For instance, the findings of this study suggest that poor sleepers may sleep through doses, forget to take their medications, and run out of pills. Extra social support may be needed to help them remember their medications and to keep medications on hand. Specific interventions for disrupted sleep quality, including sleep hygiene instructions and relaxation training exercises such as progressive muscle relaxation and autogenic training, may be sufficient to promote restful sleep. In severe cases of insomnia, sedative hypnotics may be prescribed.

Our results indicate that women with depression may be more likely to sleep through medication doses and to feel that the drugs are toxic or harmful. Exploration of their beliefs about medications may help to improve adherence for depressed women. Individual or group counseling is advised for depressed HIV-infected women. Increasing social support and empathetic responses by health care providers may help reduce depression. Antidepressants may be necessary to provide relief from deeper depression. Treatment of depression is also likely to alleviate depression-related sleep disturbances such as terminal wakening.
CONCLUSION

Findings indicate that sleep disturbances and depressive symptoms are associated with antiretroviral medication adherence in a population of low-income, HIV-infected women in the southeastern United States. Depressive symptoms play a role in the relationship between sleep disturbance and antiretroviral medication adherence. These findings are of particular importance in HIV disease because of an adverse effect of sleep deprivation on immunity in healthy individuals and in HIV disease. Advanced practice and primary clinical nurses remain at the forefront of caring for HIV-infected women and have the requisite skills to deliver nursing care that addresses their holistic needs.

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