Supplementary Information for Thompson et al.'s *Air pollution, traffic noise, mental health and cognitive development: a multi-exposure longitudinal study of London Adolescents in the SCAMP cohort*

SI 1. Supplementary methods

1. Further methodological detail on air pollution modelling

Outdoor air pollution concentrations at a grid of 20x20m were generated using the CMAQ-urban model[1]. Hybrid exposure was predicted using the London Hybrid Exposure Model (LHEM).[2] An indoor model, based on an EnergyPlus model, used different building archetypes to determine the ingress of outdoor air into indoor environments, and a mass balance approach was used to estimate air quality inside trains and cars.[3] Measurements of residential air pollution indoors and outdoors were taken over 48-72 hours using AQMesh, PurpleAir, and TZOA monitors. These measurements were used to estimate the strength of cooking emissions and loss rates of air pollutants, in order to estimate exposure for the wider sample.[2] Questionnaire information about cooking fuel (gas/electricity) and cooking frequency was also used. Missing cooking fuel data was input based on an energy performance certificate (EPC) database of London homes, and missing cooking frequency was imputed with the median collected value. Geolocation and self-reported time-activity data from the sub-study was used to make assumptions about the time spent in different locations for the wider cohort. However, the high uncertainty created by substantial missing data on cooking behaviours (85-90%, impacting estimates including indoor sources) and time activity (97.5%, impacting hybrid exposure estimates) meant that outdoor exposure was the main analytical exposure for this study, with other exposures analysed as sensitivity analyses.

2. Further methodological detail on psychological outcomes

The Culture Fair Intelligence Test (CFT**)** measured fluid intelligence.[4] The speech-in-noise (SPIN) task measured auditory processing.[5] A processing speed composite measure was produced by averaging z-score transformed (i) time to complete the simplest condition of the Trail Making Task (TMT),[6] (ii) average reaction time on the Enumeration task for trials with 1-2 dots,[7] and (iii) time to answer four long questions. An executive function (EF) composite was produced by averaging z-score transformed performance in (i) the TMT B vs. A condition (measuring cognitive flexibility),[8] (ii) backward digit span (verbal working memory),[9] and (iii) find-the-phone task (spatial working memory)[10,11]. The Strengths and Difficulties Questionnaire (SDQ) measured total emotional and behavioural problems over the past 6 months, also split into internalising and externalising problems subscales.[12] The Patient Health Questionnaire-9 (PHQ-9) measured depression symptoms and the Generalized Anxiety Disorder 7-item scale (GAD-7) measured anxiety symptoms over the past two weeks.[13,14]

Table SI 2. Descriptive statistics of mental health and cognitive variables measured at baseline (2014-2016) and follow-up (2016-2018) in total cohort

Outcome	Baseline N for outcome	Baseline median (IQR)	Follow-up N for outcome	Follow-up median (IQR)
SDQ total score [a]	3300	9.00 (7)	3183	10.00 (7)
SDQ internalising [a]	3300	4.00 (4)	3183	4.00 (5)
SDQ externalising [a]	3300	5.00 (4)	3183	6.00 (5)
PHQ-9 (Depression) [a]	-	-	2585	3.00 (6)
GAD-7 (Anxiety) [a]	-	-	2631	3.00 (5)
Processing speed composite score [a]	2634	-0.11 (0.56)	2452	-0.44 (0.49)
EF composite score [b]	5757	0.09 (0.90)	4298	0.25 (0.83)
Culture fair task total score [b]	5787	13.00 (5)	4563	15.00 (5)
Speech-in-noise threshold [a]	4944	-6.00 (3)	2273	-7.50 (4.5)

SDQ: Strengths and Difficulties Questionnaire. PHQ-9: Patient hHalth Questionnaire-9. GAD-7: The Generalized Anxiety Disorder 7-item scale (GAD-7). EF: Executive Function.

[a] Higher scores correspond to worse mental health or cognitive functioning

[b] Higher scores correspond to better mental health or cognitive functioning

Table SI 3. Descriptive statistics for individual-level outdoor exposure (mean annual average 2013-2018) in air pollution sample, N=3529

Exposure	**Mean (range)**	**$PM_{2.5}$** ***r(p)***	**PM10** ***r(p)***	**NO2** ***r(p)***	**O3** ***r(p)***	**Lden** ***r(p)***	**Lday** ***r(p)***	**Lnight** ***r(p)***	**Leve** ***r(p)***
$PM_{2.5}$	11.9 $\mu g/m^3$ (9.2-17.1)	1	0.96 (<0.001)	0.88 (<0.001)	-0.88 (<0.001)	0.36 (<0.001)	0.26 (<0.001)	0.36 (<0.001)	0.36 (<0.001)
PM_{10}	19.3 $\mu g/m^3$ (15.8-29.4)		1	0.93 (<0.001)	-0.89 (<0.001)	0.47 (<0.001)	0.34 (<0.001)	0.47 (<0.001)	0.46 (<0.001)
NO_2	15.7 $\mu g/m^3$ (7.4-34.5)			1	-0.98 (<0.001)	0.46 (<0.001)	0.35 (<0.001)	0.46 (<0.001)	0.46 (<0.001)
O_3	21.1 ppb (11.9-27.6)				1	-0.39 (<0.001)	-0.29 (<0.001)	-0.39 (<0.001)	-0.39 (<0.001)
Lden	54.6 dB(A) (43.8-81.2)					1	0.68 (<0.001)	0.99 (<0.001)	0.99 (<0.001)
Lday	55.8 dB(A) (39.1-78.5)						1	0.68 (<0.001)	0.67 (<0.001)
Lnight	47.9 dB(A) (37.9-74.4)							1	0.99 (<0.001)

Leve	51.8 dB(A) (38.0-79.0)								1
$PM_{2.5}$ = particulate matter < 2.5 micrometres in diameter. PM_{10} = particulate matter <10 micrometres in diameter. NO_2 = Nitrogen Dioxide. O_3 = ozone. Lden = 24-hour A-weighted equivalent noise level, +10db penalty for evening and night. Lday = A-weighted equivalent noise level 7am-7pm. Lnight = A-weighted equivalent noise level 11pm-7am. Leve = A-weighted equivalent noise level 7pm-11pm.									

Table SI 4. Associations between exposure to outdoor $PM_{2.5}$, PM_{10}, NO_2, and O_3 (per interquartile range (IQR) increase) and psychological outcomes at baseline and follow-up, in single exposure models

		$PM_{2.5}$			PM_{10}			NO_2			O_3		
Baseline outcomes	**Model**	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***
SDQ emotional and behavioural problems [a]	Unadjusted N=3057	**-0.199**	**0.093**	**0.033**	**0.285**	**0.103**	**0.006**	0.114	0.122	0.349	-0.112	0.131	0.393
	Adjusted [c] N=3027	-0.081	0.129	0.532	**0.334**	**0.131**	**0.011**	**0.333**	**0.159**	**0.037**	**-0.418**	**0.184**	**0.024**
SDQ internalising problems [a]	Unadjusted N=3057	-0.050	0.054	0.363	**0.133**	**0.060**	**0.027**	0.035	0.071	0.623	-0.016	0.076	0.832
	Adjusted [c] N=3027	-0.015	0.074	0.841	**0.154**	**0.076**	**0.043**	0.142	0.092	0.123	-0.155	0.106	0.146
SDQ externalising problems [a]	Unadjusted N=3057	**-0.149**	**0.058**	**0.010**	**0.152**	**0.064**	**0.017**	0.079	0.075	0.293	-0.095	0.081	0.237
	Adjusted [c] N=3027	-0.075	0.079	0.342	**0.182**	**0.079**	**0.021**	*0.182*	*0.095*	*0.058*	**-0.241**	**0.109**	**0.028**
Executive functioning [b]	Unadjusted N=3158	**0.022**	**0.011**	**0.046**	*-0.022*	*0.012*	*0.074*	0.014	0.015	0.320	-0.016	0.016	0.298
	Adjusted [c] N=3128	0.003	0.015	0.831	-0.006	0.015	0.676	0.004	0.018	0.840	-0.014	0.021	0.491
Fluid intelligence [b]	Unadjusted N=3188	-0.038	0.058	0.515	-0.086	0.065	0.188	0.026	0.077	0.736	-0.017	0.083	0.840
	Adjusted [c] N=3153	-0.031	0.086	0.718	0.024	0.084	0.776	0.023	0.102	0.822	-0.019	0.121	0.874
Processing speed [a]	Unadjusted N=1522	-0.001	0.010	0.959	0.015	0.012	0.200	0.000	0.014	0.994	-0.004	0.015	0.760
	Adjusted [c] N=1512	-0.014	0.014	0.328	-0.002	0.015	0.868	-0.004	0.018	0.835	-0.003	0.021	0.901
Speech-in-noise perception threshold [a]	Unadjusted N=2483	**-0.137**	**0.061**	**0.025**	**0.160**	**0.063**	**0.011**	0.035	0.075	0.646	-0.060	0.080	0.457
	Adjusted [c] N=2460	-0.077	0.079	0.335	0.058	0.077	0.451	0.019	0.095	0.842	-0.029	0.108	0.786
Follow-up 1 outcomes		**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***
SDQ emotional and behavioural problems [a]	Unadjusted N=2954	*0.233*	*0.128*	*0.067*	**0.253**	**0.121**	**0.037**	-0.024	0.126	0.850	0.035	0.131	0.788
	Adjusted [d] N=2937	*0.331*	*0.180*	*0.067*	-0.024	0.145	0.871	-0.087	0.134	0.519	0.134	0.153	0.385
SDQ internalising problems [a]	Unadjusted N=2954	0.037	0.077	0.624	0.069	0.073	0.342	-0.067	0.075	0.375	0.068	0.079	0.389

	Adjusted [d] N=2937	0.022	0.109	0.836	-0.117	0.086	0.175	*-0.137*	*0.079*	*0.084*	*0.149*	*0.089*	*0.098*
SDQ externalising problems [a]	Unadjusted N=2954	**0.196**	**0.081**	**0.016**	**0.184**	**0.077**	**0.017**	0.043	0.08	0.588	-0.032	0.083	0.697
	Adjusted [d] N=2937	0.139	0.106	0.188	0.097	0.094	0.305	0.049	0.088	0.574	-0.017	0.101	0.865
PHQ-9 depression symptoms [a]	Unadjusted N=2389	0.057	0.049	0.248	0.071	0.046	0.124	0.047	0.050	0.348	-0.079	0.054	0.144
	Adjusted [e] N=2361	0.011	0.069	0.874	0.031	0.061	0.618	0.008	0.059	0.897	-0.044	0.069	0.524
GAD-7 anxiety symptoms [a]	Unadjusted N=2433	*0.092*	*0.050*	*0.066*	**0.096**	**0.048**	**0.043**	0.064	0.051	0.213	*-0.094*	*0.056*	*0.093*
	Adjusted [e] N=2404	0.068	0.068	0.313	0.074	0.061	0.221	0.025	0.060	0.676	-0.058	0.068	0.390
Executive functioning [b]	Unadjusted N=2814	**0.035**	**0.014**	**0.014**	*0.025*	*0.013*	*0.062*	**0.067**	**0.013**	**<0.001**	**-0.077**	**0.014**	**<0.001**
	Adjusted [d] N=2785	**0.036**	**0.018**	**0.045**	*0.030*	*0.016*	*0.057*	**0.038**	**0.014**	**0.007**	**-0.058**	**0.016**	**<0.001**
Fluid intelligence [b]	Unadjusted N=2982	-0.026	0.082	0.750	-0.004	0.078	0.956	**0.158**	**0.080**	**0.048**	-0.130	0.084	0.122
	Adjusted [d] N=2953	0.077	0.098	0.429	0.092	0.087	0.292	0.093	0.081	0.254	-0.092	0.092	0.322
Processing speed [a]	Unadjusted N=940	**0.033**	**0.014**	**0.017**	**0.028**	**0.013**	**0.037**	0.008	0.014	0.549	-0.013	0.014	0.382
	Adjusted [d] N=936	0.009	0.020	0.634	0.006	0.018	0.753	-0.005	0.017	0.769	0.001	0.019	0.970
Speech-in-noise perception threshold [a]	Unadjusted N=1349	0.084	0.106	0.428	0.106	0.101	0.297	0.009	0.102	0.926	-0.026	0.105	0.804
	Adjusted [d] N=1338	-0.114	0.147	0.439	-0.081	0.134	0.545	-0.080	0.124	0.522	0.140	0.140	0.322

Analyses of baseline outcomes are in relation to year-prior exposure, and analyses of follow-up outcomes are in relation to annual average exposure between baseline and follow-up assessment. Ordinal logistic (PHQ-9 and GAD-7 outcomes) and linear (all other outcomes) regressions were used. Categorical PHQ-9 cut-offs: no or minimal depression, 0 to 4; mild depression, 5 to 10; moderate depression, 11 to 14; moderately severe and severe dep ression, 15+. Categorical GAD-7 cut-offs: no or minimal anxiety, 0 to 4; mild anxiety, 5 to 9; moderate anxiety, 10 to 14; and moderately severe and severe anxiety, 15+.

Effects are per IQR increase in exposure Effects are per IQR increase exposure: Year-prior to baseline IQR $PM_{2.5}$ = 1.57µg/m3, PM_{10} = 2.10µg/m3, NO_2 = 4.13µg/m3, O_3 = 3.21ppb. Average annual exposure baseline to follow-up IQR $PM_{2.5}$ = 1.60µg/m3, PM_{10} = 2.12µg/m3, NO_2 = 3.65µg/m3, O_3 = 3.11ppb.

Bold: *p*<0.05. *Italics: p*<0.10

SDQ: Strengths and Difficulties Questionnaire. GAD-7: General Anxiety Disorder-7 (questionnaire). PHQ-9: Patient Health Questionnaire-9

[a] Higher values reflect worse mental health or cognition

[b] Higher values reflect better mental health or cognition

[c] adjusted for baseline age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[d] adjusted for baseline score, follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[e] adjusted for follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

Table SI 5. Associations between exposure to traffic noise (in quartiles, reference first quartile) and psychological outcomes at baseline and follow-up, in single exposure models

	Model	Quartile	Lden			Lday			Leve			Lnight		
Baseline outcomes			**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***
SDQ emotional and behavioural problems [a]	Unadjusted N=3289	2nd	*0.523*	*0.271*	*0.053*	0.323	0.283	0.253	*0.513*	*0.271*	*0.059*	**0.599**	**0.271**	**0.027**
		3rd	*0.521*	*0.268*	*0.052*	0.324	0.281	0.249	*0.450*	*0.268*	*0.093*	**0.567**	**0.268**	**0.035**
		4th	**0.861**	**0.270**	**0.001**	**-0.663**	**0.260**	**0.011**	**0.788**	**0.270**	**0.004**	**0.888**	**0.270**	**0.001**
	Adjusted [c] N=3259	2nd	0.367	0.268	0.172	0.230	0.310	0.458	0.363	0.269	0.178	0.439	0.269	0.102
		3rd	0.345	0.270	0.201	0.333	0.333	0.317	0.271	0.269	0.313	0.386	0.269	0.152
		4th	**0.683**	**0.272**	**0.012**	0.208	0.347	0.548	**0.609**	**0.273**	**0.025**	**0.693**	**0.272**	**0.011**
SDQ internalising problems [a]	Unadjusted N=3289	2nd	0.243	0.158	0.123	0.108	0.165	0.514	*0.276*	*0.158*	*0.081*	*0.277*	*0.158*	*0.079*
		3rd	0.154	0.157	0.326	0.258	0.164	0.117	0.127	0.156	0.416	0.195	0.157	0.212
		4th	**0.442**	**0.158**	**0.005**	-0.243	0.152	0.110	**0.422**	**0.158**	**0.007**	**0.451**	**0.158**	**0.004**
	Adjusted [c] N=3259	2nd	0.171	0.157	0.277	0.047	0.180	0.795	0.202	0.157	0.199	0.206	0.157	0.190
		3rd	0.025	0.158	0.876	0.145	0.192	0.449	-0.004	0.157	0.978	0.066	0.158	0.677
		4th	**0.364**	**0.159**	**0.022**	0.115	0.199	0.563	**0.343**	**0.159**	**0.031**	**0.366**	**0.159**	**0.022**
SDQ externalising problems [a]	Unadjusted N=3289	2nd	*0.280*	*0.167*	*0.094*	0.216	0.175	0.218	0.237	0.168	0.159	*0.322*	*0.167*	*0.055*
		3rd	**0.368**	**0.166**	**0.027**	0.067	0.174	0.702	*0.323*	*0.166*	*0.052*	**0.372**	**0.166**	**0.025**
		4th	**0.419**	**0.167**	**0.012**	**-0.420**	**0.161**	**0.009**	**0.365**	**0.167**	**0.029**	**0.436**	**0.167**	**0.009**
	Adjusted [c] N=3259	2nd	0.194	0.165	0.239	0.181	0.190	0.339	0.159	0.165	0.334	0.232	0.165	0.160
		3rd	*0.317*	*0.165*	*0.055*	0.187	0.203	0.358	*0.273*	*0.165*	*0.098*	*0.317*	*0.165*	*0.055*
		4th	*0.319*	*0.167*	*0.056*	0.058	0.211	0.783	0.267	0.167	0.111	**0.328**	**0.167**	**0.049**
Executive functioning [b]	Unadjusted N=5670	2nd	-0.020	0.025	0.439	0.026	0.026	0.306	-0.011	0.025	0.673	-0.021	0.025	0.411
		3rd	**-0.053**	**0.025**	**0.039**	**0.101**	**0.025**	**<0.001**	-0.041	0.025	0.105	**-0.054**	**0.025**	**0.035**
		4th	**-0.082**	**0.026**	**0.001**	**0.224**	**0.025**	**<0.001**	**-0.078**	**0.026**	**0.002**	**-0.086**	**0.026**	**0.001**
	Adjusted [c] N=5375	2nd	-0.002	0.024	0.941	-0.004	0.027	0.880	0.004	0.024	0.881	-0.001	0.024	0.966
		3rd	-0.005	0.024	0.852	-0.024	0.030	0.411	0.002	0.024	0.936	-0.002	0.024	0.928
		4th	-0.029	0.025	0.233	0.001	0.032	0.987	-0.025	0.025	0.300	-0.032	0.025	0.191
Fluid intelligence [b]	Unadjusted N=5693	2nd	-0.107	0.140	0.445	-0.048	0.141	0.732	-0.027	0.140	0.845	-0.138	0.139	0.322
		3rd	**-0.285**	**0.139**	**0.041**	**0.308**	**0.140**	**0.028**	*-0.252*	*0.139*	*0.070*	**-0.294**	**0.139**	**0.035**
		4th	-0.176	0.139	0.206	**0.792**	**0.140**	**<0.001**	-0.137	0.139	0.326	-0.189	0.139	0.174

