Daytime sleepiness, exercise, and physical function in older adults

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SUMMARY The purpose of this study was to describe the association between sleepiness, exercise, and physical function in older adults, testing the hypothesis that sleepiness predicts decreased exercise and impaired physical function in this population. We performed a secondary analysis of data from the National Sleep Foundation’s Sleep in America Poll, comparing frequency of exercise and ability to perform functional tasks between sleepy and non-sleepy subjects. Trained interviewers administered a scripted telephone survey. Participants (n = 1506) were community-dwelling older Americans (55–84 years) randomly chosen from geographically representative households with listed telephone numbers. Sleepiness ‘so severe that it interferes with daytime activity’ was dichotomized as ‘daily/frequently’ or ‘never/rare’. Exercise frequency was scored 1–4 (‘less than once a week’ to ‘more than five times a week’). Responses to five questions (walk 0.5 mile, climb stairs, push/pull heavy object, stoop/crouch/or kneel, write, handle small objects), rated 1–5 (‘no difficulty’ to ‘unable to do’), were summed; a mean score of ≥2.5 was considered impaired physical function. Daytime sleepiness predicted low exercise frequency while controlling for age and body mass index (BMI) (OR = 1.40, 95% CI 1.031–1.897, P = 0.031). Frequent daytime sleepiness predicted impaired physical function (OR = 2.76, 95%CI = 0.237–0.553, P = 0.001) after controlling for age, BMI, income and number of co-morbid conditions. The conclusion was that daytime sleepiness in older adults is associated with physical functional impairments and decreased exercise frequency. The findings suggest that sleepiness in older adults is not benign but has implications for continued physical decline and warrants attention.

KEYWORDS disorders of excessive somnolence, older adults, physical activity, physical function, sleep

INTRODUCTION

The benefits of routine physical activity for all adults include decreased risk for cardiovascular disease and osteoporosis, lowered blood pressure, increased glucose tolerance and insulin responsiveness, improved mental acuity, and psychological well-being. However, many older Americans are sedentary despite the growing evidence that regular exercise has multiple health benefits (American College of Sports Medicine Position Stand, 1998; US Department of Health and Human Services, 2000). According to Healthy People 2010, 50% of men and almost 70% of women over age 75 engage in no regular physical activity.

Poor sleep quality, a common problem in older adults, is likely to erode both the propensity for, and tolerance of, physical activity. Normal changes in sleep architecture with aging include decreased sleep efficiency, decreased slow-wave sleep, and increased spent time awake after sleep onset.
Sleep disturbances such as insomnia, restless leg syndrome, and obstructive sleep apnea (OSA) increase in prevalence among older adults. (Avidan, 2005). In addition, older adults commonly have one or more chronic disease or symptoms such as nocturia and pain that interrupt sleep and impair sleep quality (Asplund, 2005; Foley et al., 2004). The Sleep in America Poll, by the National Sleep Foundation (2003) examined sleep behaviors and problems, diagnosis and treatment of sleep disorders, frequency and impact of daytime sleepiness, and the association of sleep and medical and physical conditions in adults aged 55–84.

The daytime behavioral correlate to disturbed or inadequate sleep is excessive daytime sleepiness. According to the Sleep in America Poll, approximately 15% of community-dwelling older adults are frequently sleepy. Although daytime sleepiness is prevalent among persons over age 65 (10% to over 30%), it is not a change that accompanies normal aging (Ancoli-Israel and Kripke, 1991; Bliwise, 2000; Gooneratne et al., 2003). Excessive daytime sleepiness is often associated with increased risk for cardiovascular mortality, impaired cognition, mood disturbances, and decreased quality of life (Bardwell et al., 1999; Engleman et al., 1993; Foley et al., 2001; Gooneratne et al., 2003; Newman et al., 2000). Gooneratne and colleagues used the Functional Outcomes of Sleep Questionnaire to measure functional areas sensitive to sleep disturbance in sleepy (n = 76) and non-sleepy (n = 38) adults (mean age = 77.7 ± 5.98 years). They found that sleepiness had a moderate to large negative effect size on the following domains of the scale: social outcomes = 0.65; general productivity = 0.59; vigilance = 0.75; and activity level = 0.83 (all P-values <0.005). It remains uncertain, however, if excessive daytime sleepiness affects the frequency of exercise or physical function in older adults. Thus, this study examined the relationship between sleep disturbances, daytime sleepiness, exercise, and physical function in community-dwelling older adults. Daytime sleepiness was hypothesized predictive of decreased exercise and impaired physical function in community-dwelling older adults.

