**Appendix**

Hvidtfeldt et al. Long-term exposure to fine particle elemental components and lung cancer incidence in the ELAPSE pooled cohort

**Table of content**:

1. Characteristics of each of the seven cohorts and their participants

2. Supplementary tables

Table S1: Distribution of elemental components of PM2.5 (ng/m3) in the pooled cohort

Table S2: Spearman correlations between PM2.5 mass and PM2.5 components at participant’s baseline addresses

Table S3: Spearman correlations between NO2 and PM2.5 components at participant’s baseline addresses

Table S4: Spearman correlations between PM2.5 components (SLR) in (sub) cohorts and the pooled cohort

Table S5: HR of PM2.5 mass (per 5 µg/m3 increment), NO2 (per 10 µg/m3 increment) and lung cancer in two-pollutant models adjusted for PM2.5 components

**Characteristics of the included cohorts**

**CEANS** (Cardiovascular Effects of Air Pollution and Noise in Stockholm)

All participants resided in Stockholm County, Sweden. The cohort is comprised of four sub-cohorts:

The Stockholm Diabetes Preventive Program (SDPP) is a population-based prospective study of 7,949 subjects aged 35–54 years.1 The Stockholm Cohort of 60-year-olds (SIXTY) consists of a random population sample of one-third of all men and women living in Stockholm County turning 60 years between August 1997 and March 1999.2 The Screening Across the Lifespan Twin Study (SALT) is a sub-study of the Swedish Twin Registry.3 All Swedish complete twin-pairs born in Sweden before 1959 were contacted. Included in this study are 7,043 SALT participants who lived in Stockholm County. Lastly, The Swedish National Study of Aging and Care in Kungsholmen (SNAC-K) randomly sampled individuals 60+ years of age from a central area in Stockholm.4

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | |  | **CEANS, (sub) cohorts** | | | |
| Variable | |  | SDPP | SIXTY | SALT | SNAC-K |
| Baseline year, range | |  | 1992–1998 | 1997–1999 | 1998–2003 | 2001–2004 |
| Enrolled, N | |  | 7,949 | 4,232 | 7,043 | 3,363 |
| Exclusionsa | |  | 546 | 376 | 945 | 666 |
| Missing on covariatesb | |  | 98 | 196 | 473 | 338 |
| Included, N | |  | 7,305 | 3,660 | 5,625 | 2,359 |
| Age at baseline, mean (SD) | |  | 47.0 (4.9) | 60 (0) | 57.3 (10.4) | 72.5 (10.4) |
| Women, N (%) | |  | 4,346 (59) | 1,831 (50) | 3,001 (53) | 1,471 (62) |
| Unemployed, N (%) | |  | 669 (9) | 1,175 (32) | 1,882 (33) | 1,794 (76) |
| Marital status, N (%) | |  |  |  |  |  |
|  | Single |  | 1,185 (16) | 172 (5) | 785 (14) | 382 (16) |
|  | Married |  | 6,120 (84) | 2,726 (75) | 3,839 (68) | 1,095 (46) |
|  | Divorced |  | - | 575 (16) | 629 (11) | 326 (14) |
|  | Widowed |  | - | 187 (5) | 372 (7) | 556 (24) |
| Smoking status, N (%) | |  |  |  |  |  |
|  | Current |  | 1,897 (26) | 767 (21) | 1,185 (21) | 350 (15) |
|  | Previous |  | 2,655 (36) | 1,397 (38) | 1,856 (33) | 892 (38) |
|  | Never |  | 2,753 (38) | 1,496 (41) | 2,584 (46) | 1,117 (47) |
| Smoking intensity, g/d mean (SD)c | |  | 13.5 (7.4) | 13.3 (7.7) | 12.7 (8.1) | 11.7 (8.3) |
| Smoking duration, yrs mean (SD)c | |  | 27.8 (8.6) | 36.2 (10.1) | 37.6 (9.1) | 43.2 (13.5) |
| BMI, kg/m2 N (%) | |  |  |  |  |  |
|  | < 18.5 |  | 49 (1) | 23 (1) | 75 (1) | 62 (3) |
|  | 18.5–24.9 |  | 3,491 (48) | 1,281 (35) | 3,296 (59) | 1,041 (44) |
|  | 25.0–29.9 |  | 2,856 (39) | 1,633 (45) | 1,887 (34) | 950 (40) |
|  | 30.0+ |  | 909 (12) | 723 (20) | 367 (7) | 306 (13) |
| Neighborhood incomed, mean (SD) | |  | 24.3 (4.2) | 24.7 (6.9) | 25.4 (6.6) | 28.7 (2.2) |
| aDue to failed exposure assignment or any cancer before baseline  bMain model 3: age, sex, year of baseline visit, smoking status, duration, intensity, intensity², BMI, marital status, employment status and 2001 mean income at the neighborhood level  cAmong current smokers  dEUR per 1,000, year 2001. Neighborhood defined as municipality | | | | | | |

