Sleep Habits of Long Island Rail Road Commuters

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Study Objectives: We addressed the issue of how commuting affects sleep habits, and its association with general health and potential sleep disorders in individuals on a large, U.S. commuter rail system.
Design: Postage-paid mail back questionnaires were distributed to commuters over 6 consecutive weekdays. The questionnaire incorporated previously validated questions regarding sleep habits.
Setting: Questionnaires were dispensed at 15 different rail stations.
Participants: 21,000 commuters accepted the questionnaire.
Measurements and results: Data was analyzed by total group and length of commute. A total of 4715 (22%) questionnaires were returned. Over 50% of the sample reported difficulty with sleep and wakefulness while only 3% sought professional help. Sleep apnea was suspected in 4.2% of male and 1% of female respondents and was associated with increased reports of excessive daytime sleepiness, and history of hypertension, diabetes and obesity. Total nocturnal sleep time was significantly less in those subjects with long commutes. Seventy percent of respondents reported napping during the commute. Length of commute was associated with hypertension.
Conclusion: Commuting long distances negatively impacts one's ability to capture adequate sleep. Data suggests that there may be significant numbers of respondents with unrecognized sleep disorders which further impact on general health.
Key words: sleep disorders; survey; commuters; snore; sleep apnea

INTRODUCTION

A LARGE PROPORTION OF EMPLOYED ADULTS commute daily to and from work by means that may restrict nocturnal sleep time but offer the opportunity to add sleep through napping. Although there have been a number of surveys of adult workers, which show a high prevalence of sleep disorders and poor sleep habits in the general population[1,2,3] as well as an association between sleep disorders and cardiovascular disease,[4] little is known about the impact of commuting on sleep, sleep and napping behavior, symptoms of sleep disorders, and the association of commuting with general health. To address these issues, we designed a questionnaire to assess the sleep habits and symptoms of sleep disorders among a large cohort of commuters in a U.S. suburban area serviced by the Long Island Rail Road (LIRR). We report the prevalence of difficulties with sleep and wakefulness and their correlations with commuting times, general health, and potential sleep disorders.

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METHODS

Postage-paid, mail-back questionnaires (n=21,000) were distributed to riders of the LIRR during the westbound morning rush hour (6–9 A.M.) over six consecutive weekdays in March of 1994. Twenty-two volunteers distributed questionnaires at 15 different stations, encompassing rides of 30–90 minutes. Commuters were asked to complete and return the questionnaire. Questions regarding sleep were selected and formatted to match those of previous community-based studies and covered a range of sleep issues.[5-11] Answers pertaining to sleep quality and symptom prevalence were arranged using a 5-point Likert frequency scale (1=Never, 2=Rarely, 3=Moderately, 4=Very often, 5=Always) and a "Don't Know" category. The "don't know" category was coded as missing data and ranged between 0.2% and 3.7% of any item. Additional demographic and general medical information was gathered. Responses could be anonymous. The project received NYU Institutional Review Board and LIRR management approval.

Once collected, questionnaires were given identifying numbers. Obvious errors and omissions such as commute times and place were identified, corrected when possible, or excluded from the database. When appropriate, categories "never" and "sometimes" were combined and con-

sidered not present or negative responses and "moderately," "very often," and "always" were considered present or positive. We employed the following definitions: A long commute—over 75 minutes in length; a short commute—under 45 minutes in length; excessive daytime sleepiness (EDS)— a positive report (at least moderate presence) of difficulty staying awake when necessary (as in working, driving, or talking on the telephone) or difficulty staying awake in the movies, theater, or show; respiratory-related symptoms (RRS)— "snoring," "gasping," and/or reports of "stop breathing" during sleep; suspected sleep disordered breathing (SDB): a positive report of any two or more respiratory variables; simple snoring: a positive report of "snoring" and a negative report for "gasping" and "stop breathing"; incidence of hypertension or diabetes was by self report; body mass index (BMI)— wt(Kg)/ht(M^2);[12] obesity— a BMI over 27;[13] socioeconomic status (SES)— categorized by the Hollingshead Scale using level of education and job title to form social levels I-V with I being the highest.[14]

Data from each questionnaire were entered into a Paradox database (Borland, Scotts Valley CA) and verified. Statistical modeling of the data was performed using CSS Statistica 3.1 (Statsoft, Tulsa, OK). Statistical significance of categorical associations was analyzed by Chi Square. 95% Confidence Intervals for the difference between means and t-tests were used to compare groups for interval data. Adjusted odds ratios, with 95 % confidence intervals, were calculated from logistic regression models for evaluation of predictor variables on hypertension. For each analysis, subjects with missing data for that analysis were deleted. A *p* level of 0.05 was considered significant; however, *p* values are provided to allow adjustment if desired.

