# Supplemental Material

# High Blood Pressure and Long-Term Exposure to Indoor Noise and Air Pollution from Road Traffic

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**Table S1.** Extension of Table 1 on the main characteristics of the study sample (n = 1926).

| Characteristic | Total (n=1926) | Non-hypertensive (n=1222) | Hypertensive (n=704) | p-value[a] |
|---|---|---|---|---|
| **Continuous variables [median (IQR)]** | | | | |
| Outdoor railway noise levels, $L_{night}$ [dB(A)] | 41.8 (15.2) | 41.5 (16.0) | 42.1 (14.2) | 0.558 |
| Daily mean temperature at lag 0 (ºC) | 13.8 (12.9) | 13.9 (13.1) | 13.6 (12.7) | 0.589 |
| **Categorical variables [n (%)]** | | | | |
| Daily alcohol intake (g/l) | | | | |
|   No alcohol | 441 (22.9) | 282 (23.1) | 159 (22.6) | 0.033 |
|   Little (≤ 20) | 1227 (63.7) | 796 (65.1) | 431 (61.2) | |
|   Moderate (20.1-39.9) | 198 (10.3) | 114 (9.30) | 84 (11.9) | |
|   Excessive (≥ 40) | 60 (3.10) | 30 (2.50) | 30 (4.30) | |
| Weekly physical activity (MET) | | | | |
|   Tertile 1 | 630 (32.7) | 399 (32.7) | 231 (32.8) | 0.655 |
|   Tertile 2 | 641 (33.3) | 415 (34.0) | 226 (32.1) | |
|   Tertile 3 | 655 (34.0) | 408 (33.4) | 247 (35.1) | |
| Hearing loss, no | 1188 (65.7) | 792 (69.4) | 396 (59.5) | 0.221 |
|   Mild | 481 (26.6) | 289 (25.3) | 192 (28.8) | |
|   Severe | 139 (7.70) | 61 (5.30) | 78 (11.7) | |
| Living alone, yes | 200 (10.4) | 119 (9.70) | 81 (11.5) | 0.221 |
| Season of re-examination, winter | 372 (19.3) | 230 (18.8) | 142 (20.2) | < 0.001 |
|   Spring | 562 (29.2) | 321 (26.3) | 241 (34.2) | |
|   Summer | 426 (22.1) | 305 (25.0) | 121 (17.2) | |
|   Autumn | 566 (29.4) | 366 (30.0) | 200 (28.4) | |

$L_{night}$: Long-term average nighttime noise level; MET: Metabolic equivalents.

[a] $\chi^2$ test and Kruskal-Wallis test for strata of hypertension with categorical or continuous variables, respectively.

**Table S2.** Estimated change in the prevalence of hypertension [odds ratios (95% CI)] and in systolic (SBP) and diastolic (DBP) blood pressure (mmHg) [beta coefficients (95% CI), in mmHg] per 5 dB(A) increase of indoor traffic noise at night ($L_{night}$) and per 10 µg/m$^3$ increase of annual average levels of outdoor nitrogen dioxide ($NO_2$) applying a linear threshold model for indoor noise at 30 dB(A), (n = 1926).

| Multi-exposure model | Hypertension | SBP | DBP |
|---|---|---|---|
| Indoor traffic $L_{night}$ | 1.14 (0.99, 1.31)* | 1.27 (0.34, 2.20)** | 0.17 (-0.36, 0.71) |
| $NO_2$ | 1.17 (1.00, 1.37)* | 1.25 (0.23, 2.27)** | 0.56 (-0.03, 1.15)* |

Model adjusted for indoor traffic $L_{night}$, annual average $NO_2$, age, age squared, sex, education, Mediterranean diet, exercise, alcohol consumption, smoking, BMI, diabetes, deprivation, daily temperature, BP-lowering medication, and indoor railway $L_{night}$.

