

Supplemental Materials for Survey results of a pilot study on the effects of aircraft noise on sleep near Atlanta International Airport

The complete postal survey is given in *Questionnaire S1*

Demographic data for the sampled census tracts are given in Table S1

Directed acyclic graphs to determine minimal required adjustment for the regression models are given in Figures S1–S3

The number of respondents in each dichotomous outcome category is given in Tables S2–S4

Results of regression model statistical testing (*p*-values) are given in Table S5

Questionnaire S1 Complete postal survey

Q1a. During the past month , at what time have you usually gone to bed on weekdays or workdays?	_____ (HH:MM AM/PM)
Q1b. During the past month , at what time have you usually woken up on weekdays or workdays?	_____ (HH:MM AM/PM)
Q1c. During the past month , how much sleep did you usually get on weekdays or workdays?	_____ (Hours)

Q2. During the past month , how would you rate your sleep quality overall?			
Very Good	Fairly Good	Fairly Bad	Very Bad
▼	▼	▼	▼
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q3. For the following questions, select the response that best reflects how often the following occurred during the past month .				
	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
	▼	▼	▼	▼
Q3a. You had trouble sleeping because you cannot get to sleep within 30 minutes ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3b. You had trouble sleeping because you wake up in the middle of the night or early morning?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3c. You have taken medicine (prescribed or “over the counter”) to help you sleep?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3d. You had trouble staying awake while driving, eating meals, or engaging in social activity?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q4. How often in the past month have you done the following because of noise when trying to sleep at home?					
	Never 1 ▼	Rarely 2 ▼	Sometimes 3 ▼	Often 4 ▼	Always 5 ▼
Q4a. Wear earplugs or headphones	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4b. Use alcohol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4c. Use medication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4d. Turn on the TV	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4e. Turn on music	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4f. Close windows	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4g. Use a sound machine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4h. Turn on a fan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q5. For the following statements respond how strongly you agree or disagree.						
	Strongly Disagree 1 ▼	2 ▼	3 ▼	4 ▼	5 ▼	Strongly Agree 6 ▼
Q5a. I am easily awakened by noise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q5b. I get used to most noises without much difficulty	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q5c. I find it hard to relax in a place that is noisy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q5d. I am good at concentrating no matter what is going on around me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q5e. I get mad at people who make noise that keeps me from falling asleep or getting work done	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q5f. I am sensitive to noise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q6. Thinking about the last 12 months or so, when you were here at home, how much was your sleep disturbed by noise from the following sources?					
	Not at all ▼	Slightly ▼	Moderately ▼	Very ▼	Extremely ▼
Q6a. Road Traffic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q6b. Trains	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q6c. Aircraft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q6d. Industries/Factories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q6e. Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q6f. Neighbors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q6g. Air Conditioner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q7. Thinking about the **last 12 months** or so, when you are here at home, how much does noise from each of the following bother, disturb, or annoy you?

	Not at all ▼	Slightly ▼	Moderately ▼	Very ▼	Extremely ▼
Q7a. Road Traffic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q7b. Trains	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q7c. Aircraft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q7d. Industries/Factories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q7e. Construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q7f. Neighbors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q7g. Air Conditioner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q8. In general, would you say your health is...?

Poor ▼	Fair ▼	Good ▼	Very Good ▼	Excellent ▼
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q9. Have you ever been diagnosed by a health professional with any of the following sleep disorders?

- | | | |
|--|-------------------------------------|--|
| <input type="checkbox"/> Sleep Apnea | <input type="checkbox"/> Narcolepsy | <input type="checkbox"/> Restless Leg Syndrome |
| <input type="checkbox"/> Periodic Limb Movement Syndrome | <input type="checkbox"/> Insomnia | <input type="checkbox"/> None |
| <input type="checkbox"/> Other (please specify): _____ | | |

Q10. Do you have any problems or difficulties with your sense of hearing? Yes No

Q11a. Have you ever been diagnosed by a health professional with the following conditions (mark all that apply)?

- Hypertension/High blood pressure
- Chronic headaches/Migraines
- Arrhythmia/Irregular heartbeat
- Heart disease
- Stomach ulcer
- Diabetes
- None of the above

Q11b. If you have been diagnosed with a condition listed under Q11a, have you been treated for the condition in the **past month**?

- | | |
|------------------------------|-----------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |

Q12. What is your marital status?

