**Supplemental Material**

Exposure to ultrafine particles and the incidence of asthma in children: A population-based open cohort study in Montreal, Canada.

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**eTable 1.** AIC and adjusted hazard ratio per interquartile range increment from single pollutant models for the association between childhood asthma onset and childhood exposure to ambient UFPs, NO2 and PM2.5 in Montréal, Québec, Canada.a,b

|  |  |  |  |
| --- | --- | --- | --- |
| **Models** | **UFPs** | **NO2** | **PM2.5** |
| **AIC** | **HR (95% CI)** | **AIC** | **HR (95% CI)** | **AIC** | **HR (95% CI)** |
| Crude model | 745,224 | 0.991 (0.984, 0.999) | 745,217 | 1.025 (1.011, 1.039) | 743,471 | 1.172 (1.163, 1.180) |
| + Sex (strata)+ Quintile of material deprivation | 703,092 | 0.991 (0.984, 0.999) | 703,090 | 1.020 (1.006, 1.035) | 701,352 | 1.171 (1.163, 1.180) |
| + Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation | 703,089 | 0.991 (0.983, 0.998) | 703,088 | 1.021 (1.006, 1.037) | 701,326 | 1.174 (1.165, 1.182) |
| + Sex (strata)+ Quintile of material deprivation+ Calendar year (strata) | 544,064 | 0.991 (0.984, 0.999) | 544,058 | 1.025 (1.011, 1.040) | 544,045 | 1.026 (1.015, 1.036) |
| + Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation+ Calendar year (strata) | 544,055 | 0.990 (0.983, 0.998) | 544,054 | 1.022 (1.007, 1.038) | 544,041 | 1.025 (1.014, 1.035) |
| Non-linear pollutant (spline)+ Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation+ Calendar year (strata) | 544,050 | - | 544,051 | - | 544,030 | - |

Abbreviations: AIC, Akaike information criterion; CI, confidence interval; HR, hazard ratio.

a Crude model: Cox model for air pollutant(s) exposure fitted as linear.

b Interquartile range (IQR) increments are 3,427 particles/cm3 for UFPs, 11.06 ppb for NO2 and 0.77 µg/m3 for PM2.5

**eTable 2.** AIC and adjusted hazard ratio per interquartile range increment from multipollutant models for the association between childhood asthma onset and childhood exposure to ambient UFPs, NO2 and PM2.5­ in Montréal, Québec, Canada.a,b

|  |  |  |  |
| --- | --- | --- | --- |
| **Models** | **UFPs + NO2** | **UFPs + PM2.5** | **UFPs + NO2 + PM2.5** |
|  | **AIC** | **HR (95% CI) for UFPs** | **HR (95% CI) for NO2** | **AIC** | **HR (95% CI)** | **HR (95% CI) for PM2.5** | **AIC** | **HR (95% CI) for UFPs** | **HR (95% CI) for NO2** | **HR (95% CI) for PM2.5** |
| Crude model | 745,209 | 0.987 (0.980, 0.995) | 1.031 (1.017, 1.046) | 743,458 | 0.985 (0.978, 0.993) | 1.172 (1.164, 1.181) | 743,352 | 0.995 (0.987, 1.003) | 0.922 (0.908, 0.937) | 1.186 1.177, 1.195) |
| + Sex (strata)+ Quintile of material deprivation | 703,083 | 0.988 (0.981, 0.996) | 1.025 (1.011, 1.041) | 701,339 | 0.986 (0.978, 0.993) | 1.172 (1.163, 1.180) | 701,224 | 0.995 (0.988, 1.003) | 0.917 (0.904, 0.932) | 1.187 (1.178, 1.196) |
| + Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation | 703,080 | 0.988 (0.980, 0.996) | 1.027 (1.012, 1.043) | 701,316 | 0.987 (0.979, 0.994) | 1.174 (1.165, 1.183) | 701,217 | 0.995 (0.988, 1.003) | 0.920 (0.906, 0.936) | 1.187 (1.178, 1.196) |
| + Sex (strata)+ Quintile of material deprivation+ Calendar year (strata) | 544,049 | 0.987 (0.980, 0.995) | 1.031 (1.016, 1.047) | 544,040 | 0.990 (0.983, 0.997) | 1.026 (1.016, 1.037) | 544,039 | 0.988 (0.981, 0.996) | 1.015, 0.999, 1.033) | 1.021 (1.009, 1.033) |
| + Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation+ Calendar year (strata) | 544,045 | 0.987 (0.979, 0.995) | 1.029 (1.013, 1.04) | 544,035 | 0.989 (0.982, 0.997) | 1.025 (1.015, 1.036) | 544,034 | 0.988 (0.981, 0.996) | 1.012 (0.996, 1.032) | 1.021 (1.009, 1.033) |
| Non-linear pollutants (spline)+ Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation+ Calendar year (strata) | 544,038 | - | - | 544,019 | - | - | 544,017 | - | - | - |

