

# Sleep Complaints and Visual Impairment Among Older Americans: A Community-Based Study

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**Background.** This report describes the associations between sleep complaints and reported visual impairment in an urban community-residing older adult sample.

**Methods.** A total of 1118 volunteers from a biracial cohort participated in the study (mean age =  $74 \pm 6$ ; mean body mass index =  $28 \pm 10$ ). Volunteers were recruited using a stratified, cluster sampling technique. In a standard order, several questionnaires were administered, soliciting information on socioeconomic status, physical health, social support, and emotional experience. The physical health questionnaire included questions on whether or not the volunteer experienced sleep disorder, visual impairment, heart disease, respiratory disease, arthritis, and hypertension. In this report, we present data on the prevalence of reported sleep problems and visual impairment among older adults.

**Results.** Of the total sample, 9% used sleep medicine, 25% reported difficulty falling asleep, 52% indicated experiencing difficulty maintaining sleep, 28% reported waking up early in the morning, and 12% reported daytime sleep longer than 2 hours. Chi-square results showed greater sleep complaints for volunteers with visual impairment. Consistent with these results, analysis of variance revealed that visually impaired volunteers had a higher index rate of sleep disturbance ( $F_{(1, 1110)} = 35.32, p < .0001$ ).

**Conclusions.** These data provide evidence that older adults reporting visual impairment are also likely to report sleep complaints. This verifies laboratory findings of an association of ophthalmic diseases with sleep-wake problems and with circadian rhythm abnormalities.

ACCORDING to the 1990 census, 0.96% of adults older than the age of 40 (95 million) in the United States are legally blind (1). Of note, among adults of similar ages, visual impairment itself is slightly higher (2.24%) (1), and according to the Salisbury Eye Evaluation Study, a population-based study among noninstitutionalized Medicare enrollees aged 65–84 years, the rate increases by 3.4% (2). Research has shown that several ophthalmic diseases may contribute to the report of visual impairment (3). They include cataract, glaucoma, macular degeneration, diabetic retinopathy, and optic nerve atrophy (4,5). These diseases are associated with diminished capacity as measured by activity of daily living scales, reduced quality of life, impaired sleep quality, and depressed moods (6–9). Furthermore, they could also have a negative effect on the suprachiasmatic nucleus (SCN) of the hypothalamus, the endogenous circadian pacemaker, by decreasing photic input. This finding is particularly important because in humans and other mammals, the SCN, the biological clock of the brain, controls most circadian rhythms, such as rest-activity rhythm (10), body temperature, corticosterone secretion, heart rate, and pineal N-acetyltransferase (11–15), which indirectly regulates physiologic and behavioral functions (16–18).

Research conducted with adults without visual compromise has shown that the photosensory system provides photic input to the SCN. This in turn synchronizes several

biological rhythms (e.g., sleep-wake cycles) to a 24-hour day (19). However, in persons with complete absence of light perception, the SCN free-runs (20), and these rhythms remain in a large measure desynchronized (21,22). It has been established that the consequences of a desynchronized SCN among blind individuals include sleep disturbances and depressed moods (21,22). However, for those who are visually impaired, the consequences of a malsynchronized SCN remain unclear, although it is speculated that those patients might experience dampened endogenous rhythms, often resulting in sleep disturbances and depression (21,23).

Recent data from a survey conducted by the National Sleep Foundation have suggested that 39% of respondents aged 65 years and older experienced symptoms of insomnia (24). Moreover, as found in clinical studies, sleep disturbances among older adults may have several etiologies. Indeed, there is a body of research demonstrating relations of sleep disturbances to several medical and psychiatric conditions (25–31).

The notion of a possible association between sleep and ophthalmic abnormalities has been investigated. For example, sleep apnea, one of the most common sleep disorders, has been reported to be associated with glaucoma (32), floppy eyelid syndrome (33,34), keratoconus (35), papilledema (36), and optic neuropathy (37). It is also assumed that optic nerve vascular dysregulation might be secondary

to sleep-disordered breathing-induced arterial hypertension and arteriosclerosis, and/or the imbalance between nitric oxide (a vasodilator) and endothelin (a vasoconstrictor) (38). Others have suggested that repetitive prolonged hypoxia, a phenomenon that is common during apneic episodes, might also directly damage the optic nerve (32). However, little is known about the relationship between sleep complaints and self-reported visual impairment. In this study, we examined the associations between sleep complaints and visual impairment among urban community-residing older Americans.

