# Supplementary Information

Supplementary table 1. International Classification of Diseases (ICD)-8 and ICD-10 codes used to identify dementia diagnosis.

Dementia type	ICD-8	ICD-10
Alzheimer's disease	290.10	F00.0, F00.1, F00.2 F00.9, G30.0, G30.1, G30.8, G30.9
Vascular dementia	293.09, 293.19	F01.0, F01.1, F01.2, F01.3, F01.8, F01.9
Parkinson's disease dementia		F02.3, G31.8E
Unspecified or other types of dementia	290.09, 290.11, 290.18, 290.19, 094.19, 292.09	F03.9, F02.8 F02.0, G31.0B
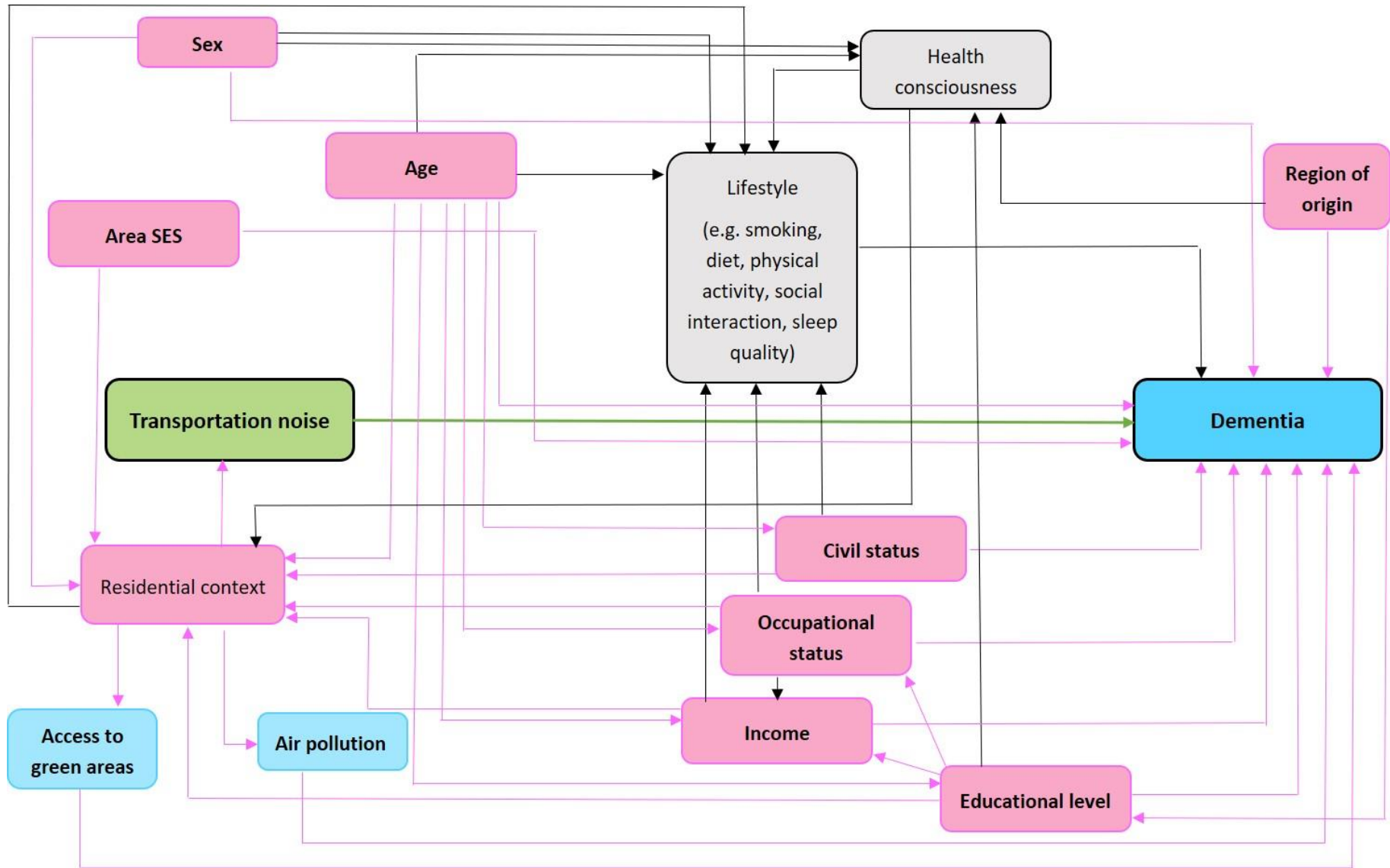
Supplementary figure 1. Directed Acyclic Graph displaying the relationship between transportation noise, dementia, and other variables. The variables in bold were used as covariates in our models.
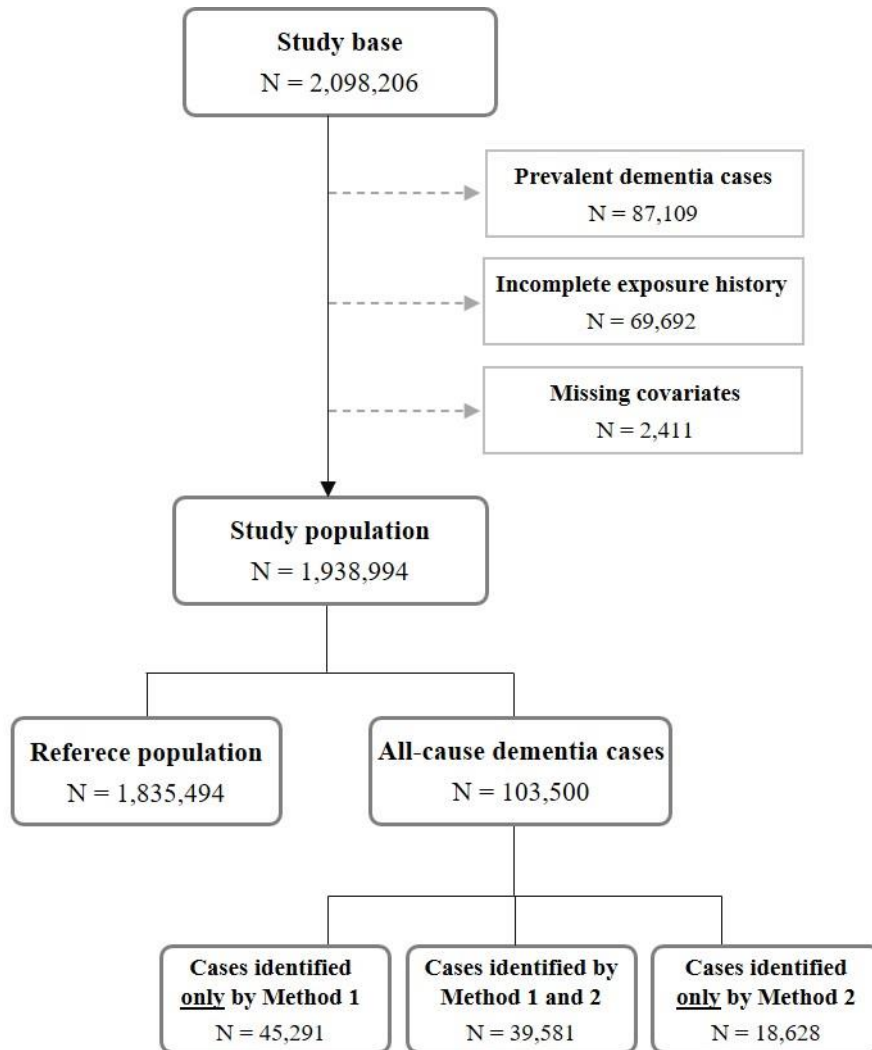
Supplementary figure 2. Flowchart of the study population and dementia cases. Method 1 refers to primary or secondary dementia diagnoses recorded at the hospital registries and Method 2 refers to at least one prescription of an anti-dementia drug.

