**eAppendix**

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

Evangelia Samoli1, Barbara K. Butland2, Rodopoulou S1, Richard W Atkinson2, Benjamin Barratt3,4, Sean D Beevers3, Andrew Beddows3, Konstantina Dimakopoulou1, Joel D Schwartz6, Mahdieh Danesh-Yadzi6, Klea Katsouyanni1,4,5

1. Department of Hygiene, Epidemiology and Medical Statistics, Medical School, National and Kapodistrian University of Athens, Athens, Greece.

2. Population Health Research Institute, St George’s, University of London, London, UK.

3. MRC Centre for Environment and Health, King’s College London, London, UK.

4. National Institute for Health Research Health Protection Research Unit (NIHR HPRU) in Health Impact of Environmental Hazards, King’s College London, London, UK.

5. School of Population Health and Environmental Sciences and MRC Centre for Environment and Health, King’s College London, London, UK.

6. Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts, USA.

**Table S1.** Baseline disease rates (C3) and concentration response function for short-term () and long-term 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 () and long-term used in our simulations.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Outcome | Baseline rate per LSOA per day | Pollutant | Concentration response function per 1 µg/m3 | |
| Short-term exposure | Long-term exposure |
| 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. The true effects considered were 0.0040 for short –term exposure and 0.4055 for long-term per 10 μg/m3 increase in PM10.

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

a Percent bias is highlighted in bold when positive (i.e. away from the null) rather than negative (i.e. towards the null); b Bias not statistically significant at the 5% level based on a one sample t-test.

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

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

a Percent bias is highlighted in bold when positive (i.e. away from the null) rather than negative (i.e. towards the null); b Bias not statistically significant at the 5% level based on a one sample t-test.

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