Processing speed [a]	Adjusted [c] N=5393	2nd	-0.030	0.135	0.826	-0.020	0.153	0.898	0.022	0.135	0.869	-0.048	0.135	0.723
		3rd	-0.041	0.136	0.765	-0.229	0.166	0.168	-0.037	0.136	0.786	-0.037	0.136	0.784
		4th	0.008	0.137	0.953	0.079	0.179	0.661	0.042	0.137	0.762	-0.001	0.137	0.996
	Unadjusted N=2613	2nd	0.021	0.024	0.398	0.015	0.025	0.553	0.023	0.024	0.353	0.013	0.024	0.592
		3rd	**0.065**	**0.024**	**0.008**	0.019	0.024	0.439	**0.058**	**0.024**	**0.017**	**0.060**	**0.024**	**0.014**
		4th	**0.049**	**0.024**	**0.044**	0.001	0.025	0.967	**0.051**	**0.024**	**0.035**	*0.045*	*0.024*	*0.062*
	Adjusted [c] N=2503	2nd	0.023	0.024	0.341	0.000	0.027	0.994	0.024	0.024	0.319	0.015	0.024	0.526
		3rd	*0.043*	*0.024*	*0.076*	0.010	0.029	0.717	0.035	0.024	0.153	0.038	0.024	0.121
		4th	0.032	0.024	0.190	0.022	0.031	0.485	0.033	0.024	0.177	0.027	0.024	0.258
Speech-in-noise perception threshold [a]	Unadjusted N=4476	2nd	0.039	0.130	0.765	0.149	0.133	0.261	0.023	0.024	0.353	0.013	0.024	0.592
		3rd	0.083	0.128	0.518	*-0.251*	*0.131*	*0.055*	**0.058**	**0.024**	**0.017**	**0.060**	**0.024**	**0.014**
		4th	**0.289**	**0.130**	**0.026**	**-0.516**	**0.128**	**<0.001**	**0.051**	**0.024**	**0.035**	*0.045*	*0.024*	*0.062*
	Adjusted [c] N=4251	2nd	-0.020	0.129	0.876	0.078	0.146	0.596	0.024	0.024	0.319	0.015	0.024	0.526
		3rd	-0.037	0.130	0.778	-0.161	0.155	0.299	0.035	0.024	0.153	0.038	0.024	0.121
		4th	0.112	0.131	0.393	0.072	0.164	0.663	0.033	0.024	0.177	0.027	0.024	0.258
Follow-up 1 outcomes														
SDQ emotional and behavioural problems [a]	Unadjusted N=2839	2nd	0.062	0.288	0.830	-0.018	0.296	0.951	0.111	0.288	0.699	0.120	0.288	0.676
		3rd	0.150	0.287	0.601	-0.215	0.294	0.465	0.097	0.287	0.736	0.223	0.287	0.436
		4th	0.175	0.286	0.540	**-0.756**	**0.284**	**0.008**	0.170	0.286	0.553	0.191	0.286	0.504
	Adjusted [d] N=2814	2nd	-0.086	0.248	0.728	-0.011	0.282	0.970	-0.079	0.248	0.751	-0.091	0.248	0.713
		3rd	-0.123	0.250	0.625	-0.240	0.297	0.420	-0.104	0.250	0.679	-0.068	0.250	0.785
		4th	-0.148	0.250	0.553	-0.126	0.326	0.700	-0.179	0.250	0.474	-0.153	0.250	0.539
SDQ internalising problems [a]	Unadjusted N=2839	2nd	-0.050	0.173	0.774	0.068	0.177	0.701	-0.059	0.173	0.731	0.009	0.173	0.960
		3rd	-0.056	0.172	0.746	-0.041	0.176	0.818	-0.104	0.172	0.547	-0.007	0.172	0.966
		4th	-0.029	0.172	0.864	**-0.493**	**0.171**	**0.004**	-0.041	0.171	0.810	-0.009	0.171	0.958
	Adjusted [d] N=2814	2nd	-0.143	0.151	0.343	-0.011	0.282	0.970	-0.161	0.151	0.287	-0.123	0.151	0.417
		3rd	-0.160	0.152	0.293	-0.240	0.297	0.420	-0.163	0.152	0.286	-0.128	0.152	0.403
		4th	-0.191	0.152	0.208	-0.126	0.326	0.700	-0.207	0.152	0.173	-0.185	0.152	0.224
	Unadjusted	2nd	0.112	0.184	0.543	-0.086	0.189	0.648	0.171	0.183	0.352	0.112	0.184	0.543

SDQ externalising problems [a]	N=2839	3rd	0.206	0.183	0.260	-0.174	0.188	0.353	0.201	0.183	0.273	0.231	0.183	0.207
		4th	0.205	0.182	0.261	-0.263	0.182	0.148	0.211	0.182	0.247	0.200	0.182	0.273
	Adjusted [d] N=2814	2nd	0.051	0.160	0.748	0.000	0.182	0.999	0.075	0.160	0.638	0.029	0.160	0.856
		3rd	0.024	0.161	0.882	0.013	0.192	0.945	0.044	0.161	0.784	0.048	0.161	0.767
		4th	0.045	0.161	0.779	0.003	0.212	0.990	0.030	0.161	0.854	0.035	0.161	0.829
PHQ-9 depression symptoms [a]	Unadjusted N=2576	2nd	-0.031	0.113	0.785	0.066	0.118	0.573	0.024	0.113	0.832	-0.006	0.113	0.957
		3rd	-0.010	0.111	0.930	**0.233**	**0.113**	**0.039**	-0.021	0.111	0.847	0.012	0.111	0.911
		4th	0.053	0.111	0.633	-0.070	0.110	0.519	0.074	0.111	0.508	0.082	0.111	0.457
	Adjusted [e] N=2548	2nd	-0.077	0.116	0.508	-0.010	0.129	0.939	-0.028	0.116	0.809	-0.051	0.116	0.659
		3rd	-0.083	0.115	0.468	0.132	0.129	0.308	-0.093	0.115	0.418	-0.061	0.115	0.596
		4th	0.019	0.116	0.872	-0.090	0.140	0.952	0.037	0.116	0.752	0.050	0.116	0.668
GAD-7 anxiety symptoms [a]	Unadjusted N=2622	2nd	0.101	0.117	0.389	0.198	0.122	0.104	0.179	0.117	0.126	0.122	0.117	0.297
		3rd	0.112	0.115	0.327	**0.398**	**0.116**	**0.001**	0.087	0.116	0.451	0.126	0.115	0.274
		4th	*0.207*	*0.115*	*0.071*	0.066	0.114	0.561	**0.241**	**0.115**	**0.036**	*0.218*	*0.115*	*0.057*
	Adjusted [e] N=2593	2nd	0.071	0.121	0.560	0.161	0.132	0.221	0.146	0.121	0.227	0.093	0.121	0.442
		3rd	0.061	0.12	0.614	**0.329**	**0.128**	**0.010**	0.039	0.121	0.745	0.073	0.120	0.543
		4th	*0.203*	*0.12*	*0.090*	0.074	0.142	0.602	**0.2395**	**0.12**	**0.046**	*0.214*	*0.120*	*0.074*
Executive functioning [b]	Unadjusted N=3040	2nd	0.020	0.030	0.504	0.036	0.031	0.236	0.023	0.030	0.439	0.007	0.030	0.817
		3rd	-0.027	0.030	0.362	0.027	0.030	0.382	-0.027	0.030	0.360	-0.028	0.030	0.359
		4th	-0.041	0.030	0.170	**0.170**	**0.030**	**<0.001**	-0.038	0.030	0.199	-0.045	0.030	0.133
	Adjusted [d] N=3011	2nd	0.029	0.026	0.262	0.004	0.030	0.903	0.029	0.026	0.264	0.021	0.026	0.411
		3rd	-0.005	0.026	0.849	-0.015	0.032	0.635	-0.011	0.026	0.682	-0.004	0.026	0.887
		4th	-0.013	0.026	0.621	0.004	0.035	0.912	-0.012	0.026	0.642	-0.013	0.026	0.606
Fluid intelligence [b]	Unadjusted N=3191	2nd	-0.225	0.181	0.214	-0.174	0.183	0.340	-0.205	0.181	0.257	-0.226	0.181	0.212
		3rd	**-0.442**	**0.180**	**0.014**	-0.112	0.183	0.540	**-0.439**	**0.180**	**0.015**	**-0.423**	**0.180**	**0.019**
		4th	-0.287	0.180	0.110	**0.858**	**0.180**	**<0.001**	-0.271	0.180	0.132	-0.285	0.180	0.112
	Adjusted [d] N=3162	2nd	-0.132	0.154	0.392	-0.248	0.171	0.146	-0.140	0.154	0.364	-0.091	0.154	0.556
		3rd	-0.193	0.155	0.212	-0.131	0.180	0.468	-0.228	0.155	0.142	-0.157	0.155	0.312
		4th	-0.157	0.155	0.312	-0.142	0.197	0.470	-0.154	0.155	0.321	-0.144	0.155	0.353

Processing speed [a]	Unadjusted N=975	2nd	0.022	0.033	0.504	0.022	0.034	0.524	0.026	0.033	0.428	0.018	0.033	0.600
		3rd	0.049	0.034	0.146	-0.054	0.034	0.113	*0.059*	*0.034*	*0.083*	0.027	0.034	0.425
		4th	0.001	0.032	0.965	0.024	0.034	0.470	0.007	0.032	0.837	-0.002	0.032	0.941
	Adjusted [d] N=971	2nd	0.022	0.030	0.460	0.035	0.035	0.309	0.017	0.030	0.567	0.014	0.030	0.654
		3rd	0.033	0.030	0.274	-0.004	0.036	0.916	0.040	0.031	0.190	0.010	0.030	0.740
		4th	-0.027	0.029	0.344	0.025	0.042	0.552	-0.027	0.029	0.363	-0.035	0.029	0.234
Speech-in-noise perception threshold [a]	Unadjusted N=1454	2nd	0.263	0.237	0.267	0.378	0.256	0.140	0.026	0.033	0.428	0.018	0.033	0.600
		3rd	**0.578**	**0.233**	**0.013**	0.251	0.258	0.331	*0.059*	*0.034*	*0.083*	0.027	0.034	0.425
		4th	*0.439*	*0.235*	*0.062*	*-0.423*	*0.236*	*0.074*	0.007	0.032	0.837	-0.002	0.032	0.941
	Adjusted [d] N=1443	2nd	0.261	0.232	0.261	*0.475*	*0.274*	*0.083*	0.017	0.030	0.567	0.014	0.030	0.654
		3rd	**0.487**	**0.231**	**0.035**	0.434	0.289	0.134	0.040	0.031	0.190	0.010	0.030	0.740
		4th	0.246	0.233	0.293	0.138	0.311	0.658	-0.027	0.029	0.363	-0.035	0.029	0.234

Analyses of baseline outcomes are in relation to year-prior exposure, and analyses of follow-up outcomes are in relation to annual average exposure between baseline and follow-up assessment. Ordinal logistic (PHQ-9 and GAD-7) and linear (all other outcomes) regressions were used. Categorical PHQ-9 cut-offs: no or minimal depression, 0 to 4; mild depression, 5 to 10; moderate depression, 11 to 14; moderately severe and severe depression, 15+. Categorical GAD-7 cut-offs: no or minimal anxiety, 0 to 4; mild anxiety, 5 to 9; moderate anxiety, 10 to 14; and moderately severe and severe anxiety, 15+.

Noise effects are for each quartile of exposure (ref: 1st quartile). **Bold: $p<0.05$**. *Italics:* $p<0.10$

SDQ: Strengths and difficulties questionnaire. GAD-7: General Anxiety Disorder-7 (questionnaire). PHQ-9: Patient Health Questionnaire-9

[a] Higher values reflect worse mental health or cognition

[b] Higher values reflect better mental health or cognition

[c] adjusted for baseline age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[d] adjusted for baseline score, follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[e] adjusted for follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

Table SI 6. Multi-exposure results in full: associations between exposure to multiple exposures (outdoor air pollutants and/or noise) and psychological outcomes

a) $PM_{2.5}$ multi-exposures

Outcome	Multi-exposure	Exposure term	β	SE	*p*
BL SDQ	**PM2.5 and Ozone**	**PM2.5**	**-0.481**	**0.169**	**0.005**
		Ozone	**-0.787**	**0.237**	**0.001**
BL Internalising	**PM2.5 and Ozone**	**PM2.5**	-0.135	0.097	0.165
		Ozone	*-0.248*	*0.136*	*0.070*
BL Externalising	**PM2.5 and Ozone**	**PM2.5**	**-0.322**	**0.100**	**0.002**
		Ozone	**-0.484**	**0.139**	**0.001**
BL Executive Function	**PM2.5 and Ozone**	**PM2.5**	-0.005	0.019	0.792
		Ozone	-0.022	0.027	0.431
BL Culture Fair Intelligence Test	**PM2.5 and Ozone**	**PM2.5**	-0.069	0.114	0.543
		Ozone	-0.103	0.160	0.520
BL Processing Speed	**PM2.5 and Ozone**	**PM2.5**	-0.027	0.019	0.151
		Ozone	-0.030	0.027	0.278
BL Speech-in-noise Threshold	**PM2.5 and Ozone**	**PM2.5**	-0.155	0.104	0.137
		Ozone	-0.166	0.141	0.240
F1 SDQ	**PM2.5 and Ozone**	**PM2.5**	0.520	0.355	0.148
		Ozone	0.302	0.338	0.375
F1 Internalising	**PM2.5 and Ozone**	**PM2.5**	0.050	0.224	0.823
		Ozone	0.061	0.212	0.775
F1 Externalising	**PM2.5 and Ozone**	**PM2.5**	**0.502**	**0.207**	**0.018**
		Ozone	**0.432**	**0.198**	**0.033**
F1 PHQ-9 Depression	**PM2.5 and Ozone**	**PM2.5**	-0.093	0.131	0.476
		Ozone	-0.123	0.131	0.346
F1 GAD-7 Anxiety	**PM2.5 and Ozone**	**PM2.5**	0.067	0.126	0.596
		Ozone	-0.002	0.127	0.987
F1 Executive Function	**PM2.5 and Ozone**	**PM2.5**	*-0.062*	*0.033*	*0.065*
		Ozone	**-0.111**	**0.031**	**0.001**
F1 Culture Fair Intelligence Test	**PM2.5 and Ozone**	**PM2.5**	-0.029	0.196	0.884
		Ozone	-0.115	0.186	0.539
F1 Processing Speed	**PM2.5 and Ozone**	**PM2.5**	0.044	0.041	0.291
		Ozone	0.039	0.041	0.340
F1 Speech-in-noise Threshold	**PM2.5 and Ozone**	**PM2.5**	0.041	0.318	0.899
		Ozone	0.186	0.302	0.541

