Published in final edited form as:

Fam Community Health. 2014 ; 37(4): 279–287. doi:10.1097/FCH.0000000000000038.

The Association of TV Watching to Sleep Problems in a Church-going Population

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Abstract

Sensory stimuli/inactivity may affect sleep. Sleep problems are associated with multiple health problems. We assessed TV habits in the Adventist Health Study-2 at baseline and sleep problems in the Biopsychosocial Religion and Health Study 1–4 years later. After exclusions, 3,914 subjects split equally into TV watchers <2 hours/day or ≥2 hours/day. Watching TV ≥2 hours/day predicted problems falling asleep, middle of the night awakening and waking early with inability to sleep again in multiple logistic regression. Excess TV watching disturbed sleep induction and quality, though the relationship may be bidirectional. TV habits should be considered in individuals with sleep problems.

Keywords

Church-goers; lifestyle; sleep; TV watching

Sleep problems are an ever-increasing public health hazard.¹ About one-tenth of respondents to the Behavioral Risk Factor Surveillance System in 2009 reported 30 days of insufficient sleep in the preceding 30 days.² Sleep problems may be related to demographic disparities. Among community-dwelling elderly Blacks, fewer sleep problems were reported compared to Whites,³ while another study found shorter sleep duration among Blacks compared to Whites;⁴ socioeconomic differences may influence these relationships.⁵ Various forms of sleep problems are associated with a spectrum of health problems, including metabolic syndrome, obesity, diabetes, cardiovascular disease, and reduced functional capacity and quality of life.^{6–10} Recently, the Health Professionals Follow-Up Study reported that difficulty initiating sleep and nonrestorative sleep was associated with mortality in men.¹¹

Lifestyle patterns are major determinants of sleep problems.^{7,10,12} Among these patterns, excess alcohol,^{10,12} stimulants as caffeine,¹³ cigarette smoking,^{12,14} diet⁷ and physical inactivity^{10,12} seem to play major roles in sleep disturbance. Body fatness and increased BMI are associated with sleep problems^{6,8,10,12} independently of physical activity level.¹⁰ Another lifestyle factor that may influence nighttime sleep is napping. Daytime napping may be a marker for sleep fragmentation, particularly in older adults.¹⁵

Putative factors associated with poor health and sleep problems include TV watching and other screen time.^{16,17} Excess TV time may impair health, rivaling the associations of lack of physical activity, obesity and smoking with reduced longevity.¹⁶ In one study, every hour of TV watching was observed to shorten life by 22 minutes.¹⁶ TV watching is associated with sedentariness and studies have linked sedentariness and sleep problems.¹² Moreover, TV watching involves exposure to bright light. Exposure to bright light, especially at night, is thought to contribute to delayed sleep induction.¹⁸ Cross-sectional studies associating TV watching to sleep have been conducted among children, adolescents, and college-age students.^{19,20} In a prospective study, adolescents who watched three or more hours of TV daily were at a significantly elevated risk for sleep problems by early adulthood, while those who reduced their TV viewing from one hour or longer to less than one hour reduced their risk for subsequent sleep problems.²¹ On the other hand, among US persons aged 13–64 years of age, only use of interactive technological devices but not passive devices like TV before bedtime was associated with sleep problems.¹⁷ Prospective data associating TV watching with sleep problems in adults appear to be lacking.

The current study was done in a sample of church goers who participated in two surveys, one to four years apart. We studied whether watching TV at baseline was associated with sleep problems, after adjusting for control variables including demographics, baseline sleep duration, BMI, exercise habits, weekend and weekday napping, diet, and caffeine and alcohol use.

METHODS

The Adventist Health Study-2 (AHS-2) was initiated in 2002 among ~97,000 Seventh-day Adventist church members aged ≥30 years who were able to read and speak English and attended churches in the United States and Canada.²² The baseline questionnaire asked about medical history, dietary habits, physical activity, lifestyle and demographics. The Biopsychosocial Religion and Health Study (BRHS)²³ consisted of a questionnaire regarding religious, health, psychological and social practices administered to a randomly chosen subset of 20,000 participants in AHS-2 one to four years following AHS-2. A total of 10,988 respondents (55% response) completed the BRHS.