Abbreviations: AIC, Akaike information criterion; CI, confidence interval; HR, hazard ratio.

a Crude model: Cox model for air pollutant(s) exposure fitted as linear.

b Interquartile range (IQR) increments are 3,427 particles/cm3 for UFPs, 11.06 ppb for NO2 and 0.77 µg/m3 for PM2.5

**eTable 3.** AIC and adjusted hazard ratio per interquartile range increment from single pollutant models for the association between childhood asthma onset and prenatal exposure to ambient UFPs, NO2 and PM2.5­ in Montréal, Québec, Canada.a,b

|  |  |  |  |
| --- | --- | --- | --- |
| **Models** | **UFPs** | **NO2** | **PM2.5** |
| **AIC** | **HR (95% CI)** | **AIC** | **HR (95% CI)** | **AIC** | **HR (95% CI)** |
| Crude model | 752,915 | 0.988 (0.980, 0.996) | 748,085 | 1.023 (1.012, 1.035) | 705,506 | 1.340 (1.325, 1.357) |
| + Sex (strata)+ Quintile of material deprivation | 710,394 | 0.987 (0.980, 0.996) | 705,820 | 1.018 (1.005, 1.035) | 707,994 | 1.342 (1.327, 1.359) |
| + Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation | 710,398 | 0.988 (0.980, 0.996) | 705,824 | 1.022 (1.006, 1.037) | 707,968 | 1.349 (1.332, 1.366) |
| + Sex (strata)+ Quintile of material deprivation+ Calendar year (strata) | 551,125 | 0.988 (0.980, 0.996) | 547,477 | 1.024 (1.009, 1.035) | 550,928 | 1.065 (1.045, 1.084) |
| + Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation+ Calendar year (strata) | 551,128 | 0.987 (0.980, 0.995) | 547,483 | 1.022 (1.006, 1.035) | 550,934 | 1.063 (1.045, 1.084) |
| Non-linear pollutant (spline)+ Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation+ Calendar year (strata) | 551,126 | - | 547,473 | - | 550,917 | - |

Abbreviations: AIC, Akaike information criterion; CI, confidence interval; HR, hazard ratio.

a Crude model: Cox model for air pollutant(s) exposure fitted as linear.

b Interquartile range (IQR) increments are 3,785 particles/cm3 for UFPs, 11.48 ppb for NO2 and 1.53 ug/m3 for PM2.5