- Single
- Married
- Widowed
- Separated
- Divorced
- Domestic Partners

Q13. What was your total household income last year?

- < \$25,000
- \$25,000-\$50,000
- \$50,000-\$75,000
- \$75,000-\$100,000
- \$100,000-\$150,000
- >\$150,000
- Prefer Not to Answer

Q14. What is the highest level of education you have completed?

- Less than High School
- High School Graduate
- College Graduate or Higher

Q15. What is your current employment status?

- Working
- Unemployed
- Student
- Retired
- Homemaker

Q16. If currently employed, does your job require overnight shift work?
 (Overnight shift work refers to work for at least 4 hours between 12 am midnight to 6 am in the morning) Yes No

Q17. Are you Hispanic or Latino? Yes No Prefer Not to Answer

Q18. What race do you consider yourself to be? (mark all that apply)

American Indian or Alaska Native Native Hawaiian or Other Pacific Islander

Asian White

Black or African American Other (please specify): _____

Prefer Not to Answer

Q19. Has your current residence received any sound proofing treatment to reduce noise? Yes No

Q20. How long have you lived at your current residence?

Less than 1 year

1-5 years

5-10 years

More than 10 years

Q21. Do you have an air conditioner in your bedroom?

No Unit

Central Air Conditioner

Window Unit

Q26. What is your height? _____ feet _____ inches

Q27. What is your weight? _____ lbs

Q24. Gender: Male Female

Q25. Age: _____ (years)

Q22. How many people (including yourself) reside in this household? _____

Q23. How many children in this household are under the age of 5? _____

Census tract-level demographic data

Table S1. Demographic characteristics of census tracts within each noise category.

Noise category	Direction re: ATL	Houses (n)	No college education (%)	Black or African American (%)	Mean household income (\$)
≥55 dB	East	1949	59.5	55.1	33,624
≥55 dB	West	7305	50.8	90.7	26,737
50<55 dB	East	9464	59.7	59.6	31,126
50<55 dB	West	11,123	34.8	77.3	40,938
45<50 dB	East	14,489	46.3	83.6	46,964
45<50 dB	West	20,457	32.2	32.2	59,955
40>45 dB	East	53,391	41.9	77.4	50,249
40>45 dB	West	30,674	45.1	81.2	39,677
<40 dB	East	118,182	35.7	52.7	50,684
<40 dB	West	55,842	41.1	58.5	54,040
All	-	322,876	40.0	62.5	49,100

The total mean household income was calculated as $(\sum(\text{houses per tract} \times \text{mean household income age per tract})) / \text{total number of houses in all tracts}$. Similarly, the total mean percentages that had no college education or were Black or African American were calculated based on proportions and number of houses in each sampling region, e.g. $(\sum(\text{houses per tract} \times \% \text{ per tract})) / \text{total number of houses in all tracts}$.

Directed Acyclic Graphs (DAGs)

According to the DAGs, for all outcomes, to estimate the total effect of L_{night} , the regression models should be minimally adjusted for age and household income.