Outcome	Multi-exposure	Exposure term	β	SE	*p*	Multi-exposure	Exposure Term	β	SE	*p*
BL SDQ	**PM2.5 and Lden**	**PM2.5**	-0.154	0.132	0.245	**PM2.5 and Lday**	**PM2.5**	**0.509**	**0.189**	**0.008**
		Lden Quartile 2	0.199	0.281	0.479		**Lday Quartile 2**	0.381	0.317	0.231
		Lden Quartile 3	0.349	0.285	0.221		**Lday Quartile 3**	0.394	0.341	0.248
		Lden Quartile 4	**0.718**	**0.291**	**0.014**		**Lday Quartile 4**	0.084	0.375	0.824
BL Internalising	**PM2.5 and Lden**	**PM2.5**	-0.054	0.075	0.473	**PM2.5 and Lday**	**PM2.5**	-0.025	0.076	0.747
		Lden Quartile 2	0.066	0.164	0.686		**Lday Quartile 2**	0.114	0.185	0.536
		Lden Quartile 3	0.020	0.167	0.904		**Lday Quartile 3**	0.121	0.197	0.540
		Lden Quartile 4	**0.356**	**0.170**	**0.036**		**Lday Quartile 4**	0.223	0.215	0.300
BL Externalising	**PM2.5 and Lden**	**PM2.5**	-0.108	0.081	0.180	**PM2.5 and Lday**	**PM2.5**	-0.073	0.081	0.368
		Lden Quartile 2	0.131	0.172	0.447		**Lday Quartile 2**	*0.288*	*0.194*	*0.139*
		Lden Quartile 3	*0.327*	*0.175*	*0.061*		**Lday Quartile 3**	*0.392*	*0.207*	*0.059*
		Lden Quartile 4	**0.367**	**0.178**	**0.040**		**Lday Quartile 4**	0.132	0.227	0.559
BL Executive Function	**PM2.5 and Lden**	**PM2.5**	0.005	0.015	0.761	**PM2.5 and Lday**	**PM2.5**	-0.001	0.015	0.955
		Lden Quartile 2	-0.018	0.032	0.571		**Lday Quartile 2**	-0.026	0.036	0.459
		Lden Quartile 3	-0.020	0.032	0.526		**Lday Quartile 3**	-0.031	0.038	0.428
		Lden Quartile 4	-0.021	0.033	0.520		**Lday Quartile 4**	0.033	0.042	0.430
BL Culture Fair Intelligence Test	**PM2.5 and Lden**	**PM2.5**	-0.051	0.089	0.565	**PM2.5 and Lday**	**PM2.5**	-0.055	0.088	0.534
		Lden Quartile 2	0.106	0.172	0.539		**Lday Quartile 2**	0.048	0.198	0.808
		Lden Quartile 3	0.193	0.175	0.271		**Lday Quartile 3**	-0.335	0.215	0.119
		Lden Quartile 4	0.212	0.179	0.237		**Lday Quartile 4**	0.261	0.235	0.266
BL Processing Speed	**PM2.5 and Lden**	**PM2.5**	-0.016	0.015	0.274	**PM2.5 and Lday**	**PM2.5**	-0.015	0.015	0.322
		Lden Quartile 2	0.045	0.032	0.157		**Lday Quartile 2**	0.006	0.036	0.878
		Lden Quartile 3	0.047	0.032	0.142		**Lday Quartile 3**	-0.011	0.039	0.782
		Lden Quartile 4	0.038	0.032	0.241		**Lday Quartile 4**	0.011	0.043	0.800
BL Speech-in-noise Threshold	**PM2.5 and Lden**	**PM2.5**	-0.094	0.082	0.252	**PM2.5 and Lday**	**PM2.5**	-0.072	0.080	0.370
		Lden Quartile 2	-0.024	0.170	0.889		**Lday Quartile 2**	0.297	0.193	0.124
		Lden Quartile 3	-0.023	0.172	0.895		**Lday Quartile 3**	-0.243	0.201	0.227
		Lden Quartile 4	0.125	0.176	0.478		**Lday Quartile 4**	0.062	0.218	0.777
F1 SDQ	**PM2.5 and Lden**	**PM2.5**	0.298	0.189	0.116	**PM2.5 and Lday**	**PM2.5**	*0.348*	*0.189*	*0.067*
		Lden Quartile 2	0.129	0.281	0.645		**Lday Quartile 2**	0.107	0.317	0.737
		Lden Quartile 3	0.014	0.286	0.962		**Lday Quartile 3**	-0.093	0.341	0.785
		Lden Quartile 4	0.209	0.298	0.482		**Lday Quartile 4**	-0.030	0.382	0.938
F1 Internalising	**PM2.5 and Lden**	**PM2.5**	0.003	0.114	0.976	**PM2.5 and Lday**	**PM2.5**	0.032	0.114	0.783
		Lden Quartile 2	-0.020	0.167	0.906		**Lday Quartile 2**	0.082	0.189	0.663
		Lden Quartile 3	-0.078	0.170	0.645		**Lday Quartile 3**	-0.074	0.204	0.717
		Lden Quartile 4	0.078	0.177	0.658		**Lday Quartile 4**	0.003	0.228	0.989
F1 Externalising		**PM2.5**	0.138	0.111	0.215		**PM2.5**	0.144	0.110	0.193

	PM2.5 and Lden	**Lden Quartile 2**	0.125	0.166	0.451	**PM2.5 and Lday**	**Lday Quartile 2**	0.100	0.189	0.597
		Lden Quartile 3	0.042	0.167	0.804		**Lday Quartile 3**	-0.006	0.202	0.975
		Lden Quartile 4	0.063	0.173	0.717		**Lday Quartile 4**	0.022	0.225	0.922
PHQ9	**PM2.5 and Lden**	**PM2.5**	-0.002	0.072	0.975	**PM2.5 and Lday**	**PM2.5**	0.016	0.071	0.826
		Lden Quartile 2	-0.050	0.121	0.677		**Lday Quartile 2**	0.017	0.134	0.896
		Lden Quartile 3	-0.083	0.120	0.488		**Lday Quartile 3**	0.069	0.140	0.620
		Lden Quartile 4	0.043	0.126	0.732		**Lday Quartile 4**	-0.022	0.155	0.887
GAD7	**PM2.5 and Lden**	**PM2.5**	0.038	0.071	0.587	**PM2.5 and Lday**	**PM2.5**	0.069	0.069	0.317
		Lden Quartile 2	0.193	0.125	0.123		**Lday Quartile 2**	0.173	0.136	0.206
		Lden Quartile 3	0.085	0.127	0.500		**Lday Quartile 3**	**0.276**	**0.136**	**0.042**
		Lden Quartile 4	*0.251*	*0.131*	*0.055*		**Lday Quartile 4**	0.046	0.155	0.767
F1 Executive Function	**PM2.5 and Lden**	**PM2.5**	**0.045**	**0.018**	**0.016**	**PM2.5 and Lday**	**PM2.5**	**0.037**	**0.018**	**0.049**
		Lden Quartile 2	0.007	0.027	0.796		**Lday Quartile 2**	-0.006	0.031	0.842
		Lden Quartile 3	-0.009	0.027	0.738		**Lday Quartile 3**	-0.025	0.033	0.439
		Lden Quartile 4	-0.039	0.028	0.167		**Lday Quartile 4**	-0.007	0.037	0.858
F1 Culture Fair Intelligence Test	**PM2.5 and Lden**	**PM2.5**	0.116	0.102	0.259	**PM2.5 and Lday**	**PM2.5**	0.087	0.102	0.398
		Lden Quartile 2	-0.205	0.160	0.201		**Lday Quartile 2**	-0.211	0.178	0.236
		Lden Quartile 3	*-0.314*	*0.162*	*0.053*		**Lday Quartile 3**	-0.113	0.190	0.552
		Lden Quartile 4	-0.274	0.168	0.102		**Lday Quartile 4**	-0.144	0.211	0.495
F1 Processing Speed	**PM2.5 and Lden**	**PM2.5**	0.020	0.020	0.325	**PM2.5 and Lday**	**PM2.5**	0.013	0.020	0.503
		Lden Quartile 2	0.027	0.031	0.384		**Lday Quartile 2**	0.041	0.036	0.253
		Lden Quartile 3	0.026	0.031	0.397		**Lday Quartile 3**	-0.024	0.038	0.540
		Lden Quartile 4	-0.045	0.031	0.144		**Lday Quartile 4**	0.020	0.043	0.646
F1 Speech-in-noise Threshold	**PM2.5 and Lden**	**PM2.5**	-0.145	0.155	0.351	**PM2.5 and Lday**	**PM2.5**	-0.116	0.151	0.445
		Lden Quartile 2	0.277	0.243	0.253		**Lday Quartile 2**	*0.521*	*0.287*	*0.070*
		Lden Quartile 3	**0.489**	**0.245**	**0.046**		**Lday Quartile 3**	0.339	0.307	0.270
		Lden Quartile 4	0.207	0.256	0.420		**Lday Quartile 4**	0.234	0.334	0.485

b) PM_{10} multi-exposures

Outcome	Multi-exposure	Exposure term	β	SE	*p*
BL SDQ	**PM10 and Ozone**	**PM10**	0.300	0.257	0.244
		Ozone	0.037	0.351	0.916
BL Internalising	**PM10 and Ozone**	**PM10**	*0.285*	*0.146*	*0.053*
		Ozone	0.251	0.196	0.206
BL Externalising	**PM10 and Ozone**	**PM10**	0.078	0.156	0.616
		Ozone	-0.106	0.211	0.616
BL Executive Function	**PM10 and Ozone**	**PM10**	**-0.064**	**0.030**	**0.031**
		Ozone	**-0.094**	**0.040**	**0.021**
BL Culture Fair Intelligence Test	**PM10 and Ozone**	**PM10**	0.062	0.175	0.725
		Ozone	0.039	0.252	0.876
BL Processing Speed	**PM10 and Ozone**	**PM10**	-0.018	0.030	0.547
		Ozone	-0.026	0.041	0.531
BL Speech-in-noise Threshold	**PM10 and Ozone**	**PM10**	0.165	0.153	0.281
		Ozone	0.168	0.212	0.431
F1 SDQ	**PM10 and Ozone**	**PM10**	*0.670*	*0.340*	*0.052*
		Ozone	0.523	0.361	0.154
F1 Internalising	**PM10 and Ozone**	**PM10**	0.188	0.214	0.382
		Ozone	0.206	0.229	0.372
F1 Externalising	**PM10 and Ozone**	**PM10**	*0.406*	*0.207*	*0.053*
		Ozone	*0.399*	*0.221*	*0.075*
F1 PHQ-9 Depression	**PM10 and Ozone**	**PM10**	-0.021	0.138	0.879
		Ozone	-0.065	0.154	0.674
F1 GAD-7 Anxiety	**PM10 and Ozone**	**PM10**	0.125	0.129	0.332
		Ozone	0.064	0.144	0.654
F1 Executive Function	**PM10 and Ozone**	**PM10**	**-0.084**	**0.032**	**0.011**
		Ozone	**-0.140**	**0.034**	**0.000**
F1 Culture Fair Intelligence Test	**PM10 and Ozone**	**PM10**	0.073	0.195	0.708
		Ozone	-0.022	0.206	0.914
F1 Processing Speed	**PM10 and Ozone**	**PM10**	0.033	0.042	0.432
		Ozone	0.033	0.045	0.465
F1 Speech-in-noise Threshold	**PM10 and Ozone**	**PM10**	0.186	0.316	0.559
		Ozone	0.328	0.331	0.328

Outcome	Multi-exposure	Exposure term	β	SE	*p*	Multi-exposure	Exposure Term	β	SE	*p*
BL SDQ	**PM10 and Lden**	**PM10**	*0.257*	*0.145*	*0.077*	**PM10 and Lday**	**PM10**	**0.477**	**0.170**	**0.005**
		Lden Quartile 2	0.178	0.281	0.527		**Lday Quartile 2**	0.365	0.317	0.249
		Lden Quartile 3	0.278	0.286	0.330		**Lday Quartile 3**	0.353	0.341	0.302
		Lden Quartile 4	0.434	0.309	0.161		**Lday Quartile 4**	0.016	0.379	0.966
BL Internalising	**PM10 and Lden**	**PM10**	0.100	0.084	0.235	**PM10 and Lday**	**PM10**	*0.153*	*0.084*	*0.067*
		Lden Quartile 2	0.058	0.164	0.722		**Lday Quartile 2**	0.099	0.185	0.591
		Lden Quartile 3	-0.006	0.167	0.970		**Lday Quartile 3**	0.050	0.200	0.803
		Lden Quartile 4	0.248	0.181	0.170		**Lday Quartile 4**	0.053	0.229	0.816
BL Externalising	**PM10 and Lden**	**PM10**	*0.158*	*0.088*	*0.071*	**PM10 and Lday**	**PM10**	**0.222**	**0.086**	**0.011**
		Lden Quartile 2	0.119	0.172	0.491		**Lday Quartile 2**	0.266	0.193	0.169
		Lden Quartile 3	0.282	0.175	0.108		**Lday Quartile 3**	0.272	0.208	0.191
		Lden Quartile 4	0.186	0.190	0.327		**Lday Quartile 4**	-0.136	0.238	0.567
BL Executive Function	**PM10 and Lden**	**PM10**	-0.005	0.017	0.765	**PM10 and Lday**	**PM10**	-0.017	0.017	0.317
		Lden Quartile 2	-0.018	0.032	0.576		**Lday Quartile 2**	-0.025	0.036	0.487
		Lden Quartile 3	-0.019	0.032	0.557		**Lday Quartile 3**	-0.024	0.039	0.542
		Lden Quartile 4	-0.015	0.035	0.664		**Lday Quartile 4**	0.050	0.045	0.262
BL Culture Fair Intelligence Test	**PM10 and Lden**	**PM10**	-0.008	0.094	0.935	**PM10 and Lday**	**PM10**	-0.016	0.093	0.863
		Lden Quartile 2	0.105	0.172	0.543		**Lday Quartile 2**	0.050	0.198	0.801
		Lden Quartile 3	0.190	0.176	0.281		**Lday Quartile 3**	-0.338	0.218	0.120
		Lden Quartile 4	0.196	0.191	0.303		**Lday Quartile 4**	0.248	0.251	0.323
BL Processing Speed	**PM10 and Lden**	**PM10**	-0.006	0.017	0.737	**PM10 and Lday**	**PM10**	-0.003	0.017	0.871
		Lden Quartile 2	0.045	0.032	0.164		**Lday Quartile 2**	0.006	0.036	0.873
		Lden Quartile 3	0.047	0.032	0.151		**Lday Quartile 3**	-0.013	0.039	0.746
		Lden Quartile 4	0.035	0.034	0.311		**Lday Quartile 4**	0.006	0.046	0.905
BL Speech-in-noise Threshold	**PM10 and Lden**	**PM10**	0.044	0.086	0.607	**PM10 and Lday**	**PM10**	0.097	0.083	0.245
		Lden Quartile 2	-0.031	0.170	0.855		**Lday Quartile 2**	0.292	0.193	0.130
		Lden Quartile 3	-0.046	0.172	0.790		**Lday Quartile 3**	-0.294	0.204	0.149
		Lden Quartile 4	0.044	0.187	0.813		**Lday Quartile 4**	-0.068	0.230	0.769
F1 SDQ	**PM10 and Lden**	**PM10**	0.278	0.171	0.106	**PM10 and Lday**	**PM10**	*0.332*	*0.170*	*0.052*
		Lden Quartile 2	0.130	0.281	0.644		**Lday Quartile 2**	0.096	0.318	0.763
		Lden Quartile 3	0.011	0.287	0.968		**Lday Quartile 3**	-0.124	0.343	0.717
		Lden Quartile 4	0.176	0.303	0.562		**Lday Quartile 4**	-0.085	0.388	0.827
F1 Internalising	**PM10 and Lden**	**PM10**	0.021	0.103	0.837	**PM10 and Lday**	**PM10**	0.054	0.103	0.604
		Lden Quartile 2	-0.020	0.167	0.904		**Lday Quartile 2**	0.079	0.189	0.675
		Lden Quartile 3	-0.082	0.170	0.630		**Lday Quartile 3**	-0.085	0.205	0.679
		Lden Quartile 4	0.068	0.180	0.708		**Lday Quartile 4**	-0.020	0.232	0.933
		PM10	0.094	0.101	0.351		**PM10**	0.102	0.100	0.312

F1 Externalising	**PM10 and Lden**	**Lden Quartile 2**	0.126	0.166	0.446	**PM10 and Lday**	**Lday Quartile 2**	0.100	0.189	0.597
		Lden Quartile 3	0.047	0.168	0.781		**Lday Quartile 3**	-0.006	0.203	0.978
		Lden Quartile 4	0.067	0.176	0.704		**Lday Quartile 4**	0.025	0.229	0.914
PHQ9	**PM10 and Lden**	**PM10**	0.018	0.066	0.789	**PM10 and Lday**	**PM10**	0.038	0.064	0.556
		Lden Quartile 2	-0.051	0.121	0.674		**Lday Quartile 2**	0.015	0.134	0.912
		Lden Quartile 3	-0.087	0.120	0.468		**Lday Quartile 3**	0.061	0.141	0.667
		Lden Quartile 4	0.031	0.128	0.810		**Lday Quartile 4**	-0.042	0.158	0.790
GAD7	**PM10 and Lden**	**PM10**	0.044	0.065	0.503	**PM10 and Lday**	**PM10**	0.074	0.063	0.238
		Lden Quartile 2	0.194	0.125	0.123		**Lday Quartile 2**	0.170	0.136	0.213
		Lden Quartile 3	0.084	0.127	0.508		**Lday Quartile 3**	*0.264*	*0.137*	*0.053*
		Lden Quartile 4	*0.241*	*0.133*	*0.070*		**Lday Quartile 4**	0.029	0.157	0.856
F1 Executive Function	**PM10 and Lden**	**PM10**	**0.041**	**0.017**	**0.014**	**PM10 and Lday**	**PM10**	*0.031*	*0.017*	*0.060*
		Lden Quartile 2	0.007	0.027	0.794		**Lday Quartile 2**	-0.007	0.031	0.825
		Lden Quartile 3	-0.009	0.027	0.735		**Lday Quartile 3**	-0.027	0.033	0.409
		Lden Quartile 4	-0.043	0.028	0.128		**Lday Quartile 4**	-0.010	0.038	0.787
F1 Culture Fair Intelligence Test	**PM10 and Lden**	**PM10**	0.137	0.094	0.144	**PM10 and Lday**	**PM10**	0.106	0.093	0.252
		Lden Quartile 2	-0.205	0.160	0.200		**Lday Quartile 2**	-0.217	0.178	0.224
		Lden Quartile 3	**-0.320**	**0.162**	**0.049**		**Lday Quartile 3**	-0.130	0.191	0.497
		Lden Quartile 4	*-0.305*	*0.171*	*0.075*		**Lday Quartile 4**	-0.175	0.214	0.414
F1 Processing Speed	**PM10 and Lden**	**PM10**	0.019	0.019	0.312	**PM10 and Lday**	**PM10**	0.009	0.019	0.614
		Lden Quartile 2	0.027	0.031	0.382		**Lday Quartile 2**	0.041	0.036	0.256
		Lden Quartile 3	0.026	0.031	0.397		**Lday Quartile 3**	-0.023	0.039	0.548
		Lden Quartile 4	-0.047	0.031	0.133		**Lday Quartile 4**	0.020	0.044	0.652
F1 Speech-in-noise Threshold	**PM10 and Lden**	**PM10**	-0.107	0.144	0.460	**PM10 and Lday**	**PM10**	-0.083	0.139	0.552
		Lden Quartile 2	0.275	0.243	0.257		**Lday Quartile 2**	*0.520*	*0.287*	*0.071*
		Lden Quartile 3	**0.483**	**0.245**	**0.049**		**Lday Quartile 3**	0.337	0.309	0.275
		Lden Quartile 4	0.203	0.261	0.436		**Lday Quartile 4**	0.226	0.337	0.504

c) NO_2 multi-exposures

Outcome	Multi-exposure	Exposure term	β	SE	*p*
BL SDQ	**NO2 and Ozone**	**NO2**	-0.370	0.662	0.576
		Ozone	-0.762	0.76	0.317
BL Internalising	**NO2 and Ozone**	**NO2**	0.247	0.384	0.520
		Ozone	0.159	0.438	0.716
BL Externalising	**NO2 and Ozone**	**NO2**	-0.495	0.399	0.215
		Ozone	-0.749	0.455	0.101
BL Executive Function	**NO2 and Ozone**	**NO2**	*-0.147*	*0.077*	*0.056*
		Ozone	**-0.182**	**0.088**	**0.04**
BL Culture Fair Intelligence Test	**NO2 and Ozone**	**NO2**	0.145	0.426	0.733
		Ozone	0.128	0.505	0.799
BL Processing Speed	**NO2 and Ozone**	**NO2**	-0.102	0.075	0.175
		Ozone	-0.118	0.086	0.172
BL Speech-in-noise Threshold	**NO2 and Ozone**	**NO2**	-0.118	0.418	0.778
		Ozone	-0.162	0.477	0.734
F1 SDQ	**NO2 and Ozone**	**NO2**	0.277	0.528	0.600
		Ozone	0.164	0.613	0.789
F1 Internalising	**NO2 and Ozone**	**NO2**	0.021	0.318	0.948
		Ozone	0.043	0.371	0.909
F1 Externalising	**NO2 and Ozone**	**NO2**	0.419	0.31	0.177
		Ozone	0.469	0.357	0.191
F1 PHQ-9 Depression	**NO2 and Ozone**	**NO2**	*-0.377*	*0.219*	*0.085*
		Ozone	*-0.465*	*0.254*	*0.067*
F1 GAD-7 Anxiety	**NO2 and Ozone**	**NO2**	-0.316	0.218	0.147
		Ozone	-0.405	0.247	0.102
F1 Executive Function	**NO2 and Ozone**	**NO2**	**-0.117**	**0.050**	**0.020**
		Ozone	**-0.188**	**0.057**	**0.001**
F1 Culture Fair Intelligence Test	**NO2 and Ozone**	**NO2**	0.202	0.295	0.494
		Ozone	0.130	0.335	0.699
F1 Processing Speed	**NO2 and Ozone**	**NO2**	-0.058	0.063	0.352
		Ozone	-0.062	0.071	0.379
F1 Speech-in-noise Threshold	**NO2 and Ozone**	**NO2**	0.572	0.472	0.226
		Ozone	0.78	0.535	0.147