Supplementary table 2. Baseline characteristics of dementia cases and non-cases.

| Baseline characteristics	Cases N = 103,500	Non-cases N = 1,835,494
Individual level		
Sex (%, men)	39.4	47.3
Age (mean ± standard deviation)	74.6 ± 8.2	65.7 ± 8.3
Country of origin (%)		
Denmark	99.5	98.7
Other Western country	0.3	0.6
Non-Western country	0.2	0.7
Civil status (%)		
Married or cohabiting	55.2	69.9
Widow(er)	30.9	13.4
Divorced	8.7	10.0
Single	5.2	6.7
Individual income (%) [b]		
Q1	45.1	28.3
Q2	27.5	23.9
Q3	10.9	15.8
Q4	7.7	14.9
Q5	8.8	17.1
Occupational status (%)		
Blue collar	1.3	8.7
White collar	7.1	36.8
Unemployed	1.0	4.3
Retired	90.6	50.2
Highest attained education (%)		
Mandatory education	45.5	36.6
Secondary or vocational education	27.5	39.2
Medium or long education	9.8	17.2
Unknown	17.2	7.0
Address-level [b]		
Proportion of high-quality green space (%)		
≥ 15 % in 150 m radius	20.6	21.1
≥ 20 % in 1000 m radius	24.6	25.8
Urbanity (%)		
Low (≤ 100 inhabitants/km^2)	20.8	26.1
Medium (101-4999 inhabitants/km^2)	70.1	67.7
High (≥ 5000 inhabitants/km^2)	9.1	6.2
Building type (%)		
Single family house	45.0	59.2
Semi-detached house	18.0	15.5
Multi-story building	36.8	25.0
Other	0.2	0.3
10-year mean air pollution exposure (mean ± standard deviation) [c]		
PM$_{2.5}$ (µg/m^3)	16.7 ± 1.4	15.5 ± 1.9
NO$_2$ (µg/m^3)	21.6 ± 8.3	18.8 ± 7.5
Area-level factors (mean ± standard deviation)		
% of population with low income (1st quartile)	4.9 ± 2.3	4.7 ± 2.2
% unemployed in population	2.0 ± 0.7	1.7 ± 0.7
% of population in manual labor	12.4 ± 3.1	12.6 ± 3.2
% of population with only basic education	11.1 ± 3.3	10.4 ± 3.4
% population with criminal record	0. 5 ± 0.3	0. 5 ± 0.3
% single-parent families	5.6 ± 1.7	5.6 ± 1.8