In the current prospective study, Black and White participants in AHS-2 who responded to the BRHS were the study sample. We excluded non-Adventists, those aged <30 years, and those with a BMI >40 kg/m². Individuals with medical disease or pain syndromes including diabetes, stroke, angina pectoris, rheumatoid arthritis, degenerative disk and arthritis disorders, asthma, fibromyalgia, and sleep apnea as reported in the BRHS were also excluded. These exclusions reduced the study sample to 4,934. The final number was 3,914,

after removal of subjects with incomplete data. Analyses were repeated with the inclusion of subjects with medical disease or pain syndromes (n=6,949).

In the baseline AHS-2 questionnaire, subjects were asked about age, race and gender, education, weight and height (to calculate BMI), diet, exercise, alcohol consumption, napping, hours of sleep each night and daily hours of TV watching. Dietary data was obtained from a validated food frequency questionnaire covering the past year. Response categories for usual vigorous exercise during the past year ranged from never to 6 times/week. Alcohol was categorized as nonuse in the last 12 months versus any use. Napping on weekdays and weekends was recorded as number of minutes on a usual weekday on average, and on the weekend. Sleep duration was assessed as “How many hours do you usually sleep each night?” Cut-offs were <6 hours/night or 9 hours/night. The number of hours of TV daily were listed as: none, <1 hour, 1 hour, 2 hours, 3–4 hours, and 5 hours with 2 hours/day chosen as a cut-off.

In the BRHS, sleep problems were assessed as: Do you have trouble falling asleep, waking in the middle of the night and finding it hard to get back to sleep, and waking up very early and can’t get back to sleep in the past four weeks? These questions were based on the Alameda county questionnaire.²⁴ Response categories were rarely or never, sometimes, often or almost every day. The latter three categories were grouped in analyses. Caffeinated beverage intake was categorized as none/rarely or 1–3 times/month in the last 12 months.

Statistical analyses

One G*POWER analysis was done with F as the test family and multiple regression testing R^2 deviation from zero.²⁵ Sample size, given alpha of 0.05, power of 0.8, a small effect size ($f^2 = .02$), and 13 as the number of predictors, yielded a minimum sample size need of 904. Descriptive characteristics were compared between subjects who reported TV watching for <2 hours/day versus 2 hours/day using chi-square or independent t-tests. Multiple logistic regression analysis was conducted with TV watching at baseline as the independent variable, and sleep problems (trouble falling asleep, waking in the middle of the night, waking early and can’t get back to sleep) as the dependent variables. The final model was adjusted for age, race, gender, education, BMI, diet, vigorous exercise, alcohol use, caffeinated beverage use, weekend and weekday napping, interval in years between questionnaires, and sleep duration at baseline. SPSS Version 20 (Statistical Package for the Social Sciences, Chicago, IL) was used for analyses.

RESULTS

One-half of the sample reported watching TV <2 hours/day (none, 12.3%; < 1 hour, 19.4%; 1 hour, 18.3%) while one half reported watching TV 2 hours/day (2 hours, 28.4%; 3–4 hours, 17.9%; 5 hours, 3.6%). Descriptive characteristics shown in table 1 indicate that subjects who watched TV 2 hours/day were older, had a higher mean BMI, were more likely to be Black, had less education, were less likely to be vegetarian, engaged in less exercise, were more likely to use caffeine and consume alcohol, were more likely to report no napping or long naps on weekdays and weekends, and were more likely to report very short or long duration of nighttime sleep compared to subjects who watched TV <2 hours/

day. There was a slightly longer elapsed time between baseline and follow-up questionnaire responses for those who watched TV <2 hours/day than for those who watched TV ≥ 2 hours/day. Table 2 shows that those who watched TV ≥ 2 hours/day were more likely to report trouble falling asleep, waking in the middle of the night, and waking early and unable to go back to sleep compared to those who watched TV <2 hours/night.