**Main references:**

1. Eriksson AK, Ekbom A, Granath F, *et al*. Psychological distress and risk of pre-diabetes and Type 2 diabetes in a prospective study of Swedish middle-aged men and women. Diabet Med 2008;25:834–42.

2. Wändell PE, Wajngot A, de Faire U, *et al*. Increased prevalence of diabetes among immigrants from non-European countries in 60-year-old men and women in Sweden. Diabetes Metab 2007;33:30–6.

3. Zagai U, Lichtenstein P, Pedersen NL, Magnusson PKE. The Swedish Twin Registry: Content and Management as a Research Infrastructure. Twin Res Hum Genet. 2019 Dec;22(6):672-680.

4. Lagergren M, Fratiglioni L, Hallberg IR, *et al*. A longitudinal study integrating population, care and social services data. The Swedish National study on Aging and Care (SNAC). Aging Clin Exp Res 2004;16:158–68.

**DCH** (Diet, Cancer and Health)

Participants were recruited among persons aged 50 years and older from the areas of greater Copenhagen and Aarhus, Denmark.

|  |  |  |
| --- | --- | --- |
| Variable | | **Total** |
| Baseline year, range | | 1993–1997 |
| Enrolled, N | | 57,053 |
| Exclusionsa | | 1,613 |
| Missing on covariatesb | | 2,661 |
| Included, N | | 52,779 |
| Age at baseline, mean (SD) | | 56.7 (4.2) |
| Women, N (%) | | 27,709 (53) |
| Unemployed, N (%) | | 11,466 (22) |
| Marital status, N (%) | |  |
|  | Single | 3,220 (6) |
|  | Married | 37,665 (71) |
|  | Divorced | 8,980 (17) |
|  | Widowed | 2,914 (6) |
| Smoking status, N (%) | |  |
|  | Current | 19,175 (36) |
|  | Previous | 14,685 (28) |
|  | Never | 18,919 (36) |
| Smoking intensity, g/d mean (SD)c | | 16.5 (9.0) |
| Smoking duration, yrs mean (SD)c | | 36.3 (7.7) |
| BMI, kg/m2 N (%) | |  |
|  | < 18.5 | 414 (1) |
|  | 18.5–24.9 | 22,781 (43) |
|  | 25.0–29.9 | 21,941 (42) |
|  | 30.0+ | 7,643 (14) |
| Neighborhood incomed, mean (SD) | | 20.1 (3.4) |
| aDue to failed exposure assignment or any cancer before baseline  bMain model 3: age, sex, year of baseline visit, smoking status, duration, intensity, intensity², BMI, marital status, employment status and 2001 mean income at the neighborhood level  cAmong current smokers  dEUR per 1,000, year 2001. Neighborhood defined as municipality | | |

**Main reference:**

Tjonneland A, Olsen A, Boll K et al. Study design, exposure variables, and socioeconomic determinants of participation in Diet, Cancer and Health: a population-based prospective cohort study of 57,053 men and women in Denmark. Scand J Public Health 2007; 35: 432–41