[a] Personal income quintiles were standardized by calendar year and sex.

[b] Address-level characteristics were calculated based on the addresses where each of the participants lived at baseline.

[c] PM2.5: fine particulate matter; NO2: nitrogen dioxide.
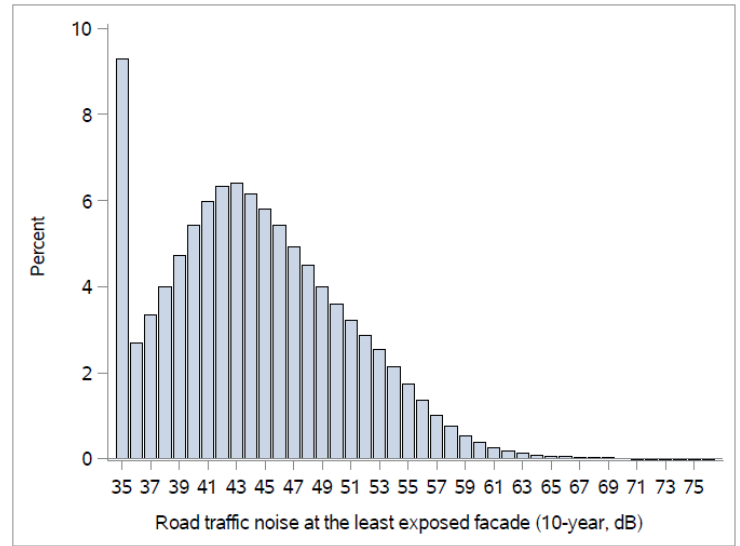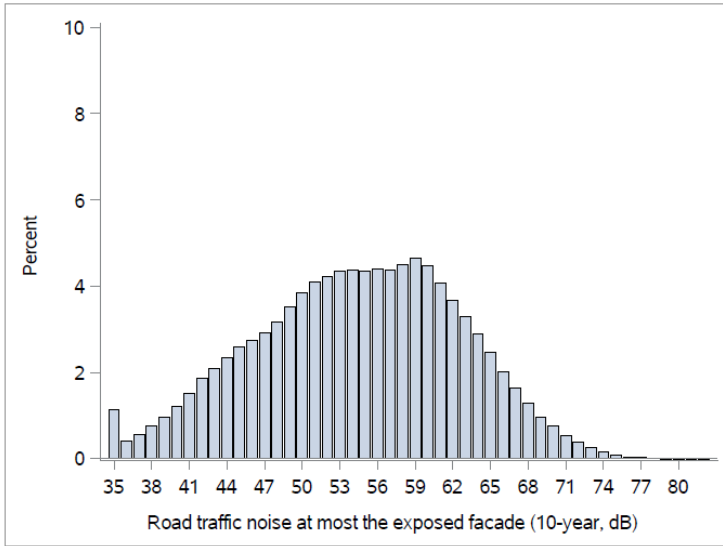
Supplementary figure 3. Distribution of road traffic noise at the most and least exposure façade (10-year mean at baseline, i.e. time-fixed) for the entire study population (N = 1,938,994)
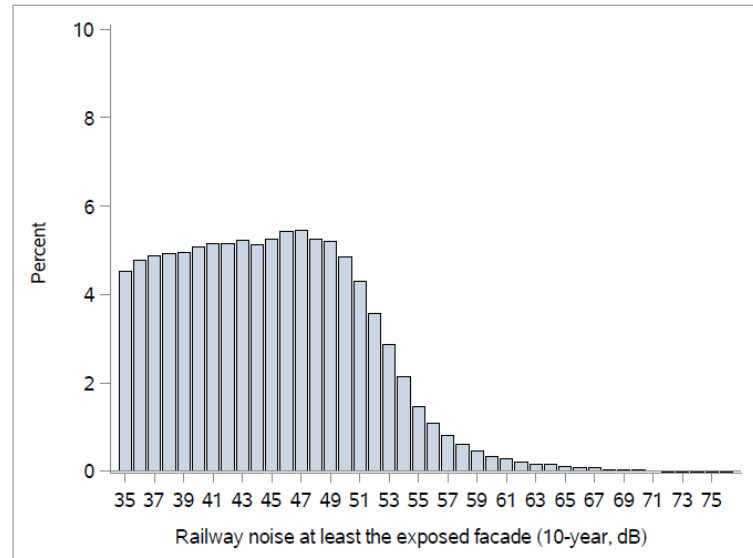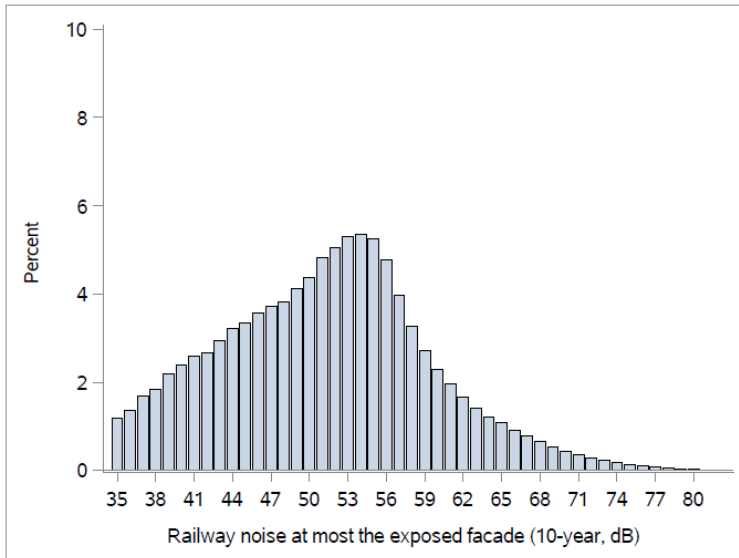
