

The effect of screen use on sleep quality among adolescents in Riyadh, Saudi Arabia

Yara Alshoaibi, Wejdan Bafil, Maheen Rahim

Department of Family Medicine, King Saud Medical City, Riyadh, Saudi Arabia

ABSTRACT

Background: Insufficient sleep associated with daytime sleepiness is predominant among the pediatric population and upsurges during adolescence. Prolonged screen use is theorized to harmfully disturb sleep through numerous pathways. Though, the connotation between media device use and poor sleep has been inadequately assessed due to the rapid development of these devices which has outdone research abilities. **Aim:** This study aims to assess the effect of screen use on sleep quality among adolescents in Riyadh, Saudi Arabia. **Methods:** An analytical cross-sectional study was carried out using a self-administered online questionnaire targeting all accessible Saudi adolescents in Riyadh. The final questionnaire was uploaded online using social media platforms by distributing at high schools and primary health care centers. The study questionnaire covered adolescent's personal data, medical history, screen use including the type of used devices, duration of use per day and at bedtime, effect of using devices, and family and friends' influence on using devices. Sleep quality was assessed using Pittsburgh Sleep Quality Index. **Results:** A total of 324 adolescents fulfilling the inclusion criteria completed the study questionnaire. Adolescents' ages ranged from 16 to 19 years with a mean age of 17.5 ± 1.1 years old. Exact of 113 (34.9%), the study adolescents used screens for 6–8 hours on a daily basis, 111 (34.3%) use screens for more than 8 hours daily. A total of 154 (47.5%) of the study adolescents were good sleepers while 170 (52.5%) were poor sleepers. **Conclusion:** In conclusion, the study revealed that adolescents in Riyadh had a high frequency rate and duration of screen use which may exceed 6 hours daily with nearly half of them with poor sleep quality, feeling fatigue, daytime sleepiness, and lack of concentration.

Keywords: Adolescents, devices addiction, effect, relation, Saudi Arabia, screen use, sleep

Introduction

Sleep is essential for our bodies to repair and regenerate our cells, maintain a strong immune system, and feel mentally alert and focused. Lack of sleep over an extended period can lead to a range of health issues, including increased stress, depression, and a weakened immune system. Ensuring that we prioritize getting enough quality sleep is crucial for maintaining good health and improving overall quality of life. As technology has continued to advance, teenagers have become increasingly

reliant on devices such as mobile phones, laptops, tablets, and gaming consoles. While these devices provide a myriad of benefits, they can also have a significant impact on sleep patterns, especially in adolescents. As a primary care physician, it is important to have knowledge about the impact of screen use on sleep because it can have a significant effect on the health and well-being of our patients. Electronic devices emit blue light that can suppress melatonin production and alter circadian rhythms, leading to disrupted sleep. Sleep deprivation can exacerbate existing health problems, impair cognitive function, and increase the risk of accidents and injuries. Furthermore, excessive screen time can lead to addiction, social isolation, and mental health issues such as anxiety and depression. Physicians should educate their patients about the importance of good sleep hygiene, why it matters and how it

Address for correspondence: Dr. Yara Alshoaibi,
Family Medicine Resident, King Saud Medical City, Riyadh,
Saudi Arabia.

E-mail: yaraalshuaibi@gmail.com

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can affect their overall health. Also, encouraging patients to discuss their sleep habits, including how long they sleep, their sleeping environment, and in what situations they experience sleep problems. Promote avoidance of excessive use of electronics and limiting screen time before bed or avoiding electronics in the bedroom can help improve sleep hygiene. By advising our patients to limit their screen time before bed and promoting healthy sleep habits, we can help them improve their overall health and quality of life.

Several studies have shown that the use of electronic devices, can significantly affect the quality and duration of sleep in teenagers. A study published in the journal *Sleep Medicine* found that teenagers who reported high levels of screen time had shorter sleep duration and more difficulty falling asleep than those with lower screen use.^[1] Another study published in the *Journal of Clinical Sleep Medicine* found that night-time use of electronic devices was associated with higher levels of daytime sleepiness and poorer academic performance.^[2] Furthermore, a review of various studies on this topic concluded that electronic device use at bedtime was consistently linked with poorer sleep outcomes in adolescents. Therefore, it is recommended that teenagers limit screen time before bed and establish a regular bedtime routine to promote healthy sleep habits.