**DNC** (Danish Nurse Cohort)

The cohort was sampled among members of The Danish Nurse Organization (DNO) including both working and retired nurses. Questionnaires were mailed in 1993 to members aged 45+ years and again in 1999 with the inclusion of new members (45+ years).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | |  | **DNC, (sub) cohorts** | |
| Variable | |  | DNC-1993 | DNC-1999 |
| Baseline year | |  | 1993 | 1999 |
| Enrolled, N | |  | 19,898 | 8,833 |
| Exclusionsa | |  | 1,970 | 814 |
| Missing on covariatesb | |  | 2,372 | 589 |
| Included, N | |  | 15,556 | 7,430 |
| Age at baseline, mean (SD) | |  | 56.0 (8.3) | 47.9 (4.1) |
| Women, N (%) | |  | 15,556 (100) | 7,430 (100) |
| Unemployed, N (%) | |  | 4,573 (29) | 365 (5) |
| Marital status, N (%) | |  |  |  |
|  | Single |  | 1,619 (10) | 679 (9) |
|  | Married |  | 10,628 (68) | 5,680 (76) |
|  | Divorced |  | 1,884 (12) | 925 (12) |
|  | Widowed |  | 1,425 (9) | 146 (2) |
| Smoking status, N (%) | |  |  |  |
|  | Current |  | 5,753 (37) | 2,056 (28) |
|  | Previous |  | 4,419 (28) | 2,420 (33) |
|  | Never |  | 5,384 (35) | 2,954 (40) |
| Smoking intensity, g/d mean (SD)c | |  | 13.8 (8.1) | 13.2 (7.4) |
| Smoking duration, yrs mean (SD)c | |  | 31.4 (9.9) | 27.1 (7.1) |
| BMI, kg/m2 N (%) | |  |  |  |
|  | < 18.5 |  | 455 (3) | 132 (2) |
|  | 18.5–24.9 |  | 10,693 (69) | 5,053 (68) |
|  | 25.0–29.9 |  | 3,593 (23) | 1,736 (23) |
|  | 30.0+ |  | 815 (5) | 509 (7) |
| Neighborhood incomed, mean (SD) | |  | 19.2 (2.6) | 19.0 (2.4) |
| aDue to failed exposure assignment or any cancer before baseline  bMain model 3: age, sex, year of baseline visit, smoking status, duration, intensity, intensity², BMI, marital status, employment status and 2001 mean income at the neighborhood level  cAmong current smokers  dEUR per 1,000, year 2001. Neighborhood defined as municipality | | | | |

**Main references:**

Hundrup YA, Simonsen M, Jørgensen T, Obel EB. Cohort profile: The Danish Nurse Cohort. International Journal of Epidemiology, 2012;41:1241–47.

**EPIC-NL** (European Prospective Investigation into Cancer and Nutrition, the Netherlands)

The EPIC-NL combines two Dutch EPIC-cohorts: The Monitoring Project on Risk Factors and chronic diseases in the Netherlands (MORGEN) cohort which consists of a general population sample aged 20–59 years from three Dutch towns (Amsterdam, Doetinchem and Maastricht). The Prospect is a prospective cohort study among women aged 49–70, residing in the city of Utrecht or its vicinity, who participated in the nationwide Dutch breast cancer screening programme between 1993 and 1997.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | |  | **EPIC-NL, sub-cohorts** | |
| Variable | |  | MORGEN | PROSPECT |
| Baseline year | |  | 1993–1997 | 1993–1997 |
| Enrolled, N | |  | 22,654 | 17,357 |
| Exclusionsa | |  | 2,557 | 2,303 |
| Missing on covariatesb | |  | 2,305 | 1,414 |
| Included, N | |  | 17,792 | 13,640 |
| Age at baseline, mean (SD) | |  | 42.7 (11.2) | 57.6 (6.0) |
| Women, N (%) | |  | 9,681 (54) | 13,640 (100) |
| Unemployed, N (%) | |  | 5,468 (31) | 6,623 (49) |
| Marital status, N (%) | |  |  |  |
|  | Single |  | 4,570 (26) | 769 (6) |
|  | Married |  | 11,554 (65) | 10,510 (77) |
|  | Divorced |  | 1,320 (7) | 1,076 (8) |
|  | Widowed |  | 348 (2) | 1,285 (9) |
| Smoking status, N (%) | |  |  |  |
|  | Current |  | 6,171 (35) | 3,113 (23) |
|  | Previous |  | 5,004 (28) | 4,463 (33) |
|  | Never |  | 6,617 (37) | 6,064 (44) |
| Smoking intensity, g/d mean (SD)c | |  | 15.7 (8.6) | 13.6 (8.7) |
| Smoking duration, yrs mean (SD)c | |  | 24.5 (10.6) | 36.7 (7.7) |
| BMI, kg/m2 N (%) | |  |  |  |
|  | < 18.5 |  | 178 (1) | 79 (1) |
|  | 18.5–24.9 |  | 8,917 (50) | 6,100 (45) |
|  | 25.0–29.9 |  | 6,648 (37) | 5,406 (40) |
|  | 30.0+ |  | 2,049 (12) | 2,055 (15) |
| Neighborhood incomed, mean (SD) | |  | 12.2 (1.6) | 13.6 (1.4) |
| aDue to failed exposure assignment or any cancer before baseline  bMain model 3: age, sex, year of baseline visit, smoking status, duration, intensity, intensity², BMI, marital status, employment status and 2001 mean income at the neighborhood level  cAmong current smokers  dEUR per 1,000, year 2001. Neighborhood defined as a neighborhood of a larger city | | | | |

