

Sleep Disruption and Health Online Appendix

October 16, 2020

1 Appendix: Robustness Tests

1.1 Further robustness testing: the exclusion restriction

We have provided evidence to argue that neighbour noise fulfills both the relevance and exogeneity conditions necessary to constitute a valid instrument for health outcomes, but our ability to address the exclusion restriction has been necessarily more circumstantial. In particular, while we control for a large set of physical, dwelling, neighbourhood, and socio-economic characteristics, and have presented evidence that it is unlikely to be the case that neighbour noise leads to poor health outcomes via moving house, or that reported neighbor noise and health are linked via individual heterogeneity in sensitivity to disturbance, it is nevertheless impossible to completely rule out all alternative mechanisms other than sleep disruption through which neighbor noise and health could be causally linked. Thus to explore the exclusion restriction further, in Table A1 we present the analysis using *two* noise-related instruments: neighbour *and* street noise. Using two instruments allows us to formally statistically test the exclusion restriction by conducting Anderson-Rubin over-identification tests (although we note these are weak tests). On the other hand, street noise is arguably less convincing as a valid instrumental variable for sleep disruption; busy streets are both clearly observable, potentially inducing a greater degree of health-related selection, and may generate higher levels of localized air pollution, potentially further violating the exclusion restriction.

In the event, the two-instrument IVE results presented in Table A1 reveal a very similar pattern to those found in Table 5. More importantly, in all cases we fail to reject the hypothesis that the instruments are excludable, confirming the statistical validity of the exclusion restriction. Although technically above the critical 5% threshold, we note that the over-identification test for cardio-vascular problems, with p-values under 0.10, is somewhat weaker; this could be consistent with either street or neighbour noise having a weak but direct effect on cardio-vascular health independent of its effect on sleep (and thus leading to IVE estimates of the causal impact of sleep that are somewhat overstated, as discussed above in section 4.2 and leave this question for further research.

1.2 Further robustness testing: controlling for possible lifestyle confounders

As described above, the results presented in Table 5 control for a host of dwelling, neighbourhood, physical, and socio-economic characteristics. However there may still be unobservable omitted variables associated with lifestyle that are correlated with neighbour noise, reported sleep disruption, and health outcomes—in particular, a concern may be that younger people may have a higher propensity for lifestyles that include partying and/or recreational drug use, and may be more likely to live near other young people who are disproportionately noisy

(for the same reasons). At the same time, although we control for age (and age-squared), this demographic group may be either more or less likely to suffer particular health outcomes (perhaps related to these lifestyle choices) and this relationship may confound the estimates.

In order to address these potential concerns we carry two additional robustness checks. In Table A2 we exclude all individuals under 30 years old from the analysis. Then in Table A3 we include the full sample, but control explicitly for the self-reported frequency of taking recreational drugs (*RecDrugFreq*), which include sedatives, soft drugs (such as hashish and marijuana), ecstasy, hallucinogens (such as LSD and magic mushroom), and hard drugs (such as stimulants, cocaine, and heroin). In both Tables A2 and A3 the magnitudes of the coefficients and pattern of statistical significance remain highly consistent with the baseline results from Table 5. Thus we conclude that it is highly unlikely that the Table 5 baseline results are being driven by unobservable lifestyle confounders.

Table A1: Robustness: Use Neighbour Noise and Street Noise as Instruments

	(31)		(32)		(33)		(34)	
	cardio-vascular		cholesterol		blood pressure		asthma	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Sleep Disruption	0.279*	0.290**	0.050	0.084	0.170	0.180	0.146	0.134
	(0.155)	(0.128)	(0.154)	(0.127)	(0.169)	(0.139)	(0.110)	(0.090)
Easily Disturbed	0.009		0.028		0.019		-0.011	
	(0.017)		(0.017)		(0.019)		(0.012)	
Ever moved	-0.033**		-0.014		-0.023		0.002	
	(0.015)		(0.015)		(0.016)		(0.011)	
<i>N</i>	5104	5104	5102	5102	5102	5102	5099	5099
over-id test	3.388	3.622	0.016	0.000	0.865	0.684	0.435	0.348
<i>p</i> – value	0.066	0.057	0.901	0.992	0.352	0.408	0.509	0.555
	(35)		(36)		(37)		(38)	
	lung disease		bone & joint		diabetes		fatigue	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Sleep Disruption	0.371**	0.363***	1.235***	1.155***	-0.101	-0.069	0.051	0.112
	(0.159)	(0.131)	(0.297)	(0.234)	(0.108)	(0.088)	(0.182)	(0.150)
Easily Disturbed	-0.001		-0.051		0.021*		0.058***	
	(0.018)		(0.033)		(0.012)		(0.020)	
Ever moved	-0.021		-0.034		-0.004		-0.034*	
	(0.015)		(0.029)		(0.011)		(0.018)	
<i>N</i>	5104	5104	5104	5104	5102	5102	5104	5104
over-id test	0.316	0.341	0.657	0.557	0.157	0.289	1.208	0.712
<i>p</i> – value	0.574	0.559	0.418	0.456	0.692	0.591	0.272	0.399
	(39)		(40)		(41)		(42)	
	headache		Alzheimer		depression		cancer	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Sleep Disruption	0.712***	0.722***	0.047	0.041	0.112	0.180*	-0.023	-0.005
	(0.216)	(0.179)	(0.033)	(0.026)	(0.118)	(0.100)	(0.090)	(0.073)
Easily Disturbed	0.006		-0.002		0.041***		0.011	
	(0.024)		(0.004)		(0.013)		(0.010)	
Ever moved	-0.006		-0.003		0.008		0.012	
	(0.021)		(0.003)		(0.012)		(0.008)	
<i>N</i>	5104	5104	5049	5049	5104	5104	5049	5049
over-id test	0.123	0.139	1.747	1.742	0.339	0.607	1.357	1.234
<i>p</i> – value	0.726	0.710	0.186	0.187	0.561	0.436	0.244	0.267

robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Included in regression but not shown: Dwelling characteristics, neighbourhood characteristics,

BMI, Age, Age², Male, Married, HH income, educational level, labor market status

alcohol consumption, number of children, religious status.

Table A2: Robustness - Exclude Individuals under 30 Years Old

	(43) cardio-vascular		(44) cholesterol		(45) blood pressure		(46) asthma	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Sleep Disruption	0.439** (0.189)	0.422*** (0.155)	0.053 (0.182)	0.098 (0.150)	0.046 (0.196)	0.095 (0.162)	0.211 (0.129)	0.182* (0.104)
Easily Disturbed	-0.005 (0.021)		0.030 (0.020)		0.033 (0.021)		-0.017 (0.014)	
Ever moved	-0.038** (0.017)		-0.015 (0.016)		-0.018 (0.018)		-0.001 (0.012)	
<i>N</i>	4606	4606	4604	4604	4604	4604	4603	4603
	(47) lung disease		(48) bone & joint		(49) diabetes		(50) fatigue	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Sleep Disruption	0.432** (0.184)	0.418*** (0.151)	1.330*** (0.346)	1.227*** (0.271)	-0.083 (0.128)	-0.053 (0.105)	-0.059 (0.217)	0.054 (0.177)
Easily Disturbed	-0.005 (0.020)		-0.057 (0.038)		0.019 (0.014)		0.074*** (0.023)	
Ever moved	-0.021 (0.017)		-0.050 (0.032)		-0.004 (0.012)		-0.029 (0.020)	
<i>N</i>	4606	4606	4606	4606	4604	4604	4606	4606
	(51) headache		(52) Alzheimer		(53) depression		(54) cancer	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Sleep Disruption	0.763*** (0.252)	0.765*** (0.208)	0.025 (0.025)	0.024 (0.022)	0.182 (0.138)	0.237** (0.116)	-0.056 (0.100)	-0.030 (0.082)
Easily Disturbed	0.002 (0.027)		0.000 (0.003)		0.034** (0.015)		0.014 (0.011)	
Ever moved	-0.010 (0.024)		-0.002 (0.002)		0.005 (0.013)		0.016* (0.009)	
<i>N</i>	4606	4606	4536	4536	4606	4606	4536	4536

robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Included in regression but not shown: Dwelling characteristics, neighbourhood characteristics, alcohol consumption, educational level, labor market status, number of children, religious status.

Table A3: Robustness: Control for Drug Taking Frequency

	(55) cardio-vascular		(56) cholesterol		(57) blood pressure		(58) asthma	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Sleep Disruption	0.476** (0.206)	0.441*** (0.165)	-0.030 (0.193)	0.026 (0.155)	0.017 (0.206)	0.076 (0.167)	0.271* (0.144)	0.230** (0.114)
Easily Disturbed	-0.014 (0.022)		0.034 (0.021)		0.037* (0.022)		-0.024 (0.015)	
Ever moved	-0.046*** (0.017)		-0.012 (0.016)		-0.021 (0.017)		-0.003 (0.013)	
<i>N</i>	4589	4589	4589	4589	4589	4589	4588	4588
	(59) lung disease		(60) bone & joint		(61) diabetes		(62) fatigue	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Sleep Disruption	0.534** (0.209)	0.492*** (0.166)	1.244*** (0.357)	1.150*** (0.277)	-0.143 (0.136)	-0.099 (0.108)	1.014*** (0.302)	1.020*** (0.247)
Easily Disturbed	-0.020 (0.022)		-0.050 (0.038)		0.026* (0.015)		0.006 (0.032)	
Ever moved	-0.035* (0.018)		-0.035 (0.031)		-0.004 (0.012)		-0.019 (0.026)	
<i>N</i>	4589	4589	4589	4589	4589	4589	4589	4589
	(63) headache		(64) Alzheimer		(65) depression		(66) cancer	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Sleep Disruption	0.916*** (0.292)	0.882*** (0.234)	0.010 (0.028)	0.013 (0.023)	0.201 (0.144)	0.236** (0.118)	-0.112 (0.111)	-0.075 (0.089)
Easily Disturbed	-0.018 (0.032)		0.002 (0.003)		0.020 (0.016)		0.020 (0.012)	
Ever moved	-0.011 (0.026)		-0.001 (0.002)		0.006 (0.013)		0.012 (0.009)	
<i>N</i>	4589	4589	4553	4553	4589	4589	4553	4553

robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Included in regression but not shown: Dwelling characteristics, neighbourhood characteristics, alcohol consumption, educational level, labor market status, number of children, religious status.