RESULTS

Based on the LIRR statistics of use for the stations targeted for this project, there was an available pool of approximately 31,300 commuters. Of the 21,000 questionnaires distributed, 4715 (22%) of these questionnaires were returned. This was better than usual, as most LIRR questionnaires have a 10–12% return (Personal communication). The demographic breakdown of the respondents (59.7% male, 40.3% female, 31.9% between ages 35–49) was comparable to previously gathered LIRR statistics for the same stations (59.5% male, 40.5% female; 40% between ages 35–49). Respondents' mean educational level was 16 years with 26% of the sample having greater than 16 years of education. Mean SES was 2.2. Mean BMI was 25.32±4.3 with 38.6 % males and 16.1% females reporting a BMI>27. There were only slight but statistically significant educational and SES differences between long and short commuters. Long commuters were less educated (Short=16.48 years versus long=15.61 years; t=6.55; p<.0001), and had lower SES (Short =2 versus Long= 2.28; t=-7.72; p<.0001). There was no correlation between SES and education and any other variable. Additionally, long commuters were bigger (mean BMI value for men with short commutes was 25.98 versus men with long commutes —27.54). For women, the mean BMI for those with short commutes was 23.15 versus 23.76 for those with long commutes.

One third (37%) of the sample complained of at least moderate difficulty falling or staying asleep. More women than men reported this symptom (40.6% females versus 35.2% males, Chi^2 14.2; p<.001). In response to questions regarding EDS, 34.8% of respondents reported at least moderate difficulty staying awake (while working, driving, talking on the telephone, and in the theater). There was no difference across gender on this response. Furthermore, there were no significant differences noted between long and short commuters on responses to these questions.

2.8% of respondents reported seeking professional help for difficulty falling or staying asleep. Overall, respondents reported the use of various remedies to "improve" sleep: alcohol (12.3%); sedatives (5.8%); tranquilizers (4.1%); antidepressants (2.2%); and relaxation therapy (11.2%). Significantly, more short commuters used tranquilizers (5.5% versus 2.7%; p<.02) and sedatives (7.4% versus 3.6%; p<.005) when compared to long commuters. Only 0.09% of respondents sought professional help for excessive daytime sleepiness. Yet, 4.9% of the respondents answered positively to the question of whether they had ever used "stimulant drugs" to improve alertness. There was no difference between long and short commuters on this variable. Overall, only 0.09% of respondents reported having been diagnosed with a sleep disorder.

Respondents tended to sleep significantly less on week nights than on weekend nights; 414.4(±55) minutes during the week versus 491.5(±75) minutes on weekends (95%CI for differences between means 74.3-79.8). Women reported sleeping significantly longer than men during both week day and weekend nights; 424(±55) minutes for the women on week nights compared to 408(±53) minutes for the men (95% CI 12.7-19.3) and 507(±77) for the women on weekends compared to 481(±72) for the men (95% CI 21.7-30.8). Length of commute was negatively associated with length of weeknight sleep. Respondents with short commutes reported a mean sleep time of 428(±51) minutes compared to those with long commutes who reported a mean of 389(±55) minutes (95% CI 24.3-36.2). On weekends, long commuters slept a mean of 97 minutes longer than they did on weeknights, while short commuters slept 64 minutes longer. There was no statistical difference between mean weekend sleep times of these groups; 492(±72) for the short commuters versus 495(±79) for the long commuters (95% CI -5.2 -11). However, the short commuters slept a mean of 144 minutes longer per week than long commuters. There were no differences in this

