Published in final edited form as:
J Am Geriatr Soc. 2008 September ; 56(9): 1674–1680. doi:10.1111/j.1532-5415.2008.01838.x.

Self-reported Napping, Sleep Duration and Quality in the Lifestyle Interventions and Independence for Elders Pilot (LIFE-P) Study

Jennifer L. Picarsic, MD[1], **Nancy W. Glynn, PhD**[2], **Christopher A. Taylor, BS**[2], **Jeffery Katula, PhD**[3], **Suzanne E. Goldman, PhD**[4], **Stephanie Studenski, MD, MPH**[5], and **Anne B. Newman, MD, MPH**[2,5]

[1] University of Pittsburgh, School of Medicine

[2] University of Pittsburgh, Graduate School of Public Health, Department of Epidemiology

[3] Wake Forest University, Department of Health & Exercise Science

[4] University of Vanderbilt, Department of Neurology

[5] University of Pittsburgh, Department of Medicine

Abstract

OBJECTIVES—To determine the prevalence of self-reported napping and its association with subjective nighttime sleep duration and quality, as measured by sleep-onset latency and sleep efficiency.

DESIGN—Cross-sectional study.

SETTING—Lifestyle Interventions and Independence for Elder's Pilot Study.

PARTICIPANTS—Community-dwelling older adults (N=414), aged 70 to 89 years.

MEASUREMENTS—Self-report questionnaire on napping and sleep, derived from the Pittsburgh Sleep Quality Index (PSQI) scale.

RESULTS—A total of 54 percent of participants reported napping with mean nap duration of 55 minutes, (SD 41.2 minutes). Compared to non-nappers, nappers were more often men (37.3% vs. 23.8%, *P* = .003), African American (20.4% vs.14.4%, *P* = .06), or diabetic (28% vs. 14.3%, *P* = .

Corresponding Author: Nancy W. Glynn, PhD, Research Assistant Professor of Epidemiology, Center for Aging and Population Health, University of Pittsburgh, Graduate School of Public Health, 130 North Bellefield Avenue-Room 444, Pittsburgh, Pa 15231, Phone: 412-383-1309, Fax: (412) 383-1308, glynnn@edc.pitt.edu.

CONFLICT OF INTEREST

Financial Disclosure: None.

Author Contributions:

Jennifer L. Picarsic, MD: Primary investigator, Instrumental in study design and concept, acquisition and interpretation of data performed primary literature search, interpretation of data, primary writer of manuscript.

Nancy W. Glynn, PhD: Project manager, Instrumental in study design and concept, acquisition of subjects, analysis and interpretation of data, editor of manuscript.

Christopher A. Taylor, BS: Primary statistician, analysis and interpretation of data, editor of manuscript.

Stephanie Studenski, MD, MPH: Investigator, Instrumental in study design and concept, acquisition of subjects, editor of manuscript.

Suzanne E. Goldman, PhD: Instrumental in study concept, acquisition of data, editor of manuscript.

Jeffery Katula, PhD: Investigator, Instrumental in study design and concept, acquisition of subjects, editor of manuscript.

Anne B. Newman, MD, MPH: Investigator, Instrumental in study design and concept, acquisition of subjects, analysis and interpretation of data, primary editor of manuscript.

007). Nappers and non-nappers had similar nighttime sleep duration and quality, but nappers spent about 10 percent of their 24-hour sleep occupied in napping. In a multivariate model, the odds of napping were higher for diabetics (OR: 1.9; 95% CI: 1.2–3.0) and men (OR: 1.9; 95% CI: 1.2–3.0)). In nappers, diabetes mellitus (β = 12.3 minutes, *P* =.005), male gender (β = 9.0 minutes, *P* = .04), higher BMI (β = 0.8 minutes, *P* = .02), and lower MMSE (β = 2.2, *P* = .03) were independently associated with longer nap duration.

CONCLUSION—Napping was a common practice in community-dwelling older adults and did not detract from nighttime sleep duration or quality. Given its high prevalence and association with diabetes, napping behavior should be assessed as part of sleep behavior, both in future research and in clinical practice.

Keywords

Napping; sleep; older adult; diabetes mellitus

INTRODUCTION

A significant proportion of older adults report napping, with prevalence estimates ranging from 23 to 61 percent.[1,2] Napping has generally been discussed in terms of its negative impact on sleep hygiene, particularly through increased sleep-onset latency,[3,4] increased nighttime awakenings,[5,6] and decreased nighttime sleep.[7,8] Given the older adult's increased risk of disrupted sleep quality and increased occurrence of fragmented sleep, any practice that may worsen nighttime sleep should be avoided. However, there is a gap in knowledge as to what specific effect napping has on nocturnal sleep and if it is a marker of poor health.