Supplementary figure 4. Distribution of railway noise at the most and least exposure façade (10-year mean at baseline, i.e. time-fixed) for all individuals exposed to railway noise ≥ 35 dB (N = 475,439 and N = 369,207 for most and least exposed façades, respectively).
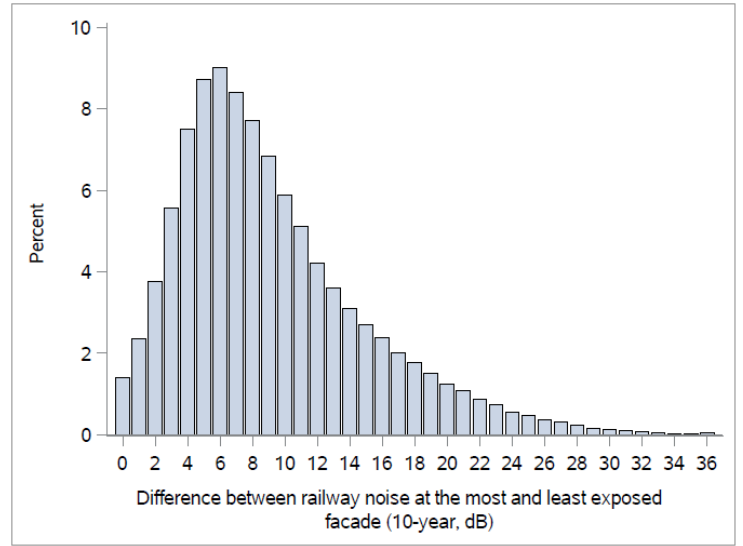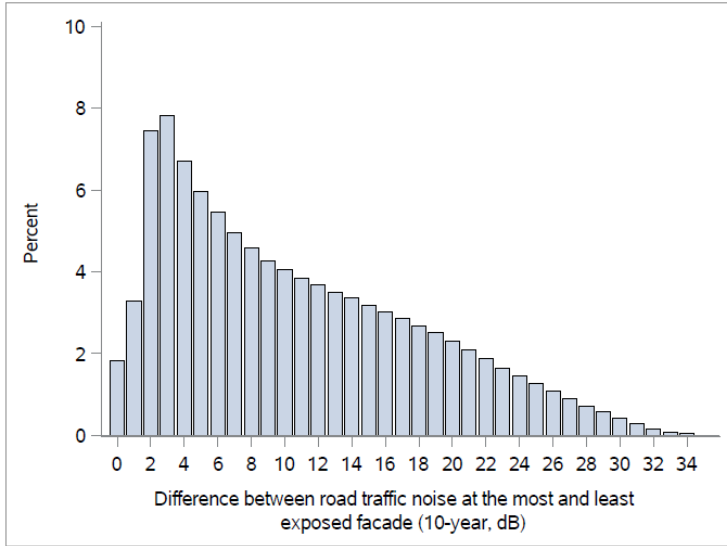
Supplementary figure 5. Distribution of the difference between road and traffic noise at the most ($L_{den}max$) and least exposed façade ($L_{den}min$) at the baseline address for the entire study population.