Outcome	Multi-exposure	Exposure term	β	SE	*p*	Multi-exposure	Exposure Term	β	SE	*p*
BL SDQ	**NO2 and Lden**	**NO2**	0.227	0.172	0.188	**NO2 and Lday**	**NO2**	**0.322**	**0.161**	**0.046**
		Lden Quartile 2	0.179	0.281	0.524		**Lday Quartile 2**	0.378	0.318	0.235
		Lden Quartile 3	0.297	0.285	0.298		**Lday Quartile 3**	0.385	0.344	0.264
		Lden Quartile 4	*0.505*	*0.305*	*0.098*		**Lday Quartile 4**	0.075	0.386	0.847
BL Internalising	**NO2 and Lden**	**NO2**	0.067	0.100	0.504	**NO2 and Lday**	**NO2**	0.133	0.1	0.187
		Lden Quartile 2	0.061	0.164	0.713		**Lday Quartile 2**	0.108	0.186	0.561
		Lden Quartile 3	0.005	0.167	0.978		**Lday Quartile 3**	0.071	0.201	0.723
		Lden Quartile 4	0.290	0.178	0.103		**Lday Quartile 4**	0.117	0.228	0.609
BL Externalising	**NO2 and Lden**	**NO2**	0.147	0.104	0.158	**NO2 and Lday**	**NO2**	**0.213**	**0.103**	**0.040**
		Lden Quartile 2	0.119	0.172	0.490		**Lday Quartile 2**	0.273	0.194	0.160
		Lden Quartile 3	*0.292*	*0.175*	*0.095*		**Lday Quartile 3**	0.297	0.21	0.157
		Lden Quartile 4	0.225	0.187	0.229		**Lday Quartile 4**	-0.077	0.237	0.746
BL Executive Function	**NO2 and Lden**	**NO2**	0.007	0.020	0.71	**NO2 and Lday**	**NO2**	-0.005	0.02	0.806
		Lden Quartile 2	-0.018	0.032	0.569		**Lday Quartile 2**	-0.026	0.036	0.467
		Lden Quartile 3	-0.021	0.032	0.517		**Lday Quartile 3**	-0.029	0.039	0.46
		Lden Quartile 4	-0.024	0.034	0.491		**Lday Quartile 4**	0.037	0.045	0.409
BL Culture Fair Intelligence Test	**NO2 and Lden**	**NO2**	-0.014	0.112	0.904	**NO2 and Lday**	**NO2**	-0.019	0.112	0.863
		Lden Quartile 2	0.105	0.172	0.543		**Lday Quartile 2**	0.05	0.198	0.802
		Lden Quartile 3	0.190	0.176	0.279		**Lday Quartile 3**	-0.338	0.218	0.120
		Lden Quartile 4	0.199	0.189	0.292		**Lday Quartile 4**	0.247	0.249	0.321
BL Processing Speed	**NO2 and Lden**	**NO2**	-0.008	0.02	0.698	**NO2 and Lday**	**NO2**	-0.004	0.02	0.856
		Lden Quartile 2	0.045	0.032	0.162		**Lday Quartile 2**	0.006	0.036	0.872
		Lden Quartile 3	0.047	0.032	0.149		**Lday Quartile 3**	-0.013	0.039	0.750
		Lden Quartile 4	0.035	0.034	0.300		**Lday Quartile 4**	0.006	0.045	0.902
BL Speech-in-noise Threshold	**NO2 and Lden**	**NO2**	-0.006	0.103	0.952	**NO2 and Lday**	**NO2**	0.055	0.101	0.587
		Lden Quartile 2	-0.028	0.170	0.868		**Lday Quartile 2**	0.293	0.193	0.129
		Lden Quartile 3	-0.036	0.172	0.836		**Lday Quartile 3**	-0.273	0.204	0.182
		Lden Quartile 4	0.085	0.184	0.642		**Lday Quartile 4**	-0.012	0.229	0.957
F1 SDQ	**NO2 and Lden**	**NO2**	0.159	0.162	0.329	**NO2 and Lday**	**NO2**	0.226	0.162	0.164
		Lden Quartile 2	0.131	0.281	0.641		**Lday Quartile 2**	0.108	0.319	0.736
		Lden Quartile 3	0.033	0.287	0.909		**Lday Quartile 3**	-0.107	0.347	0.759
		Lden Quartile 4	0.228	0.308	0.459		**Lday Quartile 4**	-0.04	0.398	0.920
F1 Internalising	**NO2 and Lden**	**NO2**	-0.025	0.096	0.798	**NO2 and Lday**	**NO2**	0.017	0.097	0.863
		Lden Quartile 2	-0.019	0.167	0.910		**Lday Quartile 2**	0.082	0.189	0.663
		Lden Quartile 3	-0.074	0.170	0.666		**Lday Quartile 3**	-0.073	0.206	0.722
		Lden Quartile 4	0.097	0.183	0.596		**Lday Quartile 4**	0.005	0.236	0.982
F1 Externalising	**NO2 and Lden**	**NO2**	0.040	0.095	0.678	**NO2 and Lday**	**NO2**	0.051	0.095	0.59
		Lden Quartile 2	0.127	0.166	0.444		**Lday Quartile 2**	0.105	0.189	0.579
		Lden Quartile 3	0.055	0.168	0.741		**Lday Quartile 3**	0.008	0.205	0.968

		Lden Quartile 4	0.094	0.179	0.600		**Lday Quartile 4**	0.052	0.232	0.823
PHQ9	**NO2 and Lden**	**NO2**	-0.010	0.065	0.861	**NO2 and Lday**	**NO2**	0.012	0.064	0.853
		Lden Quartile 2	-0.050	0.121	0.678		**Lday Quartile 2**	0.017	0.134	0.897
		Lden Quartile 3	-0.082	0.120	0.497		**Lday Quartile 3**	0.068	0.142	0.632
		Lden Quartile 4	0.050	0.129	0.698		**Lday Quartile 4**	-0.024	0.160	0.883
GAD7	**NO2 and Lden**	**NO2**	-0.017	0.065	0.796	**NO2 and Lday**	**NO2**	0.021	0.063	0.744
		Lden Quartile 2	0.194	0.125	0.122		**Lday Quartile 2**	0.176	0.137	0.198
		Lden Quartile 3	0.096	0.127	0.447		**Lday Quartile 3**	*0.284*	*0.138*	*0.039*
		Lden Quartile 4	**0.282**	**0.134**	**0.035**		**Lday Quartile 4**	0.067	0.159	0.675
F1 Executive Function	**NO2 and Lden**	**NO2**	**0.053**	**0.015**	**0.001**	**NO2 and Lday**	**NO2**	**0.043**	**0.015**	**0.006**
		Lden Quartile 2	0.006	0.027	0.819		**Lday Quartile 2**	-0.009	0.03	0.772
		Lden Quartile 3	-0.012	0.027	0.669		**Lday Quartile 3**	-0.035	0.033	0.282
		Lden Quartile 4	*-0.056*	*0.029*	*0.051*		**Lday Quartile 4**	-0.025	0.038	0.505
F1 Culture Fair Intelligence Test	**NO2 and Lden**	**NO2**	0.142	0.089	0.110	**NO2 and Lday**	**NO2**	0.11	0.088	0.209
		Lden Quartile 2	-0.207	0.16	0.196		**Lday Quartile 2**	-0.218	0.178	0.221
		Lden Quartile 3	**-0.322**	**0.162**	**0.047**		**Lday Quartile 3**	-0.142	0.191	0.460
		Lden Quartile 4	*-0.323*	*0.173*	*0.062*		**Lday Quartile 4**	-0.195	0.216	0.367
F1 Processing Speed	**NO2 and Lden**	**NO2**	0.008	0.018	0.661	**NO2 and Lday**	**NO2**	-0.002	0.018	0.896
		Lden Quartile 2	0.027	0.031	0.377		**Lday Quartile 2**	0.042	0.036	0.249
		Lden Quartile 3	0.028	0.031	0.362		**Lday Quartile 3**	-0.018	0.039	0.644
		Lden Quartile 4	-0.042	0.032	0.187		**Lday Quartile 4**	0.028	0.045	0.531
F1 Speech-in-noise Threshold	**NO2 and Lden**	**NO2**	-0.103	0.135	0.448	**NO2 and Lday**	**NO2**	-0.08	0.131	0.545
		Lden Quartile 2	0.279	0.243	0.251		**Lday Quartile 2**	*0.518*	*0.287*	*0.071*
		Lden Quartile 3	**0.483**	**0.244**	**0.049**		**Lday Quartile 3**	0.344	0.31	0.267
		Lden Quartile 4	0.214	0.265	0.42		**Lday Quartile 4**	0.233	0.34	0.495

d) Ozone and noise multi-exposures

Outcome	Multi-exposure	Exposure	Estimate	SE	p	Multi-exposure	Exposure	Estimate	SE	p
BL SDQ	**Ozone and Lden**	**Ozone**	-0.306	0.195	0.119	**Ozone and Lday**	**Ozone**	**-0.436**	**0.196**	**0.027**
		Lden Quartile 2	0.176	0.281	0.531		**Lday Quartile 2**	0.376	0.319	0.238
		Lden Quartile 3	0.289	0.286	0.312		**Lday Quartile 3**	0.376	0.346	0.277
		Lden Quartile 4	*0.496*	*0.301*	*0.099*		**Lday Quartile 4**	0.056	0.388	0.885
BL Internalising	**Ozone and Lden**	**Ozone**	-0.072	0.112	0.523	**Ozone and Lday**	**Ozone**	-0.142	0.113	0.214
		Lden Quartile 2	0.061	0.164	0.712		**Lday Quartile 2**	0.108	0.186	0.561
		Lden Quartile 3	0.005	0.167	0.977		**Lday Quartile 3**	0.077	0.201	0.703
		Lden Quartile 4	*0.297*	*0.176*	*0.091*		**Lday Quartile 4**	0.137	0.225	0.542
BL Externalising	**Ozone and Lden**	**Ozone**	*-0.204*	*0.116*	*0.080*	**Ozone and Lday**	**Ozone**	**-0.270**	**0.117**	**0.022**
		Lden Quartile 2	0.117	0.172	0.498		**Lday Quartile 2**	0.268	0.194	0.167
		Lden Quartile 3	0.285	0.175	0.104		**Lday Quartile 3**	0.292	0.210	0.164
		Lden Quartile 4	0.215	0.184	0.244		**Lday Quartile 4**	-0.075	0.235	0.748
BL Executive Function	**Ozone and Lden**	**Ozone**	-0.020	0.022	0.380	**Ozone and Lday**	**Ozone**	-0.008	0.022	0.715
		Lden Quartile 2	-0.018	0.032	0.564		**Lday Quartile 2**	-0.027	0.036	0.448
		Lden Quartile 3	-0.022	0.032	0.486		**Lday Quartile 3**	-0.033	0.039	0.393
		Lden Quartile 4	-0.029	0.034	0.399		**Lday Quartile 4**	0.028	0.044	0.528
BL Culture Fair Intelligence Test	**Ozone and Lden**	**Ozone**	0.022	0.131	0.864	**Ozone and Lday**	**Ozone**	0.021	0.130	0.871
		Lden Quartile 2	0.105	0.172	0.542		**Lday Quartile 2**	0.050	0.198	0.802
		Lden Quartile 3	0.191	0.176	0.277		**Lday Quartile 3**	-0.339	0.218	0.120
		Lden Quartile 4	0.201	0.186	0.280		**Lday Quartile 4**	0.245	0.245	0.318
BL Processing Speed	**Ozone and Lden**	**Ozone**	0.001	0.022	0.976	**Ozone and Lday**	**Ozone**	-0.004	0.022	0.854
		Lden Quartile 2	0.044	0.032	0.168		**Lday Quartile 2**	0.005	0.036	0.890
		Lden Quartile 3	0.045	0.032	0.161		**Lday Quartile 3**	-0.016	0.039	0.691
		Lden Quartile 4	0.030	0.033	0.362		**Lday Quartile 4**	0.000	0.045	0.997
BL Speech-in-noise Threshold	**Ozone and Lden**	**Ozone**	-0.006	0.115	0.958	**Ozone and Lday**	**Ozone**	-0.070	0.113	0.536
		Lden Quartile 2	-0.029	0.170	0.865		**Lday Quartile 2**	0.292	0.193	0.131
		Lden Quartile 3	-0.038	0.172	0.827		**Lday Quartile 3**	-0.276	0.204	0.178
		Lden Quartile 4	0.078	0.181	0.665		**Lday Quartile 4**	-0.013	0.226	0.954

F1 SDQ	**Ozone and Lden**	**Ozone**	-0.171	0.185	0.355	**Ozone and Lday**	**Ozone**	-0.243	0.187	0.194
		Lden Quartile 2	0.132	0.281	0.640		**Lday Quartile 2**	0.111	0.319	0.728
		Lden Quartile 3	0.033	0.287	0.910		**Lday Quartile 3**	-0.098	0.347	0.778
		Lden Quartile 4	0.249	0.302	0.411		**Lday Quartile 4**	-0.001	0.392	0.997
F1 Internalising	**Ozone and Lden**	**Ozone**	0.024	0.110	0.824	**Ozone and Lday**	**Ozone**	-0.018	0.111	0.872
		Lden Quartile 2	-0.019	0.167	0.909		**Lday Quartile 2**	0.083	0.189	0.662
		Lden Quartile 3	-0.074	0.170	0.665		**Lday Quartile 3**	-0.073	0.206	0.723
		Lden Quartile 4	0.093	0.180	0.606		**Lday Quartile 4**	0.009	0.233	0.970
F1 Externalising	**Ozone and Lden**	**Ozone**	-0.001	0.108	0.990	**Ozone and Lday**	**Ozone**	-0.013	0.108	0.902
		Lden Quartile 2	0.129	0.166	0.437		**Lday Quartile 2**	0.108	0.189	0.568
		Lden Quartile 3	0.062	0.168	0.709		**Lday Quartile 3**	0.025	0.204	0.902
		Lden Quartile 4	0.120	0.176	0.496		**Lday Quartile 4**	0.088	0.229	0.700
PHQ9	**Ozone and Lden**	**Ozone**	-0.031	0.073	0.672	**Ozone and Lday**	**Ozone**	-0.050	0.072	0.492
		Lden Quartile 2	-0.051	0.121	0.672		**Lday Quartile 2**	0.014	0.134	0.920
		Lden Quartile 3	-0.089	0.120	0.458		**Lday Quartile 3**	0.054	0.142	0.704
		Lden Quartile 4	0.025	0.128	0.845		**Lday Quartile 4**	-0.046	0.158	0.768
GAD7	**Ozone and Lden**	**Ozone**	-0.023	0.072	0.754	**Ozone and Lday**	**Ozone**	-0.050	0.071	0.476
		Lden Quartile 2	0.194	0.125	1.540		**Lday Quartile 2**	0.173	0.136	0.205
		Lden Quartile 3	0.089	0.126	0.481		**Lday Quartile 3**	**0.273**	**0.137**	**0.047**
		Lden Quartile 4	*0.258*	*0.132*	*0.051*		**Lday Quartile 4**	0.052	0.157	0.739
F1 Executive Function	**Ozone and Lden**	**Ozone**	-0.072	0.017	<0.001	**Ozone and Lday**	**Ozone**	-0.065	0.017	<0.001
		Lden Quartile 2	0.006	0.027	0.832		**Lday Quartile 2**	-0.012	0.030	0.702
		Lden Quartile 3	-0.014	0.027	0.593		**Lday Quartile 3**	-0.042	0.032	0.195
		Lden Quartile 4	**-0.057**	**0.028**	**0.044**		**Lday Quartile 4**	-0.032	0.036	0.387
F1 Culture Fair Intelligence Test	**Ozone and Lden**	**Ozone**	-0.136	0.098	0.169	**Ozone and Lday**	**Ozone**	-0.106	0.098	0.281
		Lden Quartile 2	-0.206	0.160	0.198		**Lday Quartile 2**	-0.216	0.178	0.225
		Lden Quartile 3	**-0.319**	**0.162**	**0.049**		**Lday Quartile 3**	-0.134	0.192	0.484
		Lden Quartile 4	*-0.296*	*0.170*	*0.082*		**Lday Quartile 4**	-0.171	0.213	0.424
F1 Processing Speed	**Ozone and Lden**	**Ozone**	-0.011	0.020	0.579	**Ozone and Lday**	**Ozone**	-0.003	0.020	0.878
		Lden Quartile 2	0.027	0.031	0.378		**Lday Quartile 2**	0.042	0.036	0.252
		Lden Quartile 3	0.028	0.031	0.372		**Lday Quartile 3**	-0.020	0.039	0.599

		Lden Quartile 4	-0.042	0.031	0.175		**Lday Quartile 4**	0.024	0.044	0.581
F1 Speech-in-noise Threshold	**Ozone and Lden**	**Ozone**	0.175	0.150	0.247	**Ozone and Lday**	**Ozone**	0.144	0.147	0.329
		Lden Quartile 2	0.283	0.243	0.243		**Lday Quartile 2**	*0.520*	*0.287*	*0.071*
		Lden Quartile 3	**0.498**	**0.245**	**0.042**		**Lday Quartile 3**	0.364	0.311	0.242
		Lden Quartile 4	0.235	0.259	0.364		**Lday Quartile 4**	0.267	0.339	0.432

Table SI 7. Effects of exposure to traffic noise and psychological outcomes, restricted to adolescents residing within the M25 .

