**eAppendix**

**The impact of measurement error in modelled ambient particles exposures on health effect estimates in multi-level analysis: a simulation study.**

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**Table S1.**Baseline disease rates (C3) and concentration response function for short-term ($β\_{1}$) and long-term $(β\_{2})$ used in our simulations.

**Table S2.**Coverage probabilities and power for the simulations on PM10.

**Table S3.**Coverage probabilities and power for the simulations of the association between PM2.5 and all-cause mortality or cardiovascular admissions.

[eAppendix references are listed at the end of this document]

**Table S1.**Baseline disease rates (C3) and concentration response function for short-term ($β\_{1}$) and long-term $(β\_{2})$ used in our simulations.

|  |  |  |  |
| --- | --- | --- | --- |
| Outcome | Baseline rate per LSOA per day$$exp(c\_{3})$$ | Pollutant | Concentration response function per 1 µg/m3 |
| Short-term exposure$$(β\_{1})$$ | Long-term exposure$$(β\_{2})$$ |
| All-cause Mortality | 0.0264§ | PM10 | 0.00032[1] | 0.00344[2] |
| PM2.5 | 0.00100[3] | 0.00686[4] |
| Cardiovascular hospital admissions | 0.0835¶ | PM10 | 0.00040[1] | 0.04055[5] |
| PM2.5 | 0.00091[6] | 0.00307[7] |

§Average death rate per LSOA per day in London in 2011 estimated using data from the Office for National Statistics.[8-9] ¶ Number of hospital admission per LSOA per day for the financial year 2011-2012 estimated using data from the Office for National Statistics,[8] and NHS Digital.[10]

**Table S2** Simulations’ results for the association between cardiovascular admissions and PM10.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Effect estimate for 10 μg/m3 increase in short-term exposure | Effect estimate for 10 μg/m3 increase in long-term exposure |
| $$\hat{β\_{1}}×10$$$$(se(\hat{β\_{1}}) ×10)$$ | Biasa(%) | Coverage probability(%) | Power(%) | $$\hat{β\_{2}}×10$$$$(se(\hat{β\_{2}}) ×10)$$ | Biasa(%) | Coverage Probability(%) | Power(%) |
| **Urban / Suburban** | Land Use Regression | 0.00466 (0.00233) | **16.6** | 95.1 | 51.5 | 0.04584 (0.08062) | -88.7 | 2.7 | 16.4 |
| Dispersion | 0.00388 (0.00144) | -2.7 | 95.3 | 77.7 | 0.19909 (0.09505) | -50.9 | 43.8 | 52.8 |
| Hybrid 1 | 0.00415 (0.00154) | **4.0** | 95 | 78.1 | 0.08338 (0.08245) | -79.4 | 5.9 | 23.7 |
| Hybrid 2 | 0.00428 (0.00159) | **7.3** | 95.1 | 76.4 | 0.20930 (0.09941) | -48.4 | 48.8 | 54.3 |
| **Roadside / Kerbside** | Land Use Regression | 0.00403 (0.00173) | **1.0** | 95.5 | 63.3 | 0.04116 (0.04997) | -89.8 | 0.0 | 15.5 |
| Dispersion | 0.00372 (0.00122) | -6.9 | 94.7 | 86.3 | 0.27562 (0.06056) | -32.0 | 43.3 | 98.4 |
| Hybrid 1 | 0.00370 (0.00124) | -7.3 | 94.3 | 84.7 | 0.10886 (0.05168) | -73.2 | 0.1 | 57.4 |
| Hybrid 2 | 0.00403 (0.00135) | **1.0** | 95.7 | 83.8 | 0.30194 (0.06531) | -25.5 | 62.2 | 98.9 |

The true effects considered were 0.0040 for short –term exposure and 0.4055 for long-term per 10 μg/m3 increase in PM10.

aPercent bias is highlighted in bold when positive (i.e. away from the null) rather than negative (i.e. towards the null).

**Table S3.**Simulations’ results for the association between cardiovascular admissions and PM2.5.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Model | Effect estimate for 10 μg/m3 increase in short-term exposure | Effect estimate for 10 μg/m3 increase in long-term exposure |
| $$\hat{β\_{1}}×10$$$$(se(\hat{β\_{1}}) ×10)$$ | Biasa(%) | Coverage probability(%) | Power(%) | $$\hat{β\_{2}}×10$$$$(se(\hat{β\_{2}}) ×10)$$ | Biasa(%) | Coverage Probability(%) | Power(%) |
| **Urban / Suburban** | Land Use Regression | 0.01054 (0.00371) | **16.3** | 92.4 | 81.0 | 0.00141 (0.12787) | -95.4 | 86.0 | 12.7 |
| Dispersion | 0.00722 (0.00206) | -20.3 | 84.9 | 93.7 | 0.00579 (0.13573) | -81.1 | 84.5 | 14.1 |
| Machine learning methods | 0.00815 (0.00234) | -10.0 | 93.5 | 93.8 | 0.00855 (0.16441) | -72.2 | 75.8 | 24.1 |
| Hybrid 1 | 0.00929 (0.00266) | **2.5** | 94.5 | 94.6 | 0.01411 (0.12849) | -54.1 | 86.4 | 13.5 |
| Hybrid 2 | 0.00900 (0.00258) | -0.7 | 95.1 | 94.1 | -0.00281 (0.15937) | -109.1 | 79.4 | 20.4 |
| Hybrid 3 | 0.00880 (0.00249) | -2.9 | 94.2 | 93.8 | 0.02418 (0.16757) | -21.3 | 84.3 | 16.8 |
| **Roadside Kerbside** | Land Use Regression | 0.00956 (0.00268) | **5.5** | 94.9 | 95.5 | 0.02895 (0.04308) | -5.8 | 46.6 | 54.6 |
| Dispersion | 0.00762 (0.00177) | -15.9 | 88.2 | 99.4 | 0.03886 (0.03989) | **26.5** | 57.5 | 46.5 |
| Machine learning methods | 0.00884 (0.00200) | -2.4 | 95.2 | 99.5 | 0.05307 (0.04415) | **72.7** | 43.0 | 61.8 |
| Hybrid 1 | 0.00876 (0.00203) | -3.3 | 94.8 | 99.4 | 0.03658 (0.04031) | **19.0** | 51.4 | 49.7 |
| Hybrid 2 | 0.00947 (0.00220) | **4.5** | 94.8 | 99.2 | 0.04896 (0.04084) | **59.3** | 50.7 | 53.1 |
| Hybrid 3 | 0.00944 (0.00212) | **4.2** | 95.3 | 99.7 | 0.03886 (0.04580) | **26.5** | 63.9 | 40.5 |

The true effects considered were 0.0091 for short –term exposure and 0.0307 for long-term per 10 μg/m3 increase in PM2.5.

 aPercent bias is highlighted in bold when positive (i.e. away from the null) rather than negative (i.e. towards the null).

**References**

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