Supplementary table 3. Spearman correlations between road and railway traffic noise (10-y mean L_{den} and L_{night}), air pollution (10-y mean) and green space at baseline (i.e. time-fixed variables).

	Road L_{den}max	Road L_{den}min	Railway L_{den}max	Railway L_{den}min	Road L_{night}max	Road L_{night}min	Railway L_{night}max	Railway L_{night}min	PM$_{2.5}$	NO$_2$	High quality green space (150 m)	High quality green space (1000 m)
Road L_{den}max	1	0.49	0.12	0.10	1.00	0.46	0.11	0.06	0.25	0.45	-0.04	-0.05
Road L_{den}min		1	0.20	0.22	0.46	1.00	0.21	0.20	0.24	0.50	-0.01	0.04
Railway L_{den}max			1	0.89	0.11	0.20	0.94	0.73	0.15	0.20	0.01	0.01
Railway L_{den}min				1	0.09	0.22	0.90	0.83	0.17	0.20	-0.00	-0.00
Road L_{night}max					1	0.46	0.11	0.07	0.22	0.38	-0.04	-0.05
Road L_{night}min						1	0.21	0.19	0.25	0.54	0.02	0.09
Railway L_{night}max							1	0.77	0.17	0.23	0.03	0.03
Railway L_{night}min								1	0.17	0.19	0.02	0.02
PM$_{2.5}$									1	0.71	-0.05	-0.03
NO$_2$										1	-0.06	-0.02
High quality green space (150 m)											1	0.38
High quality green space (1000 m)												1

Supplementary table 4. Associations between categories of 10-year mean residential exposure to road traffic and railway noise at the most (L_{night}max) and least (L_{night}min) exposed façade and risk for all-cause dementia.

Noise exposure (10-year)	Category	N cases	Model 1 HR (95% CI) [a,b]	Model 2 HR (95% CI) [a,c]
Road, L_{night}max	<40 dB [c]	18315	1	1
	40 – 45 dB	19682	1.16 (1.14 to 1.19)	1.11 (1.08 to 1.13)
	45 – 50 dB	23862	1.21 (1.19 to 1.24)	1.13 (1.11 to 1.15)
	50 – 55 dB	23739	1.24 (1.22 to 1.26)	1.13 (1.11 to 1.16)
	≥60 dB	17902	1.26 (1.23 to 1.28)	1.12 (1.10 to 1.15)
Road, L_{night}min	<40 dB [c]	68258	1	1
	40 – 45 dB	20953	1.18 (1.16 to 1.19)	1.09 (1.08 to 1.11)
	45 – 50 dB	10843	1.19 (1.16 to 1.21)	1.07 (1.05 to 1.10)
	≥50 dB	3446	1.21 (1.17 to 1.19)	1.05 (1.01 to 1.09)
Railway, L_{night}max	<40 dB [c]	82706	1	1
	40 – 45 dB	6420	1.23 (1.20 to 1.26)	1.15 (1.12 to 1.18)
	45 – 50 dB	7692	1.25 (1.22 to 1.28)	1.17 (1.14 to 1.20)
	50 – 55 dB	4118	1.29 (1.25 to 1.33)	1.21 (1.17 to 1.25)
	≥55 dB	2564	1.24 (1.19 to 1.29)	1.14 (1.10 to 1.19)
Railway, L_{night}min	<40 dB [c]	94772	1	1
	40 – 45 dB	5581	1.24 (1.21 to 1.28)	1.15 (1.12 to 1.18)
	≥45 dB	3147	1.28 (1.23 to 1.32)	1.18 (1.14 to 1.22)

[a] Hazard ratio (95% confidence interval).
[b] Adjusted for age (by design), sex and calendar year.
[c] Adjusted for age (by design), sex, calendar year, civil status, income, region of origin, occupational status, proportion of high-quality green space, and a number of area-level socioeconomic variables: percent population with low income, with only basic education, who are unemployed, with manual labor, who are single-parent and with a criminal record, as well as mutual road traffic and railway noise adjustment. All covariates, apart from sex and region of origin, were included in the model as time-varying variables.