Table 1

Napping on the Morning versus Evening Commute

	Male	Female	Chi^2	Short commute	Long commute	Chi^2	EDS	No EDS	Chi^2
AM Nap	45.5%	53.8%	31.8*	27.9%	72.1%	240.6*	53.9%	45.9%	26.6*
PM Nap	62.5%	61.5%	.49 ns	51.1%	69.6%	46.6*	68.1%	58.8%	38.9*
AM or PM Nap	69.7%	70.6%	.38 ns	56%	82.1%	97.7*	75.6%	66.8%	37*
AM and PM Nap	38.2%	44.8%	20.3*	22.9%	57.2%	176.4*	46.4%	37.8%	32.1*

*p=<.00001

Table 2

Prevalence of Respiratory Related Symptoms by Gender

	Male n=2492	Female n=1679	Chi^2	p value
SNORE (%)	56.2	30.5	267.4	p<0.00001
GASP (%)	10.1	6.1	20.4	p<0.00001
STOP BREATHING (%)	7.3	2.0	57.5	p<0.00001
1 OF 3 SYMPTOMS (%)	46.7	28.9	260.8	p<0.00001
2 OF 3 SYMPTOMS (%)	7.2	3.5		
3 OF 3 SYMPTOMS (%)	4.2	1.0		

Table 3

Association of Respiratory-Related Symptoms (RRS) with Sleepiness and Obesity

Respiratory Related Symptoms	Percent with Self reported EDS* n=1393	Percent with BMI ≥27 n=1170
No symptoms	30.1%	19.3%
1 of 3 symptoms	35%	37.6%
2 of 3 symptoms	46.8%	40.7%
3 of 3 symptoms	52.9%	58.3%
Chi ^{2}	52.14 p<.00001	215.7 p<.00001

*** EDS= excessive daytime sleepiness**

behavior according to sex or age.

A total of 70% of 4683 respondents, reported at least moderate napping during their commute. Among nappers, 40.9% reported napping on both morning and evening rides. As noted on Table 1, significantly more women than men reported napping on both rides. Similarly, more women napped on the morning ride than men. More long commuters napped on the A.M .or P.M .rides and on both the A.M. and P.M. rides. Those respondents who napped slept significantly less during their work week and appeared to compensate by increased sleep time during the weekend. Nappers reported sleeping a mean of 408±52.63 minutes during the weeknights while non-nappers reported 431±55.3 minutes (95% CI for difference 19.5-26.5). Over the weekend nights, there was no difference. Nappers slept 496.3±75.4 minutes versus 489±75.1 minutes for non-nappers (95% CI for difference -0.9-8.9). Respondents who reported at least moderate "EDS," compared to those with little or no EDS, were more likely to nap on either ride and on both morning and evening rides. Interestingly, among respondents reporting no "EDS," 66.8% reported at least moderate napping on either the morning or evening commutes and 37.8% reported napping on both rides.

Over 4,000 respondents (n=4171) answered the questions regarding respiratory-related symptoms. Positive reports by gender are shown in Table 2. More males than females reported the presence of snoring, gasping and/or stopping breathing during sleep. 8.6% reported two or more of the respiratory-related symptoms (11.4% were male and 4.5% female). Furthermore, 2.9% of the sample reported all three symptoms (4.2% males/1% females, Chi square 260.8; p<0.00001). There was no significant association between the prevalence of napping and reports of respiratory symptoms. However, 4.2% (5.7% male/2% female) of the respondents reported at least two respiratory symptoms and at least moderate EDS.

Among the 4048 respondents who answered questions on BMI and respiratory symptoms, it was clear that the prevalence of obesity increased as the number of reported respiratory related symptoms increased (Table 3, above). Of the respondents who denied any respiratory symptoms, 19.3% were obese. In contrast, of those respondents reporting all three respiratory symptoms, 58.3% were obese (overall Chi square 215.7;p<0.00001).

Of the 4564 respondents who answered questions regarding hypertension and diabetes, 398 cases of hypertension were reported. More respondents with hypertension reported at least moderate snoring than would be expected by chance (74% versus 26% Chi square 112;p=<0.0001).