Poor nighttime sleep and daytime sleepiness, which may be associated with napping[9,10] have detrimental impacts on mood, attention, memory, and quality of life, along with public health concerns of increased fall risk, usage of sedating medications, and mortality in the older adult.[11,12,13,14,15] The time a nap occurs during the day, specifically an evening nap, may lead to disrupted sleep in older adults, especially decreased nocturnal sleep, which may be explained by altering their circadian rhythms.[8,16] Large epidemiological studies of older adults have found napping to be an independent risk factor for mortality, especially on cardiovascular health. More recent data show that heart rate and blood pressure significantly increase after awakenings, both after nocturnal and daytime sleep.[17,18,19,20,21,22] Still others report that napping improves mood and cognitive performance, having little or no impact on nighttime sleep.[1,23,24,25,26] Few even report that napping may decrease coronary heart disease risk, depending on nap duration and health status.[27,28] Despite the growing literature on napping, few studies to date specifically address the prevalence of napping in sedentary community dwelling adults, who are not selected by specific sleep complaints.[8,29] Furthermore, few studies have described the correlation of napping to co-morbidity.

Our objective was to characterize the prevalence of self-reported napping in a group of community dwelling older adults with impaired physical performance and determine its association with nighttime sleep duration, sleep-onset latency, and sleep efficiency. We also sought to identify if other demographic factors, performance variables, and co-morbid conditions were predictive of napping using standardized, interview administered questionnaires in these community-dwelling older adults. We hypothesized that self-reported napping was related to fewer hours of reported nighttime sleep, longer sleep-onset latency, and decreased sleep efficiency, along with a greater prevalence of co-morbid psychological and physical illnesses in nappers.

METHODS

Data were collected on participants enrolled in the Lifestyle Interventions and Independence for Elders Pilot (LIFE-P) study. [30,31] LIFE-P is a multi-center, single-blind, randomized controlled clinical trial in which community-living sedentary older adults age 70 to 89 at risk for disability were assigned to either physical activity or "successful aging" intervention lasting between 12 and 18 months depending on the month of randomization. The physical activity intervention consisted of a structured exercise program focused on walking supplemented with behavioral counseling. The "successful aging" intervention consisted of educational meetings not expected to impact the main study outcomes. Participants were recruited primarily via direct mailings, but media advertisements (radio and newspaper advertisements, press releases, articles) and other community outreach efforts were also used. The goal of the LIFE-P study was to obtain key design benchmarks in preparation for a larger study of the efficacy of physical activity for preventing disability in this population. The study was approved by the local institutional review boards of all four participating field centers (The Cooper Institute, Dallas, TX; Stanford University, Stanford, CA; University of Pittsburgh, Pittsburgh, PA; and Wake Forest University, Winston-Salem, North Carolina) and all enrolled participants gave written informed consent. The protocol is consistent with the principles of the Declaration of Helsinki and is registered at www.ClinicalTrials.gov (registration # NCT00116194).

The design and methods of the trial are described in detail elsewhere. [30,31] Briefly, eligibility criteria included being able to walk 400 meters within 15 minutes without sitting and without the use of any assistive device, having a Short Physical Performance Battery (SPPB) score of ≤9 [The SPPB is a standardized, well documented measure of lower extremity physical performance that includes walking, balance, and strength tasks, scaled 0–12, higher scores indicating better performance[32]], having completed a behavioral run-in related to logging health behavior, given informed consent, living in the study area, and not planning to move for at least nine months. Participants were ineligible if they had severe heart failure, uncontrolled angina, severe pulmonary disease, chest pain or severe shortness of breath during the 400-meter walk test, severe arthritis, cancer requiring treatment in the past three years, Parkinson's disease, other severe illness that may interfere with physical activity, illness with life expectancy of less than 12 months, or a Mini-Mental State Examination (MMSE) score < 21. Temporary exclusion criteria were acute myocardial infarction, deep venous thrombosis, pulmonary embolism, major arrhythmias, stroke within six months, recent major surgery, uncontrolled hypertension, uncontrolled diabetes mellitus, or ongoing lower extremity physical therapy.

Baseline cross-sectional data on nap duration and prevalence, nighttime sleep duration, sleep-onset latency, and efficiency were collected via standardized interview at baseline. Of the 424 participants, 414 had completed data on napping and sleep and are included in the analysis.