Tables 3–5 show multivariate adjusted odds ratios and confidence intervals for the relationship between TV watching and sleep problems. After adjusting for all control variables watching TV ≥ 2 hours/day was associated with higher odds of trouble falling asleep (Table 3). Trouble falling asleep increased with age, female gender, weekday napping and sleeping less than 6 hours/night at baseline, while male gender, nonuse of caffeine and sleeping ≥ 9 hours/night at baseline were associated with less trouble falling asleep. As shown in Table 4, after adjusting for all control variables, watching TV ≥ 2 hours/day was associated with waking in the middle of the night and finding it hard to get back to sleep. Waking in the middle of the night was associated with being a White female, weekend napping, short naps on weekdays, and less than 6 hours of sleep per night at baseline. Protection against waking in the middle of the night was associated with Black race.

Table 5 shows that after adjusting for all control variables watching TV ≥ 2 hours/day was associated with higher odds of waking early and inability to go back to sleep. Waking early and inability to go back to sleep was also associated with age, vegetarian diet, napping on weekends and short naps on weekdays, and less than 6 hours of sleep/night at baseline. Protection against waking early and unable to go back to sleep was associated with Black race, having a master's degree or higher education, and sleeping ≥ 9 hours per night.

All analyses were repeated including subjects with medical disease or pain syndromes. These results showed similar relationships between TV watching and sleep problems as in the sample without disease or pain (data not shown); only the relationship of some control variables to sleep problems differed (data not shown).

DISCUSSION

In a bi-ethnic church-going sample, we found that watching TV ≥ 2 hours daily was associated with trouble falling asleep, waking in the middle of the night and finding it hard to get back to sleep, and waking early with inability to fall sleep again. Several demographic and lifestyle factors were associated with increased TV watching, however, adjustment for these factors did not change the findings. The data is prospective, with TV watching assessed at baseline and sleep problems assessed at follow-up after a mean of three years. However, the time of observation was short. Thus, it remains possible that sleep problems lead to TV watching, as well as TV watching leading to sleep difficulties.

The study had adequate power as estimated *a priori*. Other strengths of the study include control for a number of confounders, including napping as well as sleep duration at baseline. About 36% of the total study sample was Black as efforts were made to include a bi-ethnic population. Very few subjects smoked cigarettes (29 subjects in total who reported smoking 1 cigarette or more daily, data not shown), in accordance with church teachings. The

absence of smokers reduced the effect of an important confounder of the relation between TV watching and sleep problems.¹⁴ Validity of the study is strengthened by our finding of associations between TV watching and all three indicators of sleep problems. While previous studies have looked at the relation of TV watching to bedtimes, falling asleep and unrefreshing sleep,^{17,20} we are unaware of previous research on the connection of TV watching to middle of the night awakening, and early awakening with inability to fall asleep again.

It is not clear how TV watching may lead to sleep problems – possible explanations include direct ones, such as encroaching of media activity on sleep time²⁰ and the effect of bright, flickering light on sleep-inducing hormones,¹⁹ as well as indirect ones as inactivity associated with TV watching and likely uncontrolled confounding in an observational study. Excess TV watching clustered with unfavorable lifestyle characteristics. Participants who watched more TV were more likely to use caffeine and alcohol, exercised less, had a higher BMI and more likely to consume a nonvegetarian diet compared to their counterparts.

There are several limitations. We lacked data on night shift work, an important indicator of sleep patterns.²⁶ We did not ask about how close to bedtime subjects watched TV, and could not distinguish total TV time from close to bedtime TV time. Another limitation is the self-reported nature of the data. However, previous studies have shown that self-reported sleep is consistent with direct (actigraphic) monitoring.²⁷ Furthermore, medical or psychiatric illness may be associated with both TV watching and sleep problems.⁶ Though we excluded several medical conditions, the role of psychiatric illness was not investigated.

The study cohort was not representative of the general population, but rather a healthier population, and the findings should not be extended to other populations. The cohort consisted of a churchgoing group belong to a denomination which encourages healthy lifestyle practices including adequate rest. Also trivial entertainment is discouraged by the church as reflected by the lesser amount of TV watching in the present sample compared to the general US population where a mean of five hours daily is reported.²⁰ However, this may be a strength of the study. The observation that a substantial minority (one-third of the sample) watched less than one hour/day gave a broader range of practices than in the general population. Practices that the church discourages include use of stimulants such as alcohol and caffeine, substances associated with sleep problems in previous research.^{12,13} However, use of alcohol in moderate amounts by a minority of the was not associated with sleep problems in the current study. This supports the notion that *excess* alcohol may increase risk of sleep problems, as shown previously.¹² Another difference in our sample versus the general population was use of caffeine. Over one-half of our subjects did not use caffeine; in comparison in the US population, caffeine is used by over 80%.²⁸ The availability of approximately equal groups of caffeine users and nonusers may have increased the of finding effects of caffeine on sleep – and caffeine may be an important confounder of the relationship between TV watching and sleep.