In 2014, the National Sleep Foundation in the Modern Family reported that about 96% of teenagers between the ages of 15 and 17 have used devices before their sleep time.^[3] According to The American Academy of Child and Adolescent Psychiatry that adolescent spends up to nine hours of screen time per day.^[4] The rising use of screens for school, entertainment, and social media may be beneficial but experts are becoming progressively worried about the effects of blue light from the used electronic devices on the sleep-wake cycle. Nearly, two in three teenagers^[5] frequently sleep less than the proper duration, and screen time may be a main cause for sleep deprivation and other associated problems.^[6] Insufficient sleep associated with daytime sleepiness is predominant among the pediatric population and upsurge during adolescence.^[7,8] In the United States, 75% of adolescents aged 17 to 18 years old experience inadequate sleep, with similar findings in further developed countries.^[9] The American Academy of Pediatrics has mentioned many issues including media device use that considerably lead to this trend of inadequate and deteriorating sleep in the adolescent population.^[6,8]

The availability of media devices is nearly common among children. About 72% of all children and 89% of adolescents have at least 1 device for their own use mainly during bedtime.^[9,6] These devices are theorized to harmfully disturb sleep through numerous pathways.^[8,9] First, they might inversely affect sleep by directly moving, delaying, or disturbing sleep time. Second, the content may be psychologically motivating, and, third, the light released from devices affects circadian rhythm, biological sleep, and attentiveness.^[10] Though, the connection between media device use and poor sleep has been

inadequately assessed due to the rapid development of these devices which has outdid research abilities.^[1,2] The aim of this study is to determine the impact of screen time on sleep in adolescents . Also, to measure the estimated time of screen use and its effects on sleep and to define the factors affecting sleep on adolescent.

Methodology

An analytical cross-sectional study was carried out using a self-administered online questionnaire targeting all accessible Saudi adolescents in Riyadh, aging 16 to 19 years during the period from January 2022 to March 2022. Non-Saudi adolescents, aged less than 16 or more than 19 years, adolescents who suffer from sleeping disorder, adolescents who don't use any screens during the day, and adolescents who use medications effect sleep were excluded. The questionnaire was uploaded online using social media platforms by distributing it at high schools and primary health care centers [Appendix]. The study questionnaire covered adolescent's personal data, medical history, screen use including type of used devices, duration of use per day and at bedtime, effect of using devices, and family and friends influence on using devices.^[11] Sleep quality was assessed using Pittsburgh Sleep Quality Index (PSQI) and other questions related to sleep quality.^[12]

Data analysis

After data were extracted, it was revised, coded, and fed to statistical software IBM SPSS version 22(SPSS, Inc. Chicago, IL). All statistical analysis was done using two-tailed tests. *P* value less than 0.05 was statistically significant. Descriptive analysis based on frequency and percent distribution was done for all variables including adolescent's personal data, medical health condition, and screen utilization pattern covering devices used, duration of use, bedtime use and effect. The global score for PSQI^[12] was obtained by summing up all items discrete scores of its seven "component" scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The sum of scores for these seven components yields one global score. In scoring the PSQI, seven component scores are derived, each scored 0 (no difficulty) to 3 (severe difficulty). The component scores are summed to produce a global score (range 0–21). Higher scores indicate worse sleep quality. Tool reliability was assessed using alpha Cronbach's coefficient which reflects the tool's internal consistency. Internal consistency reliability of 0.7 or more is judged good.^[13] Total score was categorized at cut-off point 7 as those who had a global score of 7 points or less were considered to have good sleep quality (good sleepers) while others with a global score of more than 7 points were considered to have moderate to poor sleep quality (poor sleepers). Cross-tabulation was used to assess the distribution of adolescents' sleep quality by their personal data and screen use. Significance of relations in cross-tabulation was tested using Pearson Chi-square test and exact probability test for small frequency distributions.

Results

A total of 324 adolescents fulfilling the inclusion criteria completed the study questionnaire. Adolescents' ages ranged from 16 to 19 years with mean age of 17.5 ± 1.1 years old. Exact of 240 (74.1%) participants were females and 308 (95.1%) were students while 16 (4.9%) were partially or fully employed. A total of 30 (9.3%) participants had a chronic health problem [Table 1].