Napping and sleep were assessed using a standardized interview. Participants were asked "During the past month, how many hours do you nap or sleep during a typical day?" Those reporting > 0 minutes of napping were classified as nappers. The Pittsburgh Sleep Quality Index (PSQI) items 1–4[33] were used to assess the following sleep measures: total time in bed, nighttime sleep duration, sleep-onset latency, and sleep efficiency.

Demographics variables assessed at baseline included age, sex, and self-designated race, marital status, level of education and self-report of smoking. Chronic health conditions considered as potential confounders included the following: hypertension, diabetes mellitus, cancer, myocardial infarction, congestive heart failure, stroke, or pacemaker placement,

were assessed by self-report. Weight was assessed by a calibrated scale and height by stadiometer. Body mass index (BMI) (kg/m^2) was calculated. Cognition, mood, fatigue, and pain were also considered as potential confounders. Cognitive function was assessed with the Folstein Mini-Mental State Examination (MMSE), depression symptoms with the Center for Epidemiologic Studies Depression (CES-D) Scale,[34] energy level with a 6-item fatigue and energy questionnaire from the Modified Exercise-Induced Feeling Inventory, and pain symptoms with a modified 12-item pain scale and a pain frequency scale.

Analysis

Wilcoxon-Mann-Whitney *t*-tests and chi-square analyses were used to examine differences between means and categorical variables between nappers and non-nappers. Logistic regression was used to examine the odds of taking a daytime nap (odds ratio 95% confidence interval). Stepwise linear regression was conducted to assess predictors of nap duration (minutes), as a continuous outcome. All models were adjusted for variables associated with napping in either univariate analysis or previous literature report.[11,15] Variables that did not reach a significance of ≤.10 were excluded from the final models.

RESULTS

Descriptive characteristics of the 414 participants are shown in Table 1, and are stratified by napping status. Napping was reported by 54 percent of participants. Average nap duration for nappers was 55 minutes (SD 41.2 min). Men reported napping more than women, and napping was more prevalent in African-Americans compared with Caucasians and other racial/ethnic minorities, but did not reach statistical significance. There was no difference in average age with respect to napping status.

Diabetes mellitus was more prevalent among those who reported napping (Table 1). Nappers had lower energy/fatigue scores than non-nappers, indicating less energy. There was a marginal, but non significant difference in terms of both a higher BMI and higher CES-D score, indicating more depression symptoms, in nappers versus non-nappers. There was no difference in the prevalence of cardiovascular diseases between nappers and non-nappers (Table 1).

Contrary to our hypothesis, there was no difference between any nighttime sleep parameters in terms of average reported nighttime sleep duration, sleep-onset latency, or sleep efficiency, between nappers and non-nappers (Table 2). While there was no difference in reported nighttime sleep duration between nappers and non-nappers, when accounting for total 24 hour sleep, nappers had greater total sleep duration compared to non-nappers, with about 10 percent of their total sleep occupied in napping (Table 2).

In the logistic regression model (Table 3), the unadjusted odds ratio for nappers was higher in men and diabetics. In the fully adjusted model, men and diabetics had significantly higher odds of napping, which were not attenuated by adjustment of other factors (Table 3).

Among nappers, male gender, diabetes mellitus, and higher BMI were all associated with longer nap duration in the unadjusted linear regression model, which continued to hold the same associations in the fully adjusted model (Table 4). In the fully adjusted model, lower MMSE scores also became associated with longer nap duration. Male gender was associated with nine minute longer nap duration, while diabetes was associated with 12 minute longer nap duration. In both the logistic and linear models, none of the nighttime sleep parameters were associated with napping status or duration.

DISCUSSION

Self-reported napping was quite common in this group of sedentary, community-dwelling older adults with impaired physical performance. The finding that 54 percent of older adults napped at least once a week is within the range that others have reported.[8,26,35,36] Currently, not all sleep studies routinely ask about nap behaviors. This study adds further supporting evidence that the prevalence of napping in older adults is high, and clearly must be accounted for in sleep studies involving older adults.