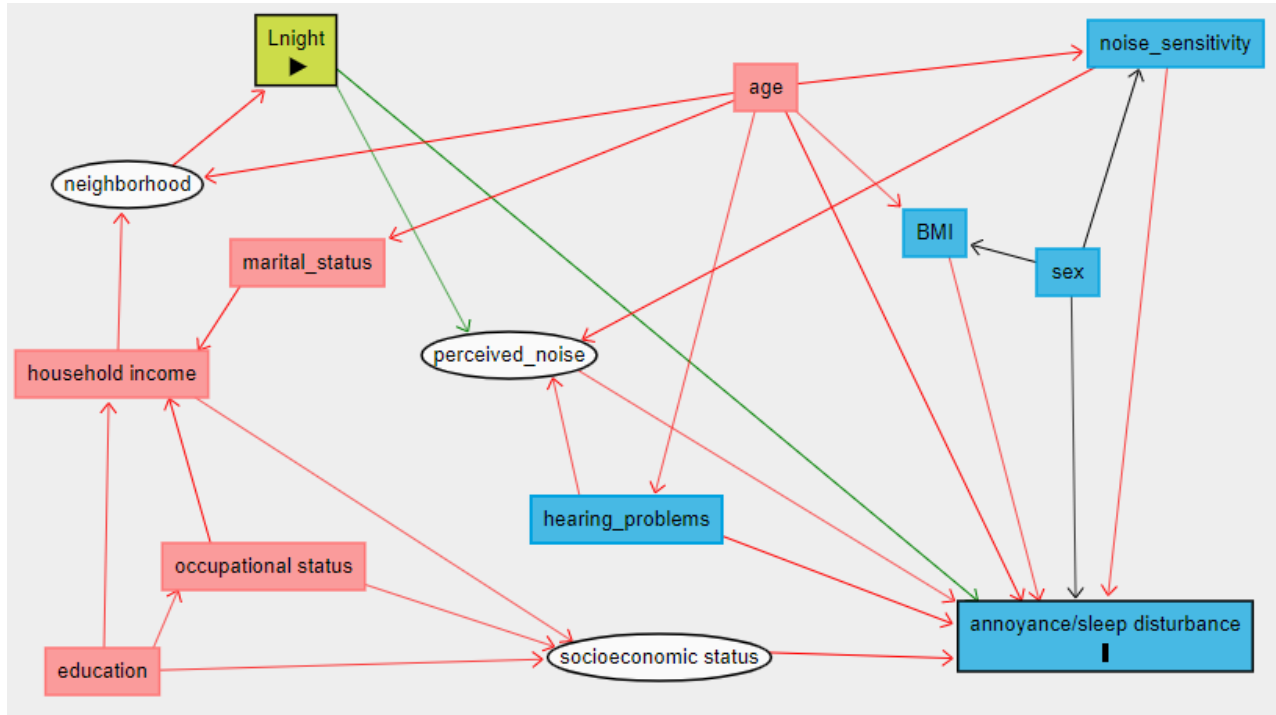


Figure S1. DAG for annoyance/sleep disturbance. To estimate the total effect of L_{night} , the model should be minimally adjusted for age and household income. Ovals indicate unmeasured variables.

