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Sleep Quality Subtypes in Midlife Women

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Summary: Eighty-two midlife women (40–59 years) were classified as poor or good sleepers according to either self-reported sleep quality or a sleep efficiency index (SEI) criterion, for comparison of wakefulness, fragmentation and other somnographic sleep variables; as well as psychological (SCL-90) and somatic symptom distress. When classified solely by self-report, the good and poor sleeper groups did not differ on any somnographic variables but self-declared poor sleepers had higher psychological distress scores than good sleepers ($p \leq 0.01$). When classified solely by the SEI criterion, the good and poor sleepers did not differ on psychological distress but, as expected, differed on various somnographic wakefulness as well as rapid eye movement and stage 2 sleep variables. Further analysis of four subgroups derived by combining objective and subjective, good and poor sleep scores indicated that 15% of this sample (n = 12) perceived but had no objective evidence of poor sleep, and this group scored highest in psychological distress. Only seven women perceived poor sleep in concert with demonstrating low SEI. They scored highest in menopausal symptoms but not in general psychological distress. **Key Words**: Women's sleep—Menopause—Psychological distress.

Surveys show that perceptions of sleep problems in the general population are prevalent (1–4). In American studies, between 31% to almost half of middle-aged people reported having sleep problems, and midlife women reported more sleep problems than men (2–4). Women between 45 and 54 years of age are reported to have the highest number of yes answers to questions specifically about insomnia (2).

The relationship of reported poor sleep to actual insomnia or to somnographic alterations is unclear. Definitions of insomnia are articulated within disorders of initiating and maintaining sleep (DIMS) (5), derived mainly from study of clinical populations. In an effort to characterize somnographic alterations, investigators have sought to recruit insomniacs with the most severe manifestations of insomnia to maximize possible differences from normal sleep. In many studies, selected insomniacs report various lengths of time to fall asleep but generally >30 min and/or extensive wakefulness throughout the night more than half of the time (e.g., four nights out of seven), and over long duration (e.g., 2 years) (6–12). Somnographic corroboration of insomnia (e.g., sleep efficiency index ≤90% or 85% or sleep onset latency >30 min) has been applied to subject selection in fewer studies (8,11).

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Few studies have looked at insomnia criterion-based sleep subtypes in nonclinical samples. One early study assessed 16 good and 16 poor sleepers between 20 and 40 years of age (gender split unspecified), classified by self-reported sleep quality (13). Another looked at mostly male subjects in the military with a mean age of 20.5 years (14). No studies have focused particularly on midlife women, but because insomnia is thought to increase dramatically in this age- and gender-specific group, sleep subtypes and the presence of insomnia indicators are important to characterize. Therefore, the purposes of this study were:

1) to determine the prevalence of self-reported poor and good sleep and somnographic poor and good sleep in a nonclinical sample of midlife women, and
2) to compare women with self-reported and somnographic good and poor sleep on:
   a) somnographic wakefulness, fragmentation, and other sleep variables;
   b) measures of psychological distress; and
   c) somatic and menopausal symptoms scores.

METHODS

Sample

Eighty-two women between the ages of 40 to 59 years were recruited. They were not selected for sleep prob-

lems but responded to public service announcements about a health study of women in midlife. They did not exceed ±15% of ideal body weight, had no history of major physical or mental illnesses, and were not taking medications for insomnia, depression, or menopausal symptoms, including estrogens.

Measurement

Self-report (i.e., subjective) good or poor sleep was assessed during a sleep history interview with an item requiring a quality rating of usual sleep. Subjects reporting very good, good, or fair sleep were placed in a self-report good sleep category, and those reporting poor or very poor sleep were placed in a self-report poor sleep category.

Somnographic (i.e., objective) good or poor sleep was determined from standard electrophysiologic methods of sleep assessment and scoring techniques (15). A 10% sample of sleep records was scored by two persons and inter-rater agreement was greater than 92%. A sleep efficiency index (SEI), defined as the ratio of time spent in any stage of sleep to the amount of time in bed spent trying to sleep, was calculated for each woman. An SEI score of 85% was used as a cutpoint to divide the women into either somnographic good or poor sleepers.