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

**Table S3.** Estimated change in the prevalence of hypertension per increment of 5dB(A) in annual average levels of indoor traffic noise at night (L$_{night}$) by subgroups of population characteristics. A subset of the main results in this table is graphically shown in Figure 1.

| Interaction term | N | Odds ratio (95% CI)[a] | p-value interaction |
|---|---|---|---|
| Age, < 50 | 591 | 1.13 (1.00, 1.28) | 0.540[b] |
| 50-59 | 594 | 1.03 (0.94, 1.13) | |
| 60-69 | 421 | 1.08 (0.98, 1.19) | |
| > 69 | 320 | 1.03 (0.92, 1.16) | |
| Gender, male | 879 | 1.09 (1.00, 1.18) | 0.315 |
| female | 1050 | 1.04 (0.96, 1.12) | |
| Traffic annoyance, no | 1198 | 1.02 (0.95, 1.10) | 0.141[c] |
| Moderate (1-5) | 549 | 1.12 (1.00, 1.25) | |
| High (6-10) | 168 | 1.18 (0.97, 1.43) | |
| Low noise sensitivity, < P50 | 908 | 1.08 (1.00, 1.17) | 0.498 |
| High noise sensitivity, ≥ P50 | 810 | 1.04 (0.96, 1.14) | |
| Anxiolytics, no | 1492 | 1.10 (1.02, 1.18) | 0.054 |
| Yes | 425 | 0.99 (0.89, 1.09) | |
| Educational level | | | |
| University or similar | 596 | 1.06 (0.96, 1.18) | 0.454 |
| Secondary | 618 | 1.12 (1.01, 1.25) | |
| Primary | 681 | 1.03 (0.95, 1.12) | |
| Illiterate | 31 | 1.18 (0.84, 1.68) | |
| Diabetes, no | 1665 | 1.07 (0.99, 1.14) | 0.798 |
| Yes | 261 | 1.05 (0.93, 1.19) | |
| Body mass index, < 20 | 68 | 0.86 (0.59, 1.25) | 0.591 |
| 20-25 | 605 | 1.04 (0.94, 1.15) | |
| 25.1-30 | 851 | 1.08 (1.00, 1.18) | |
| >30 | 402 | 1.05 (0.94, 1.17) | 0.559 |
| Hearing loss, no | 1188 | 1.08 (0.99, 1.17) | |
| Mild | 481 | 1.04 (0.96, 1.15) | |
| Severe | 139 | 1.16 (0.97, 1.39) | |

[a]Each multivariate logistic regression model is adjusted for the corresponding interaction-term, one at a time, and annual average NO$_2$ levels, age, age squared, sex, education, Mediterranean diet, exercise, alcohol consumption, smoking, BMI, diabetes, deprivation, daily temperature, and indoor railway L$_{night}$ levels. [b]p-value for trend = 0.381 and p-value of interaction for the continuous variable = 0.386. [c]p-value for trend = 0.052 and p-value of interaction for the continuous variable = 0.033.

**Table S4.** Estimated change in systolic (SBP) and diastolic (DBP) blood pressure [beta coefficients (95% CI), in mmHg] per increments[a] of indoor traffic noise at night ($L_{night}$) and annual average levels of nitrogen dioxide ($NO_2$) using different methods to control for BP-lowering medication.

| Multi-exposure models[b] | n | SBP, $L_{night}$ | SBP, $NO_2$ | DBP, $L_{night}$ | DBP, $NO_2$ |
|---|---|---|---|---|---|
| Non-medicated[c] | 1462 | 0.38 (-0.08, 0.83) | 1.10 (0.03, 2.18)** | -0.06 (-0.33, 0.22) | 0.59 (-0.06, 1.24)* |
| Medicated[c] | 464 | 1.64 (0.57, 2.70)** | 1.59 (-1.02, 4.20) | 0.60 (0.04, 1.15)** | -0.01 (-1.37, 1.35) |
| Not adjusting for medication[d] | 1926 | 0.75 (0.32, 1.18)** | 1.27 (0.23, 2.30)** | 0.12 (-0.14, 0.37) | 0.58 (-0.02, 1.18)* |
| Adjusting for medication[e] | 1926 | 0.72 (0.29, 1.15)** | 1.23 (0.21, 2.25)** | 0.10 (-0.15, 0.34) | 0.56 (-0.03, 1.14)* |
| SBP + 10 mmHg[f] | 1926 | 0.79 (0.33, 1.25)** | 1.32 (0.22, 2.42)** | - | - |
| DBP + 5 mmHg[f] | 1926 | - | - | 0.14 (-0.13, 0.40) | 0.60 (-0.03, 1.24)* |
| Censored regression[g] | 1926 | 0.76 (0.26, 1.26)** | 1.24 (0.05, 2.44)** | 0.12 (-0.17, 0.42) | 0.65 (-0.05, 1.35)* |