**Main references:**

Beulens JWJ, Monninkhof EM, Verschuren WMM et al. Cohort Profile: The EPIC-NL study. International Journal of Epidemiology 2010; 39: 1170–78.

**HNR** (Heinz Nixdorf Recall study)

The cohort consists of randomly sampled persons aged 45 to 75 years from the Ruhr area (Bochum, Essen, and Mülheim), Germany.

|  |  |  |
| --- | --- | --- |
| Variable | | **HNR** |
| Baseline year, range | | 2000–2003 |
| Enrolled, N | | 4,814 |
| Exclusionsa | | 1,142 |
| Missing on covariatesb | | 61 |
| Included, N | | 3,611 |
| Age at baseline, mean (SD) | | 59.1 (7.7) |
| Women, N (%) | | 1,790 (50) |
| Unemployed, N (%) | | 2,061 (57) |
| Marital status N (%) | |  |
|  | Single | 215 (6) |
|  | Married | 2,714 (75) |
|  | Divorced | 367 (10) |
|  | Widowed | 315 (9) |
| Smoking status, N (%) | |  |
|  | Current | 886 (25) |
|  | Previous | 1,219 (34) |
|  | Never | 1,506 (42) |
| Smoking intensity, g/d mean (SD)c | | 19.1 (12.5) |
| Smoking duration, yrs mean (SD)c | | 33.9 (9.2) |
| BMI, kg/m2 N (%) | |  |
|  | < 18.5 | 11 (0) |
|  | 18.5–24.9 | 972 (27) |
|  | 25.0–29.9 | 1,652 (46) |
|  | 30.0+ | 976 (27) |
| Neighborhood incomed, mean (SD) | | 25.1 (8.1) |
| aDue to failed exposure assignment or any cancer before baseline  bMain model 3: age, sex, year of baseline visit, smoking status, duration, intensity, intensity², BMI, marital status, employment status and 2001 mean income at the neighborhood level  cAmong current smokers  dEUR per 1,000, year 2001. Neighborhood defined as city district | | |

**Main reference:**

Schmermund A, Möhlenkamp S, Stang A et al. Assessment of clinically silent atherosclerotic disease and established and novel risk factors for predicting myocardial infarction and cardiac death in healthy middle-aged subjects: Rationale and design of the Heinz Nixdorf RECALL Study. American Heart Journal, 2002; 144: 212–2018.

**E3N** (Etude Epidémiologique auprès de femmes de la Mutuelle Générale de l'Education Nationale)

The cohort was selected among French women aged 40 to 65 years who were insured through a national health system that primarily covered teachers.