This study failed to show a clear association between age and napping, unlike others who have shown that the prevalence of napping increases with age.[1,26,29,37] This difference could be explained by the fact that our population had a more narrow range of ages, focusing on the "oldest" old (70–89 years), while others have compared napping behavior between "younger" old (50–60 years) and "oldest" old (70–80 years). Men napped significantly more than women, which has been noted by others.[1,26,38,39,40] While few studies have looked specifically at napping and race, our results suggest that African Americans nap more than other racial groups, a finding reported in two other studies.[41,42]

Reported poor sleep was not more prevalent in nappers versus non-nappers. There was no difference between nappers and non-nappers in terms of reported nighttime sleep duration, sleep-onset latency, or sleep efficiency. This finding is consistent with others,[7,29] one of which used objective measures to show that daytime sleep was not related to nocturnal sleep in post-menopausal women. While self-reported napping did not have a negative effect on reported nighttime sleep as we had hypothesized, there is a speculation that napping may actually be a compensation for daytime sleepiness incurred from fragmented nighttime sleep. Sleep apnea[43] or sleep fragmentation due to nocturia[10,44,45] are two prevalent conditions that may not be reported as detracting from nocturnal sleep duration and quality but may still contribute to daytime sleepiness and thus increase the propensity to nap. A recent population based study suggested that napping could be regarded as a marker of sleep apnea, which could account for the incidence of cardiovascular diseases observed in nappers. Data in that study showed that nappers had a higher frequency of sleep apnea compared to controls at three different cutoff points.[46] In addition, a study of female insomniacs showed that habitual nap behavior was not related to subjective or objective measures of nocturnal sleep but was rather indicative of their daytime sleepiness.[47] This may be suggested by our finding that nappers spent 10 percent of 24-hour sleep occupied in napping, despite having no significant difference in nocturnal sleep parameters as compared to non-nappers.

In this cohort, napping was more prevalent in those with diabetes mellitus. The diagnosis of diabetes mellitus and higher BMI were also associated with longer nap duration. This finding provides a new piece of evidence that diabetes mellitus has an effect on daytime sleep. Others have described poor nighttime sleep in diabetics, particularly with respect to altered sleep durations[48] and sleep disordered breathing,[49,50] along with higher rates of insomnia, hypnotic medication use, and daytime sleepiness compared to controls. Studies correlating diabetes mellitus with increased daytime sleepiness have shown that daytime sleepiness was greatest in those with frequent nocturnal micturition episodes, somewhat explained by increased sleep apnea syndrome. Further study with objective actigraphy or polysomnography measurements of nighttime sleep and napping behavior is required to address such hypotheses.

A limitation to this study is the lack of a full sleep habits inventory or polysomnography. Given the nature of this ancillary study, within the larger framework of its parent study, we were limited by participant burden to a subset of questions from the PSQI that were

previously shown to be prevalent in older adults recruited for exercise trials and responsive to a physical activity intervention.[51] Therefore, we cannot address the potential importance of primary sleep disorders as potential correlates of napping. However, our finding of an association of napping with obesity and diabetes implicates sleep apnea and thus nocturnal arousals as a possible cause. Finally, a possible confounding variable not defined in our study was medication usage, especially hypnotics. Some reports do not show a correlation of hypnotics with daytime sleepiness while others have shown correlations of these medications with disturbed sleep[11,52] and napping status.

Self-reported sleep disorders are poorly correlated with polysomnography. Ideally, objective measures of nighttime sleep as well as napping should be used in future research. Recent studies, using objective assessment show under-reporting of napping behavior when compared to actigraphy and polysomnography measurements.[8,29]

It remains unclear whether napping should be an endorsed or discouraged practice, with reports that a short nap may be beneficial to cognitive status[1,23,24,25] while others reporting that napping increases mortality rate.[9,11,12] Our study provides further evidence that napping is a common practice of older adults and does not appear to worsen nighttime sleep. We provide evidence that napping behavior should always be assessed in sleep studies of older adults. It is also important for clinicians to ask about napping behavior and determine its relationship to daytime sleepiness and nighttime sleep before making clinical recommendations.

In summary, this is one of the first studies to show that those with diabetes have a higher risk of napping and subsequently sleep longer when day and nighttime sleep are considered together. It may be suggested that napping is an indicator of silent co-morbid disease complications. In our study population, nappers had a higher prevalence of diabetes mellitus, while cardiovascular disease has been extensively cited in the literature to be associated both with napping and daytime sleepiness, particularly in myocardial infarction survivors.[17,18,19,20,21] While it remains unclear whether illness might increases actual sleep need, older individuals who are sicker may report more sleep per day due to an increase in their subjective need for sleep. As illness often reduces nighttime sleep quality, daytime napping may be an important mechanism for addressing their desire for more sleep.