**eTable 4.** AIC and adjusted hazard ratio per interquartile range increment from multipollutant models for the association between childhood asthma onset and prenatal exposure to ambient UFPs, NO2 and PM2.5­ in Montréal, Québec, Canada.a,b

|  |  |  |  |
| --- | --- | --- | --- |
| **Models** | **UFPs + NO2** | **UFPs + PM2.5­** | **UFPs + NO2 + PM2.5­** |
|  | **AIC** | **HR (95% CI) for UFPs** | **HR (95% CI) for NO2** | **AIC** | **HR (95% CI)** | **HR (95% CI) for PM2.5** | **AIC** | **HR (95% CI) for UFPs** | **HR (95% CI) for NO2** | **HR (95% CI) for PM2.5** |
| Crude model | 748,073 | 0.984 (0.976, 0.993) | 1.030 (1.015, 1.047) | 750,489 | 0.983 (0.975, 0.991) | 1.342 (1.327, 1.359) | 745,561 | 0.994 (0.986, 1.002) | 0.914 (0.900, 0.929) | 1.369 (1.352, 1.386) |
| + Sex (strata)+ Quintile of material deprivation | 705,809 | 0.985 (0.977, 0.993) | 1.027 (1.010, 1.042) | 707,978 | 0.983 (0.975, 0.991) | 1.344 (1.327, 1.361) | 703,295 | 0.994 (0.986, 1.002) | 0.910 (0.895, 0.925) | 1.371 (1.354, 1.388) |
| + Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation | 705,812 | 0.985 (0.976, 0.993) | 1.029 (1.013, 1.046) | 707,955 | 0.984 (0.976, 0.992) | 1.349 (1.332, 1.366) | 703,296 | 0.994 (0.986, 1.002) | 0.915 (0.900, 0.931) | 1.371 (1.354, 1.390) |
| + Sex (strata)+ Quintile of material deprivation+ Calendar year (strata) | 547,463 | 0.984 (0.976, 0.992) | 1.031 (1.016, 1.048) | 550,918 | 0.986 (0.979, 0.994) | 1.065 (1.046, 1.085) | 547,274 | 0.986 (0.978, 0.994) | 1.005 (0.987, 1.023) | 1.062 (1.040, 1.084) |
| + Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation+ Calendar year (strata) | 547,469 | 0.984 (0.975, 0.991) | 1.030 (1.014, 1.047) | 550,924 | 0.986 (0.978, 0.994) | 1.065 (1.046, 1.085) | 547,280 | 0.986 (0.978, 0.994) | 1.005 (0.986, 1.023) | 1.062 (1.040, 1.084) |
| Non-linear pollutants (spline)+ Sex (strata)+ Quintile of social deprivation+ Quintile of material deprivation+ Calendar year (strata) | 547,461 | - | - | 550,908 | - | - | 547,253 | - | - | - |

Abbreviations: AIC, Akaike information criterion; CI, confidence interval; HR, hazard ratio.

a Crude model: Cox model for air pollutant(s) exposure fitted as linear.

b Interquartile range (IQR) increments are 3,785 particles/cm3 for UFPs, 11.48 ppb for NO2 and 1.53 ug/m3 for PM2.5

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**eFigure 1. Adjusted response functions between childhood exposure to(A) UFP, (B) NO2 and (C) PM2.5 and the hazard of childhood-onset asthma in children born in Montreal.** The horizontal axis represents the concentrations of UFPs, NO2 and PM2.5. The vertical axis represents the hazard ratio (HR). The solid red line represents the mean HR from the non-linear function fitted using restricted cubic splines with three knots (10th, 50th and 90th percentile of the exposure distribution), with the dashed blue lines representing the 95% confidence interval. The response functions are adjusted for quintiles of material deprivation, social deprivation, sex (as strata) and calendar year (as strata).



**eFigure 2. Adjusted response functions between prenatal exposure to (A) UFP, (B) NO2 and (C) PM2.5 and the hazard of childhood-onset asthma in children born in Montreal.** The horizontal axis represents the concentrations of UFPs, NO2 and PM2.5. The vertical axis represents the log-hazard ratio (log HR). The solid red line represents the mean HR from the non-linear function fitted using restricted cubic splines with three knots (10th, 50th and 90th percentile of the exposure distribution), with the dashed orange lines representing the 95% confidence interval. The response functions are adjusted for quintiles of material deprivation, social deprivation, sex (as strata) and calendar year (as strata).

**eFigure 3.** Number of events (asthma cases) by age group in the cohort.