|  |  |  |
| --- | --- | --- |
| Variable | | **E3N** |
| Baseline year, range | | 1989–1991 |
| Enrolled, N | | 98,995 |
| Exclusionsa | | 50,544 |
| Missing on covariatesb | | 12,193 |
| Included, N | | 36,258 |
| Age at baseline, mean (SD) | | 52.8 (6.7) |
| Women, N (%) | | 36,258 (100) |
| Unemployed, N (%) | | 11,391 (31) |
| Marital status | |  |
|  | Single | 5,974 (16) |
|  | Married | 30,284 (84) |
|  | Divorced | - |
|  | Widowed | - |
| Smoking status, N (%) | |  |
|  | Current | 4,714 (13) |
|  | Previous | 6,975 (19) |
|  | Never | 24,569 (68) |
| Smoking intensity, g/d mean (SD)c | | 11.3 (9.1) |
| Smoking duration, yrs mean (SD)c | | 28.5 (7.6) |
| BMI, kg/m2 | |  |
|  | < 18.5 | 1,306 (4) |
|  | 18.5–24.9 | 27,542 (76) |
|  | 25.0–29.9 | 6,129 (17) |
|  | 30.0+ | 1,281 (4) |
| Neighborhood incomed, mean (SD) | | 11.2 (3.0) |
| aDue to failed exposure assignment or any cancer before baseline  bMain model 3: age, sex, year of baseline visit, smoking status, duration, intensity, intensity², BMI, marital status, employment status and 2001 mean income at the neighborhood level  cAmong current smokers  dEUR per 1,000, year 2001. Neighborhood defined as IRIS – a small administrative unit of a city | | |

**Main reference:**

Francoise Clavel-Chapelon for the E3N Study Group. Cohort Profile: The French E3N Cohort Study. International Journal of Epidemiology 2015; 44: 801–809.

**VHM&PP** (Vorarlberg Health Monitoring and Prevention Programme)

The VHM&PP is a population-based cohort recruited among all adults of the province of Vorarlberg, Austria.

|  |  |  |
| --- | --- | --- |
| Variable | | **VHM&PP** |
| Baseline year, range | | 1985–2005 |
| Enrolled, N | | 181,350 |
| Exclusionsa | | 15,780 |
| Missing on covariatesb | | 25,481 |
| Included, N | | 140,089 |
| Age at baseline, mean (SD) | | 41.7 (14.9) |
| Women, N (%) | | 78,796 (56) |
| Unemployed, N (%) | | 40,983 (29) |
| Marital status | |  |
|  | Single | 24,496 (17) |
|  | Married | 96,501 (69) |
|  | Divorced | 9,507 (7) |
|  | Widowed | 9,585 (7) |
| Smoking status, N (%) | |  |
|  | Current | 28,325 (20) |
|  | Previous | 8,665 (6) |
|  | Never | 103,099 (74) |
| Smoking intensity, g/d mean (SD)c | | 15.6 (8.9) |
| Smoking duration, yrs mean (SD)c | | 13.4 (8.2) |
| BMI, kg/m2 | |  |
|  | < 18.5 | 4,375 (3) |
|  | 18.5–24.9 | 76,712 (55) |
|  | 25.0–29.9 | 43,905 (31) |
|  | 30.0+ | 15,097 (11) |
| Neighborhood incomed, mean (SD) | | 22.9 (1.7) |
| aDue to failed exposure assignment or any cancer before baseline  bMain model 3: age, sex, year of baseline visit, smoking status, duration, intensity, intensity², BMI, marital status, employment status and 2001 mean income at the neighborhood level  cAmong current smokers  dEUR per 1,000, year 2001. EUR per 1,000, year 2001. Neighborhood defined as municipality | | |