METHODS

Design

The Sleep in America Poll was a national cross-sectional telephone survey conducted by the National Sleep Foundation. The National Sleep Foundation originally recorded the results of the survey without identifiers and then reviewed the data to ensure that subjects could not be identified before the data file was released for this analysis. The Institutional Review Board at the University of Pittsburgh approved the secondary analysis of the data.

Subjects

The sample (n = 1506) for the 2003 Sleep in America Poll was obtained from a purchased list of random nationwide telephone numbers. The National Sleep Foundation established quotas by geographic region and age to obtain a sample that would be representative according to the US Census of the general population of older adults. Inclusion criteria were men and women aged 55–84 years, community dwelling, and able to speak English. Approximately 25% of eligible persons who were contacted agreed to complete the brief (approximately 20-min) telephone survey.

Measures

The survey, developed by a panel of experts in sleep and geriatrics research on behalf of the National Sleep Foundation, was administered over 3 months during the fall of 2002 by a national research firm, using trained telephone interviewers who read from a script. Subjects were asked to specify their age, sex, race, marital status, and highest level of education completed. They also were asked their height and weight without shoes, from which their body mass index (BMI) was calculated.

The methods used to determine sleep disorders, sleep habits, and co-morbid medical conditions have been described elsewhere (Foley et al., 2004; National Sleep Foundation, 2003). All subjects were asked if a physician had told them (yes/no) that they had heart disease, hypertension or high blood pressure, arthritis, diabetes, cancer, stroke, lung disease (asthma, chronic bronchitis, emphysema), depression, osteoporosis, memory problems or forgetfulness, and, for male subjects, an enlarged prostate. Subjects also were asked if they had been diagnosed (yes/no) with insomnia, restless leg syndrome, or OSA and the frequency of symptoms. Subjects were asked how many hours they slept, not including naps, each weekday to compute sleep duration. Sleep duration was further classified as short (<7 h of sleep night), normal (>7 to 8.5 h a night), and long (>8.5 h of sleep night). Sleepiness was assessed by responses to the question ‘How often do you have daytime sleepiness so severe that it interferes with your daily activities,’ using a 5-point Likert scale from ‘every day or almost every day’ to ‘never’ that we then dichotomized for analysis as ‘frequently sleepy’ or ‘never/rarely sleepy’. Global sleep quality was self-rated on a scale from 1 (poor) to 5 (excellent).

Physical function was measured by the following six items that represented the average level of difficulty quantified by the respondents (4-point Likert scale with 4 ‘very difficult to do’ to 1 ‘not at all difficult’): walking one-half mile; walking up and down a flight of stairs without help; pushing or pulling heavy objects; being able to stoop, crouch or kneel; writing with a pen or pencil; and handling small objects. A fifth response option (unable to do) was scored with the value of ‘5’, and then the mean of these five items was computed for each subject. Mean scores ≥2.5 were classified as impaired physical function.

Frequency of exercise that ‘increases your heart rate or improves the muscles, bones, or overall fitness’ was measured with a 4-point Likert scale from ‘less than once a week’ to
‘more than five times a week’. Exercise frequency was examined as a binary variable of subjects who report exercising less than twice a week (48%) and those who report exercising three or more times a week (52%) comparing age, BMI, number of co-morbid conditions, income, physical function, and daytime sleepiness. Respondents were asked whether they participated in any form of physical recreational activity with the responses on a 4-point Likert scale from ‘less than once a week’ to ‘more than five times a week’.

Analyses

The statistical analysis was performed using SPSS software version 12.0 (SPSS, Inc., Chicago, IL, USA). Data entry was validated by examining ranges and frequencies for the variables: age, sex, BMI, sleep quality, daytime sleepiness, exercise frequency, and the individual items used to compute physical function. Missing data analysis examined the variables of age, BMI, co-morbidities, income, physical function, and frequency of exercise. Less than 5% of the data was missing for all the variables except for annual household income. Almost 18% of the sample refused to disclose information about their household income, a pattern of missing for all the variables except for annual household income. Almost 18% of the sample refused to disclose their income. Statistical analysis included descriptive statistics; chi-squared tests of independence; and unadjusted odds ratios of the association of daytime sleepiness and symptoms of insomnia, restless leg syndrome and OSA. Stepwise multiple logistic regression was used to estimate models to predict the odds for low exercise frequency and decreased physical function. The P-value for entry of variables was 0.05 and for removal of variables 0.10. In the hierarchical binary logistic regression models, potential covariates were entered in the first block, followed by daytime sleepiness to predict exercise frequency or physical function. Odds ratios, P-values, and confidence intervals were calculated.