Table 2. Screen use pattern and effect among adolescents in Riyadh, Saudi Arabia. The most used devices were phones (84%), tablets (5.6%), computers (5.2%), and video games (2.8%). Exact of 113 (34.9%), the study adolescents used screens for 6–8 hours on a daily basis, 111 (34.3%) use screens for more than 8 hours daily. A total of 71.6% of the study participants reported that their family/friends influenced them with the amount of screen time you use. As for time spent using devices before sleep while lying in bed, 96 (29.6%) reported more than 60 minutes, 17% used for 46–60 minutes, and 22.5% for 16–30 minutes. A total of 119 (36.7%) told that using devices at bedtime affects their productivity on the next day. The most reported effect was feeling fatigue (63.9%), followed by sleepiness (54.6%), headache (52.9%), and low mood (34.5%).

Table 3. Pittsburgh sleep quality index components among study adolescents, Saudi Arabia. Subjective sleep quality was bad among 35.5% of the study participants, sleep latency was also bad among 47.5% of the participants, and only 19.8% sleep more than 7 hours. Habitual sleep efficiency was less than 85% among 81.2% of the adolescents and 21.9% had high sleep disturbance score with 20.4% high level of daytime dysfunction. Global PSQI score ranged from 0 to 16 with a mean score of 6.4 ± 3.7 points.

Figure 1. Overall sleep quality among adolescents in Riyadh, Saudi Arabia. Exact of 154 (47.5%) of the study adolescents were good sleepers while 170 (52.5%) were poor sleepers.

Table 1: Personal data of study adolescents in Riyadh, Saudi Arabia

Personal data	No	%
Age in years		
16	92	28.4%
17	73	22.5%
18	69	21.3%
19	90	27.8%
Gender		
Male	84	25.9%
Female	240	74.1%
Career		
Students	308	95.1%
Students with part-time job	7	2.2%
Employed	9	2.8%
Have chronic health problem		
Yes	30	9.3%
No	294	90.7%

Table 4. Distribution of adolescents' sleep quality by their personal data. Exact of 57.6% of adolescents aged 16 years were good sleepers versus 37.8% of others aged 19 years old with recorded statistical significance ($P = 0.048$). Adolescents' age, career, and health problems were insignificantly associated with their sleep quality.

Table 5. The effect of the screen uses on sleep quality among adolescents in Riyadh, Saudi Arabia. Exact of 62.2% of adolescents who used screens for more than 8 hours daily were poor sleepers versus 59.3% of others who use screens for 6–8 hours and 20% of those who use screens for less than 1 hour daily ($P = 0.001$). Also, 63.5% of adolescents who spent more than 60 minutes using devices before sleep while lying in bed were poor sleepers in comparison to 35.6% of others who spent 15 minutes or less ($P = 0.001$). Poor sleep quality was assessed among 85.7% of adolescents who told that using devices at

Table 2: Screen use pattern and effect among adolescents in Riyadh, Saudi Arabia

Screen use	No	%
Which devices do you use on a daily basis?		
Phone	272	84.0%
Tablet	18	5.6%
Laptop	6	1.9%
Computer	17	5.2%
TV	2	0.6%
Video games	9	2.8%
How much screen time do you use on a daily basis?		
<1 hour	5	1.5%
1–2 hours	11	3.4%
3–5 hours	84	25.9%
6–8 hours	113	34.9%
>8 hours	111	34.3%
Do you believe that your family/friends have influenced you with the amount of screen time you use?		
Yes	100	30.9%
May be	132	40.7%
No	92	28.4%
How much time do you spend using devices before sleep while lying in bed?		
15 minutes or less	59	18.2%
16–30 minutes	73	22.5%
31–45 minutes	41	12.7%
46–60 minutes	55	17.0%
>60 minutes	96	29.6%
Using devices at bedtime affect your productivity on the next day?		
Yes	119	36.7%
No	122	37.7%
I don't know	83	25.6%
If yes, what is the effect?		
Fatigue	76	63.9%
Sleepiness	65	54.6%
Headache	63	52.9%
Low mood	41	34.5%
Low concentration at work	35	29.4%
Drowsiness	29	24.4%

Table 3: Pittsburgh sleep quality index components among adolescents in Riyadh, Saudi Arabia