**Main reference:**

Ulmer H, Kelleher CC, Fitz-Simon N et al. Secular trends in cardiovascular risk factors: an age-period cohort analysis of 698,954 health examinations in 181,350 Austrian men and women. Journal of Internal Medicine, 2007; 261: 566–576.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table S1. Distribution of elemental components of PM2.5 (ng/m3) in the pooled cohort** | | | | | | | | | | |
| **Pollutant** | **Mean** | **SD** | **IQR** | **Min** | **P5** | **P25** | **Median** | **P75** | **P95** | **Max** |
| PM2.5 Cu SLR | 3.47 | 2.56 | 3.74 | 0.00 | 0.00 | 1.35 | 3.46 | 5.09 | 7.30 | 42.41 |
| PM2.5 Cu RF | 3.90 | 1.62 | 1.93 | 0.85 | 1.87 | 2.66 | 3.87 | 4.59 | 6.61 | 19.17 |
| PM2.5 Fe SLR | 86.79 | 45.39 | 56.11 | 0.00 | 20.82 | 56.03 | 84.30 | 112.13 | 157.98 | 438.83 |
| PM2.5 Fe RF | 83.44 | 33.10 | 34.04 | 21.04 | 43.90 | 62.50 | 74.90 | 96.53 | 152.27 | 311.83 |
| PM2.5 K SLR | 165.99 | 52.40 | 81.55 | 31.84 | 90.72 | 122.75 | 163.40 | 204.30 | 255.65 | 321.38 |
| PM2.5 K RF | 211.76 | 102.19 | 201.83 | 74.42 | 89.53 | 111.81 | 208.52 | 313.64 | 371.91 | 480.60 |
| PM2.5 Ni SLR | 0.79 | 0.69 | 0.77 | 0.00 | 0.00 | 0.34 | 0.55 | 1.11 | 2.17 | 12.68 |
| PM2.5 Ni RF | 0.81 | 0.58 | 0.92 | 0.07 | 0.17 | 0.28 | 0.79 | 1.20 | 1.89 | 3.79 |
| PM2.5 S SLR | 655.21 | 139.07 | 209.30 | 299.00 | 437.30 | 552.58 | 645.92 | 761.88 | 881.93 | 1251.90 |
| PM2.5 S RF | 684.88 | 128.61 | 117.69 | 484.19 | 528.55 | 612.89 | 639.49 | 730.59 | 921.86 | 1314.09 |
| PM2.5 Si SLR | 96.08 | 20.43 | 23.73 | 37.46 | 68.67 | 82.41 | 93.71 | 106.15 | 133.27 | 255.29 |
| PM2.5 Si RF | 85.53 | 24.65 | 23.08 | 38.13 | 60.50 | 70.81 | 78.42 | 93.89 | 131.21 | 299.72 |
| PM2.5 V SLR | 1.35 | 1.42 | 1.67 | 0.00 | 0.00 | 0.40 | 0.78 | 2.07 | 4.14 | 17.82 |
| PM2.5 V RF | 1.34 | 1.12 | 1.61 | 0.25 | 0.30 | 0.33 | 1.32 | 1.94 | 3.52 | 7.34 |
| PM2.5 Zn SLR | 16.74 | 10.98 | 10.67 | 0.00 | 3.72 | 10.84 | 15.28 | 21.51 | 30.85 | 145.40 |
| PM2.5 Zn RF | 19.45 | 7.35 | 9.63 | 9.52 | 11.22 | 13.48 | 19.97 | 23.11 | 30.12 | 73.93 |
| SLR, Supervised Linear regression; RF, Random Forest | | | | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table S2. Spearman correlations between PM2.5 mass and PM2.5 components at participant’s baseline addresses (2010 exposure), N=306,104.** | | | | | | | | | | | | | | | | |
| (Sub) cohort | **PM2.5 Cu** | | **PM2.5 Fe** | | **PM2.5 K** | | **PM2.5 Ni** | | **PM2.5 S** | | **PM2.5 Si** | | **PM2.5 V** | | **PM2.5 Zn** | |
| SLR | RF | SLR | RF | SLR | RF | SLR | RF | SLR | RF | SLR | RF | SLR | RF | SLR | RF | |
| CEANS-SDPP | 0.19 | 0.60 | 0.31 | 0.36 | -0.07 | 0.39 | -0.23 | 0.07 | 0.55 | 0.47 | 0.21 | -0.20 | -0.23 | 0.32 | -0.18 | 0.44 | |