Table 1 Description of sample (n = 1506) and comparison of the subsamples of respondents that were never/rarely sleepy (n = 1271) and frequently sleepy (n = 220)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total sample</th>
<th>Never or rarely sleepy</th>
<th>Frequently sleepy</th>
<th>d.f.</th>
<th>P-value (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years (n = 1506)</td>
<td>66.9 ± 7.99</td>
<td>66.7 ± 7.9</td>
<td>67.59 ± 8.4</td>
<td>291</td>
<td>0.171</td>
</tr>
<tr>
<td>Female (n = 723)</td>
<td>57.9%</td>
<td>56.9%</td>
<td>63.6%</td>
<td>1</td>
<td>0.065</td>
</tr>
<tr>
<td>Body Mass Index (n = 1451)</td>
<td>26.99 ± 5.58</td>
<td>26.69 ± 5.3</td>
<td>28.66 ± 6.9</td>
<td>1434</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of Co-morbidities (n = 1506)</td>
<td>2.10 ± 1.59</td>
<td>1.95 ± 1.25</td>
<td>2.92 ± 1.79</td>
<td>1489</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Self-Rated Health (n = 1484)</td>
<td>3.41 ± 1.033</td>
<td>3.50 ± 0.992</td>
<td>2.92 ± 1.11</td>
<td>283</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Global Sleep Quality (n = 1487)</td>
<td>3.20 ± 1.079</td>
<td>3.31 ± 1.024</td>
<td>2.61 ± 1.173</td>
<td>1485</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Difficulty Initiating Sleep (n = 1495)</td>
<td>18%</td>
<td>7%</td>
<td>34%</td>
<td>1478</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Awake A Lot During Night (n = 1495)</td>
<td>33%</td>
<td>30%</td>
<td>50%</td>
<td>1479</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Difficulty Returning to Sleep (n = 1487)</td>
<td>23%</td>
<td>20%</td>
<td>41%</td>
<td>1471</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Snoring (n = 1092)</td>
<td>44%</td>
<td>43%</td>
<td>52%</td>
<td>1083</td>
<td>0.036</td>
</tr>
<tr>
<td>Pauses in Breathing (n = 1171)</td>
<td>6%</td>
<td>7%</td>
<td>22%</td>
<td>1158</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Nocturia (n = 1504)</td>
<td>65%</td>
<td>62%</td>
<td>81%</td>
<td>1487</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Symptoms of Restless Leg (n = 1495)</td>
<td>17%</td>
<td>14%</td>
<td>35%</td>
<td>1480</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Values are expressed as mean or %. Number of Co-morbidities = 1–8; Self-Rated Health = 1 ‘Poor’ to 5 ‘Excellent’; Global Sleep Quality = 1 ‘Poor’ to 5 ‘Excellent’; Difficulty Initiating Sleep, Awake A Lot During Night, Difficulty Returning to Sleep, Snoring, Pauses in Breathing, Nocturia; Symptoms of Restless = A few nights a week to every night or almost every night.


RESULTS

Description of the sample

Eighty percent of sample were between 55 and 75 years of age and primarily female (58%), married (63.9%), and Caucasian (91.3%). The sample was apparently financially stable, almost half of the respondents reporting an annual household income of more than $35 000 and most (85%) rating their financial security as either ‘very secure’ or ‘somewhat secure’. Subjects who exercised frequently had a higher physical function and a higher annual household income (all P < 0.001).

Table 1 describes the total sample and compares respondents who were ‘never’ or ‘rarely’ sleepy with those who were ‘frequently’ sleepy. Respondents ‘never’ or ‘rarely’ sleepy had no difference in age or gender compared with those who were ‘frequently’ sleepy during the day. Female subjects had significantly lower rates of exercise frequency and physical functional ability than males (P < 0.05). Age did not have a statistically significant association with self-rated health, exercise frequency, exercising for recreation, or sleep quality. Increased age had a weak detrimental effect on physical function such as difficulty in walking one-half mile (r = 0.16, P < 0.05). However, increasing age was not significantly associated with decreased sleep quality or increased frequency of daytime sleepiness.