Supplementary table 5. Associations between categories combining residential exposure to road traffic at the most and least exposed façade and risk for incident all-cause dementia. [a,b]

Road traffic noise, L_{den}min	Road traffic noise, L_{den}max		
	<55 dB	55-60 dB	≥60 dB
<40 dB	N = 12,236	N = 3,029	N = 2,871
	Reference	1.05 (1.01 to 1.09)	1.00 (0.96 to 1.04)
40-50 dB	N = 28,294	N = 12,511	N = 16,832
	1.13 (1.10 to 1.15)	1.18 (1.15 to 1.21)	1.17 (1.14 to 1.19)
≥50 dB	N = 4,426	N = 9,200	N = 14,101
	1.21 (1.17 to 1.26)	1.19 (1.16 to 1.23)	1.20 (1.17 to 1.23)

[a] Results are given in hazard ratio (95% confidence interval).

[b] Model 2: adjusted for age (by design), railway noise, sex, calendar year, civil status, income, region of origin, occupational status, proportion of high-quality green space, and a number of area-level socioeconomic variables: percent population with low income, with only basic education, who are unemployed, with manual labor, who are single-parent and with a criminal record. All covariates, apart from sex and region of origin, were included in the model as time-varying variables.

Supplementary table 6. Associations between categories combining residential exposure to road traffic and railway noise (at the most and least exposed façade) and risk for incident all-cause dementia. [a,b]

Railway noise, $L_{den, max}$	Road traffic noise, $L_{den, max}$		
	< 55dB	55-65 dB	≥65 dB
<40 dB	N = 35,238	N = 32,071	N = 8,381
	Reference	1.05 (1.04 to 1.07)	1.06 (1.03 to 1.09)
40 – 50 dB	N = 3,747	N = 4,930	N = 1,611
	1.09 (1.05 to 1.13)	1.18 (1.15 to 1.22)	1.16 (1.10 to 1.22)
≥50 dB	N = 5,971	N = 8,857	N = 2,694
	1.18 (1.15 to 1.22)	1.27 (1.24 to 1.30)	1.22 (1.18 to 1.27)
Railway noise, $L_{den, min}$	Road traffic noise, $L_{den, min}$		
	<45 dB	45-55 dB	≥55 dB
<35 dB	N = 41,530	N = 32,321	N = 6,676
	Reference	1.11 (1.10 to 1.13)	1.11 (1.08 to 1.14)
35 – 45 dB	N = 4,141	N = 6,277	N = 1,396
	1.15 (1.12 to 1.19)	1.23 (1.20 to 1.26)	1.21 (1.14 to 1.27)
≥45 dB	N = 2,771	N = 6,704	N = 1,684
	1.22 (1.17 to 1.27)	1.31 (1.27 to 1.34)	1.24 (1.18 to 1.31)

[a] Results are given in hazard ratio (95% confidence interval).
[b] Model 2: adjusted for age (by design), sex, calendar year, civil status, income, region of origin, occupational status, proportion of high-quality green space, and a number of area-level socioeconomic variables: percent population with low income, with only basic education, who are unemployed, with manual labor, who are single-parent and with a criminal record, as well as mutual road traffic and railway noise adjustment. All covariates, apart from sex and region of origin, were included in the model as time-varying variables.

Supplementary table 7. Associations between categories of 10-year mean residential exposure to road traffic and railway noise at the most (L_{den}max) and least (L_{den}min) exposed façade and risk for all-cause dementia.