Somnographic variables included: 1) wakefulness: sleep latencies to stages 1 and 2, percentage of stage 0 (awake), duration of episodes of stage 0; 2) sleep fragmentation: number of episodes of stage 0, number and duration of episodes of all sleep stages per night, and the fragmentation and arousal indexes; and 3) other sleep variables: latencies to slow-wave (SW) and rapid eye movement (REM) sleep, percentage of time in each sleep stage, and time in bed. Sleep latency was defined as the time from lights out to the first epoch of a sleep stage. The fragmentation index was calculated as the number of changes from a stage of deeper sleep to awake or stage 1 per hour of the sleep period time. The number of alpha or movement events lasting between 3 to 15 s/h comprised the arousal index.

Psychological distress scores were derived from the Symptom Checklist 90 (SCL-90), a psychiatric rating instrument with 90 items, each of which is rated on a five-point scale of distress, yielding nine subscale scores and three global index scores. Test–retest reliability coefficients for these subscales were found to vary from 0.78 to 0.90 in psychiatric outpatients with 1 week between testings (16) and internal consistency varied between 0.71 and 0.87 in our sample.

Symptom frequencies were reported on a 13-item health symptom inventory. Subjects indicated the symptoms that they experienced very often, often, or sometimes. Symptoms were divided into a cluster of 10 somatic symptoms: headache, backache, joint pain, diarrhea, tingling, heart racing, dizziness, tiredness, cough, and shortness of breath and a cluster of 3 menopausal symptoms: night sweats, daytime hot spells, and daytime sweats. Scores for the frequencies were added for all symptoms and divided by the number of symptoms mentioned.

Procedure

During a presleep interview, subjects completed the sleep history, the SCL-90, and the health symptom inventory. Women then were scheduled to sleep for two consecutive nights in a sound-attenuated sleep laboratory during the luteal phase of their menstrual cycle, if cycling. The first night in the sleep laboratory was an adaptation period, and only data from the second night were analyzed. Subjects were asked to come to the laboratory about 2 h before their regular bedtime, and to refrain from drinking caffeinated or alcoholic beverages during the afternoon and evening prior to sleeping. Subjects were allowed to go to sleep at their regular bedtime and were awakened at their usual arise time or naturally awoke.

Initially, the total sample was divided into two groups of subjective poor (n = 19) and good (n = 63) sleepers and then reclassified into two groups of objective poor (n = 23) and good (n = 59) sleepers for separate comparisons of sleep patterns, psychological distress, and symptom scores. Following this, four comparative groups were formed based on combinations of good and poor objective and subjective sleep. Statistical *t* tests were used for all paired comparisons and one-way analysis of variance (ANOVA) was used to determine differences across the four sleep groups.

RESULTS

No significant sociodemographic differences existed among the subgroups. The mean age of the women in this study was 48.2 years, most had completed college, and their average annual income was approximately $25,000. Approximately 44% were either married or partnered.

Two group comparisons

Classification of good or poor sleepers by self-report only indicated no statistically significant differences on any sleep variables. However, the subjective poor sleepers had significantly higher SCL-90 psychological distress scores (see Fig. 1). They also had higher somatic symptom (2.8 versus 1.5) and menopausal symptom (1.5 versus 0.7) scores as compared to subjective good sleepers ($p \leq 0.01$).

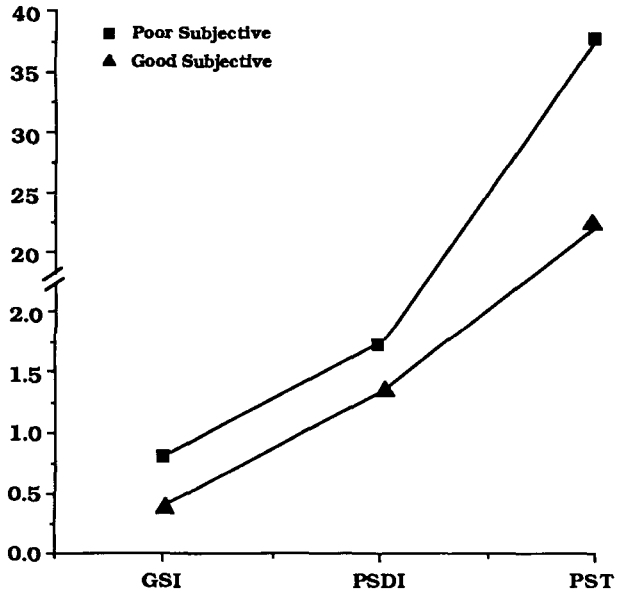

FIG. 1. Significant differences between good and poor subjective sleeper groups on SCL-90 global scale ($p \leq 0.01$).