Acknowledgments

Funding sources and related paper presentations: NIH training grant T32 AG 021885

References

1. Asplund R. Daytime sleepiness and napping amongst the elderly in relation to somatic health and medical treatment. J Intern Med 1996;239:261–267. [PubMed: 8772626]
2. Ancoli-Israel S, Martin JL. Insomnia and daytime napping in older adults. J Clin Sleep Med 2006;2:333–342. [PubMed: 17561549]
3. Agnew HW, Webb WB. Sleep latencies in human subjects: Age, prior wakefulness and reliability. Psychonomic Sci 1971;24:253–254.
4. Karacan I, Finley WW, Williams RL, et al. The effects of naps on nocturnal sleep: Influence of the need for stage-1 REM and stage 4 sleep. Biol Psychiatry 1970;2:391–399. [PubMed: 4320228]
5. Tune GS. Sleep and wakefulness in 509 normal human adults. Brit J Med Psychol 1969;42:75–79. [PubMed: 5785529]
6. Tune GS. Sleep and wakefulness in normal human adults. Brit J Med Psychol 1968;2:269–271.
7. Buysse DJ, Browman KE, Monk TH, et al. Napping and 24-hour sleep/wake patterns in healthy elderly and young adults. J Am Geriatr Soc 1992;40:779–786. [PubMed: 1634721]

8. Yoon IN, Kripke DF, Youngstedt SD, et al. Actigraphy suggests age-related differences in napping and nocturnal sleep. J Sleep Res 2003;12:87–93. [PubMed: 12753345]
9. Roth T, Ancoli-Israel S. Daytime consequences and correlates of insomnia in the United States: results of the 1991 National Sleep Foundation survey. Sleep 1999;22:S354–S358. [PubMed: 10394607]
10. Foley DJ, Vitiello MV, Bilwise DL, et al. Frequent napping is associated with excessive daytime sleepiness, depression, pain, and nocturia in older adults: Findings from the National Sleep Foundation '2003 Sleep in America' poll. Am J Geriatr Psychiatry 2007;15:344–350. [PubMed: 17384317]
11. Foley DJ, Monjan AA, Brown SL, et al. Sleep complaints among elderly persons: an epidemiologic study of three communities. Sleep 1995;184:25–32.
12. Mellinger CD, Balter MD, Uhlenhuth EH. Insomnia and its treatment: prevalence and correlates. Arch of Gen Psychiatry 1985;42:225–232. [PubMed: 2858188]
13. American Academy of Sleep Medicine. Sleep and growing older. [Accessed January 2, 2007]. [On-line]. www.sleepeducation.com/Topic.aspx?id=30
14. Cooke JR, Ancoli-Israel S. Sleep and its disorders in older adults. Psychiatr Cli N Am 2006;29:1077–1093.
15. Ancoli-Israel S. Sleep and aging: prevalence of disturbed sleep and treatment considerations in older adults. J Clin Psychiatry 2005;66:S24–S30.
16. Yoon IN, Kripke DF, Elliott JA, et al. Age-related changes of circadian rhythms and sleep-wake cycles. J Am Geriatr Soc 2003;51:1085–1091. [PubMed: 12890070]
17. Bursztyn M, Ginsberg G, Hammerman-Rozenberg R, et al. The siesta in the elderly. Arch Intern Med 1999;159:1582–1586. [PubMed: 10421281]
18. Campos H, Siles X. Siesta and the risk of coronary heart disease. Int J Epi 2000;29:429–437.
19. Hays JC, Blazer DG, Foley DJ. Risk of napping. J Am Geriatr Soc 1996;44:693–699. [PubMed: 8642162]
20. Burazeri G, Gofin J, Dark JD. Siesta and mortality in a Mediterranean population: a community study in Jerusalem. Sleep 2003;26:578–584. [PubMed: 12938811]
21. Newman AB, Spiekerman CF, Enright P, et al. Daytime sleepiness predicts mortality and cardiovascular disease in older adults. J Am Geriatr Soc 2000;48:115–123. [PubMed: 10682939]
22. Bursztyn M, Jacob J, Stressman J. Usefulness of nocturia as a mortality risk factor for coronary heart disease among persons born in 1920 or 1921. Am J Cardiol 2006;98(10):1311–1315. [PubMed: 17134620]
23. Tamaki M, Shirota A, Tanaka H, et al. Aging and sleep: effects of a daytime nap in the aged. Psychiatry Clin Neurosci 1999;53:273–275. [PubMed: 10459710]
24. Tamaki M, Shirota A, Hayashi M, et al. Restorative effects of a short nap (<30 minutes) in the elderly on subjective mood, performance, and EEG activity. Sleep Res Online 2000;3:131–139. [PubMed: 11382911]
25. Campbell SS, Murphy PJ, Stauble TN. Effects of a nap on nighttime sleep and waking function in older subjects. J Am Geriatr Soc 2005;53:48–53. [PubMed: 15667375]
26. Metz ME, Bunnell DE. Napping and sleep disturbances in the elderly. Fam Pract Res J 1990;10:47–56. [PubMed: 2382580]
27. Kalandidi A, Tzonou A, Toupadaki N, et al. A case control study of coronary heart disease in Athens, Greece. Int J Epidemiol 1992;21:1074–1080. [PubMed: 1483811]
28. Naska A, Oikonomou E, Trichopoulou A, et al. Siesta in healthy adults and coronary mortality in the general population. Arch Intern Med 2007;167:296–301. [PubMed: 17296887]
29. Jean-Louis G, Kripke DF, Assmus JD, et al. Sleep-wake patterns among postmenopausal women: A 24-hour unattended polysomnographic study. Journal of Gerontology 2000;55A(3):M120–M123.
30. The Life Study Investigators. The lifestyle interventions and independence for elders (LIFE) pilot study: design and methods. Contemp Clin Trials 2005;26:141–154. [PubMed: 15837437]