Sleep quality components	No	%
Subjective sleep quality		
Very good	123	38.0%
Fairly good	86	26.5%
Fairly bad	103	31.8%
Very bad	12	3.7%
Sleep latency		
Very good	72	22.2%
Fairly good	98	30.2%
Fairly bad	119	36.7%
Very bad	35	10.8%
Sleep duration		
>7 hours	64	19.8%
6–7 hours	225	69.4%
5–6 hours	22	6.8%
<5 hours	13	4.0%
Habitual sleep efficiency		
>85%	74	22.8%
75–84%	215	66.4%
65–74%	18	5.6%
<65%	17	5.2%
Sleep disturbances		
Very low	68	21.0%
Fairly low	185	57.1%
Fairly high	66	20.4%
Very high	5	1.5%
Use of sleeping medication		
Not during Hajj	259	79.9%
Less than once	31	9.6%
once or twice	18	5.6%
Three or more times	16	4.9%
Daytime dysfunction		
Very low	134	41.4%
Fairly low	124	38.3%
Fairly high	60	18.5%
Very high	6	1.9%
Global PSQI		
Range	0-16	
Mean±SD	6.4±3.7	

bedtime affect their productivity on the next day in comparison to 32% of others who were not affected ($P = .001$).

Discussion

Sleep is vital for the mental and physical health wellbeing. Adolescents should have enough sleep duration for about 8-10 hours every night. Sleep plays a significant role in alertness, attention, cognitive function, learning and working memory.^[14] Then, sleep has a massive effect on mental health and academic performance.^[14,8] Currently, screen addiction is estimated to be a thoughtful issue in adolescents. Screen time utilization excessively growing with adolescents starting themselves to screen time at a young age. The high rate of screen time among paediatrics and adolescents increased the alarms about its effects on their health. Inappropriately, there is currently a lack of research on

Table 4: Distribution of adolescents' sleep quality by their personal data

Personal data	Sleep hygiene				P
	Poor sleepers		Good sleepers		
	No	%	No	%	
Age in years					
16	39	42.4%	53	57.6%	0.048*
17	36	49.3%	37	50.7%	
18	39	56.5%	30	43.5%	
19	56	62.2%	34	37.8%	
Gender					
Male	46	54.8%	38	45.2%	0.625
Female	124	51.7%	116	48.3%	
Career					
Students	161	52.3%	147	47.7%	0.536 [§]
Students with part-time job	5	71.4%	2	28.6%	
Employed	4	44.4%	5	55.6%	
Have chronic health problem					
Yes	18	60.0%	12	40.0%	0.386
No	152	51.7%	142	48.3%	

P: Pearson X2. §: Exact probability test. * $P < 0.05$ (significant)

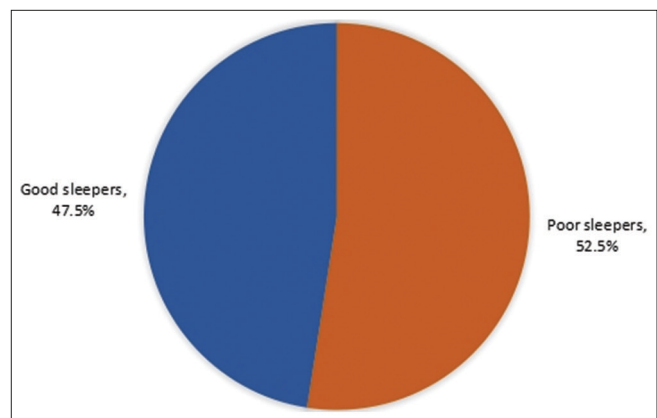


Figure 1: Overall sleep quality among adolescents in Riyadh, Saudi Arabia

the link between screen time and sleep quality among Saudi adolescents.^[15,16]

This study aims to assess the impact of screen time on sleep among adolescents in Riyadh, Saudi Arabia. As for screen use, the study showed that more than two-thirds of adolescents used screen for 6 hours or more daily which was phone among vast majority of them. Also, more than one third of them spend 46 minutes or more using devices before sleep while lying in bed. Consequently, one-third of the study adolescents experienced negative effect on their productivity next day which was mainly due to fatigue, daytime sleepiness and headache. Johnson AR *et al.*^[17] found that 20% of adolescents felt thoughtful with screens, 8% felt restless, moody, and anxious when not using them, 26% used screen devices to escape of problems or releasing irritable mood, 12% had depression, and 3.9% had screen addiction. Also, A study in Gwalior city among private school students estimated that 24% adolescents have moderate