## METHODS

### Participants and Procedures

A total of 1118 volunteers from a biracial cohort (60% African Americans, 40% European Americans) in Brooklyn, New York, participated in the study (Table 1). Volunteers were recruited using a stratified, cluster sampling technique, and those who provided valid data were paid \$20 for their participation. Trained interviewers of the same race as the respondents gathered data during face-to-face interviews conducted either in the respondent's home or another location of their choice; interviews lasted approximately an hour and a half. In a standard order, several questionnaires were administered soliciting information on socioeconomic status, physical health, social support, and emotional experience.

This report is based on sociodemographic and physical health data, as part of a larger study on stress and coping among adult Americans. The sociodemographic data included age, gender, ethnicity, household income, and educational attainment. Physical health was measured with the Comprehensive Assessment and Referral Evaluation Scale (39). This instrument is used to assess physical disability and has been used extensively in investigations involving older individuals in minority populations and has shown good construct validity (40) as well as concurrent and predictive validity (41). The physical health questionnaire included questions on sleep disorders, visual impairment, heart disease, respiratory disease, arthritis, and hypertension.

### Statistical Analysis

The present analysis focuses on the sleep disorder and the visual impairment components of the physical health questionnaire. Six questions comprise the sleep disorder subscale (Table 2). Eleven questions comprise the visual impairment subscale (Table 3).

To explore the relationship between sleep complaint and visual impairment, chi-square tests were used with two dummy-coded variables: sleep complaint (yes or no) and vi-

Table 1. Sociodemographic Characteristics of Participating Older Adults

Variable	African American	European American
Mean Age ( <i>SD</i> )	74 (6)	75 (6)
Mean Household Income, \$10,000 ( <i>SD</i> )	17 (16)	21 (12)
Female, %	62	63
Married, %	30	44
No High School Degree, %	64	36

Table 2. Sleep Questionnaire

Question	% Yes
1. Do you depend on medications to sleep?	8.7
2. Do you have difficulty falling asleep?	24.8
3. Do you wake up often during the night?	52.1
4. Do you wake up too early?	28.4
5. Do you wake up feeling tired?	28.2
6. Do you sleep during the day for more than 2 hours?	12.0

sual impairment (yes or no). Individuals responding yes to any of the five questions composing the sleep disorder subscale were coded as one, and those responding no to all five were coded as zero. Individuals responding yes to any of the 11 questions from the visual impairment subscale were coded as one, and those responding no to all 11 were coded as zero. It was hypothesized that individuals reporting visual impairment would also report sleep complaints. Using analysis of variance (ANOVA), volunteers with and without visual impairment were further compared using a severity index for sleep difficulty based on the cumulative summary of the five sleep questions. This analysis was performed to determine whether the pattern of sleep complaints was consistent across the sample.

## RESULTS

Of the total sample, 45% reported visual impairment, 9% indicated a reliance on medicine to sleep, 25% reported difficulty falling asleep, 52% reported difficulty maintaining sleep, 28% reported early morning awakening, and 12% reported daytime sleep longer than 2 hours. Responses to sleep questions on the basis of whether individuals reported visual impairment are compared in Table 4, showing more sleep complaints for elders with visual impairment. Consistent with the chi-square results, ANOVA showed that visually impaired participants had a higher index rate of sleep disturbances than their counterparts ( $F(1,1110) = 35.32, p < .0001$ ).

## DISCUSSION

To our knowledge, this is the first study that investigated the relationships between sleep complaints and visual impairment in a community-based sample of older Americans. Our analyses suggested an association between self-reported visual impairment and sleep complaints. These re-

Table 3. Vision Questionnaire

Question	% Yes
1. Do you have poor vision even with glasses, such that it limits desired activities?	20.4
2. Do you find you can't read regular print?	16.7
3. Do you find you can't read a telephone directory?	18.4
4. Do you find you can't read or see public signs or traffic?	9.5
5. Do you find that leisure activities are curtailed by your vision?	10.9
6. Do you find reading labels or prices is a problem?	17.5
7. Do you have difficulty recognizing people due to poor eyesight?	16.5
8. Do you have difficulty reading labels on medicine bottles?	16.5
9. Do you have difficulty seeing steps due to poor eyesight?	9.0
10. Do you have difficulty seeing in poor or dim light?	28.1
11. Is housework restricted by poor eyesight?	7.0

Table 4. Proportion of Sleep-Related Problems by Visual Impairment

Variable	Yes	No	$\chi^2$
Difficulty Falling Asleep (%)	35	17	48**
Difficulty Maintaining Sleep (%)	61	45	30**
Early Morning Awakening (%)	39	20	45**
Daytime Sleep (%)	14	10	5*
Sleep Medicine (%)	13	5	23**

\* $p < .05$ ; \*\* $p < .01$ .

sults are important in the sense that they verify laboratory findings, which showed an association of ophthalmic diseases with sleep-wake problems (18,22) and with circadian rhythm abnormalities (21). Some investigators have found that up to 55% of patients without light perception experience desynchronized circadian rhythms with accompanying sleep disturbances (21). Thus, blind patients exhibit a much higher frequency of nocturnal sleep disruptions and insomnia than age-matched visually intact individuals.