31. The Life Study Investigators. Effects of a physical activity intervention on measures of physical performance: results of the lifestyle interventions and independence for elders pilot (LIFE-P) study. J Gerontol A Biol Sci Med Sci 2006;61A:M1157–M1165.
32. Folstein MF, Folstein SE, McHugh PR. “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189–198. [PubMed: 1202204]
33. Buysse DJ, Reynolds CF, Monk TH, et al. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. Psychiatry Research 1989;28:193–213. [PubMed: 2748771]
34. Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. Appl Psychol Meas 1977;1:385–401.
35. Ohayon MM, Zulley J, Guilleminault C, et al. How age and daytime activities are related to insomnia in the general population: consequences for older people. J Am Geriatr Soc 2001;49:360–366. [PubMed: 11347777]
36. Frisoni GB, De Leo D, Rozzini R, et al. Napping in the elderly and its association with night sleep and psychological status. Int Psychogeriatr 1996;8:477–487. [PubMed: 9116183]
37. The National Sleep Foundation. Summary findings of the 2005 Sleep in America poll. [Accessed January 23, 2007]. [Online]. www.sleepfoundation.org
38. Mallon L, Hetta J. A survey of sleep habits and sleeping difficulties in an elderly Swedish population. Ups J Med Sci 1997;102:185–197. [PubMed: 9556843]
39. Gislason T, Reynisdottir H, Kristbjarnarson H, et al. Sleep habits and sleep disturbances among the elderly – an epidemiological survey. J Intern Med 1993;234:31–39. [PubMed: 8326287]
40. Bazargan M. Self-reported sleep disturbance among African-American elderly: the effects of depression, health status, exercise, and social support. Int J Aging Hum Dev 1996;42:143–160. [PubMed: 8859496]
41. Durrence HH, Lichstein KL. The sleep of African Americans: A comparative review. Behav Sleep Med 2006;4:29–44. [PubMed: 16390283]
42. Ancol-Israel S, Klauber MR, Stepnowski C, et al. Sleep-disordered breathing in African-American elderly. Am J Respir Crit Care Med 1995;152:1946–1949. [PubMed: 8520760]
43. Elbaz M, Roue GM, Lofaso F, et al. Utility of actigraphy in the diagnosis of obstructive sleep apnea. Sleep 2002;25:525–529.
44. Endeshaw YW, Johnson TM, Kutner MH, et al. Sleep-disordered breathing and nocturia in older adults. J Am Geriatr Soc 2004;52:957–960. [PubMed: 15161461]
45. Asplund R. Nocturia in relation to sleep, health, and medical treatment in the elderly. BJU Int 2005;96:15–21. [PubMed: 16083452]
46. Masa JF, Rubio M, Pérez P, et al. Association between habitual naps and sleep apnea. Sleep 2006;29(11):1463–1468. [PubMed: 17162994]
47. Johnston SK, Landis CA, Lentz MJ, et al. Self-reported nap behavior and polysomnography at home in midlife women with and without insomnia. Sleep 2001;24(8):913–919. [PubMed: 11766161]
48. Gottlieb DJ, Punjabi NM, Newman AB, et al. Association of sleep time with diabetes mellitus and impaired glucose tolerance. Arch Intern Med 2005;165:863–868. [PubMed: 15851636]
49. Punjabi NM, Shahar E, Redline S, et al. Sleep-disordered breathing, glucose intolerance, and insulin resistance: the Sleep Heart Health Study. Am J Epidemiol 2004;160:521–530. [PubMed: 15353412]
50. Resnick HE, Redline S, Shahar E, et al. Diabetes and sleep disturbances: findings from the Sleep Heart Health Study. Diabetes Care 2003;26:702–709. [PubMed: 12610025]
51. King AC, Oman RF, Brassington GS, Bliwise DL, Haskell WL. Moderate-intensity exercise and self-rated quality of sleep in older adults. A randomized controlled trial. JAMA 1997;277:32–37. [PubMed: 8980207]
52. Balter MB, Uhlenhuth EH. New epidemiologic findings about insomnia and treatment. J Clin Psychiatry 1992;53:S34–S39.