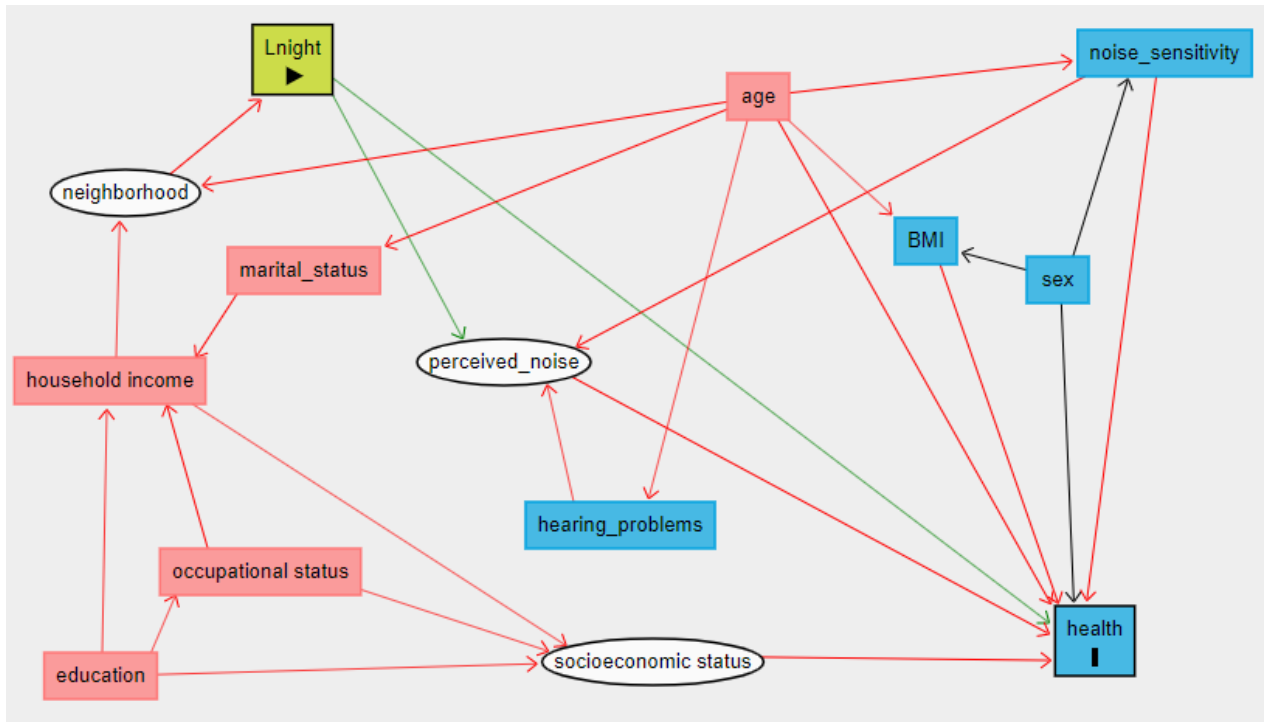


Figure S2. DAG for health outcomes. To estimate the total effect of L_{night} , the model should be minimally adjusted for age and household income. Ovals indicate unmeasured variables.

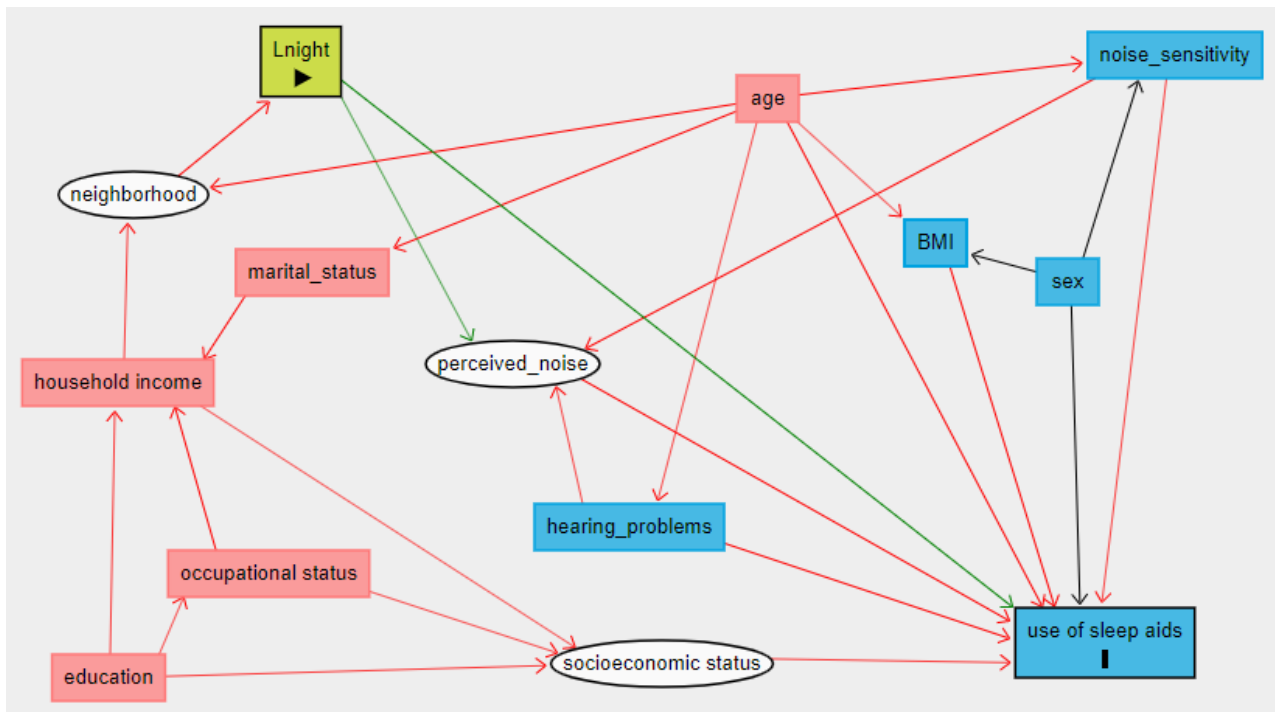


Figure S3. DAG for use of sleep aids. To estimate the total effect of L_{night} , the model should be minimally adjusted for age and household income. Ovals indicate unmeasured variables.

Prevalence of questionnaire outcome responses

These tables give the number of responses in each dichotomous response variable.

Table S2. Respondents (n) indicating being disturbed and annoyed by aircraft noise, fair or poor sleep quality, and trouble sleeping due to noise ≥ 1 /week.