Co-existing medical conditions

Almost half of the sample considered their overall health ‘excellent’ or ‘very good,’ while 12.8% described their health as ‘fair’ and 4.7%, as ‘poor.’ The majority of the sample was either overweight (BMI 25–29, 40%) or obese (BMI ≥ 30, 22%). Many respondents reported being told by a physician that they had medical conditions, including heart disease (18.2%), hypertension or high blood pressure (47.3%), arthritis (46.4%), diabetes (16.3%), cancer (13.6%), stroke (5.6%),
lung disease (13.2%), depression (16%), osteoporosis (13.7%) memory problems or forgetfulness (11.4%), enlarged prostate (22% of males). Whereas 18.7% of the entire sample reported having four or more physician-diagnosed co-morbid conditions, almost 25% of the respondents over age 65 years had at least four such coexisting medical conditions. As expected, increased age was significantly associated with the number of co-existing medical conditions \((r = 0.24, \ P < 0.001)\). Respondents with multiple co-existing medical conditions had more frequent daytime sleepiness and lower exercise frequency \((P < 0.001 \text{ for both})\).

**Sleep disorders and sleepiness**

Sleep quality was judged 'good,' 'very good,' or 'excellent' by 77% of the subjects. The following sleep complaints were cited: frequent (several times a week to nightly) wakening during the night (33%), awaking not refreshed (26.7%), snoring (32%), nocturia (64.8%), and excessive daytime sleepiness (14.8%).

When sleepy and non-sleepy subjects were compared, the sleepy group reported significantly lower global sleep quality and self-rated health \((P < 0.001 \text{ for both})\). Sleepy subjects also reported significantly more frequent insomnia (difficulty in initiating sleep, difficulty in maintaining sleep, and difficulty in returning to sleep if awoken), symptoms of OSA (frequent snoring, pauses in breathing, nocturia), and symptoms of restless leg syndrome \((P < 0.001 \text{ for all})\).

**Sleepiness and exercise frequency**

A total of 778 subjects said they exercised frequently \((\geq 3 \text{ times a week})\), and 711 reported infrequent exercise \((\leq 2 \text{ times a week})\). Although increasing age was not significantly related to exercise frequency \((P = 0.99)\), more women than men reported exercising two or fewer times each week \((\chi^2 = 14.93, \ d.f. = 1, \ P < 0.001)\). In addition, subjects with co-existing medical conditions, higher BMI, and difficulty walking one-half mile were less likely to exercise frequently \((P < 0.001)\). Respondents who exercised three or more times a week reported better sleep quality and less frequent daytime sleepiness \((P < 0.001)\) than those who exercised less often.

As Table 2 shows, infrequent exercise was significantly associated with poor/fair sleep quality, daytime sleepiness, multiple co-morbidities, and difficulty walking one-half mile. Overall, exercise frequency correlated negatively with difficulty walking one-half mile \((r = -0.28, \ P = 0.001)\) and positively with exercising for recreation \((r = 0.51, \ P = 0.001)\). Although age had a small association with difficulty in walking one-half mile \((r = 0.16, \ P < 0.001)\), it had none with exercise frequency, sleep quality, or self-rated health. Likewise, BMI had a small but significant negative association with exercise frequency \((r = -0.17, \ P < 0.001)\) and difficulty in walking one-half mile \((r = 0.21, \ P < 0.001)\). Subjects who exercised less often \((\leq 2 \text{ per week})\) had more frequent insomnia symptoms, snoring, restless leg symptoms, daytime sleepiness, as well as poorer sleep quality \((P < 0.001)\).

Over half the sample (56%) reported sleeping between 7 and 8.5 h a night, while 34% were short sleepers reporting under 7 h and 9% were long sleepers reporting 8.5 or more hours of sleep a night. Although both long and short sleep duration were statistically significant in predicting low exercise frequency \((P < 0.05)\), the analysis showed that daytime sleepiness remained predictive of low exercise frequency while controlling for sleep duration \((\text{OR} = 1.379, \ P = 0.037)\).