When respondents were divided into simple snorers (those who reported only the symptom of snoring) and suspected SDB (those reporting at least two of the respiratory symptoms) and compared to those reporting no respiratory symptoms ("normals"), there was an association between reported respiratory variables and EDS, hypertension, diabetes, and obesity (Table 4).

Because of the known association of multiple factors on hypertension, we looked at the adjusted odds ratios for diabetes, obesity, age by decade, length of commute, gender, alcohol, EDS, and smoking in simple snorers and suspect-

ed apneics. Both simple snorers and suspected apneics had an increased risk of hypertension when other factors are held constant. Simple snorers had an adjusted odds ratio of 2.21 (1.54-3.18) and suspected apneics had an increased adjusted odds ratio of 2.20 (1.36-3.57) (Table 5). Unadjusted odds ratios are included for comparison. Gender, alcohol, EDS, and smoking were non-significant. Based on the adjusted odds model, it appears there may also be an increased risk of hypertension associated with a long commute.

DISCUSSION

The LIRR is the largest commuter rail line in the country, servicing over 100,000 daily commuters between the end of Long Island and New York City. We were able to distribute questionnaires to 67% of the available commuters and our respondents were representative of the available adult population. Half of these suburban adults reported significant difficulties with sleep and wakefulness. One third reported excessive daytime sleepiness but few sought professional help. These findings are remarkably close to those of the recent Gallup Survey entitled "Sleep in America II." [2] The large percentage reporting difficulty with sleep and wakefulness that is uninvestigated, untreated, or self-treated suggests that people with sleepiness may not recognize their "difficulties" as abnormal. It may be that commuters accept sleepiness as part of suburban life where the realities of a long commute and early work start times could impact on their ability to schedule adequate nightly sleep time. In any case, the result appears to indicate significant sleep deprivation across weeknights affects the respondent's ability to remain fully awake during the day. This is supported by the data showing that respondents with long commutes appear to sleep less during the weeknights and attempt to "catch up " with a greater increase in weekend sleep than do short commuters. Additionally, they nap more during commutes than short commuters. The large percentage of respondents reporting and apparently accepting difficulty with sleep and wakefulness may also indicate there is a general lack of public awareness regarding proper sleep habits and expectations of normal sleep.

It is interesting to note that even those respondents not complaining of EDS frequently nap. This could suggest the nap is valuable in increasing daytime levels of alertness. However, nappers still attempted to "catch up" on sleep over the weekend. It may be that the sleep obtained on the moving train is not refreshing and cannot be factored into total sleep time over the week. Alternatively, nappers who do not report EDS may be reflective of unrecognized EDS, and sleep disorders in the adult working public. Unfortunately, it is difficult to incorporate the role of motivation into the reported incidence of napping. Sleep physiologists would argue that manifestations of EDS such as napping, would not occur in the presence of adequate sleep, and that the rested individual would remain alert even under unstimulating circumstances. However, animal data argues against this idea and suggests that sleep occurs in the absence of physiological need when there is no incentive to remain awake. [15] It is, however, difficult to assess how "incentive" in that study compares to the idea of "motivation" among commuters.

Snoring and EDS are important symptoms. [16] In the LIRR cohort, 48% of respondents reported at least moderate snoring. This is somewhat higher than in community based epidemiological studies. [17,18] However, the estimate of the prevalence of suspected sleep-disordered breathing in this cohort, based on the definition of reports of at least two "respiratory" symptoms (snoring, gasps, or stop breathing), and EDS is similar to others previously published. [3,4] We report the combination of at least moderate reports of EDS, snoring, gasping, and/or stop breathing among 4.2% of the cohort (5.7% males and 2% of females). The combination of these symptoms suggests significant sleep apnea in these respondents.

Links between sleep apnea, diabetes, hypertension and cardiovascular disease have been noted in the literature. [18,19] Our results show that symptoms suggestive of sleep apnea were associated with increased reports of excessive daytime sleepiness, hypertension, diabetes and obesity. In addition, they also suggest a higher risk for "hypertension" in the population defined as simple snorers and those defined as suspected apneics when compared to "normals" and adjusted for age, gender, obesity, diabetes, smoking, alcohol, EDS, and length of commute. This is similar to the findings in 1060 subjects from the Wisconsin Sleep Cohort Study where an association between hypertension and sleep apnea was independent of obesity, age, and gender. [20] Our data also suggest an independent risk of developing hypertension for those with long commutes compared to short commutes. While this is an interesting finding in our cohort, further research will be needed to clarify this association.