J Am Geriatr Soc. Author manuscript; available in PMC 2010 June 18.

Table 1

Baseline Characteristics of the Lifestyle Interventions and Independence for Elders Pilot Study Participants by Napping Status.

	All participants (n=414)	No reported nap (n=189)	Reported naps (n=225)	*p*-value *
Demographic Variables				
Age year (mean, SD)	76.8 (4.2)	76.9 (4.3)	76.6 (4.2)	.447
< 80 years (n, %)	304 (73.4)	137 (72.5)	167 (74.2)	.691
≥ 80 years (n, %)	110 (26.6)	52 (27.5)	58 (25.8)	
Gender†				.003
Men (n, %)	129 (31.1)	45 (23.8)	84 (37.3)	
Women (n, %)	285 (68.8)	144 (76.2)	141 (62.7)	
Race				.068
White (n, %)	311 (75.1)	142 (75.5)	169 (75.1)	
Black (n, %)	73 (17.6)	27 (14.4)	46 (20.4)	
Other minority/ethnic (n, %)	29 (7.3)	19 (10.1)	10 (4.4)	
Education				.063
No formal education (n, %)	0	0	0	
Elementary School (n, %)	11 (2.7)	2 (1.1)	9 (4.0)	
High School or Equivalency (n, %)	110 (26.6)	49 (26.1)	61 (27.1)	
College (n, %)	191 (46.2)	86 (45.7)	105 (46.7)	
Post-Graduate (n, %)	90 (21.8)	42 (22.3)	48 (21.3)	
Other (n, %)	11 (2.7)	9 (4.8)	2 (0.9)	
Marital Status				.121
Never Married (n, %))	16 (3.9)	9 (4.8)	7 (3.1)	
Married (n, %)	165 (40.1)	65 (34.6)	100 (44.8)	
Separated (n, %)	2 (0.5)	0	2 (0.9)	
Divorced (n, %))	60 (14.6)	30 (16.0)	30 (13.5)	
Widowed (n, %)	168 (40.9)	84 (44.7)	84 (37.7)	
Other Demographic Variables				
Smoking status-current (n, %)	12 (2.9)	4 (2.1)	8 (3.6)	.666

	All participants (n=414)	No reported nap (n=189)	Reported naps (n=225)	*p*-value *
Body Mass Index (kg/m^2) (mean, SD)	30.3 (6.1)	29.7 (6.0)	30.7 (6.1)	.063
Health Variables:				
Mental State Examination Score (MMSE) (mean, SD)	27.3 (2.3)	27.5 (2.1)	27.1 (2.3)	.192
Depression (CES-D) ‡ score (mean, SD)	7.2 (6.6)	6.8 (7.1)	7.5 (6.2)	.062
Diabetes§ (n, % yes)	90 (21.7)	27 (14.3)	63 (28.0)	.001
Cardiovascular disease || (n, % yes)	299 (72.2)	141 (74.6)	158 (70.2)	.322
Hypertension (n, % yes)	287 (69.3)	137 (75.2)	150 (66.7)	.163
Myocardial infarction (n, % yes)	39 (9.4)	15 (7.9)	24 (10.7)	.363
Congestive Heart Failure (n, % yes)	23 (5.6)	8 (4.2)	15 (6.7)	.720
Stroke (n, % yes)	20 (4.8)	11 (5.8)	9 (4.0)	.456
Pacemaker (n, % yes)	8 (1.9)	4 (2.1)	4 (1.8)	.721
Energy/Fatigue score† (scale 0–5) (mean, SD)	2.76 (1.0)	2.91 (1.1)	2.64 (1.0)	.007
Pain Frequency score (scale 0–4) (mean, SD)	1.26 (1.0)	1.21 (1.1)	1.30 (0.97)	.196

*Tests for differences by napping status

†p ≤.01

‡Center for Epidemiologic Depression Score

§p ≤.001

||History of hypertension myocardial infarction, congestive heart failure, stroke, or pacemaker placement.