	Model	Quartile	Lden			Lday			Leve			Lnight		
Baseline outcomes			**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***
SDQ emotional and behavioural problems [a]	Unadjusted N=3057	2nd	0.395	0.286	0.168	0.309	0.294	0.294	0.377	0.287	0.189	*0.484*	*0.286*	*0.091*
		3rd	*0.497*	*0.283*	*0.079*	0.359	0.293	0.220	0.416	0.282	0.140	*0.543*	*0.282*	*0.054*
		4th	**0.835**	**0.285**	**0.003**	*-0.539*	*0.278*	*0.053*	**0.753**	**0.285**	**0.008**	**0.876**	**0.285**	**0.002**
	Adjusted [c] N=3027	2nd	0.264	0.284	0.353	0.289	0.322	0.369	0.253	0.284	0.374	0.350	0.284	0.218
		3rd	0.360	0.283	0.204	0.446	0.348	0.200	0.277	0.283	0.328	0.400	0.283	0.158
		4th	**0.691**	**0.287**	**0.016**	0.322	0.365	0.378	**0.610**	**0.287**	**0.034**	**0.716**	**0.287**	**0.013**
SDQ internalising problems [a]	Unadjusted N=3057	2nd	0.172	0.167	0.303	0.090	0.172	0.601	0.203	0.167	0.226	0.213	0.167	0.202
		3rd	0.140	0.165	0.396	0.271	0.171	0.113	0.110	0.165	0.506	0.180	0.165	0.274
		4th	**0.416**	**0.166**	**0.013**	-0.190	0.163	0.242	**0.393**	**0.167**	**0.018**	**0.435**	**0.166**	**0.009**
	Adjusted [c] N=3027	2nd	0.105	0.166	0.526	0.071	0.187	0.704	0.135	0.166	0.417	0.147	0.166	0.376
		3rd	0.030	0.166	0.855	0.199	0.202	0.324	-0.002	0.165	0.989	0.069	0.166	0.677
		4th	**0.355**	**0.168**	**0.035**	0.167	0.211	0.428	**0.331**	**0.168**	**0.049**	**0.365**	**0.168**	**0.030**
SDQ externalising problems [a]	Unadjusted N=3057	2nd	0.223	0.177	0.208	0.219	0.182	0.229	0.174	0.177	0.326	0.271	0.177	0.125
		3rd	**0.357**	**0.175**	**0.041**	0.088	0.181	0.626	*0.307*	*0.174*	*0.079*	**0.363**	**0.175**	**0.038**
		4th	**0.419**	**0.176**	**0.017**	**-0.348**	**0.172**	**0.043**	**0.360**	**0.176**	**0.041**	**0.441**	**0.176**	**0.012**
	Adjusted [c] N=3027	2nd	0.157	0.174	0.367	0.218	0.197	0.267	0.118	0.174	0.500	0.202	0.174	0.246
		3rd	*0.328*	*0.174*	*0.059*	0.248	0.212	0.243	0.278	0.173	0.109	*0.329*	*0.174*	*0.058*
		4th	*0.338*	*0.176*	*0.055*	0.135	0.222	0.545	0.281	0.176	0.111	**0.352**	**0.176**	**0.045**
Executive functioning [b]	Unadjusted N=3158	2nd	-0.028	0.034	0.402	0.020	0.034	0.559	-0.020	0.034	0.552	-0.033	0.034	0.331
		3rd	**-0.070**	**0.033**	**0.036**	0.039	0.034	0.252	-0.058	0.033	0.080	**-0.068**	**0.033**	**0.040**
		4th	*-0.062*	*0.034*	*0.067*	**0.218**	**0.033**	**<0.001**	-0.057	0.034	0.092	**-0.068**	**0.034**	**0.044**
	Adjusted [c] N=3128	2nd	-0.015	0.032	0.640	-0.021	0.036	0.567	-0.008	0.032	0.813	-0.018	0.032	0.575
		3rd	-0.019	0.032	0.547	-0.025	0.039	0.522	-0.011	0.032	0.733	-0.013	0.032	0.682
		4th	-0.017	0.032	0.611	0.029	0.042	0.488	-0.012	0.033	0.717	-0.022	0.032	0.502
Fluid intelligence [b]	Unadjusted N=3188	2nd	0.014	0.182	0.938	0.060	0.185	0.744	0.080	0.182	0.661	-0.014	0.181	0.937
		3rd	-0.075	0.179	0.675	-0.012	0.185	0.949	-0.078	0.179	0.663	-0.074	0.179	0.680

		4th	0.016	0.181	0.931	**0.789**	**0.176**	**<0.001**	0.054	0.182	0.768	0.017	0.181	0.927
	Adjusted [c] N=3157	2nd	0.099	0.174	0.569	0.100	0.200	0.617	0.147	0.174	0.400	0.082	0.174	0.635
		3rd	0.193	0.174	0.267	-0.246	0.220	0.264	0.172	0.174	0.323	0.210	0.174	0.227
		4th	0.179	0.177	0.312	0.199	0.232	0.393	0.203	0.177	0.252	0.188	0.176	0.286
Processing speed [a]	Unadjusted N=1522	2nd	0.034	0.033	0.299	-0.029	0.034	0.388	0.038	0.033	0.249	0.020	0.033	0.535
		3rd	**0.072**	**0.032**	**0.025**	-0.006	0.033	0.866	0.059	0.032	0.067	**0.064**	**0.032**	**0.047**
		4th	0.049	0.032	0.123	-0.048	0.032	0.135	0.053	0.032	0.093	0.044	0.032	0.161
	Adjusted [c] N=1512	2nd	0.038	0.032	0.240	-0.005	0.037	0.893	0.040	0.032	0.223	0.027	0.032	0.402
		3rd	0.050	0.032	0.117	-0.005	0.039	0.901	0.034	0.032	0.292	0.043	0.032	0.183
		4th	0.031	0.032	0.320	-0.012	0.042	0.781	0.033	0.032	0.294	0.028	0.032	0.383
Speech-in-noise perception threshold [a]	Unadjusted N=2483	2nd	-0.072	0.174	0.679	0.162	0.181	0.370	0.038	0.033	0.249	0.020	0.033	0.535
		3rd	0.058	0.171	0.735	-0.107	0.178	0.548	0.059	0.032	0.067	**0.064**	**0.032**	**0.047**
		4th	0.192	0.173	0.269	**-0.372**	**0.168**	**0.027**	0.053	0.032	0.093	0.044	0.032	0.161
	Adjusted [c] N=2460	2nd	-0.109	0.171	0.524	0.132	0.197	0.501	0.040	0.032	0.223	0.027	0.032	0.402
		3rd	-0.067	0.170	0.696	-0.144	0.209	0.491	0.034	0.032	0.292	0.043	0.032	0.183
		4th	0.053	0.173	0.758	0.034	0.218	0.875	0.033	0.032	0.294	0.028	0.032	0.383
Follow-up 1 outcomes														
SDQ emotional and behavioural problems [a]	Unadjusted N=2654	2nd	0.078	0.303	0.797	0.054	0.306	0.861	0.130	0.302	0.667	0.138	0.303	0.649
		3rd	0.181	0.300	0.547	-0.161	0.304	0.596	0.137	0.300	0.648	0.257	0.299	0.390
		4th	0.235	0.299	0.433	**-0.662**	**0.303**	**0.029**	0.237	0.299	0.428	0.251	0.299	0.401
	Adjusted [d] N=2629	2nd	-0.031	0.260	0.904	0.064	0.291	0.827	-0.008	0.260	0.975	-0.033	0.260	0.898
		3rd	-0.063	0.260	0.809	-0.166	0.308	0.592	-0.042	0.260	0.871	-0.004	0.260	0.987
		4th	-0.080	0.261	0.759	-0.087	0.344	0.801	-0.101	0.261	0.700	-0.084	0.261	0.748
SDQ internalising problems [a]	Unadjusted N=2654	2nd	-0.044	0.182	0.808	0.081	0.183	0.659	-0.053	0.181	0.769	0.001	0.182	0.997
		3rd	-0.057	0.180	0.753	-0.036	0.182	0.845	-0.097	0.180	0.588	-0.013	0.179	0.941
		4th	-0.004	0.180	0.984	**-0.492**	**0.181**	**0.007**	-0.017	0.180	0.927	0.010	0.179	0.954
	Adjusted [d] N=2629	2nd	-0.105	0.158	0.509	0.064	0.291	0.827	-0.115	0.158	0.467	-0.096	0.158	0.543
		3rd	-0.118	0.158	0.455	-0.166	0.308	0.592	-0.118	0.158	0.457	-0.090	0.158	0.568
		4th	-0.146	0.159	0.356	-0.087	0.344	0.801	-0.159	0.159	0.315	-0.146	0.158	0.357

SDQ externalising problems [a]	Unadjusted N=2654	2nd	0.122	0.192	0.525	-0.027	0.195	0.888	0.183	0.192	0.339	0.137	0.192	0.476
		3rd	0.237	0.190	0.212	-0.126	0.193	0.516	0.234	0.190	0.218	0.270	0.190	0.155
		4th	0.239	0.190	0.209	-0.169	0.192	0.380	0.254	0.190	0.182	0.241	0.190	0.204
	Adjusted [d] N=2629	2nd	0.066	0.167	0.691	0.031	0.188	0.871	0.098	0.167	0.556	0.059	0.167	0.724
		3rd	0.042	0.167	0.802	0.052	0.199	0.795	0.062	0.167	0.712	0.075	0.167	0.653
		4th	0.067	0.168	0.688	0.045	0.222	0.839	0.059	0.168	0.725	0.064	0.167	0.702
PHQ-9 depression symptoms [a]	Unadjusted N=2389	2nd	-0.059	0.118	0.620	0.055	0.121	0.647	-0.005	0.118	0.968	-0.038	0.118	0.751
		3rd	-0.038	0.115	0.740	*0.223*	*0.117*	*0.056*	-0.049	0.115	0.668	-0.017	0.115	0.883
		4th	0.026	0.116	0.821	-0.079	0.116	0.495	0.043	0.116	0.708	0.055	0.116	0.633
	Adjusted [e] N=2361	2nd	-0.103	0.122	0.397	-0.012	0.134	0.929	-0.054	0.121	0.655	-0.085	0.122	0.485
		3rd	-0.099	0.119	0.406	0.123	0.137	0.367	-0.109	0.120	0.360	-0.079	0.119	0.506
		4th	0.004	0.121	0.974	-0.041	0.154	0.791	0.020	0.121	0.866	0.033	0.121	0.786
GAD-7 anxiety symptoms [a]	Unadjusted N=2433	2nd	0.148	0.123	0.228	0.183	0.126	0.145	0.220	0.122	0.072	0.159	0.123	0.195
		3rd	0.107	0.120	0.371	**0.383**	**0.120**	**0.001**	0.088	0.121	0.465	0.115	0.120	0.335
		4th	*0.224*	*0.120*	*0.063*	0.062	0.121	0.608	**0.257**	**0.120**	**0.033**	*0.230*	*0.120*	*0.055*
	Adjusted [e] N=2404	2nd	0.119	0.127	0.348	0.148	0.137	0.279	0.191	0.126	0.131	0.130	0.127	0.305
		3rd	0.069	0.125	0.583	**0.312**	**0.135**	**0.021**	0.054	0.126	0.668	0.075	0.125	0.549
		4th	*0.234*	*0.126*	*0.063*	0.036	0.157	0.819	**0.272**	**0.126**	**0.031**	*0.239*	*0.126*	*0.058*
Executive functioning [b]	Unadjusted N=2814	2nd	0.023	0.032	0.470	0.045	0.032	0.160	0.024	0.032	0.450	0.008	0.032	0.802
		3rd	-0.021	0.031	0.504	0.039	0.031	0.215	-0.020	0.031	0.522	-0.022	0.031	0.490
		4th	-0.046	0.031	0.140	**0.204**	**0.032**	**<0.001**	-0.044	0.031	0.162	-0.051	0.031	0.104
	Adjusted [d] N=2785	2nd	0.031	0.027	0.256	0.004	0.031	0.896	0.028	0.027	0.292	0.022	0.027	0.408
		3rd	0.003	0.027	0.915	-0.011	0.032	0.729	-0.003	0.027	0.907	0.004	0.027	0.878
		4th	-0.015	0.027	0.591	0.015	0.036	0.686	-0.014	0.027	0.600	-0.015	0.027	0.576
Fluid intelligence [b]	Unadjusted N=2982	2nd	-0.211	0.190	0.267	-0.079	0.189	0.675	-0.204	0.190	0.283	-0.210	0.190	0.269
		3rd	**-0.427**	**0.188**	**0.023**	0.002	0.189	0.992	**-0.429**	**0.188**	**0.023**	**-0.405**	**0.188**	**0.031**
		4th	-0.274	0.188	0.146	**1.020**	**0.192**	**<0.001**	-0.263	0.188	0.163	-0.270	0.188	0.151
	Adjusted [d] N=2953	2nd	-0.197	0.162	0.223	-0.243	0.177	0.169	-0.208	0.161	0.198	-0.150	0.162	0.353
		3rd	*-0.266*	*0.161*	*0.099*	-0.103	0.187	0.582	*-0.304*	*0.162*	*0.060*	-0.226	0.161	0.161

		4th	-0.196	0.162	0.227	-0.103	0.208	0.619	-0.195	0.162	0.231	-0.180	0.162	0.267
Processing speed [a]	Unadjusted N=940	2nd	0.029	0.034	0.398	0.026	0.035	0.455	0.033	0.034	0.331	0.019	0.034	0.586
		3rd	0.053	0.034	0.120	*-0.059*	*0.035*	*0.097*	*0.063*	*0.034*	*0.065*	0.028	0.034	0.412
		4th	0.003	0.033	0.935	0.027	0.035	0.432	0.008	0.033	0.804	-0.004	0.033	0.906
	Adjusted [d] N=936	2nd	0.029	0.031	0.359	0.038	0.036	0.285	0.023	0.031	0.457	0.016	0.031	0.613
		3rd	0.036	0.031	0.250	-0.011	0.037	0.778	0.043	0.031	0.171	0.010	0.031	0.743
		4th	-0.028	0.030	0.347	0.030	0.044	0.494	-0.027	0.030	0.366	-0.037	0.030	0.211
Speech-in-noise perception threshold [a]	Unadjusted N=1349	2nd	0.340	0.250	0.174	0.299	0.266	0.261	0.033	0.034	0.331	0.019	0.034	0.586
		3rd	**0.549**	**0.245**	**0.026**	0.126	0.268	0.638	*0.063*	*0.034*	*0.065*	0.028	0.034	0.412
		4th	0.404	0.247	0.103	**-0.671**	**0.251**	**0.008**	0.008	0.033	0.804	-0.004	0.033	0.906
	Adjusted [d] N=1338	2nd	0.341	0.245	0.164	*0.470*	*0.284*	*0.099*	0.023	0.031	0.457	0.016	0.031	0.613
		3rd	*0.459*	*0.243*	*0.059*	0.378	0.300	0.208	0.043	0.031	0.171	0.010	0.031	0.743
		4th	0.178	0.246	0.469	-0.022	0.327	0.946	-0.027	0.030	0.366	-0.037	0.030	0.211

Analyses of baseline outcomes are in relation to year-prior exposure, and analyses of follow-up outcomes are in relation to annual average exposure between baseline and follow-up assessment. Ordinal logistic (PHQ-9 and GAD-7) and linear (all other outcomes) regressions were used. Categorical PHQ-9 cut-offs: no or minimal depression, 0 to 4; mild depression, 5 to 10; moderate depression, 11 to 14; moderately severe and severe depression, 15+. Categorical GAD-7 cut-offs: no or minimal anxiety, 0 to 4; mild anxiety, 5 to 9; moderate anxiety, 10 to 14; and moderately severe and severe anxiety, 15+.