Noise exposure (10-year)	Category	N cases	Model 1 HR (95% CI) [a,b]	Model 2 HR (95% CI) [a,c]	Model 3 HR (95% CI) [a,d]
Road, L_{den}max	< 45 dB [c]	9718	1	1	1
	45 – 50 dB	13500	1.14 (1.11 to 1.17)	1.09 (1.06 to 1.12)	1.08 (1.05 to 1.11)
	50 – 55 dB	21738	1.25 (1.22 to 1.28)	1.16 (1.13 to 1.19)	1.15 (1.12 to 1.18)
	55 – 60 dB	24533	1.29 (1.26 to 1.32)	1.17 (1.14 to 1.20)	1.15 (1.13 to 1.18)
	60 – 65 dB	21196	1.30 (1.27 to 1.33)	1.16 (1.13 to 1.19)	1.14 (1.11 to 1.17)
	≥ 65 dB	12815	1.34 (1.30 to 1.38)	1.16 (1.13 to 1.19)	1.08 (1.05 to 1.11)
Road, L_{den}min	< 40 dB [c]	18136	1	1	1
	40 – 45 dB	30306	1.19 (1.17 to 1.22)	1.12 (1.10 to 1.14)	1.10 (1.08 to 1.13)
	45 – 50 dB	27261	1.31 (1.28 to 1.33)	1.18 (1.16 to 1.20)	1.16 (1.13 to 1.18)
	50 – 55 dB	18005	1.39 (1.36 to 1.41)	1.21 (1.19 to 1.24)	1.18 (1.16 to 1.21)
	≥ 55 dB	9792	1.39 (1.35 to 1.42)	1.18 (1.15 to 1.21)	1.14 (1.11 to 1.17)
Railway, L_{den}max	< 40 dB [c]	75690	1	1	1
	40 – 45 dB	4441	1.13 (1.10 to 1.17)	1.09 (1.06 to 1.12)	1.09 (1.05 to 1.12)
	45 – 50 dB	5844	1.19 (1.16 to 1.22)	1.11 (1.08 to 1.14)	1.10 (1.07 to 1.13)
	50 – 55 dB	8040	1.28 (1.25 to 1.31)	1.19 (1.16 to 1.22)	1.16 (1.13 to 1.19)
	55 – 60 dB	5577	1.27 (1.24 to 1.31)	1.19 (1.16 to 1.23)	1.16 (1.13 to 1.19)
	≥ 60 dB	3908	1.26 (1.22 to 1.30)	1.16 (1.12 to 1.20)	1.13 (1.09 to 1.16)
Railway, L_{den}min	< 40 dB [c]	86286	1	1	1
	40 – 45 dB	6049	1.22 (1.18 to 1.25)	1.12 (1.09 to 1.15)	1.10 (1.07 to 1.13)
	45 – 50 dB	6302	1.29 (1.25 to 1.32)	1.17 (1.14 to 1.20)	1.14 (1.11 to 1.17)
	≥ 50 dB	4863	1.27 (1.24 to 1.31)	1.16 (1.12 to 1.19)	1.13 (1.10 to 1.16)

[a] Hazard ratio (95% confidence interval).

[b] Adjusted for age (by design), sex and calendar year.

[c] Adjusted for age (by design), sex, calendar year, civil status, income, region of origin, occupational status, proportion of high-quality green space, and a number of area-level socioeconomic variables: percent population with low income, with only basic education, who are unemployed, with manual labor, who are single-parent and with a criminal record, as well as mutual road traffic and railway noise adjustment. All covariates, apart from sex and region of origin, were included in the model as time-varying variables.

[d] Model 2 plus adjustment for time-weighted 10-y mean $PM_{2.5.}$

Supplementary table 8. Sensitivity analysis for the associations between categories of 10-year mean residential exposure to road traffic and railway noise at the most ($L_{den}max$) and least ($L_{den}min$) exposed façade and risk for all-cause dementia.