When age, BMI, frequent co-morbid medical conditions, and daytime sleepiness were entered into a binary logistic regression model to predict exercise frequency \((P < 0.001)\), age did not contribute to the equation and was removed from the predictive model. While controlling for BMI, the analysis showed that daytime sleepiness was predictive of low exercise frequency, \((\text{OR} = 1.421, \ P = 0.049)\). However, when income was entered into the model sleepiness became only marginally significant \((P = 0.052)\) and when physical function and number of co-morbid conditions were added to the model, daytime sleepiness was not statistically significant.

**Sleepiness and physical function**

This sample of older adults generally had high physical function. More than one-fourth of the sample reported no difficulty in performing any of the target activities (walking one-half mile, climbing stairs, pushing or pulling heavy objects, stooping/crouching/kneeling, writing, or handling small objects). The small proportion who reported impaired functional ability (14%) were significantly older, heavier, and had more co-morbid conditions than subjects with good functional ability \((P < 0.005)\). Conversely, fewer subjects with good physical function (11.4%) reported having daytime sleepiness, whereas a greater proportion of those with impaired physical functioning (32%) reported sleepiness \((\chi^2 = 57.2, \ d.f. = 1, \ P = 0.001)\). Overall, physical function was significantly lower in sleepy subjects \((t = 8.1, \ d.f. = 250, \ P = 0.001)\). Using hierarchical binary logistic regression model (see Table 3), daytime sleepiness was predictive of impaired physical function \((\text{OR} = 2.76, \ 95\% \ CI = 0.237–0.553, \ P = 0.001)\) after controlling for age, BMI, income, and co-morbid conditions.

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Table 2 Unadjusted odds ratios and confidence intervals for low exercise frequency

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
<th>(\chi^2)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>1.25</td>
<td>1.11–1.39</td>
<td>14.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Poor or fair sleep quality</td>
<td>1.22</td>
<td>1.08–1.39</td>
<td>9.68</td>
<td>&lt;0.002</td>
</tr>
<tr>
<td>Frequent or daily daytime sleepiness</td>
<td>1.21</td>
<td>1.06–1.38</td>
<td>6.5</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>≥4 co-morbid conditions</td>
<td>1.39</td>
<td>1.12–1.73</td>
<td>8.73</td>
<td>&lt;0.003</td>
</tr>
<tr>
<td>Difficulty walking 0.5 mile</td>
<td>1.65</td>
<td>1.49–1.83</td>
<td>70.22</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Household income &lt; $35,000 year−1</td>
<td>1.56</td>
<td>1.24–1.96</td>
<td>14.54</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Pearson chi-square (continuity-corrected).
Table 3 Results of binary logistic regressions to predict low exercise frequency and physical function

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE</th>
<th>$\chi^2$</th>
<th>P-value</th>
<th>OR</th>
<th>95% CI</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables to predict low exercise frequency 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>-0.058</td>
<td>0.010</td>
<td>30.82</td>
<td>&lt;0.001</td>
<td>0.94</td>
<td>0.924-0.963</td>
<td>$\chi^2$ HL = 41.83, d.f. = 2, $R^2$ model = 41.83, d.f. = 2, $P$ = 0.376</td>
</tr>
<tr>
<td>Daytime sleepiness</td>
<td>0.335</td>
<td>0.156</td>
<td>4.64</td>
<td>&lt;0.031</td>
<td>1.40</td>
<td>1.031-1.897</td>
<td>$\chi^2$ HL = 8.610, d.f. = 8, $P$ = 0.037</td>
</tr>
<tr>
<td>Variables to predict low physical function 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>-0.065</td>
<td>0.014</td>
<td>21.52</td>
<td>&lt;0.001</td>
<td>0.94</td>
<td>1.038-1.907</td>
<td>$\chi^2$ HL = 154.56, d.f. = 4, $R^2$ model = 154.56, d.f. = 4, $P$ = 0.053</td>
</tr>
<tr>
<td>Co-morbid conditions</td>
<td>1.319</td>
<td>0.199</td>
<td>44.12</td>
<td>&lt;0.001</td>
<td>3.74</td>
<td>1.81-0.395</td>
<td>$\chi^2$ HL = 8.379, d.f. = 8, $P$ = 0.397</td>
</tr>
<tr>
<td>Low income</td>
<td>1.060</td>
<td>0.205</td>
<td>26.65</td>
<td>&lt;0.001</td>
<td>2.89</td>
<td>0.232-0.518</td>
<td></td>
</tr>
<tr>
<td>Daytime sleepiness</td>
<td>1.017</td>
<td>0.217</td>
<td>22.01</td>
<td>&lt;0.001</td>
<td>2.76</td>
<td>0.237-0.553</td>
<td></td>
</tr>
</tbody>
</table>

1Age entered in step 1, $P = 0.23$, removed from model. 2Age entered in step 1, $P = 0.38$, removed from model. Daytime sleepiness = few time week to daily; co-morbid conditions = 4 or more; low income = $35 000 or less/annual household income; BMI, body mass index.