Compared with a previous study (42), which found that 26.9% of Swedish respondents with a mean age of 73 years reported visual impairment, a greater proportion of elders (45%) in our study were visually impaired. This may be explained by the fact that our survey included several questions ascertaining problems with vision, whereas the previous study used only one question: "I have good eyesight" (y/n). It is important to note, nonetheless, that both studies may have overestimated the actual rate of visual impairment in the population.

We acknowledge that causal inferences cannot be drawn from our results, but some suggestions can be gleaned from the study. The association between sleep complaints and visual impairment suggests that respondents may be experiencing sleep disturbances because of an inability to regulate light stimuli; light is believed to be the best synchronizer of sleep-wake cycles (43–45). It is also likely that visual impairment, which limits outdoor activities, does not offer an opportunity for bright light exposure. It has been found that even healthy older adults spend only 1 hour daily in outdoor daylight receiving up to 2000 lux (46), and at home, daily illumination levels are usually below 300 lux, the commonly quoted office lighting intensity (47). One could also surmise that reduction of daytime activity itself might contribute to the dysregulation of sleep-wake patterns, leaving even more uncertain the direct effect of visual impairment on sleep.

To determine further the factors that might help explain the present findings, we conducted several analyses to ascertain whether these findings may have been influenced by a response bias. Thus, a random sample of the health questions was used to determine the degree to which they correlated with sleep complaints. In addition to visual impairment, only hypertension correlated moderately with sleep complaints. Such results are not surprising, because hypertension has been demonstrated to be associated with sleep-disordered breathing (48–50). Another way to test for possible response bias would be to assess whether auditory disturbance to some degree may have been responsible for sleep complaints. Our analysis did not show any significant correlation between hearing complaints and sleep complaints. Ultimately, the ideal way to verify these findings is

to have objective ophthalmic and sleep assessment for those participants, which remains an important empirical question for future studies (51).

These data suggest that visual impairment may have an effect on sleep among elderly adults, either by limiting daily activity or by reducing light exposure. However, causal links will have to be established by systematic, controlled studies. The observations of this study warrant further investigations on the relationship between visual impairment and sleep disturbance with objective measures, as respondents may have overestimated vision problems. It is suggested that elderly volunteers undergo baseline ophthalmic assessment before assignment to treatment conditions in bright light studies. This suggestion is supported by findings that visually impaired elders with dementia did not respond to light treatment, whereas visually intact patients responded positively (52). It is also conceivable that older adults with visual impairment might necessitate brighter illumination for circadian entrainment. Indeed, work by Lucassen and colleagues (53) suggested that aged-related declines in some components of SCN functions may be countered by high-intensity light exposure.

Some methodological issues might limit the generalizability of the present findings. One possible limitation of the study is that we used a sampling technique that favored the recruitment of a high percentage of African Americans relative to European Americans, although we did not specifically ask questions about specific eye conditions. It is known that glaucoma, cataract, and diabetic retinopathy are more prevalent among African Americans, whereas macular degeneration is more prevalent among European Americans (2).

With respect to sleep complaints, there have been conflicting observations made regarding ethnic differences. Some studies have shown greater sleep problems among African Americans, whereas others have indicated fewer sleep complaints (29,54). To assess further the effect of ethnicity on sleep complaints, we conducted a separate analysis on the data (published elsewhere), which assessed the unique contribution of several demographic, lifestyle, stress, and health-related factors in explaining the variance in reported sleep problems. In addition, consistent with evidence showing ethnic disparity in health status, we examined ethnic differences for each sleep-related complaint. African Americans in our data reported fewer sleep complaints than their European-immigrant counterparts (51).

Another relates to the fact that the ethnic composition of our Brooklyn sample may not reflect the U.S. population as a whole. However, trends observed in our study were consistent with findings from the Swedish sample, suggesting that these self-reported data may be observed across other U.S. cities.

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