| Noise exposure (10-year)	Category	Model 2 HR (95% CI) [a,b,c]	Model 2 + Mutual adjustment for $L_{den}max$ and $L_{den}min$ HR (95% CI) [a,b,c]	Model 2 + Adjustment for 10-y mean $PM_{2.5}$ and NO_2. HR (95% CI) [a,b,c]	Model 2 + Adjustment for education HR (95% CI) [a,b,d]	Model 2 Cases with a primary dementia diagnosis HR (95% CI) [a,b,e]
Road, $L_{den}max$	<45 dB [c]	1	1	1	1	1
	45 – 50 dB	1.09 (1.06 to 1.12)	1.04 (1.01 to 1.07)	1.08 (1.05 to 1.11)	1.09 (1.06 to 1.12)	1.07 (1.02 to 1.11)
	50 – 55 dB	1.16 (1.13 to 1.19)	1.08 (1.06 to 1.11)	1.15 (1.12 to 1.17)	1.16 (1.13 to 1.19)	1.16 (1.12 to 1.21)
	55 – 60 dB	1.17 (1.14 to 1.20)	1.09 (1.06 to 1.12)	1.14 (1.12 to 1.17)	1.17 (1.14 to 1.20)	1.15 (1.11 to 1.19)
	60 – 65 dB	1.16 (1.13 to 1.19)	1.08 (1.05 to 1.11)	1.12 (1.10 to 1.15)	1.16 (1.13 to 1.19)	1.14 (1.10 to 1.19)
	≥65 dB	1.16 (1.13 to 1.19)	1.08 (1.05 to 1.11)	1.04 (1.01 to 1.08)	1.14 (1.11 to 1.18)	1.17 (1.12 to 1.22)
Road, $L_{den}min$	<40 dB [c]	1	1	1	1	1
	40 – 45 dB	1.12 (1.10 to 1.14)	1.10 (1.08 to 1.12)	1.10 (1.08 to 1.12)	1.12 (1.09 to 1.14)	1.13 (1.09 to 1.16)
	45 – 50 dB	1.18 (1.16 to 1.20)	1.14 (1.12 to 1.17)	1.15 (1.13 to 1.18)	1.17 (1.15 to 1.20)	1.22 (1.18 to 1.26)
	50 – 55 dB	1.21 (1.19 to 1.24)	1.16 (1.14 to 1.19)	1.18 (1.15 to 1.20)	1.20 (1.17 to 1.23)	1.33 (1.28 to 1.37)
	≥55 dB	1.18 (1.15 to 1.21)	1.13 (1.10 to 1.17)	1.13 (1.10 to 1.16)	1.16 (1.13 to 1.19)	1.30 (1.25 to 1.35)
Railway, $L_{den}max$	<40 dB [c]	1	1	1	1	1
	40 – 45 dB	1.09 (1.06 to 1.12)	1.08 (1.05 to 1.12)	1.08 (1.05 to 1.12)	1.10 (1.06 to 1.14)	1.01 (0.96 to 1.06)
	45 – 50 dB	1.11 (1.08 to 1.14)	1.09 (1.06 to 1.13)	1.10 (1.07 to 1.13)	1.11 (1.08 to 1.15)	1.07 (1.03 to 1.11)
	50 – 55 dB	1.19 (1.16 to 1.22)	1.15 (1.11 to 1.19)	1.16 (1.13 to 1.19)	1.19 (1.16 to 1.22)	1.20 (1.16 to 1.25)
	55 – 60 dB	1.19 (1.16 to 1.23)	1.15 (1.11 to 1.19)	1.16 (1.13 to 1.19)	1.18 (1.14 to 1.22)	1.18 (1.13 to 1.23)
	≥60 dB	1.16 (1.12 to 1.20)	1.11 (1.07 to 1.16)	1.13 (1.09 to 1.16)	1.16 (1.12 to 1.21)	1.15 (1.10 to 1.21)
Railway, $L_{den}min$	<40 dB [c]	1	1	1	1	1
	40 – 45 dB	1.12 (1.09 to 1.15)	1.01 (0.98 to 1.05)	1.10 (1.07 to 1.13)	1.13 (1.10 to 1.16)	1.10 (1.06 to 1.15)
	45 – 50 dB	1.17 (1.14 to 1.20)	1.04 (1.00 to 1.08)	1.14 (1.11 to 1.17)	1.16 (1.12 to 1.19)	1.18 (1.14 to 1.23)
	≥50 dB	1.16 (1.12 to 1.19)	1.03 (0.99 to 1.08)	1.13 (1.10 to 1.17)	1.15 (1.12 to 1.19)	1.21 (1.16 to 1.27)

[a] Hazard ratio (95% confidence interval).

[b] Model 2: adjusted for age (by design), sex, calendar year, civil status, income, region of origin, occupational status, proportion of high-quality green space, and a number of area-level socioeconomic variables: percent population with low income, with only basic education, who are unemployed, with manual labor, who are single-parent and with a criminal record, as well as mutual road traffic and railway noise adjustment. All covariates, apart from sex and region of origin, were included in the model as time-varying variables.

[c] N = 103,500 cases.

[d] N = 85,684 cases.

[e] N = 42,413 cases.
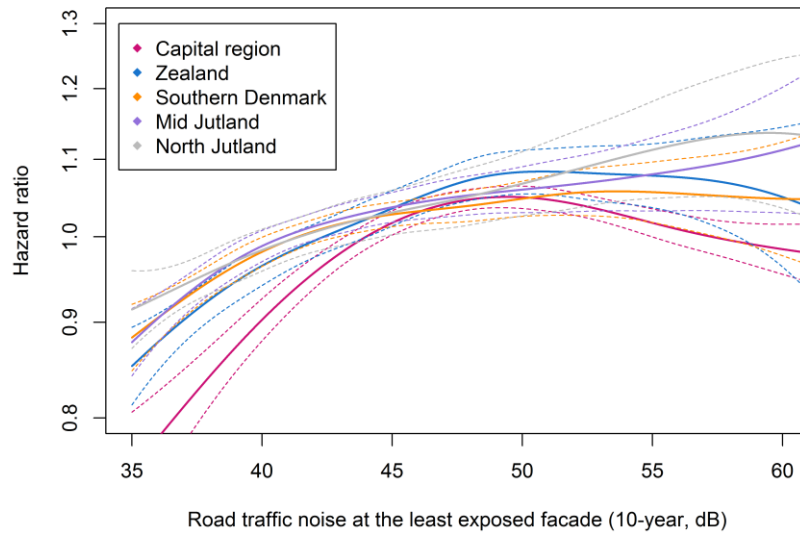
Supplementary figure 6. Associations between 10-year mean exposure to road traffic noise at the least exposed façade and risk for incident all-cause dementia according to the five regions in Denmark. The figure shows hazard ratios and corresponding 95% confidence intervals.