Table 5: The effect of screen use on sleep quality among adolescents in Riyadh, Saudi Arabia

Screen use	Sleep hygiene				P
	Poor sleepers		Good sleepers		
	No	%	No	%	
Which devices do you use on a daily basis?					0.429 [§]
Phone	141	51.8%	131	48.2%	
Tablet	12	66.7%	6	33.3%	
Laptop	2	33.3%	4	66.7%	
Computer	10	58.8%	7	41.2%	
TV	0	0.0%	2	100.0%	
Video games	5	55.6%	4	44.4%	
How much screen time do you use on a daily basis?					0.001* [§]
<1 hour	1	20.0%	4	80.0%	
1–2 hours	3	27.3%	8	72.7%	
3–5 hours	30	35.7%	54	64.3%	
6–8 hours	67	59.3%	46	40.7%	
>8 hours	69	62.2%	42	37.8%	
How much time do you spend using devices before sleep while lying in bed?					0.001*
15 minutes or less	21	35.6%	38	64.4%	
16–30 minutes	36	49.3%	37	50.7%	
31–45 minutes	16	39.0%	25	61.0%	
46–60 minutes	36	65.5%	19	34.5%	
>60 minutes	61	63.5%	35	36.5%	
Using devices at bedtime affect your productivity on the next day?					0.001*
Yes	102	85.7%	17	14.3%	
No	39	32.0%	83	68.0%	
I don't know	29	34.9%	54	65.1%	

P: Pearson X2. §: Exact probability test. *P<0.05 (significant)

internet addiction and 6.3% had severe addiction.^[18] Another study among rural school students in Haryana estimated that 30.3% had SA.^[19] In Saudi Arabia, Saquib N *et al.*^[20] estimated that 75% of adolescents had screen time ≥ 2 h/day, and 20% slept < 5 h/night. Sixteen percent (16%) were addicted to video games and 54% had psychological distress which is nearly similar to the current study findings.

As for sleep quality, the study revealed that nearly half of the adolescents were poor sleepers especially for sleeping duration as only about one-fifth of the adolescents sleep more than 7 hours. Also, habitual sleep efficiency was less than 85% among vast majority of the adolescents especially most of them are students and about one-fifth experience high sleep disturbance score with high level of daytime dysfunction. Similar findings were reported among adolescents in Saudi Arabia by Merdad RA *et al.*^[21] who found that the prevalence of sleep disturbance was 65%, and excessive daytime sleepiness was found in 37% of the students. Also, Nasim M *et al.*^[22] reported that sleep duration for < 7 h/day was detected among 46% on weekdays and 33% on weekends. Three-fourths of all adolescents reported feeling unrefreshed on awakening.

As for association between screen time and sleep quality, the study showed that about two-thirds of adolescents who used screens for more than 8 hours daily were poor sleepers versus one-fifth of those who use screens for less than 1 hour daily (P=.001). Also, about two-thirds of adolescents who spent

more than 60 minutes using devices before sleep while lying in bed were poor sleepers in comparison to one-third of others who spent 15 minutes or less (P=.001). Poor sleep quality was assessed among vast majority of adolescents who told that using devices at bedtime affect their productivity on the next day in comparison to only one-third of others who were not affected (P=.001). A recent systematic literature review study showed an adverse association between screen time and sleep quality in 90% of studies.^[23] Similarly, a study among US young adult ages 19–32 nationally representative sample demonstrated a strong association between social media use and sleep disturbance.^[24] Likewise, another study conducted on Spanish adolescents aged 17–18 years suggests a positive relationship between telecommunication and other screen devices use and an increase in sleep problems.^[25] Moreover, a recent study carried out in May 2020 on French middle school students aged 11 to 12 years highlights an inverse association between screen time and sleep duration.^[26] These recent studies have begun to provide insight into how an increased screen time use may negatively affect sleep parameters. A study conducted at King Abdulaziz University, Saudi Arabia^[27] showed high frequency of mobile phone usage (73.4% used it > 5 h/day). About two-thirds of participants had poor sleep quality. Another study showed that the average mobile screen usage time among adolescents was $8.57 \pm 4.59/24$ hours, whereas average mobile screen usage time in the bed was 38.17 ± 11.7 minutes. Screen usage time of ≥ 8 hours was positively correlated with sleep disturbances and decrease in the length of actual sleeping time (p = 0.023 and 0.022). Also, Using

the mobile for at least 30 minutes showed positive correlation with poor sleep quality, daytime sleepiness, sleep disturbances and increased sleep latency.^[28]

Conclusions and Recommendations

In conclusion, the study revealed that adolescents in Riyadh had high frequency rate and duration of screen use which may exceed 6 hours daily with nearly half of them with poor sleep quality, feeling fatigue, daytime sleepiness and lack of concentration.