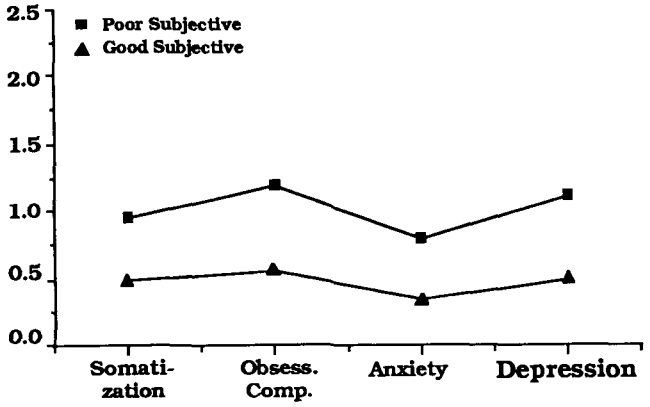

FIG. 2. Significant differences between good and poor subjective sleeper groups on SCL-90 subscale ($p \leq 0.01$).

Comparisons of good and poor sleepers, classified objectively, indicated no differences in psychological distress or symptom frequency scores. As expected, there were significant differences ($p \leq 0.01$) in sleep latencies, amount of time awake (stage 0), and other sleep variables (Table 1).

Four group comparisons

Nineteen women (23.2%) reported poor sleep with 7 women (8.5%) also demonstrating poor sleep and 12 women (14.7%) demonstrating good sleep. Sixty-three women (76.8%) reported good sleep with 16 women (19.5%) demonstrating sleep efficiencies <85% and the remaining 47 (57.3%) having sleep efficiencies ≥85%.

Somnographic variables. Using ANOVA, the somnographic variables that exhibited a difference at the $p \leq 0.01$ level across the four subgroups are shown in Table 2. Inspection of Table 2 shows longer latencies to stages 1 and 2, higher percentage awake (stage 0), longer latencies to REM sleep, and less percentage of REM sleep in both objective poor as compared to both objective good sleep subgroups.

Pair-by-pair *t*-test comparisons between the two subgroups reporting poor sleep (n = 19) revealed that they did not differ on sleep latencies but the subgroup with no objective evidence of insomnia (n = 12) had less percentage of awake time, lower fragmentation scores, as well as a shorter latency to REM, more transition (stage 1) sleep, and a higher mean percentage of stage 2 sleep than the subgroup also demonstrating poor sleep (n = 7). The subgroup with poor sleep by both criteria also scored higher on the fragmentation variables and had more transitional sleep (stage 1) and less stage 2 sleep than the subgroup reporting good sleep but with low SEI (n = 16). (See underlined values comparing column 1 to 2 and 3 in Table 2.)

The subgroup with a low SEI but reporting good sleep had more wakefulness (longer mean sleep latencies and more percentage time awake) as well as a longer mean REM sleep latency and less percentage REM sleep than the sleepers with good sleep by both criteria or the group with reported but no objective evidence of insomnia. No differences were evident in the sleep fragmentation variables. (See values with asterisks comparing column 2 to 3 and 4 on Table 2.)

Psychological distress and symptoms

Table 3 shows significant differences ($p \leq 0.01$) across the subgroups for the psychological distress and symptom scores. Women with subjective poor sleep but no

TABLE 1 *Significant differences in sleep variables between objective poor (SEI ≤84.9%) and good (SEI ≥85%) sleep subtypes (ANOVA, $p \leq 0.01$)*

	Poor (n = 23)		Good (n = 59)	
Sleep variables	Mean	SD	Mean	SD
Wakefulness				
Latency to 1 (min)	14.1	12.3	5.5	6.9
Latency to 2 (min)	19.0	13.4	10.0	7.9
Stage 0 (%)	16.1	7.6	4.1	3.3
Fragmentation				
Number of episodes of 0	20.8	11.6	11.7	3.3
Other sleep variables				
Latency of REM (min)	118.3	57.4	72.4	23.6
REM sleep (%)	15.9	4.5	22.4	5.6
Stage 2 (%)	44.3	10.0	53.7	9.0
Time in bed (min)	464.0	69.4	422.0	58.3