Despite differences from a general population, expected associations between demographics and sleep problems were seen, strengthening the validity of the findings. Our results are generally consistent with previous research that found Whites to report more sleep problems

than Blacks after control for age and education.³ In this study, length of education was a surrogate for occupation, and showed protection against sleep problems, consistent with previous studies.^{4,5} Obesity is typically associated with short sleep duration,^{6,8} but we did not find an association between obesity and sleep problems. Explanations for our findings may include the fact that we controlled for diet and exercise, factors that may influence the relation between BMI and sleep problems.^{7,29}

Our sample had a mean age of ~57 years and sleep problems were common. Sleep problems are typically greater in the elderly, which contributes to risk of mortality.³⁰ The potential of preventing sleep problems with lifestyle change in the elderly is of public health interest.

Conclusion

Our study showed that TV watching for 2 hours/day was associated with a range of sleep problems. Experimental studies of the effect of limiting the use of TV to improve sleep quality may be valuable. Furthermore, studying the association of TV watching with onset of chronic diseases associated with sleep problems may be of interest.

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Table 1

Baseline characteristics according to TV watching. Mean (SD) values or percentages are shown. N=1,957 in each group.

	<2 hours/day	2 hours/day	P-value
Age, years	55.5 (12.2)	58.4 (13.3)	<0.001
BMI, kg/m ²	24.7 (4.1)	26.7 (4.5)	<0.001
Race/gender			<0.001
Black female	18.4%	32.0%	
Black male	8.3%	12.8%	
White female	43.6%	32.5%	
White male	29.7%	22.6%	
Education			<0.001
High/trade school or less	14.6%	22.0%	
Some college or graduate	58.5%	58.5%	
Master's degree or higher	27.0%	19.5%	
Diet			<0.001
Vegetarian	57.2%	33.6%	
Non-vegetarian	42.8%	66.4%	
Frequency of vigorous exercise			<0.001
Never to <1 bout/week	24.2%	31.7%	
1–3 bouts/week	43.4%	41.3%	
4–5 bouts/week	24.5%	20.7%	
6 or more bouts/week	7.8%	6.3%	
Caffeine use			<0.001
No	68.9%	59.5%	
Yes	31.1%	40.5%	
Alcohol consumption			<0.001
No	92.9%	90.8%	
Yes	7.1%	9.2%	
Napping – weekend			<0.001
None	31.0%	22.9%	
<40 min	17.0%	16.0%	
40 min	52.1%	61.1%	
Napping – weekdays			<0.001
None	69.0%	55.8%	
<20 min	17.6%	21.0%	
20 min	13.4%	23.2%	
Hours of sleep			0.001
<6	6.8%	11.8%	
6–8	87.8%	82.0%	
9	5.4%	6.2%	
Interval between questionnaires, years	3.1 (1.1)	3.0 (1.1)	0.04

Table 2

Sleep problems at follow-up according to TV watching at baseline. Percentages are shown. P-values were <0.001 for all comparisons between groups.

	<2 hours/day (n=1,957)	2 hours/day (n=1,957)
Trouble falling asleep		
Rarely or never	69.3%	58.8%
Sometimes/often/everyday	30.7%	41.2%
Waking in the middle of the night		
Rarely or never	54.6%	47.6%
Sometimes/often/everyday	45.4%	52.4%
Waking early and unable to go back to sleep		
Rarely or never	59.0%	52.7%
Sometimes/often/everyday	41.0%	47.3%

Table 3

Relation of TV watching 2 hours/day versus <2 hours/day to trouble falling asleep adjusted for all variables (N=3,914).