[a]Per 5 dB(A) of traffic $L_{night}$ and 10 $\mu g/m^3$ of NO. [b]All models adjusted for age, age squared, sex, education, Mediterranean diet, exercise, alcohol consumption, smoking, BMI, diabetes, deprivation, daily temperature, indoor railway $L_{night}$, $NO_2$, and indoor traffic $L_{night}$. [c]Medicated means use of BP-lowering medication. [d]Model for the entire study sample, adjusted for variables in [a], but not for BP-lowering medication. [e]Model for the entire study sample, adjusted for variables in [a] and for BP-lowering medication. [f]Addition of 10 mmHg to SBP or 5 mmHg to DBP levels if participant uses BP-lowering medication. [g]Model for the entire study sample. It assumes that had participants under BP-lowering medication not been treated, they would have BP levels.
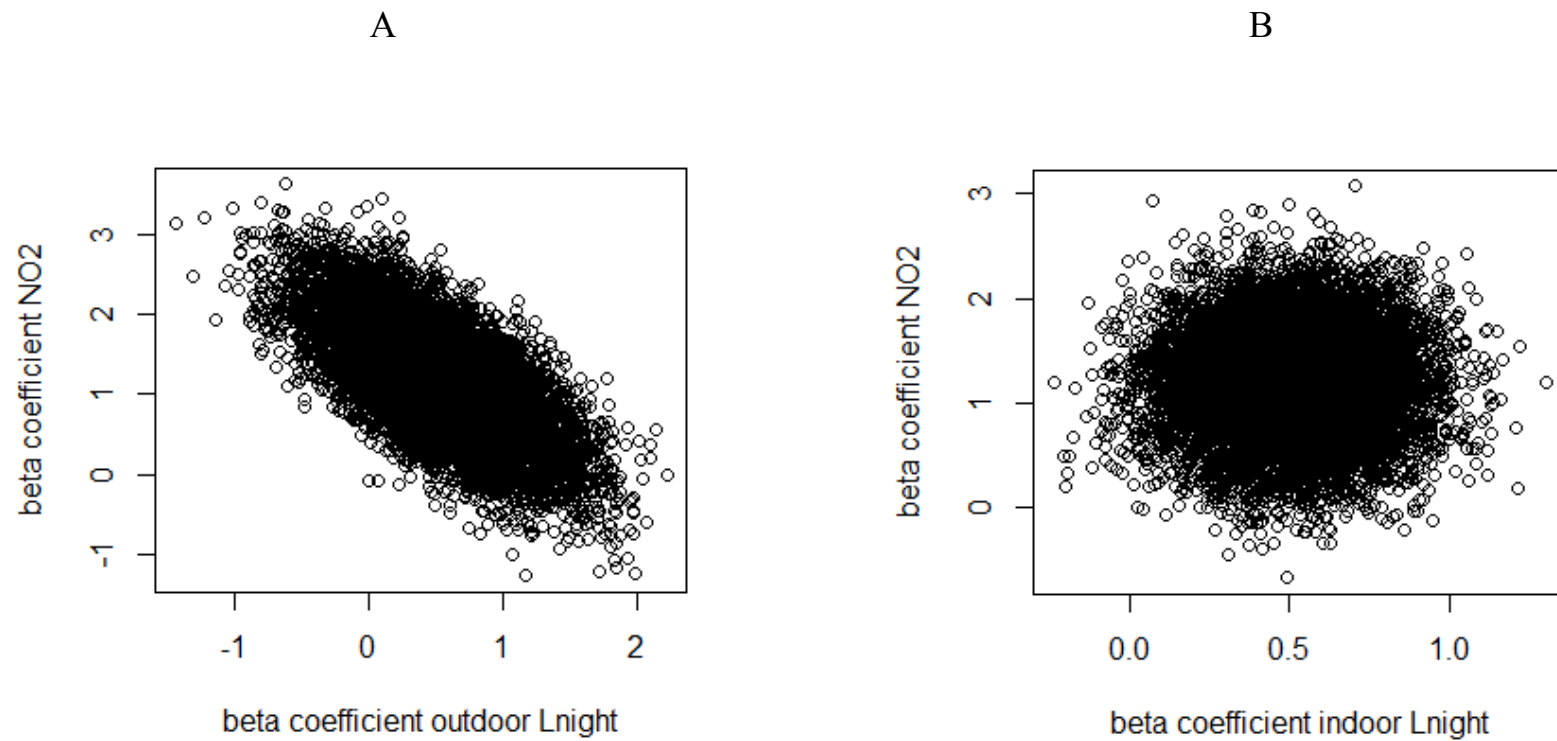
**Figure S1.** A: Correlation between beta coefficients of $NO_2$ and *outdoor* traffic $L_{night}$ from 10,000 simulated databases. B: Correlation between beta coefficients of $NO_2$ and *indoor* traffic $L_{night}$ from 10,000 simulated databases. Multi-exposure regression models for systolic blood pressure and $L_{night}$ and $NO_2$ adjusted for for: age, age squared, sex, education, Mediterranean diet, exercise, alcohol consumption, smoking, BMI, diabetes, deprivation, daily temperature (lag 0), BP-lowering medication, indoor railway $L_{night}$.