Noise effects are for each quartile of exposure (ref: 1st quartile). **Bold: $p<0.05$**. *Italics:* $p<0.10$

SDQ: Strengths and difficulties questionnaire. GAD-7: General Anxiety Disorder-7 (questionnaire). PHQ-9: Patient Health Questionnaire-9

[a] Higher values reflect worse mental health or cognition

[b] Higher values reflect better mental health or cognition

[c] adjusted for baseline age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[d] adjusted for baseline score, follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[e] adjusted for follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

Table SI 8. Exposure to air pollution and psychological outcomes - hybrid air pollution exposure with indoor sources

		$PM_{2.5}$			PM_{10}			NO_2			O_3		
Baseline outcomes	**Model**	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***P***
SDQ emotional and behavioural problems [a]	Unadjusted N=3057	-0.269	0.107	**0.012**	0.141	0.098	0.150	-0.016	0.117	0.893	-0.051	0.125	0.682
	Adjusted [c] N=3027	-0.083	0.144	0.563	0.209	0.115	*0.069*	0.243	0.149	0.103	-0.180	0.153	0.238
SDQ internalising problems [a]	Unadjusted N=3057	-0.090	0.063	0.149	0.032	0.057	0.581	-0.068	0.068	0.319	-0.018	0.073	0.806
	Adjusted [c] N=3027	-0.020	0.082	0.807	0.084	0.067	0.210	0.052	0.085	0.545	-0.038	0.088	0.668
SDQ externalising problems [a]	Unadjusted N=3057	-0.179	0.066	**0.007**	0.110	0.061	*0.071*	0.052	0.072	0.469	-0.033	0.077	0.666
	Adjusted [c] N=3027	-0.074	0.088	0.399	0.125	0.070	*0.073*	0.176	0.090	*0.050*	-0.135	0.093	0.144
Executive functioning [b]	Unadjusted N=3158	0.048	0.012	**<0.001**	0.034	0.012	**0.004**	0.054	0.014	**<0.001**	-0.011	0.015	0.462
	Adjusted [c] N=3128	0.026	0.017	0.122	0.026	0.013	**0.048**	0.029	0.017	*0.083*	-0.007	0.018	0.673
Fluid intelligence [b]	Unadjusted N=3188	0.002	0.067	0.977	0.071	0.063	0.259	0.101	0.074	0.170	-0.042	0.080	0.598
	Adjusted [c] N=3153	-0.055	0.094	0.560	0.014	0.073	0.846	-0.007	0.095	0.945	-0.072	0.099	0.465
Processing speed [a]	Unadjusted N=1522	-0.006	0.012	0.610	-0.003	0.011	0.783	-0.006	0.013	0.645	0.006	0.015	0.689
	Adjusted [c] N=1512	-0.019	0.016	0.221	-0.013	0.012	0.292	-0.005	0.017	0.767	0.012	0.018	0.491
Speech-in-noise perception threshold [a]	Unadjusted N=2483	-0.194	0.070	**0.005**	0.043	0.060	0.473	-0.035	0.072	0.629	-0.046	0.076	0.542
	Adjusted [c] N=2460	-0.108	0.088	0.221	-0.003	0.068	0.970	-0.011	0.088	0.900	-0.058	0.091	0.522
Follow-up 1 outcomes		**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***P***
SDQ emotional and behavioural problems [a]	Unadjusted N=2954	0.105	0.119	0.379	-0.007	0.104	0.944	-0.135	0.118	0.251	-0.027	0.131	0.834
	Adjusted [d] N=2937	0.177	0.157	0.259	-0.140	0.106	0.186	-0.107	0.123	0.384	0.018	0.136	0.895
SDQ internalising problems [a]	Unadjusted N=2954	-0.008	0.072	0.908	-0.043	0.063	0.490	-0.124	0.070	*0.079*	-0.002	0.078	0.977

	Adjusted [d] N=2937	0.012	0.094	0.902	-0.091	0.063	0.150	-0.100	0.072	0.167	0.063	0.080	0.431
SDQ externalising problems [a]	Unadjusted N=2954	0.113	0.076	0.135	0.036	0.066	0.587	-0.011	0.075	0.883	-0.025	0.083	0.761
	Adjusted [d] N=2937	0.023	0.091	0.798	-0.043	0.068	0.525	-0.009	0.080	0.911	-0.029	0.088	0.739
PHQ-9 depression symptoms [a]	Unadjusted N=2389	0.049	0.046	0.284	0.035	0.040	0.379	0.035	0.046	0.448	-0.054	0.055	0.332
	Adjusted [e] N=2361	0.034	0.061	0.573	0.031	0.047	0.505	0.034	0.054	0.531	0.045	0.065	0.492
GAD-7 anxiety symptoms [a]	Unadjusted N=2433	0.100	0.047	**0.034**	0.093	0.042	**0.026**	0.071	0.048	0.139	-0.068	0.057	0.235
	Adjusted [e] N=2404	0.103	0.061	*0.094*	0.098	0.048	**0.042**	0.064	0.054	0.233	0.006	0.100	0.923
Executive functioning [b]	Unadjusted N=2814	0.052	0.013	**<0.001**	0.048	0.011	**<0.001**	0.086	0.012	**<0.001**	-0.068	0.014	**<0.001**
	Adjusted [d] N=2785	0.027	0.015	*0.079*	0.014	0.012	0.234	0.033	0.013	**0.011**	-0.045	0.014	**0.002**
Fluid intelligence [b]	Unadjusted N=2982	0.073	0.077	0.342	0.159	0.067	**0.018**	0.216	0.074	**0.004**	-0.157	0.084	**0.063**
	Adjusted [d] N=2953	0.089	0.086	0.301	0.075	0.066	0.253	0.055	0.075	0.465	-0.138	0.084	0.100
Processing speed [a]	Unadjusted N=940	0.031	0.013	**0.016**	0.022	0.011	*0.053*	0.011	0.013	0.408	0.016	0.015	0.286
	Adjusted [d] N=936	0.016	0.017	0.353	0.015	0.013	0.221	0.005	0.015	0.726	0.018	0.016	0.259
Speech-in-noise perception threshold [a]	Unadjusted N=1349	-0.005	0.098	0.962	-0.015	0.085	0.858	-0.086	0.094	0.359	-0.006	0.103	0.951
	Adjusted [d] N=1338	-0.117	0.127	0.357	-0.019	0.097	0.846	-0.058	0.112	0.603	0.084	0.122	0.490

Analyses of baseline outcomes are in relation to year-prior exposure, and analyses of follow-up outcomes are in relation to annual average exposure between baseline and follow-up assessment. Ordinal logistic (PHQ-9 and GAD-7) and linear (all other outcomes) regressions were used. . Categorical PHQ-9 cut-offs: no or minimal depression, 0 to 4; mild depression, 5 to 10; moderate depression, 11 to 14; moderately severe and severe depression, 15+. Categorical GAD-7 cut-offs: no or minimal anxiety, 0 to 4; mild anxiety, 5 to 9; moderate anxiety, 10 to 14; and moderately severe and severe anxiety, 15+.

Effects are per IQR increase in exposure Effects are per IQR increase exposure: Year-prior to baseline IQR $PM_{2.5}$ = 1.20µg/m3, PM_{10} = 1.01 µg/m3, NO_2 = 1.91µg/m3, O_3 = 0.79ppb. Average annual exposure baseline to follow-up IQR $PM_{2.5}$ = 1.01µg/m3, PM_{10} = 1.01µg/m3, NO_2 = 1.66µg/m3, O_3 = 0.78ppb.

Bold: *p*<0.05. *Italics: p*<0.10

SDQ: Strengths and difficulties questionnaire. GAD-7: General Anxiety Disorder-7 (questionnaire). PHQ-9: Patient Health Questionnaire-9

[a] Higher values reflect worse mental health or cognition

[b] Higher values reflect better mental health or cognition

[c] adjusted for baseline age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[d] adjusted for baseline score, follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[e] adjusted for follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

Table SI 9. Exposure to air pollution and psychological outcomes- hybrid exposure air pollution exposure with no indoor sources

		$PM_{2.5}$			PM_{10}			NO_2			O_3		
Baseline outcomes	**Model**	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***P***
SDQ emotional and behavioural problems [a]	Unadjusted N=3057	-0.250	0.107	**0.019**	0.219	0.113	*0.054*	0.041	0.120	0.734	-0.051	0.125	0.682
	Adjusted [c] N=3027	-0.080	0.145	0.581	0.296	0.141	**0.036**	0.322	0.159	**0.044**	-0.180	0.153	0.238
SDQ internalising problems [a]	Unadjusted N=3057	-0.080	0.062	0.197	0.058	0.066	0.382	-0.028	0.070	0.687	-0.018	0.073	0.806
	Adjusted [c] N=3027	-0.015	0.083	0.855	0.126	0.082	0.125	0.110	0.092	0.234	-0.038	0.088	0.668
SDQ externalising problems [a]	Unadjusted N=3057	-0.170	0.066	**0.010**	0.161	0.070	**0.022**	0.069	0.074	0.351	-0.033	0.077	0.666
	Adjusted [c] N=3027	-0.076	0.088	0.386	0.168	0.086	*0.050*	0.196	0.096	**0.042**	-0.135	0.093	0.144
Executive functioning [b]	Unadjusted N=3158	0.036	0.012	**0.003**	0.010	0.014	0.450	0.037	0.014	**0.008**	-0.011	0.015	0.462
	Adjusted [c] N=3128	0.011	0.017	0.511	0.003	0.017	0.843	0.010	0.018	0.566	-0.007	0.018	0.673
Fluid intelligence [b]	Unadjusted N=3188	-0.023	0.066	0.732	0.021	0.072	0.768	0.073	0.076	0.338	-0.042	0.080	0.598
	Adjusted [c] N=3153	-0.060	0.095	0.529	0.008	0.091	0.927	-0.002	0.103	0.981	-0.072	0.099	0.465
Processing speed [a]	Unadjusted N=1522	-0.001	0.012	0.901	0.008	0.012	0.493	-0.003	0.013	0.845	0.006	0.015	0.689
	Adjusted [c] N=1512	-0.011	0.016	0.488	0.001	0.016	0.966	0.000	0.018	0.990	0.012	0.018	0.491
Speech-in-noise perception threshold [a]	Unadjusted N=2483	-0.171	0.070	**0.014**	0.116	0.070	*0.098*	-0.011	0.074	0.883	-0.046	0.076	0.542
	Adjusted [c] N=2460	-0.096	0.089	0.281	0.025	0.085	0.766	-0.005	0.095	0.957	-0.058	0.091	0.522
Follow-up 1 outcomes		**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***P***
SDQ emotional and behavioural problems [a]	Unadjusted N=2954	0.146	0.117	0.210	0.058	0.116	0.617	-0.077	0.122	0.526	-0.027	0.131	0.834
	Adjusted [d] N=2937	0.219	0.158	0.168	-0.102	0.127	0.424	-0.078	0.133	0.556	0.018	0.136	0.895
SDQ internalising problems [a]	Unadjusted N=2954	0.004	0.070	0.958	-0.043	0.070	0.537	-0.098	0.073	0.177	-0.002	0.078	0.977

	Adjusted [d] N=2937	0.024	0.095	0.799	-0.112	0.076	0.144	-0.107	0.078	0.173	0.063	0.080	0.431
SDQ externalising problems [a]	Unadjusted N=2954	0.143	0.074	*0.054*	0.101	0.074	0.170	0.021	0.077	0.784	-0.025	0.083	0.761
	Adjusted [d] N=2937	0.077	0.093	0.406	0.013	0.083	0.870	0.026	0.087	0.769	-0.029	0.088	0.739
PHQ-9 depression symptoms [a]	Unadjusted N=2389	0.066	0.044	0.136	0.076	0.044	*0.080*	0.060	0.048	0.209	-0.054	0.055	0.332
	Adjusted [e] N=2361	0.067	0.061	0.273	0.101	0.055	*0.064*	0.058	0.058	0.313	0.045	0.065	0.492
GAD-7 anxiety symptoms [a]	Unadjusted N=2433	0.095	0.046	**0.036**	0.107	0.045	**0.018**	0.077	0.049	0.118	-0.068	0.057	0.235
	Adjusted [e] N=2404	0.097	0.061	0.109	0.125	0.055	**0.023**	0.058	0.057	0.314	0.006	0.065	0.923
Executive functioning [b]	Unadjusted N=2814	0.038	0.013	**0.003**	0.034	0.013	**0.008**	0.077	0.013	**<0.001**	-0.068	0.014	**<0.001**
	Adjusted [d] N=2785	0.023	0.015	0.133	0.013	0.014	0.358	0.033	0.014	**0.020**	-0.045	0.014	**0.002**
Fluid intelligence [b]	Unadjusted N=2982	0.010	0.075	0.895	0.059	0.074	0.429	0.186	0.077	**0.015**	-0.157	0.084	*0.063*
	Adjusted [d] N=2953	0.032	0.086	0.710	-0.019	0.077	0.811	0.039	0.080	0.623	-0.138	0.084	0.100
Processing speed [a]	Unadjusted N=940	0.033	0.012	**0.009**	0.034	0.012	**0.006**	0.013	0.013	0.318	0.016	0.015	0.286
	Adjusted [d] N=936	0.013	0.017	0.435	0.018	0.015	0.239	0.005	0.017	0.766	0.018	0.016	0.259
Speech-in-noise perception threshold [a]	Unadjusted N=1349	-0.008	0.096	0.937	0.000	0.094	1.000	-0.105	0.098	0.284	-0.006	0.103	0.951
	Adjusted [d] N=1338	-0.159	0.128	0.216	-0.052	0.114	0.652	-0.126	0.122	0.301	0.084	0.122	0.490

Analyses of baseline outcomes are in relation to year-prior exposure, and analyses of follow-up outcomes are in relation to annual average exposure between baseline and follow-up assessment. Ordinal logistic (PHQ-9 and GAD-7) and linear (all other outcomes) regressions were used. Categorical PHQ-9 cut-offs: no or minimal depression, 0 to 4; mild depression, 5 to 10; moderate depression, 11 to 14; moderately severe and severe depression, 15+. Categorical GAD-7 cut-offs: no or minimal anxiety, 0 to 4; mild anxiety, 5 to 9; moderate anxiety, 10 to 14; and moderately severe and severe anxiety, 15+.

Effects are per IQR increase in exposure Effects are per IQR increase exposure: Year-prior to baseline IQR $PM_{2.5}$ = 1.20µg/m3, PM_{10} =1.15µg/m3, NO_2 = 1.91µg/m3, O_3 = 0.79ppb. Average annual exposure baseline to follow-up IQR $PM_{2.5}$ = 0.98µg/m3, PM_{10} = 1.08µg/m3, NO_2 = 1.64µg/m3, O_3 = 0.78ppb.

Bold: *p*<0.05. *Italics: p*<0.10

SDQ: Strengths and difficulties questionnaire. GAD-7: General Anxiety Disorder-7 (questionnaire). PHQ-9: Patient Health Questionnaire-9

[a] Higher values reflect worse mental health or cognition

[b] Higher values reflect better mental health or cognition

[c] adjusted for baseline age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[d] adjusted for baseline score, follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[e] adjusted for follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

Table SI 10. Exposure to air pollution and psychological outcomes- Indoor air pollution with indoor sources

		$PM_{2.5}$			PM_{10}			NO_2			O_3		
Baseline outcomes	**Model**	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***P***
SDQ emotional and behavioural problems [a]	Unadjusted N=3057	-0.210	0.116	*0.069*	0.106	0.076	0.163	0.047	0.101	0.642	-0.076	0.111	0.495
	Adjusted [c] N=3027	-0.008	0.146	0.958	0.124	0.081	0.125	0.188	0.111	*0.091*	-0.037	0.119	0.758
SDQ internalising problems [a]	Unadjusted N=3057	-0.054	0.067	0.424	0.041	0.045	0.356	-0.009	0.059	0.882	-0.008	0.065	0.900
	Adjusted [c] N=3027	0.019	0.084	0.821	0.061	0.047	0.198	0.064	0.065	0.323	0.030	0.069	0.662
SDQ externalising problems [a]	Unadjusted N=3057	-0.156	0.071	**0.029**	0.065	0.047	0.165	0.056	0.062	0.371	-0.068	0.069	0.325
	Adjusted [c] N=3027	-0.037	0.089	0.677	0.063	0.049	0.202	0.116	0.068	*0.086*	-0.066	0.073	0.362
Executive functioning [b]	Unadjusted N=3158	0.033	0.014	**0.015**	0.012	0.009	0.197	0.022	0.012	*0.066*	0.011	0.013	0.397
	Adjusted [c] N=3128	0.027	0.017	0.115	0.019	0.009	**0.046**	0.021	0.013	*0.093*	-0.002	0.014	0.861
Fluid intelligence [b]	Unadjusted N=3188	-0.096	0.072	0.183	-0.030	0.049	0.535	-0.029	0.063	0.647	-0.031	0.071	0.668
	Adjusted [c] N=3153	-0.088	0.094	0.347	-0.019	0.050	0.705	-0.038	0.068	0.581	-0.095	0.075	0.205
Processing speed [a]	Unadjusted N=1522	0.003	0.013	0.824	0.002	0.008	0.783	0.004	0.011	0.748	0.008	0.013	0.546
	Adjusted [c] N=1512	-0.013	0.016	0.413	-0.007	0.009	0.436	0.001	0.012	0.966	0.008	0.014	0.541
Speech-in-noise perception threshold [a]	Unadjusted N=2483	-0.167	0.074	**0.024**	0.010	0.046	0.834	-0.006	0.061	0.928	-0.074	0.066	0.265
	Adjusted [c] N=2460	-0.126	0.089	0.155	-0.034	0.048	0.482	-0.021	0.067	0.750	-0.059	0.070	0.400
Follow-up 1 outcomes		**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***P***
SDQ emotional and behavioural problems [a]	Unadjusted N=2954	0.130	0.111	0.242	0.005	0.075	0.943	-0.087	0.098	0.377	-0.049	0.116	0.671
	Adjusted [d] N=2937	0.166	0.133	0.215	-0.077	0.068	0.261	-0.080	0.091	0.384	-0.026	0.108	0.808
SDQ internalising problems [a]	Unadjusted N=2954	0.027	0.067	0.689	0.001	0.045	0.990	-0.062	0.059	0.295	0.029	0.070	0.682