The impact of the consequences of EDS remains a significant risk to society in terms of loss of productivity and safety. This risk may increase in suburban areas as the numbers of long distance commuters increase. From a social perspective, based on previous gathered data, the large percentage of LIRR responders who report significant daytime sleepiness raises the issue of serious consequences to society from sleep-deprived commuters. [21] Specifically, there could be concern raised about highway safety, particularly in suburban areas during the commuter's morning and evening travel to and from the train. A recent survey regarding drowsy drivers in New York State, surveyed 1000 licensed drivers in NYS. [22] Fifty-five percent had driven while drowsy over the last year; 24% reported falling asleep at the wheel. Fewer hours of sleep at night and greater difficulty staying awake during the day were vari-

TABLE 4

Conditions Associated with Snoring and Suspected Sleep Disordered Breathing (SDB)

CONDITIONS	"NORMALS" n=2152 (52.9%)	SIMPLE SNORERS n=1560 (38.4%)	SUSPECTED SDB n=354 (8.7%)	Chi ^{2}	p value
EDS (%)	30.0	34.6	48.9	50.08	p<.00001
HYPERTENSION(%)	4.5	12.4	16.9	105.2	p<.00001
DIABETES (%)	1.3	2.7	4.2	17.21	p<.00005
OBESITY (%)	19.3	38.9	46.5	218	p<.00001
MALES (%)	48.2	71.7	79.3	270	p<.00001

TABLE 5

Association with Hypertension

	Adjusted Odds Ratio for Hypertension	95% Confidence Interval for Odds Ratio	Unadjusted Odds
SIMPLE SNORE	2.21	1.54-3.18	1.95
SUSPECTED APNEA	2.20	1.36-3.57	2.31
DIABETES	7.42	4.58-12.02	7.35
OBESITY	2.65	1.87-3.75	3.66
AGE (Decade)	1.98	1.71-2.30	
LONG COMMUTE	1.69	1.20-2.38	1.00
MALE GENDER	1.34	0.92-1.97	2.80
ALCOHOL	0.90	0.66-1.24	0.73
EDS	0.74	0.53-1.03	1.49
SMOKING	1.08	0.71-1.67	1.11

ables predictive of fall asleep incidents while driving. Furthermore, 33% of those questioned reported snoring during sleep. Snorers were more likely to have fallen asleep at the wheel than non-snorers (34.4% versus 18.9% ;OR 2.25; 95% CI= 1.66-3.06).

We recognize several inherent limitations in this study. First, our sample may be biased with an over representation of people who are concerned about sleep and sleepiness. While the sample respondent demographics were representative of the available pool of commuters, and even though the topic of sleep and sleepiness are popular topics of discussions to commuters (author's personal observation), "non responders" may have ignored the questionnaire or considered it irrelevant. Second, we were not able to do

test-retest reliability in our sample. Third, our questionnaire was not validated to physiologic measures. However, we were careful to use items from questionnaires validated in other populations in these analyses and sorted responses using categories similar to those validated studies. Additionally, there is face validity of self-reported napping during the commute.

CONCLUSION

This study polled a representative group of suburban rail road commuters and examined results as they applied to those with short commutes (<45 minutes) versus long commutes (>75 minutes). Over 50% of respondents reported significant difficulty with sleep and wakefulness. Respondents with long commutes reported less sleep and more daytime sleepiness overall. It is surprising that few respondents attempted to improve sleep times. It may be that respondents accept the price of sleep loss for the perceived improvements in quality of life in suburbia. This study also suggests that a large portion of society may have unrecognized and consequently untreated sleep disorders. Over 8% of this population report symptoms and conditions which in combination suggest a presence of sleep disordered breathing, a treatable medical condition. Failure to seek professional help may reflect the public's failure to recognize the significance of symptoms related to sleep disorders. This is especially true for the group of long commuters who are at risk to be significantly sleep deprived by their imposed sleep schedules. Public education and improved awareness among health professionals regarding sleep needs, the risks of sleep loss, and sleep disorders may encourage evaluation of the personal impact of increased length of commute on health.