Hypertension                                    Systolic blood pressure
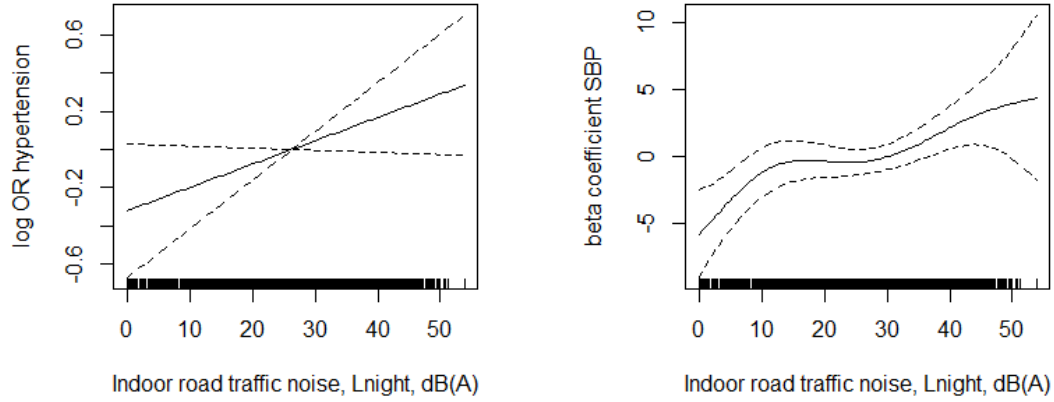


**Figure S2.** Smooth spline for the effect of 1 dB(A) increase in indoor road traffic $L_{night}$ and 95%

confidence intervals in a generalized additive model for hypertension (left) and systolic blood

pressure (mmHg) (right). Model adjusted for: age, age squared, sex, education, Mediterranean

diet, exercise, alcohol consumption, smoking, BMI, diabetes, deprivation, daily temperature (lag

0), BP-lowering medication, indoor railway $L_{night}$, and annual average $NO_2$ (n =1926).