	Adjusted [d] N=2937	0.049	0.080	0.538	-0.029	0.041	0.491	-0.047	0.055	0.396	0.069	0.065	0.288
SDQ externalising problems [a]	Unadjusted N=2954	0.103	0.071	0.143	0.005	0.048	0.919	-0.025	0.062	0.687	-0.078	0.074	0.291
	Adjusted [d] N=2937	0.001	0.078	0.992	-0.043	0.044	0.325	-0.034	0.059	0.568	-0.081	0.069	0.242
PHQ-9 depression symptoms [a]	Unadjusted N=2389	0.069	0.044	0.115	0.080	0.043	*0.060*	0.045	0.044	0.300	0.014	0.048	0.776
	Adjusted [e] N=2361	0.074	0.059	0.208	0.119	0.053	**0.024**	0.048	0.049	0.334	0.086	0.052	*0.098*
GAD-7 anxiety symptoms [a]	Unadjusted N=2433	0.086	0.045	*0.058*	0.088	0.044	**0.045**	0.046	0.045	0.303	-0.007	0.050	0.896
	Adjusted [e] N=2404	0.090	0.059	0.123	0.117	0.054	**0.028**	0.044	0.050	0.381	0.037	0.053	0.485
Executive functioning [b]	Unadjusted N=2814	0.033	0.012	**0.007**	0.020	0.008	**0.014**	0.047	0.010	**<0.001**	-0.020	0.012	0.101
	Adjusted [d] N=2785	0.020	0.013	0.120	0.007	0.007	0.346	0.019	0.010	*0.050*	-0.012	0.011	0.287
Fluid intelligence [b]	Unadjusted N=2982	0.002	0.072	0.980	0.056	0.048	0.248	0.079	0.062	0.201	-0.060	0.075	0.426
	Adjusted [d] N=2953	0.088	0.074	0.234	0.061	0.043	0.162	0.049	0.056	0.385	-0.068	0.067	0.312
Processing speed [a]	Unadjusted N=940	0.032	0.012	**0.008**	0.015	0.008	*0.065*	0.013	0.011	0.228	0.025	0.013	*0.063*
	Adjusted [d] N=936	0.016	0.014	0.271	0.010	0.008	0.237	0.004	0.011	0.713	0.012	0.013	0.337
Speech-in-noise perception threshold [a]	Unadjusted N=1349	0.057	0.092	0.537	0.036	0.062	0.565	0.018	0.081	0.823	-0.042	0.091	0.642
	Adjusted [d] N=1338	-0.073	0.111	0.514	0.009	0.065	0.895	-0.028	0.085	0.745	0.005	0.097	0.962

Analyses of baseline outcomes are in relation to year-prior exposure, and analyses of follow-up outcomes are in relation to annual average exposure between baseline and follow-up assessment. Ordinal logistic (PHQ-9 and GAD-7) and linear (all other outcomes) regressions were used. Categorical PHQ-9 cut-offs: no or minimal depression, 0 to 4; mild depression, 5 to 10; moderate depression, 11 to 14; moderately severe and severe depression, 15+. Categorical GAD-7 cut-offs: no or minimal anxiety, 0 to 4; mild anxiety, 5 to 9; moderate anxiety, 10 to 14; and moderately severe and severe anxiety, 15+.

Effects are per IQR increase in exposure Effects are per IQR increase exposure: Year-prior to baseline IQR $PM_{2.5}$ = 1.28µg/m3, PM_{10} = 0.86µg/m3, NO_2 = 1.36µg/m3, O_3 = 0.97ppb. Average annual exposure baseline to follow-up IQR $PM_{2.5}$ = 0.96µg/m3, PM_{10} = 0.81µg/m3, NO_2 = 1.19µg/m3, O_3 = 0.97ppb.

Bold: *p*<0.05. *Italics: p*<0.10

SDQ: Strengths and difficulties questionnaire. GAD-7: General Anxiety Disorder-7 (questionnaire). PHQ-9: Patient Health Questionnaire-9

[a] Higher values reflect worse mental health or cognition

[b] Higher values reflect better mental health or cognition

[c] adjusted for baseline age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[d] adjusted for baseline score, follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[e] adjusted for follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

Table SI 11. Exposure to air pollution and psychological outcomes - Indoor air pollution without indoor sources (indoor-outdoor air exchange only)

		$PM_{2.5}$			PM_{10}			NO_2			O_3		
Baseline outcomes	**Model**	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***
SDQ emotional and behavioural problems [a]	Unadjusted N=3057	-0.190	0.112	*0.090*	0.246	0.111	**0.026**	0.139	0.113	0.217	-0.076	0.111	0.495
	Adjusted [c] N=3027	-0.012	0.147	0.934	0.282	0.132	**0.033**	0.302	0.131	**0.021**	-0.037	0.119	0.758
SDQ internalising problems [a]	Unadjusted N=3057	-0.035	0.066	0.598	0.119	0.065	*0.066*	0.059	0.066	0.371	-0.008	0.065	0.900
	Adjusted [c] N=3027	0.031	0.085	0.714	0.167	0.077	**0.030**	0.147	0.076	*0.054*	0.030	0.069	0.662
SDQ externalising problems [a]	Unadjusted N=3057	-0.156	0.069	**0.025**	0.127	0.068	*0.063*	0.080	0.070	0.249	-0.068	0.069	0.325
	Adjusted [c] N=3027	-0.055	0.090	0.542	0.112	0.081	0.167	0.146	0.080	*0.068*	-0.066	0.073	0.362
Executive functioning [b]	Unadjusted N=3158	0.015	0.013	0.255	-0.026	0.014	*0.053*	-0.001	0.013	0.934	0.011	0.013	0.397
	Adjusted [c] N=3128	0.007	0.017	0.659	-0.002	0.015	0.908	0.003	0.015	0.818	-0.002	0.014	0.861
Fluid intelligence [b]	Unadjusted N=3188	-0.139	0.070	**0.047**	-0.164	0.070	**0.019**	-0.088	0.071	0.211	-0.031	0.071	0.668
	Adjusted [c] N=3153	-0.109	0.095	0.252	-0.071	0.083	0.395	-0.048	0.081	0.555	-0.095	0.075	0.205
Processing speed [a]	Unadjusted N=1522	0.009	0.012	0.459	0.022	0.012	*0.075*	0.009	0.013	0.471	0.008	0.013	0.546
	Adjusted [c] N=1512	-0.002	0.016	0.884	0.009	0.015	0.545	0.006	0.015	0.702	0.008	0.014	0.541
Speech-in-noise perception threshold [a]	Unadjusted N=2483	-0.127	0.072	*0.080*	0.131	0.069	*0.056*	0.034	0.070	0.624	-0.074	0.066	0.265
	Adjusted [c] N=2460	-0.104	0.090	0.247	-0.017	0.080	0.833	-0.017	0.080	0.829	-0.059	0.070	0.400
Follow-up 1 outcomes		**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***
SDQ emotional and behavioural problems [a]	Unadjusted N=2954	0.212	0.117	*0.070*	0.140	0.116	0.228	-0.009	0.115	0.939	-0.049	0.116	0.671
	Adjusted [d] N=2937	0.259	0.150	*0.084*	-0.052	0.121	0.667	-0.059	0.113	0.602	-0.026	0.108	0.808
SDQ internalising problems [a]	Unadjusted N=2954	0.065	0.070	0.354	0.056	0.069	0.420	-0.018	0.069	0.799	0.029	0.070	0.682

	Adjusted [d] N=2937	0.104	0.090	0.247	-0.012	0.073	0.865	-0.046	0.068	0.497	0.069	0.065	0.288
SDQ externalising problems [a]	Unadjusted N=2954	0.147	0.074	0.048	0.084	0.073	0.255	0.009	0.073	0.904	-0.078	0.074	0.291
	Adjusted [d] N=2937	0.051	0.087	0.560	-0.033	0.078	0.669	-0.016	0.073	0.829	-0.081	0.069	0.242
PHQ-9 depression symptoms [a]	Unadjusted N=2389	0.037	0.042	0.385	0.008	0.028	0.763	0.010	0.038	0.781	0.014	0.048	0.776
	Adjusted [e] N=2361	0.025	0.053	0.636	0.011	0.031	0.722	0.017	0.041	0.669	0.086	0.052	*0.098*
GAD-7 anxiety symptoms [a]	Unadjusted N=2433	0.083	0.044	*0.059*	0.047	0.030	0.118	0.035	0.039	0.371	-0.007	0.050	0.896
	Adjusted [e] N=2404	0.089	0.054	0.101	0.055	0.033	*0.096*	0.046	0.042	0.264	0.037	0.053	0.485
Executive functioning [b]	Unadjusted N=2814	0.018	0.013	0.165	0.004	0.013	0.736	0.038	0.012	**0.002**	-0.020	0.012	0.101
	Adjusted [d] N=2785	0.020	0.014	0.168	0.012	0.013	0.338	0.022	0.012	*0.066*	-0.012	0.011	0.287
Fluid intelligence [b]	Unadjusted N=2982	-0.091	0.075	0.223	-0.098	0.073	0.182	0.036	0.072	0.615	-0.060	0.075	0.426
	Adjusted [d] N=2953	0.030	0.082	0.710	-0.015	0.073	0.834	0.046	0.069	0.504	-0.068	0.067	0.312
Processing speed [a]	Unadjusted N=940	0.039	0.013	**0.002**	0.044	0.012	**<0.001**	0.020	0.013	0.121	0.025	0.013	*0.063*
	Adjusted [d] N=936	0.015	0.016	0.360	0.018	0.014	0.214	0.004	0.014	0.776	0.012	0.013	0.337
Speech-in-noise perception threshold [a]	Unadjusted N=1349	0.057	0.096	0.553	0.101	0.095	0.289	0.007	0.096	0.940	-0.042	0.091	0.642
	Adjusted [d] N=1338	-0.162	0.124	0.193	-0.057	0.112	0.614	-0.122	0.107	0.252	0.005	0.097	0.962

Analyses of baseline outcomes are in relation to year-prior exposure, and analyses of follow-up outcomes are in relation to annual average exposure between baseline and follow-up assessment. Ordinal logistic (PHQ-9 and GAD-7) and linear (all other outcomes) regressions were used. Categorical PHQ-9 cut-offs: no or minimal depression, 0 to 4; mild depression, 5 to 10; moderate depression, 11 to 14; moderately severe and severe depression, 15+. Categorical GAD-7 cut-offs: no or minimal anxiety, 0 to 4; mild anxiety, 5 to 9; moderate anxiety, 10 to 14; and moderately severe and severe anxiety, 15+. Effects are per IQR increase in exposure Effects are per IQR increase exposure: Year-prior to baseline IQR $PM_{2.5}$ = 1.23µg/m3, PM_{10} = 1.07µg/m3, NO_2 = 1.41µg/m3, O_3 = 0.97ppb. Average annual exposure baseline to follow-up IQR $PM_{2.5}$ = 0.96µg/m3, PM_{10} = 1.01µg/m3, NO_2 = 1.25µg/m3, O_3 = 0.97ppb.
Bold: *p*<0.05. *Italics: p*<0.10
SDQ: Strengths and difficulties questionnaire. GAD-7: General Anxiety Disorder-7 (questionnaire). PHQ-9: Patient Health Questionnaire-9
[a] Higher values reflect worse mental health or cognition
[b] Higher values reflect better mental health or cognition
[c] adjusted for baseline age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)
[d] adjusted for baseline score, follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)
[e] adjusted for follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

Table SI 12. Results of associations between outdoor air pollution and psychological outcomes using certain geocodes only (N=3037)

		$PM_{2.5}$			PM_{10}			NO_2			O_3		
Baseline outcomes	**Model**	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***P***
SDQ emotional and behavioural problems [a]	Unadjusted N=2640	-0.204	0.101	**0.044**	0.259	0.115	**0.024**	0.060	0.136	0.659	-0.066	0.144	0.647
	Adjusted [c] N=2636	-0.115	0.138	0.406	0.260	0.142	*0.068*	0.249	0.174	0.153	-0.328	0.198	*0.098*
SDQ internalising problems [a]	Unadjusted N=2640	-0.056	0.059	0.342	0.094	0.067	0.160	-0.019	0.079	0.813	0.030	0.084	0.722
	Adjusted [c] N=2636	-0.051	0.079	0.516	0.091	0.082	0.270	0.060	0.100	0.547	-0.072	0.113	0.524
SDQ externalising problems [a]	Unadjusted N=2640	-0.148	0.062	**0.018**	0.165	0.071	**0.020**	0.079	0.084	0.348	-0.096	0.089	0.281
	Adjusted [c] N=2636	-0.065	0.084	0.438	0.175	0.086	**0.042**	0.178	0.104	*0.089*	-0.232	0.117	*0.050*
Executive functioning [b]	Unadjusted N=2728	0.028	0.012	**0.014**	-0.015	0.014	0.269	0.030	0.016	*0.063*	-0.030	0.017	*0.073*
	Adjusted [c] N=2724	0.004	0.016	0.822	-0.003	0.017	0.851	0.007	0.02	0.714	-0.018	0.023	0.425
Fluid intelligence [b]	Unadjusted N=2757	-0.033	0.062	0.590	-0.044	0.072	0.539	0.085	0.085	0.317	-0.076	0.090	0.400
	Adjusted [c] N=2753	-0.05	0.092	0.584	0.044	0.092	0.629	0.036	0.112	0.748	-0.045	0.131	0.731
Processing speed [a]	Unadjusted N=1333	0.001	0.011	0.913	0.013	0.013	0.296	-0.001	0.015	0.928	-0.003	0.016	0.840
	Adjusted [c] N=1330	-0.018	0.015	0.254	-0.011	0.016	0.486	-0.013	0.020	0.519	0.008	0.023	0.723
Speech-in-noise perception threshold [a]	Unadjusted N=2162	-0.150	0.065	**0.021**	0.164	0.069	**0.017**	0.032	0.082	0.695	-0.066	0.087	0.444
	Adjusted [c] N=2159	-0.086	0.085	0.309	0.048	0.083	0.561	0.028	0.103	0.785	-0.048	0.116	0.681
Follow-up 1 outcomes		**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***P***
SDQ emotional and behavioural problems [a]	Unadjusted N=2313	0.238	0.140	0.089	0.283	0.134	**0.035**	-0.028	0.137	0.837	0.077	0.142	0.588
	Adjusted [d] N=2309	0.081	0.174	0.642	0.091	0.158	0.564	-0.004	0.146	0.977	0.079	0.164	0.633
SDQ internalising problems [a]	Unadjusted N=2313	0.044	0.084	0.605	0.084	0.081	0.300	-0.077	0.083	0.353	0.090	0.085	0.294

	Adjusted [d] N=2309	-0.113	0.103	0.276	-0.071	0.094	0.450	-0.106	0.086	0.220	0.129	0.096	0.180
SDQ externalising problems [a]	Unadjusted N=2313	0.194	0.089	**0.030**	0.200	0.086	**0.020**	0.048	0.088	0.582	-0.013	0.091	0.889
	Adjusted [d] N=2309	0.183	0.113	0.105	0.153	0.102	0.135	0.086	0.095	0.365	-0.035	0.107	0.744
PHQ-9 depression symptoms [a]	Unadjusted N=2067	0.103	0.054	*0.058*	0.121	0.052	**0.02**	0.097	0.056	*0.083*	-0.13	0.060	**0.032**
	Adjusted [e] N=2063	0.042	0.076	0.578	0.071	0.068	0.297	0.054	0.066	0.412	-0.089	0.075	0.237
GAD-7 anxiety symptoms [a]	Unadjusted N=2099	0.106	0.056	*0.059*	0.112	0.054	**0.038**	0.07	0.058	0.230	-0.102	0.062	0.101
	Adjusted [e] N=2095	0.062	0.076	0.414	0.072	0.069	0.302	0.017	0.068	0.806	-0.051	0.076	0.499
Executive functioning [b]	Unadjusted N=2444	0.05	0.015	**0.001**	0.039	0.015	**0.008**	0.088	0.015	**<0.001**	-0.097	0.015	**<0.001**
	Adjusted [d] N=2440	0.043	0.019	**0.026**	0.038	0.017	**0.030**	0.048	0.016	**0.003**	-0.069	0.017	**<0.001**
Fluid intelligence [b]	Unadjusted N=2585	-0.031	0.091	0.729	-0.008	0.087	0.930	0.202	0.088	**0.022**	-0.182	0.092	**0.047**
	Adjusted [d] N=2581	0.059	0.103	0.569	0.083	0.094	0.379	0.115	0.088	0.191	-0.122	0.097	0.214
Processing speed [a]	Unadjusted N=838	0.033	0.015	**0.025**	0.028	0.015	*0.057*	0.005	0.015	0.723	-0.011	0.015	0.496
	Adjusted [d] N=836	0.007	0.021	0.755	0.003	0.019	0.875	-0.01	0.018	0.573	0.006	0.020	0.751
Speech-in-noise perception threshold [a]	Unadjusted N=1203	0.077	0.112	0.488	0.076	0.108	0.480	-0.036	0.107	0.736	-0.005	0.109	0.962
	Adjusted [d] N=1200	-0.051	0.154	0.738	-0.059	0.142	0.675	-0.075	0.131	0.567	0.105	0.146	0.472