	Odds ratio	95% confidence limits	P-value
Age	1.007	1.001, 1.013	0.028
BMI	1.006	0.990, 1.023	0.454
Ethnicity/gender (referent White male)			
Black female	1.256	1.016, 1.554	0.035
Black male	0.569	0.426, 0.759	<0.001
White female	2.153	1.798, 2.578	<0.001
Education (referent high/trade school or less)			
Some college/graduate	0.868	0.724, 1.041	0.127
Master's degree or higher	0.842	0.675, 1.049	0.125
Diet (referent non-vegetarian)			
Vegetarian	1.001	0.856, 1.172	0.986
Exercise	0.973	0.942, 1.005	0.096
Caffeine nonuse	0.772	0.660, 0.904	<0.001
Alcohol nonuse	1.065	0.819, 1.383	0.640
Napping – weekend (referent none)			
<40 min	0.955	0.765, 1.194	0.687
40 min	1.071	0.900, 1.275	0.441
Napping – weekdays (referent none)			
<20 min	1.278	1.060, 1.540	0.010
20 min	1.327	1.086, 1.622	0.006
Hours of sleep/night (referent 6–8 hours/night)			
<6	2.868	1.264, 3.634	<0.001
9	0.645	0.475, 0.875	0.005
Interval between questionnaires	0.977	0.917, 1.040	0.465
TV watching	1.491	1.288, 1.727	<0.001

Table 4

Relation of TV watching 2 hours/day versus <2 hours/day to waking in the middle of the night adjusted for all variables (N=3,914).

	Odds ratio	95% confidence limits	P-value
Age	1.013	1.008, 1.019	<0.001
BMI	0.991	0.976, 1.007	0.270
Ethnicity/gender (referent white male)			
Black female	0.773	0.634, 0.942	0.011
Black male	0.448	0.346, 0.579	<0.001
White female	1.251	1.058, 2.480	0.009
Education (referent high/trade school or less)			
Some college/graduate	1.021	0.856, 1.217	0.817
Master's degree or higher	0.925	0.750, 1.140	0.463
Diet (referent non-vegetarian)			
Vegetarian	1.119	0.964, 1.300	0.139
Exercise	1.008	0.978, 1.040	0.600
Caffeine nonuse	0.898	0.621, 1.024	0.077
Alcohol nonuse	0.798	0.819, 1.383	0.640
Napping – weekend (referent none)			
<40 min	1.256	1.019, 1.549	0.033
40 min	1.188	1.008, 1.400	0.040
Napping – weekdays (referent none)			
<20 min	1.284	1.073, 1.536	0.006
20 min	1.154	0.952, 1.399	0.143
Hours of sleep/night (referent 6–8 hours/night)			
<6	2.646	2.079, 3.369	<0.001
9	0.858	0.65, 1.131	0.277
Interval between questionnaires	0.976	0.920, 1.036	0.429
TV watching	1.347	1.172, 1.549	<0.001

Table 5

Relation of TV watching 2 hours/day versus <2 hours/day to waking early and unable to go back to sleep adjusted for all variables (N=3,914).

	Odds ratio	95% confidence limits	P-value
Age	1.009	1.003, 1.015	0.002
BMI	1.000	0.984, 1.016	0.995
Ethnicity/gender (referent white male)			
Black female	0.677	1.555, 0.827	<0.001
Black male	0.380	0.292, 0.495	<0.001
White female	0.916	0.774, 1.084	0.306
Education (referent high/trade school or less)			
Some college/graduate	0.876	0.734, 1.045	0.142
Master's degree or higher	0.804	0.651, 0.993	0.043
Diet (referent non-vegetarian)			
Vegetarian	1.254	1.079, 1.459	0.003
Exercise	1.026	0.995, 1.058	0.105
Caffeine nonuse	0.916	0.786, 1.068	0.263
Alcohol nonuse	0.858	0.667, 1.104	0.234
Napping – weekend (referent none)			
<40 min	1.257	1.018, 1.553	0.034
40 min	1.198	1.094, 1.415	0.034
Napping – weekdays (referent none)			
<20 min	1.265	1.057, 1.515	0.010
20 min	1.175	1.968, 1.426	0.104
Hours of sleep/night (referent 6–8 hours/night)			
<6	2.899	2.282, 3.683	<0.001
9	0.445	0.328, 0.604	0.005
Interval between questionnaires	1.036	0.975, 1.100	0.255
TV watching	1.327	1.153, 1.528	<0.001