Response	Outcome Measure						
	Sleep disturbance	Annoyance	Overall sleep quality	Trouble falling asleep	Trouble sleeping at night	Sleep medication	Trouble staying awake
Disturbed/Annoyed/ Poor/ ≥ 1 /week	83	78	86	146	176	45	41
Not disturbed/Not annoyed/ Poor/ < 1 /week	180	188	176	116	86	211	217
Missing	5	2	6	6	6	12	10

Table S3. Respondents (n) indicating using sleep aids because of noise often or more frequently.

Response	Outcome							
	Earplugs	Alcohol	Medication	TV	Music	Close windows	Sound machine	Fan
Often or more	17	12	36	78	38	109	13	71
Sometimes or less	242	248	225	181	223	152	247	190
Missing	9	8	7	9	7	7	8	7

Table S4. Respondents (n) indicating poor or fair general health, diagnosis of any sleep disorder, and diagnosis of relevant health outcomes.

Response	Outcome Measure							
	General health	Sleep disorder	Hypertension	Chronic headaches/ Migraine	Arrythmia	Heart disease	Stomach ulcer	Diabetes
Poor/Yes	59	58	125	19	19	12	8	34
Good/no	207	210	143	249	249	256	260	234
Missing	2	0	0	0	0	0	0	0

Regression model *p*-values

Table S5. *p*-values for covariates included in the crude (L_{night} only) and fully adjusted regression model for each questionnaire outcome measure.

	Outcome measure	Model covariate									
		L_{night} crude	L_{night} adjusted	BMI	Sex	Age	Hearing	Noise sensitivity	\$50–100k	>\$100k	Prefer not to answer
Sleep	Sleep disturbance	<0.001	<0.001	0.022	0.889	0.929	0.498	0.001	0.065	0.022	0.326
	Annoyance	<0.001	<0.001	0.037	0.721	0.819	0.408	0.001	0.339	0.030	0.709
	Overall sleep quality	0.013	0.029	0.907	0.962	0.593	0.341	0.010	0.805	0.494	0.603
	Trouble falling asleep	0.002	0.003	0.748	0.453	0.177	0.029	0.001	0.862	0.272	0.191
	Trouble sleeping at night	0.019	0.040	0.864	0.074	0.146	0.044	<0.001	0.736	0.452	0.140
	Sleep medication	0.809	0.525	0.163	0.260	0.575	0.322	0.031	0.774	0.321	0.170
	Trouble staying awake	0.016	0.061	0.891	0.083	0.140	0.085	0.018	0.213	0.714	0.264
Coping	Earplugs	0.208	0.345	0.032	0.859	0.907	0.068	0.101	0.148	0.531	0.911
	Alcohol	0.028	0.046	0.868	0.869	0.161	0.589	0.187	0.796	0.926	0.447
	Medication	0.608	0.738	0.303	0.682	0.904	0.016	0.029	0.812	0.330	0.710
	TV	0.004	0.011	0.533	0.625	0.108	<0.001	0.022	0.452	0.889	0.058
	Music	0.004	0.020	0.160	0.675	0.000	0.001	0.855	0.514	0.332	0.989
	Close windows	0.007	0.006	0.074	0.603	0.146	0.889	0.055	0.961	0.282	0.066
	Sound machine	0.451	0.744	0.329	0.962	0.846	0.872	0.942	0.528	0.336	0.889
Health	Fan	0.212	0.496	0.116	0.407	0.007	0.065	0.020	0.538	0.996	0.811
	General health	0.004	0.052	0.001	0.398	0.565	0.049	0.469	0.529	0.056	0.536
	Sleep disorder	0.927	0.701	0.003	0.618	0.010	0.074	0.137	0.752	0.143	0.277
	Hypertension	0.858	0.990	<0.001	0.910	<0.001	0.606	0.673	0.705	0.168	0.821
	Chronic headaches/migraine	0.192	0.383	0.613	0.254	0.225	0.752	0.550	0.760	0.357	0.469
	Arrhythmia	0.525	0.689	0.840	0.813	0.002	0.202	0.330	0.690	0.943	0.708
	Heart disease	0.186	0.114	0.614	0.344	0.014	0.255	0.976	0.629	0.979	0.615
	Stomach ulcer	0.301	0.381	0.488	0.448	0.322	0.729	0.330	0.782	0.693	0.968
	Diabetes	0.448	0.119	0.001	0.662	<0.001	0.778	0.518	0.428	0.696	0.028