TABLE 2. *Significant differences in somnographic variables across four sleep subtypes (ANOVA, $p \leq 0.01$)*

	Objective poor				Objective good			
	Subjective				Subjective			
	Poor (n = 7)		Good (n = 16)		Poor (n = 12)		Good (n = 47)	
Sleep variables	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Wakefulness								
Latency to 1 (min)	12.7	12.4	13.5*	12.1	6.1*	5.3	5.3*	7.3
Latency to 2 (min)	17.4	12.4	18.6*	13.8	10.3*	6.1	9.9*	8.4
Stage 0 (%)	16.4	6.7	15.8*	8.4	5.2*	3.8	3.8*	3.1
Fragmentation								
Number of episodes 0	28.9	13.5	16.5	8.5	12.3	5.8	11.6	7.9
Number of episodes 1	74.9	28.5	43.0	15.1	45.5	15.6	46.3	18.9
Number of episodes 2	79.6	18.3	46.2	14.5	49.3	14.6	55.3	17.5
Number of episodes SWS	33.0	8.6	16.0	13.0	12.7	12.3	23.3	16.4
Arousal index	29.8	22.1	10.7	3.8	10.4	6.5	11.8	5.8
Other								
REM latency (min)	151.9	61.5	104.2*	52.9	69.9*	25.7	73.0*	23.3
Stage REM (%)	16.1	4.2	16.0*	4.9	20.2*	4.4	23.0*	5.7
Stage 1 (%)	22.1	11.1	13.2	5.1	13.5	5.2	13.5	5.8
Stage 2 (%)	36.1	12.8	48.0*	6.5	57.3*	8.7	52.8	8.9

Underlined values denote pair-by-pair *t*-test comparisons, columns 1 to 2 and 3 ($p \leq 0.04$); * indicates pair-by-pair *t*-test comparisons, columns 2 to 3 and 4 ($p \leq 0.04$).

objective evidence (column 3) had the highest mean psychological distress and somatic symptom scores and this tested statistically different from the two subgroups reporting good sleep. The subgroup having both subjective and objective poor sleep had the highest mean menopausal symptom score but this was statistically different only from the subgroup classified with good sleep by both criteria.

DISCUSSION

Overall, 23% (n = 19) of the women reported poor sleep, in agreement with a European study wherein 23.1% of the females over 20 years of age reported sleeping badly (1) but higher than 10.1% of women between 40 and 49 years and 19.1% between 50 and 59 years who reported poor sleep in another European study (17). In comparison, about 17% of women 40–59 years in a separate American study (3) reported trouble with sleeping often or all of the time.

Poor subjective and objective sleep occurred in 8.5% of the women in this study, who were not selected for sleep problems. According to records of accredited sleep disorder centers, about 25% of all cases had DIMS and 15% of those (less than 4% of the total) were diagnosed as having persistent psychophysiologic insomnia (18).

Women reporting poor sleep but with no objective evidence were 15% of the total sample in our study.

TABLE 3. *Significant differences in psychological and symptom scores across four sleep subtypes (ANOVA, $p \leq 0.01$)*

	Objective poor				Objective good			
	Subjective				Subjective			
	Poor (n = 7)		Good (n = 16)		Poor (n = 12)		Good (n = 47)	
SCL-90 scales	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Somatization	0.83	0.73	0.48	0.34	1.00	0.65	0.51	0.52
Obsessive–compulsive	1.20*	1.10	0.77*	0.54	1.20	0.90	0.55*	0.50
Anxiety	0.56	0.61	0.35	0.35	0.93	0.83	0.39	0.48
Depression	0.64	0.51	0.62	0.50	1.40	0.92	0.57	0.59
GSI	0.64	0.51	0.39	0.35	0.91	0.57	0.43	0.40
PSI	1.60	0.45	1.30	0.29	1.80	0.37	1.40	0.37
PSDI	31.00	19.60	27.00	20.50	41.50	22.00	22.50	17.30
Symptom frequency								
Somatic*	2.43	1.6	1.50	1.50	3.00	2.30	1.50	1.40
Menopause*	1.43*	1.50	0.63	1.20	0.75	0.97	0.35*	0.70

Underlined values denote pair-by-pair *t*-test comparisons, columns 3 to 2 and 4 ($p \leq 0.04$); * indicates pair-by-pair *t*-test comparisons, columns 1 to 2 and 4 ($p \leq 0.04$).