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REFERENCES

1) National Commission on Sleep Disorders Research Report. V 1. Executive Summary and Executive Report. Bethesda, MD: National Institutes of Health, 1993.

2) The Gallup Organization. Sleep in america II. Princeton, NJ: The Gallup Organization, 1997.

3) Young T, Palta M, Dempsey J, Skatrud J. Weber S, Badr S. Occurrence of sleep disordered breathing among middle aged adults. N Engl J Med 1993;328:1230-1235.

4) Hla KM, Young TB, Bidwell T, Palta M, Skatrud JB, Dempsey J. Sleep apnea and hypertension. Ann Intern Med 1994;120:382-388.

5) Haraldsson P-O, Carenfelt C, Knutsson E, Persson HE, Rinder J. Preliminary report:validity of symptom analysis and daytime polysomnography in diagnosis of sleep apnea. Sleep 1992;15(3):261-263.

6) Kapuniai LE, Andrew DJ, Crowell DH, Pearce JW. Identifying sleep apnea from self-reports. Sleep 1988;11(5):430-436.

7) Crocker BD, Olson LG, Saunders NA, et al. Estimation of the probability of disturbed breathing during sleep before a sleep study. Am Rev Respir Dis 1990;142-14:14-18.

8) Maislin G, Pack AI, Kribbs NB, et al. A survey screen for prediction of apnea. Sleep 1995;18(3):158-166.

9) Hoffstein V, Szalai JP. Predictive value of clinical features in diagnosing obstructive sleep apnea. Sleep 1993;16(2):118-122.

10) Stradling JR, Crosby JH. Predictors and prevalence of obstructive sleep apnea and snoring in 1,001 middle-aged men. Thorax 1991;46:85-90.

11) Kump K, Whalen C, Tishler PV, et al. Assessment of the validity and utility of a sleep-symptom questionnaire. Am J Respir Crit Care Med 1994;150:735-741.

12) Khosla T, Lowe FR. Indices of obesity derived from body weight and height. Br J Prev Soc Med 1967;21:122-128.

13) Partinen M. Epidemiology of sleep disorders. In Kryger MH, Roth T, Dement WC Principles and practice of sleep medicine. 2nd edition. Philadelphia:WB Saunders, 1994:437-452.

14) Hollinghead AB, Redlich EC. Index of social position. In (Eds) Hollingshead, AB and Redlich, eds. Social class and mental illness, a community study. New York: J. Wiley and Sons Inc., 1958.

15) Ruckebusch Y. Sleep and environment. Sleep 1976:152-69.

16) Strohl KP, Redline S. Recognition of sleep apnea. Am J Respir Crit Care Med 1996;154:279-289.

17) Lugaresi E, Coccagno G, Farneti M, Mantovani M. Cirignotta F. Snoring. Electroenceph and Clin Neurophysiol 1975; 39:59-64

18) Schmidt-Nowara WW, Coultas DB, Wiggins CL, Skipper BE, Samet JM. Snoring in an hispanic-american population: risk factors and association with hypertension and other morbidity. Arch Intern Med 1990;50:597-601.

19) Katsumada K, Okada T, Miyao M, Katsumata Y. High incidence of sleep apnea syndrome in a male diabetic population. Diab Res Clin Prac 1991;13:45-52.

20) Young T, Peppard P, Palta M, Hla M, Finn L, Morgan B, Skatrud J. Population-based study of sleep disordered breathing as a risk factor for hypertension, Arch Intern Med 1997;157:1746-1752.

21) Mitler M, Carskadon M, Czeisler C, Dement W, Dinges D, Graeber R. Catastrophes, sleep and public policy:consensus report. Sleep 1988; 11:100-9.

22) McCartt A. Ribner SA, Pack AI, Hammer MC. The scope and nature of the drowsy driver problem in New York State. Presented at the 39th Annual meeting of the Association for the advancement of Automotive Medicine; October 16-18, 1995, Chicago, Illinois.