| CEANS-SIXTY | 0.48 | 0.59 | 0.53 | 0.51 | 0.07 | 0.54 | 0.31 | 0.33 | 0.47 | 0.33 | 0.48 | 0.36 | -0.03 | 0.25 | 0.45 | 0.43 | |
| CEANS-SALT | 0.49 | 0.57 | 0.51 | 0.51 | 0.06 | 0.54 | 0.30 | 0.35 | 0.47 | 0.31 | 0.47 | 0.40 | -0.02 | 0.28 | 0.42 | 0.42 | |
| CEANS-SNACK | 0.50 | 0.65 | 0.53 | 0.65 | 0.55 | 0.55 | 0.18 | 0.50 | 0.47 | 0.25 | 0.46 | 0.31 | 0.43 | 0.29 | 0.39 | 0.57 | |
| DCH | 0.74 | 0.72 | 0.76 | 0.66 | -0.19 | 0.54 | 0.52 | 0.64 | 0.66 | 0.65 | 0.65 | 0.41 | 0.32 | 0.60 | 0.68 | 0.67 | |
| DNC-1993 | 0.41 | 0.40 | 0.38 | 0.37 | 0.17 | 0.42 | 0.21 | 0.27 | 0.42 | 0.50 | 0.35 | 0.22 | 0.10 | 0.28 | 0.48 | 0.34 | |
| DNC-1999 | 0.30 | 0.28 | 0.27 | 0.24 | 0.11 | 0.36 | 0.11 | 0.18 | 0.30 | 0.38 | 0.21 | 0.12 | 0.00 | 0.22 | 0.36 | 0.22 | |
| EPIC-NL, Morgen | 0.22 | 0.24 | 0.28 | 0.24 | 0.50 | 0.49 | 0.14 | 0.06 | 0.46 | 0.61 | 0.28 | 0.46 | -0.16 | -0.52 | 0.55 | 0.55 | |
| EPIC-NL, Prospect | 0.40 | 0.32 | 0.37 | 0.33 | 0.44 | 0.43 | 0.11 | 0.41 | 0.63 | 0.54 | 0.30 | 0.23 | 0.24 | 0.22 | 0.34 | 0.29 | |
| HNR | 0.39 | 0.44 | 0.44 | 0.63 | -0.33 | 0.53 | 0.28 | 0.52 | 0.49 | 0.29 | 0.36 | 0.29 | 0.29 | 0.40 | 0.46 | 0.59 | |
| E3N | 0.62 | 0.63 | 0.67 | 0.56 | 0.31 | -0.12 | 0.41 | 0.20 | 0.43 | 0.50 | 0.51 | 0.08 | 0.17 | 0.24 | 0.64 | 0.66 | |
| VHM&PP | 0.72 | 0.63 | 0.62 | 0.39 | 0.76 | 0.59 | 0.54 | -0.30 | 0.79 | 0.55 | 0.38 | -0.20 | 0.64 | -0.04 | 0.68 | 0.44 | |
| CEANS: Cardiovascular Effects of Air Pollution and Noise in Stockholm; SDPP: The Stockholm Diabetes Preventive Program; SIXTY: The Stockholm cohort of 60-year-olds; SALT: Screening Across the Lifespan Twin Study; SNAC-K: The Swedish National Study of Aging and Care in Kungsholmen; DCH: Diet, Cancer and Health; DNC: Danish Nurses Cohort; EPIC-NL: European Prospective Investigation into Cancer and Nutrition, the Netherlands; MORGEN: Monitoring Project on Risk Factors and chronic diseases in the Netherlands; HNR: Heinz Nixdorf Recall study; E3N (EPIC-France): Etude Epidémiologique auprès de femmes de la Mutuelle Générale de l'Education Nationale; VHM&PP: Vorarlberg Health Monitoring and Prevention Programme.  SLR, Supervised Linear regression; RF, Random Forest | | | | | | | | | | | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table S3. Spearman correlations between NO2 and PM2.5 components at participant’s baseline addresses (2010 exposure), N=306,104.** | | | | | | | | | | | | | | | | |
| (Sub) cohort | **PM2.5 Cu** | | **PM2.5 Fe** | | **PM2.5 K** | | **PM2.5 Ni** | | **PM2.5 S** | | **PM2.5 Si** | | **PM2.5 V** | | **PM2.5 Zn** | |
| SLR | RF | SLR | RF | SLR | RF | SLR | RF | SLR | RF | SLR | RF | SLR | RF | SLR | RF | |
| CEANS-SDPP | 0.29 | 0.81 | 0.84 | 0.70 | 0.07 | 0.79 | 0.16 | 0.30 | 0.30 | -0.06 | 0.73 | -0.20 | 0.03 | 0.33 | 0.38 | 0.62 | |