Others report that up to 60% of self-described poor sleepers do not meet a somnographic criterion of taking 30 min or longer to fall asleep (19). Further, of all people presenting at sleep centers with insomnia complaints, 25% are said to have no objective evidence (18).

Women reporting good sleep but with objective poor sleep represented 20% (n = 16) of the sample, agreeing with a study in which 22% of 18 good sleepers (n = 4), who were controls for insomnia subjects, exhibited sleep efficiencies less than 85% (7). Arguments about the validity of laboratory sleep assessment pertain (20).

Few studies have compared the somnography of good and poor sleepers selected from a general population. In Monroe's study (13) of self-declared good (n = 16) and poor sleepers (n = 16) from a university population, only two somnographic variables differed significantly between the groups at the $p \leq 0.01$ level. The REM time in minutes (58.7 vs. 92.3 min) and as a proportion of sleep time (16.9% vs. 24.2%) was less in poor sleepers. In contrast, another study of self-reported good and poor sleepers revealed no differences in somnographic sleep variables (14). In this study, no differences were found on any of the sleep variables, including REM sleep, when midlife women were classified strictly by how they rated their usual sleep.

In studies comparing insomniacs to normal sleepers, few sleep stage differences apart from wakefulness have been reported. Many studies report no differences in REM sleep (7,8,11,21) between insomniacs and good sleepers, in agreement with our comparison of self-declared poor and good sleepers. Yet, Schneider-Helmert (10) reported lower REM sleep percent in a subgroup of insomniacs reporting but having no objective evidence of insomnia (19.7%) as compared to controls (25.4%). Comparable data for this study show a lower REM sleep percent for those reporting but not demonstrating poor sleep (20.2%) as compared to good sleepers (23.0%), but statistical significance was not reached.

One observation in this study implies that wakefulness alone does not provoke reports of poor sleep, but accompanying lighter and less stable sleep might do so. Both groups with low SEI had comparable latencies and wake after sleep onset but those women reporting poor sleep had higher sleep instability scores and more stage 1 and less stage 2 sleep than the group reporting good sleep.

The highest psychological distress and somatic symptom frequencies occurred in women with subjective but no objective evidence of poor sleep. Higher Minnesota Multiphasic Personality Inventory (MMPI) (13) and Profile of Mood States (14) scores have been found in nonclinical poor sleepers compared to good sleepers. Insomniacs are reported to have mild depression, anxiety, obsessive worrying, and hypochondriacal concerns (6) with evidence that the degree of sleep difficulty is directly related to the degree of MMPI psychopathology (9). The SCL-90 mean scores did not reach published psychiatric outpatient mean levels, however. The GSI total mean score was 0.91 ± 0.57 for the subjective poor and objective good sleep subgroup as compared to a psychiatric outpatient group mean of 1.26, calculated for mixed gender, and a normal nonpatient mean of 0.31 (16).

In sum, midlife women were identified who perceived symptom distress and poor sleep, despite having fairly stable and efficient laboratory sleep. This subset of women were most likely to be psychologically distressed, thereby linking distress and perceptions of poor sleep. As well, women were identified who perceived poor sleep in the face of unstable sleep but whose psychological distress scores did not differ from women with good sleep. Their sleep instability might coincide with midlife physiological instability, manifested as hot flashes and sweats. The vast majority of women in this nonclinical sample perceived and demonstrated good sleep. Sleepers reporting good sleep but demonstrating low sleep efficiencies had comparatively low psychological distress, somatic, and menopausal symptom scores. Their increased wakefulness was not associated with increased fragmentation as compared to good sleepers by both criteria.

Of note in this sample of healthy midlife women, 35 (42.6%) had poor sleep by either the objective or subjective criterion, with overlap occurring in only seven women. It could be argued that self-reported poor sleep and psychological distress do not predict objectively defined poor sleep. As well, those with objective poor sleep are not necessarily psychologically distressed. Longer term sleep assessment and more study of the effects of environment on sleep would help validate sleep subtypes.

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