Analyses of baseline outcomes are in relation to year-prior exposure, and analyses of follow-up outcomes are in relation to annual average exposure between baseline and follow-up assessment. Ordinal logistic (PHQ-9 and GAD-7) and linear (all other outcomes) regressions were used. Categorical PHQ-9 cut-offs: no or minimal depression, 0 to 4; mild depression, 5 to 10; moderate depression, 11 to 14; moderately severe and severe depression, 15+. Categorical GAD-7 cut-offs: no or minimal anxiety, 0 to 4; mild anxiety, 5 to 9; moderate anxiety, 10 to 14; and moderately severe and severe anxiety, 15+.
Effects are per IQR increase in exposure: Year-prior to baseline IQR $PM_{2.5}$ = 0.97µg/m3, PM_{10} = 0.96µg/m3, NO_2 = 0.98µg/m3, O_3 = 0.97ppb. Average annual exposure baseline to follow-up IQR $PM_{2.5}$ = 0.99µg/m3, PM_{10} = 1.01µg/m3, NO_2 = 0.98µg/m3, O_3 = 0.96ppb.
Bold: *p*<0.05. *Italics: p* <0.10
SDQ: Strengths and difficulties questionnaire. GAD-7: General Anxiety Disorder-7 (questionnaire). PHQ-9: Patient Health Questionnaire-9
[a] Higher values reflect worse mental health or cognition
[b] Higher values reflect better mental health or cognition
[c] adjusted for baseline age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)
[d] adjusted for baseline score, follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)
[e] adjusted for follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

Table SI 13. Results of associations between traffic noise and psychological outcomes using certain geocodes only (N=3276)

	Model	Quartile	Lden			Lday			Leve			Lnight		
Baseline outcomes			**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***	**β**	**SE**	***p***
SDQ emotional and behavioural problems [a]	Unadjusted N=2851	2nd	**0.592**	**0.285**	**0.038**	0.198	0.302	0.511	*0.544*	*0.286*	*0.057*	**0.635**	**0.285**	**0.026**
		3rd	**0.566**	**0.286**	**0.048**	0.231	0.299	0.440	0.460	0.285	0.107	**0.596**	**0.285**	**0.037**
		4th	**0.732**	**0.291**	**0.012**	**-0.868**	**0.277**	**0.002**	**0.649**	**0.291**	**0.026**	**0.731**	**0.291**	**0.012**
	Adjusted [c] N=2847	2nd	0.462	0.282	0.102	-0.044	0.333	0.894	0.428	0.283	0.131	*0.493*	*0.282*	*0.081*
		3rd	0.435	0.285	0.127	0.239	0.356	0.503	0.332	0.285	0.244	0.451	0.285	0.113
		4th	**0.617**	**0.291**	**0.034**	0.014	0.375	0.971	*0.535*	*0.291*	*0.066*	**0.600**	**0.291**	**0.039**
SDQ internalising problems [a]	Unadjusted N=2851	2nd	*0.279*	*0.166*	*0.094*	0.026	0.176	0.884	*0.298*	*0.167*	*0.074*	*0.300*	*0.166*	*0.071*
		3rd	0.171	0.167	0.306	0.196	0.175	0.261	0.135	0.166	0.418	0.211	0.166	0.205
		4th	**0.362**	**0.170**	**0.033**	**-0.405**	**0.162**	**0.012**	**0.336**	**0.170**	**0.047**	**0.358**	**0.170**	**0.035**
	Adjusted [c] N=2847	2nd	0.227	0.165	0.169	-0.093	0.192	0.631	0.251	0.165	0.130	0.247	0.165	0.135
		3rd	0.060	0.167	0.720	0.125	0.205	0.542	0.024	0.166	0.883	0.093	0.167	0.577
		4th	*0.311*	*0.170*	*0.068*	-0.042	0.214	0.844	*0.286*	*0.170*	*0.093*	*0.301*	*0.170*	*0.077*
SDQ externalising problems [a]	Unadjusted N=2851	2nd	*0.313*	*0.176*	*0.075*	0.173	0.186	0.354	0.246	0.176	0.163	*0.335*	*0.176*	*0.057*
		3rd	**0.395**	**0.176**	**0.025**	0.035	0.185	0.849	*0.326*	*0.176*	*0.064*	**0.385**	**0.176**	**0.029**
		4th	**0.370**	**0.179**	**0.039**	**-0.463**	**0.171**	**0.007**	*0.313*	*0.179*	*0.081*	**0.373**	**0.179**	**0.038**
	Adjusted [c] N=2847	2nd	0.233	0.173	0.177	0.053	0.203	0.794	0.176	0.173	0.310	0.246	0.173	0.155
		3rd	**0.370**	**0.175**	**0.034**	0.116	0.217	0.595	*0.302*	*0.174*	*0.083*	**0.353**	**0.175**	**0.043**
		4th	*0.306*	*0.178*	*0.086*	0.018	0.228	0.938	0.250	0.178	0.161	*0.300*	*0.178*	*0.092*
Executive functioning [b]	Unadjusted N=2950	2nd	-0.012	0.033	0.721	0.011	0.034	0.742	-0.006	0.033	0.851	-0.015	0.033	0.658
		3rd	**-0.078**	**0.033**	**0.019**	0.027	0.035	0.438	**-0.066**	**0.033**	**0.046**	**-0.073**	**0.033**	**0.028**
		4th	-0.026	0.034	0.449	**0.231**	**0.032**	**<0.001**	-0.025	0.034	0.471	-0.036	0.034	0.293
	Adjusted [c] N=2946	2nd	0.008	0.031	0.799	-0.012	0.037	0.738	0.011	0.031	0.721	0.006	0.031	0.840
		3rd	-0.016	0.032	0.617	-0.021	0.040	0.604	-0.008	0.032	0.812	-0.008	0.032	0.793
		4th	0.009	0.033	0.793	0.056	0.043	0.189	0.009	0.033	0.781	0.001	0.033	0.969
	Unadjusted	2nd	0.009	0.180	0.961	0.144	0.189	0.446	0.081	0.180	0.651	-0.010	0.180	0.954

Fluid intelligence [b]	N=2966	3rd	-0.156	0.181	0.387	-0.090	0.189	0.635	-0.153	0.180	0.396	-0.158	0.180	0.382
		4th	-0.034	0.184	0.853	**0.602**	**0.175**	**0.001**	-0.004	0.184	0.984	-0.037	0.184	0.839
	Adjusted [c] N=2962	2nd	0.059	0.173	0.735	0.217	0.208	0.298	0.103	0.173	0.551	0.047	0.173	0.784
		3rd	0.050	0.176	0.778	-0.307	0.227	0.175	0.035	0.176	0.844	0.062	0.176	0.723
		4th	0.034	0.179	0.849	0.206	0.243	0.398	0.051	0.179	0.776	0.041	0.179	0.819
Processing speed [a]	Unadjusted N=1382	2nd	0.032	0.033	0.340	-0.027	0.034	0.426	0.035	0.033	0.293	0.015	0.033	0.651
		3rd	**0.074**	**0.033**	**0.024**	-0.009	0.033	0.786	*0.060*	*0.033*	*0.065*	*0.064*	*0.033*	*0.050*
		4th	0.027	0.033	0.403	-0.052	0.033	0.112	0.033	0.033	0.322	0.022	0.033	0.510
	Adjusted [c] N=1379	2nd	0.036	0.033	0.274	0.002	0.038	0.954	0.037	0.033	0.260	0.021	0.033	0.526
		3rd	0.046	0.033	0.161	-0.009	0.040	0.828	0.028	0.033	0.388	0.036	0.033	0.268
		4th	0.012	0.033	0.723	-0.029	0.043	0.497	0.014	0.033	0.670	0.006	0.033	0.849
Speech-in-noise perception threshold [a]	Unadjusted N=2369	2nd	-0.208	0.170	0.221	*0.320*	*0.183*	*0.080*	0.035	0.033	0.293	0.015	0.033	0.651
		3rd	0.101	0.169	0.551	-0.071	0.180	0.693	*0.060*	*0.033*	*0.065*	*0.064*	*0.033*	*0.050*
		4th	0.153	0.173	0.376	**-0.381**	**0.164**	**0.020**	0.033	0.033	0.322	0.022	0.033	0.510
	Adjusted [c] N=2366	2nd	-0.272	0.167	0.104	0.260	0.199	0.191	0.037	0.033	0.260	0.021	0.033	0.526
		3rd	-0.062	0.167	0.711	-0.108	0.211	0.608	0.028	0.033	0.388	0.036	0.033	0.268
		4th	0.016	0.172	0.925	0.106	0.219	0.627	0.014	0.033	0.670	0.006	0.033	0.849
Follow-up 1 outcomes														
SDQ emotional and behavioural problems [a]	Unadjusted N=2483	2nd	0.180	0.301	0.549	-0.028	0.313	0.929	0.201	0.301	0.505	0.205	0.301	0.495
		3rd	0.211	0.302	0.486	-0.199	0.309	0.520	0.152	0.302	0.615	0.273	0.302	0.366
		4th	0.167	0.304	0.584	**-0.840**	**0.301**	**0.005**	0.142	0.304	0.640	0.162	0.303	0.593
	Adjusted [d] N=2479	2nd	-0.019	0.260	0.943	0.068	0.300	0.822	-0.040	0.260	0.878	-0.047	0.260	0.857
		3rd	-0.078	0.264	0.767	-0.120	0.314	0.702	-0.064	0.264	0.809	-0.024	0.263	0.926
		4th	-0.103	0.265	0.697	0.062	0.350	0.860	-0.155	0.266	0.559	-0.122	0.265	0.644
SDQ internalising problems [a]	Unadjusted N=2483	2nd	-0.099	0.181	0.583	0.096	0.188	0.609	-0.120	0.181	0.508	-0.067	0.181	0.712
		3rd	-0.080	0.182	0.660	0.032	0.186	0.862	-0.142	0.182	0.435	-0.041	0.181	0.822
		4th	-0.052	0.183	0.774	**-0.525**	**0.181**	**0.004**	-0.067	0.183	0.714	-0.046	0.182	0.801
	Adjusted [d] N=2479	2nd	-0.203	0.158	0.201	0.068	0.300	0.822	-0.230	0.158	0.145	-0.205	0.158	0.196
		3rd	-0.177	0.160	0.270	-0.120	0.314	0.702	-0.187	0.160	0.242	-0.149	0.160	0.351

		4th	-0.182	0.161	0.259	0.062	0.350	0.860	-0.203	0.161	0.209	-0.188	0.161	0.244
SDQ externalising problems [a]	Unadjusted N=2483	2nd	0.280	0.193	0.148	-0.124	0.202	0.539	*0.320*	*0.193*	*0.097*	0.272	0.193	0.159
		3rd	0.291	0.194	0.135	-0.231	0.199	0.245	0.294	0.194	0.130	0.314	0.194	0.105
		4th	0.219	0.195	0.262	-0.315	0.194	0.104	0.209	0.195	0.285	0.208	0.195	0.286
	Adjusted [d] N=2479	2nd	0.175	0.169	0.299	0.023	0.194	0.906	0.180	0.168	0.285	0.152	0.169	0.368
		3rd	0.083	0.171	0.626	0.046	0.203	0.822	0.109	0.171	0.523	0.112	0.171	0.512
		4th	0.078	0.172	0.649	0.079	0.226	0.728	0.046	0.172	0.791	0.065	0.172	0.703
PHQ-9 depression symptoms [a]	Unadjusted N=2238	2nd	-0.057	0.119	0.632	0.110	0.126	0.385	0.006	0.119	0.957	-0.049	0.119	0.679
		3rd	-0.004	0.118	0.974	**0.312**	**0.121**	**0.010**	-0.023	0.118	0.847	0.011	0.117	0.925
		4th	0.043	0.120	0.721	-0.068	0.118	0.564	0.069	0.120	0.564	0.067	0.120	0.576
	Adjusted [e] N=2234	2nd	-0.103	0.123	0.402	0.012	0.138	0.929	-0.047	0.122	0.701	-0.091	0.123	0.458
		3rd	-0.072	0.122	0.555	*0.227*	*0.136*	*0.094*	-0.087	0.123	0.476	-0.055	0.122	0.652
		4th	-0.002	0.125	0.988	0.022	0.151	0.883	0.022	0.125	0.864	0.025	0.125	0.841
GAD-7 anxiety symptoms [a]	Unadjusted N=2272	2nd	0.062	0.124	0.616	*0.249*	*0.131*	*0.057*	0.156	0.123	0.205	0.076	0.124	0.536
		3rd	0.098	0.122	0.422	0.475	0.125	<0.001	0.066	0.123	0.592	0.108	0.122	0.375
		4th	0.170	0.124	0.169	0.057	0.124	0.645	*0.215*	*0.124*	*0.084*	0.178	0.124	0.149
	Adjusted [e] N=2268	2nd	0.024	0.128	0.853	0.182	0.143	0.204	0.112	0.128	0.379	0.042	0.128	0.745
		3rd	0.042	0.128	0.740	**0.389**	**0.137**	**0.005**	0.018	0.129	0.889	0.053	0.128	0.675
		4th	0.139	0.130	0.283	0.054	0.157	0.733	0.185	0.130	0.155	0.147	0.130	0.256
Executive functioning [b]	Unadjusted N=2651	2nd	0.019	0.031	0.554	0.037	0.032	0.252	0.025	0.031	0.423	0.005	0.031	0.886
		3rd	-0.036	0.032	0.261	0.018	0.032	0.573	-0.035	0.032	0.272	-0.034	0.032	0.277
		4th	-0.036	0.032	0.262	**0.186**	**0.032**	**<0.001**	-0.034	0.032	0.286	-0.041	0.032	0.198
	Adjusted [d] N=2647	2nd	0.022	0.027	0.422	-0.005	0.032	0.876	0.026	0.027	0.338	0.013	0.027	0.641
		3rd	-0.020	0.027	0.471	-0.032	0.034	0.352	-0.022	0.027	0.415	-0.018	0.027	0.500
		4th	-0.022	0.028	0.436	0.007	0.039	0.854	-0.021	0.028	0.447	-0.022	0.028	0.419
Fluid intelligence [b]	Unadjusted N=2774	2nd	-0.141	0.190	0.457	-0.060	0.196	0.760	-0.116	0.190	0.542	-0.146	0.190	0.443
		3rd	**-0.376**	**0.191**	**0.049**	-0.159	0.194	0.411	**-0.382**	**0.191**	**0.046**	*-0.347*	*0.191*	*0.069*
		4th	-0.202	0.192	0.294	**0.878**	**0.192**	**<0.001**	-0.194	0.193	0.314	-0.209	0.192	0.276
	Adjusted [d]	2nd	-0.059	0.161	0.716	-0.207	0.182	0.256	-0.065	0.161	0.685	-0.030	0.161	0.850

	N=2770	3rd	-0.098	0.163	0.549	-0.128	0.189	0.499	-0.138	0.163	0.398	-0.066	0.163	0.688
		4th	-0.053	0.164	0.748	-0.088	0.211	0.677	-0.054	0.165	0.741	-0.049	0.164	0.767
Processing speed [a]	Unadjusted N=872	2nd	0.018	0.035	0.608	-0.004	0.035	0.905	0.022	0.034	0.523	0.020	0.035	0.563
		3rd	0.033	0.035	0.345	*-0.065*	*0.036*	*0.069*	0.043	0.035	0.222	0.012	0.035	0.729
		4th	-0.016	0.034	0.638	0.027	0.035	0.438	-0.010	0.034	0.771	-0.016	0.034	0.632
	Adjusted [d] N=870	2nd	0.021	0.031	0.507	0.008	0.036	0.829	0.015	0.031	0.628	0.021	0.031	0.496
		3rd	0.021	0.032	0.503	-0.015	0.037	0.691	0.030	0.032	0.348	0.000	0.031	0.998
		4th	-0.031	0.031	0.310	0.043	0.045	0.340	-0.031	0.031	0.318	-0.034	0.031	0.266
Speech-in-noise perception threshold	Unadjusted N=1303	2nd	0.383	0.239	0.110	0.430	0.262	0.102	0.022	0.034	0.523	0.020	0.035	0.563
		3rd	**0.658**	**0.238**	**0.006**	0.216	0.263	0.411	0.043	0.035	0.222	0.012	0.035	0.729
		4th	*0.444*	*0.241*	*0.065*	*-0.440*	*0.242*	*0.070*	-0.010	0.034	0.771	-0.016	0.034	0.632
	Adjusted [d] N=1300	2nd	0.360	0.235	0.126	*0.477*	*0.282*	*0.091*	0.015	0.031	0.628	0.021	0.031	0.496
		3rd	**0.533**	**0.234**	**0.023**	0.442	0.296	0.136	0.030	0.032	0.348	0.000	0.031	0.998
		4th	0.342	0.238	0.152	0.250	0.326	0.445	-0.031	0.031	0.318	-0.034	0.031	0.266

Analyses of baseline outcomes are in relation to year-prior exposure, and analyses of follow-up outcomes are in relation to annual average exposure between baseline and follow-up assessment. Ordinal logistic (PHQ-9 and GAD-7) and linear (all other outcomes) regressions were used. Categorical PHQ-9 cut-offs: no or minimal depression, 0 to 4; mild depression, 5 to 10; moderate depression, 11 to 14; moderately severe and severe depression, 15+. Categorical GAD-7 cut-offs: no or minimal anxiety, 0 to 4; mild anxiety, 5 to 9; moderate anxiety, 10 to 14; and moderately severe and severe anxiety, 15+.

Noise effects are for each quartile of exposure (ref: 1st quartile). **Bold: $p<0.05$**. *Italics:* $p<0.10$

SDQ: Strengths and difficulties questionnaire. GAD-7: General Anxiety Disorder-7 (questionnaire). PHQ-9: Patient Health Questionnaire-9

[a] Higher values reflect worse mental health or cognition

[b] Higher values reflect better mental health or cognition

[c] adjusted for baseline age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[d] adjusted for baseline score, follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

[e] adjusted for follow-up age, sex, ethnicity, maternal education, first language, parental NS-SEC, school type (fixed effects), neighbourhood, school (random effects)

Supplementary information references

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