Screen use particularly before bed can have a negative impact on sleep quality. To promote better sleep, it's recommended to limit screen time at least one hour before bedtime. Additionally, establishing a relaxing bedtime routine such as reading a book, taking a warm bath and practicing relaxation techniques can also improve sleep quality. Initiation of educational programs covering the hazards of increased screen use is mandatory for adolescents and all other community members to reduce screen use and dependency. More studies are needed to be done on other physical and mental effects of screen use.

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Conflicts of interest

There are no conflicts of interest.

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Appendix

Questionnaire

Please answer the following questions:

1. Age:
 - 16 years
 - 17 years
 - 18 years
 - 19 years
2. Nationality:
 - Saudi
 - non-Saudi
3. Gender:
 - Male
 - Female
4. Career:
 - student
 - employee
 - student with part-time job
5. Do you suffer from any chronic diseases?
 - Yes
 - No
6. If your answer to the previous question is yes, mention the chronic diseases that you have:
 - Hypertension
 - Diabetes
 - Asthma
 - Other, (specify).
7. Have you been diagnosed with any sleep disorders?
 - Yes, (specify).
 - No

The following questions are related to the use of electronic device screens

8. Which devices do you use on a daily basis?
 - Phone
 - Tablet
 - Laptop
 - Computer
 - TV
 - Other:
9. Which one do you use the most?
 - Phone
 - Tablet
 - Laptop
 - Computer
 - TV
 - Other:
10. How much screen time do you use on a daily basis?
 - < 1 HOUR
 - 1–2 HOURS
 - 3–5 HOURS
 - 6–8 HOURS
 - > 8
11. Do you believe that your family/friends have influenced you with the amount of screen time you use?
 - Yes
 - No
 - Maybe

12. How much time do you spend using devices before sleep while lying in bed?
- 15 minutes or less
 - 16–30 minutes
 - 45–31 minutes
 - 60–46 minutes
 - More than 60 minutes
13. Does using devices at bedtime affect your productivity on the next day?
- Yes
 - No
 - I don't know
14. If yes, what is the effect? More than one answer can be chosen
- Drowsiness
 - Fatigue
 - Headache
 - Dizziness
 - Low mood
 - Low concentration at work
 - Otherwise, (specify)...

**The following questions are related to your sleep habits only once in the past month. Can you please answer all questions:

During the past month,

1. When have you usually gone to bed?
 - Early in the evening.
 - Before midnight
 - After midnight
 - Late at night
2. How long (in minutes) has it taken you to fall asleep each night?
 - 15 minutes and less
 - 15–30 minutes
 - 30–45 minutes
 - 45–60 minutes
 - More than one hour
3. What time have you usually get up in the morning?
 - Before 6 AM
 - 6–7 AM
 - 7–8 AM
 - 8–9 AM
 - After 12 PM
4. How many hours of actual sleep did you get at night?
 - 4–6 hours
 - 6–8 hours
 - 8–10 hours
 - 10–12 hours
 - More than 12 hours

	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
5. During the past month, how often have you had trouble sleeping because you				
A. Cannot get to sleep within 30 minutes				
B. Wake up in the middle of the night or early morning				
C. Have to get up to use the bathroom				
D. Cannot breathe comfortably				
E. Cough or snore loudly				
F. Feel too cold				
G. Feel too hot				
H. Have bad dreams				
I. Have pain				
J. Other reason (s), please describe, including how often you have had trouble sleeping because of this reason (s):				
6. During the past month, how often have you taken medicine (prescribed or “over the counter”) to help you sleep?				
7. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
8. During the past month, how much of a problem has it been for you to keep up enthusiasm to get things done?				
9. During the past month, how would you rate your sleep quality overall?				