Table 2

Descriptive Characteristics of Nap and Sleep Outcomes by Self-Reported Napping Status.

	All participants (n=414)	No reported nap (n=189)	Reported naps (n=225)	*p*-value*
Self-reported nap outcome				
Nap Duration (minute) (mean, SD)	29.9 (40.9)	—	55.0 (41.2)	<.001
Self-reported sleep outcomes				
Nighttime sleep (hour) (mean, SD)	6.9 (1.4)	7.0 (1.4)	6.8 (1.4)	.304
Total 24 h sleep, (hour) (mean, SD)	7.4 (1.6)	7.0 (1.4)	7.7 (1.6)	<.001
Sleep efficiency (%) (mean SD)	83.4 (14.3)	82.7 (14.8)	83.9 (13.8)	.506
< 85% (n, %)	197 (47.6)	93 (49.2)	104 (46.2)	.545
≥ 85% (n, %)	217 (52.4)	96 (50.8)	121 (53.8)	
Sleep onset latency (minute) (mean, SD)	21.7 (24.0)	23.3 (27.1)	20.3 (21.0)	.156
≤ 30 min (n, %)	361 (87.2)	160 (84.7)	201 (89.3)	
> 30 min (n, %)	53 (12.8)	29 (15.3)	24 (10.7)	

*Tests for difference by napping status.

Table 3

Odds Ratio (95% confidence interval) of Taking a Daytime Nap in LIFE-P Study.*

	Unit/Reference†	Unadjusted		Adjusted ‡		Fully Adjusted Model§	
		Odds ratio	Confidence interval	Odds ratio	Confidence interval	Odds ratio	Confidence interval
Age	Year	.98	(.94–1.03)	—	—	.99	(.94–1.04)
Race	White	1.02	(.65–1.6)	1.02	(0.64–1.6)	1.01	(.61–1.66)
Sex	Woman	1.91‖	(1.24–2.93)	1.77‖	(1.13–2.75)	1.87‖	(1.18–2.96)
Body Mass Index	1 SD¶	1.03	(1.0–1.06)	—	—	1.02	(.98–1.06)
Diabetes (n=90)	None	2.17‖	(1.39–3.41)	2.04§	(1.28–3.23)	1.87‖	(1.17–3.01)

*Only variables with a significance level of p ≤.10 in univariate, logistic regression, or linear regression models.

†The reference group does not have the characteristic; Units for continuous variables approximate 1 standard deviation.

‡Adjusted for sex, race, and clinical site.

§Adjusted for gender, race, clinical site, body mass index (kg/m^2), education, marital status, the Modified Mini-Mental State Examination score, Center for Epidemiologic Studies Depression score, the energy/fatigue score, the pain frequency score, and diagnosis of diabetes mellitus.

‖p ≤.01.

¶Standard Deviation (SD)

Table 4

Multivariate Linear Regression with Nap Duration (minutes) as the Outcome in LIFE-P Study for Nappers Only.*

	Unit/Reference†	Unadjusted (N = 225)		Adjusted‡ (N = 225)		Fully adjusted model§ (N = 223)	
		β	p-value	β	p-value	β	p-value
Age	Year	−.2	.62	—	—	−.07	.89
Race	White	−1.1	.82	−5.5	.26	−3.95	.44
Sex	Woman	12.2	.005*	9.4	.03*	9.00	.04*
Body Mass Index	1 SD¶ increase	.97	.003*	—	—	.81	.02*
MMSE score‖	1 SD¶ decrease	1.4	.12	1.6	.09*	2.2	.03*
Diabetes (n=90)	None	16.2	.0001*	12.6	.004*	12.3	.005*

*Only variables with a significance level of p ≤.10 in univariate, logistic regression, or linear regression models are shown here.

†The reference group does not have the characteristic; Units for continuous variables approximate 1 standard deviation.

‡Adjusted for sex, race, and clinical site.

§Adjusted for sex, race, clinical site, body mass index (kg/m^2), education, marital status, the Modified Mini-Mental State Examination score, Center for Epidemiologic Studies Depression score, the energy/fatigue score, the pain frequency score, and diagnosis of diabetes mellitus.

‖Mini-Mental State Exam

¶Standard Deviation (SD)