DISCUSSION

Sedentary lifestyle is widespread not only among the elderly but exists in all age groups. It is interesting that in this study increasing age was not a significant factor with frequency of exercise. The findings suggest that in healthy older adults, sleep quality and daytime function are normally maintained; simply the aging process could not explain any decrease in physical activity. In this sample of relatively healthy older persons, increasing age was not strongly associated with the frequency of sleep disturbances (symptoms of restless leg syndrome, insomnia, OSA) or with the frequency of daytime sleepiness. Indeed, the findings support the suggestion of Gooneratne et al. (2003) that sleepiness in the elderly may be associated with deconditioning and declines in physical function.

Foley et al. (2004) concluded from the 2003 Sleep in America Poll that sleep complaints are not the result of normal aging and proposed that they are often secondary to chronic disease. The data also support the hypothesis that sleepiness has a negative impact on physical activity in relatively healthy community-dwelling elders. Although aging is related to a decline in physical function, excess weight increases the risk for physical decline (Brach et al., 2004) and vice versa. A 10-year longitudinal study of community-dwelling older women found that physical activity was as important as body weight in predicting physical function (Brach et al., 2004). Previous studies have found a strong association between excessive daytime sleepiness and BMI (Bixler et al., 2005; Vgontzas et al., 1998) but after the study controlled for BMI, daytime sleepiness remained predictive of decreased exercise frequency. These results suggest that sleepiness may be as important as body weight in predicting whether older adults exercise. This is especially important because exercise and physical activity promote healthy aging and can reduce or prevent functional declines that are associated with aging. In a prospective clinical trial, women aged 65 years or older with greater physical activity at baseline were less likely to experience cognitive decline during a 6- to 8-year follow-up period (Yaffe et al., 2001). High-intensity exercise interventions have been found effective in improving insulin sensitivity and glucose tolerance in subjects with type 2 diabetes (Irwin et al., 2002) but moderate-intensity activities such as walking have also been effective in improving metabolic control (Kriska et al., 2001).

The authors acknowledge certain important intrinsic limitations of the study. First, because it was a descriptive study from a cross-sectional survey, causation cannot be inferred and only associations can be reported. The survey had limitations in that it only queried respondents on the frequency of participation in exercise and did not obtain information about the intensity or duration of their physical activity. The lack of a longitudinal design with a randomly assigned experimental manipulation limits the ability to investigate cause and effect. Indeed, the fact that persons are not exercising may be a factor in further weight gain, increased sleep disturbances, and a worsening of their daytime sleepiness. In addition, subjective recall has potential biases that are inherent in all survey data. In addition, although the study used a quota-sampling plan to include older subjects to increase external validity, only one-quarter of solicited qualified persons agreed to participate.

It is well known that insomnia, restless leg syndrome, and OSA are highly prevalent in older adults (Avidan, 2005). It is not remarkable that one-third of the subjects reported symptoms suggestive of insomnia and restless leg syndrome, both treatable conditions. More than half of the sample reported frequent night awakenings, and almost one-quarter reported being told they have frequent pauses in their breathing during sleep. These high rates of symptoms of sleep disorders suggest that screening for sleep disorders should be the ‘new vital sign’ in medical care, especially in geriatrics (Wilson, 2005). Much like nutrition and exercise, the issue of sleep and sleepiness is emerging as an important aspect of health promotion and disease prevention.

Despite the limitations of the study, daytime sleepiness in older adults was found to have a negative impact on their physical activity and functional ability. Although greater age was not a significant predictor of sleepiness, daytime sleepiness could predict exercise frequency. Although regular physical activity contributes substantially to the health, quality of life, and maintenance of function of older adults (American College of Sports Medicine Position Stand, 1998; Brach et al., 2003; US Department of Health and Human Services, 2000), treatable sleep disorders that limit such activity may be overlooked in older populations. In conclusion, sleep disturbances not only affect nighttime sleep quality, but are also a risk factor for daytime sleepiness that may have negative consequences for physical exercise and ultimately, functional ability.
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