| CEANS-SIXTY | 0.83 | 0.89 | 0.90 | 0.85 | -0.24 | 0.68 | 0.52 | 0.58 | 0.46 | 0.30 | 0.82 | 0.64 | -0.13 | 0.21 | 0.58 | 0.70 | |
| CEANS-SALT | 0.85 | 0.89 | 0.90 | 0.87 | -0.27 | 0.69 | 0.53 | 0.63 | 0.44 | 0.32 | 0.82 | 0.71 | -0.11 | 0.25 | 0.56 | 0.69 | |
| CEANS-SNACK | 0.74 | 0.84 | 0.77 | 0.88 | 0.72 | 0.73 | 0.27 | 0.66 | 0.47 | 0.35 | 0.68 | 0.56 | 0.63 | 0.30 | 0.54 | 0.70 | |
| DCH | 0.90 | 0.88 | 0.88 | 0.79 | -0.24 | 0.63 | 0.55 | 0.62 | 0.57 | 0.58 | 0.63 | 0.31 | 0.36 | 0.61 | 0.62 | 0.68 | |
| DNC-1993 | 0.56 | 0.60 | 0.58 | 0.50 | -0.11 | 0.42 | 0.27 | 0.25 | 0.32 | 0.28 | 0.50 | 0.17 | 0.01 | 0.28 | 0.39 | 0.51 | |
| DNC-1999 | 0.36 | 0.36 | 0.35 | 0.28 | -0.12 | 0.27 | 0.12 | 0.13 | 0.19 | 0.18 | 0.27 | 0.08 | -0.07 | 0.16 | 0.23 | 0.29 | |
| EPIC-NL, Morgen | 0.88 | 0.90 | 0.88 | 0.88 | -0.39 | -0.45 | 0.72 | 0.71 | 0.27 | -0.30 | 0.76 | 0.51 | 0.65 | 0.45 | 0.27 | -0.35 | |
| EPIC-NL, Prospect | 0.86 | 0.89 | 0.89 | 0.88 | -0.11 | 0.71 | 0.57 | 0.09 | 0.41 | 0.56 | 0.86 | 0.77 | 0.32 | -0.21 | 0.66 | 0.73 | |
| HNR | 0.70 | 0.71 | 0.72 | 0.72 | -0.14 | 0.33 | 0.17 | 0.62 | 0.42 | 0.33 | 0.53 | 0.34 | 0.33 | 0.42 | 0.26 | 0.49 | |
| E3N | 0.81 | 0.82 | 0.86 | 0.81 | 0.28 | -0.16 | 0.58 | 0.36 | 0.58 | 0.59 | 0.76 | 0.31 | 0.36 | 0.43 | 0.73 | 0.72 | |
| VHM&PP | 0.83 | 0.79 | 0.88 | 0.76 | 0.71 | 0.67 | 0.72 | -0.52 | 0.72 | 0.63 | 0.80 | -0.24 | 0.75 | 0.10 | 0.76 | 0.65 | |
| CEANS: Cardiovascular Effects of Air Pollution and Noise in Stockholm; SDPP: The Stockholm Diabetes Preventive Program; SIXTY: The Stockholm cohort of 60-year-olds; SALT: Screening Across the Lifespan Twin Study; SNAC-K: The Swedish National Study of Aging and Care in Kungsholmen; DCH: Diet, Cancer and Health; DNC: Danish Nurses Cohort; EPIC-NL: European Prospective Investigation into Cancer and Nutrition, the Netherlands; MORGEN: Monitoring Project on Risk Factors and chronic diseases in the Netherlands; HNR: Heinz Nixdorf Recall study; E3N (EPIC-France): Etude Epidémiologique auprès de femmes de la Mutuelle Générale de l'Education Nationale; VHM&PP: Vorarlberg Health Monitoring and Prevention Programme.  SLR, Supervised Linear regression; RF, Random Forest | | | | | | | | | | | | | | | | | |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Table S4. Spearman correlations between PM2.5 components (SLR) in (sub) cohorts, N=306,104** | | | | | | | |
| **Pollutant** | **PM2.5 Cu** | **PM2.5 Fe** | **PM2.5 K** | **PM2.5 Ni** | **PM2.5 S** | **PM2.5 Si** | **PM2.5 V** |
|  | ***CEANS- SDPP*** | | | | | | |
| **PM2.5 Fe** | .30 | 1 |  |  |  |  |  |
| **PM2.5 K** | .04 | .01 | 1 |  |  |  |  |
| **PM2.5 Ni** | .01 | .34 | .33 | 1 |  |  |  |
| **PM2.5 S** | .22 | .20 | .07 | -.07 | 1 |  |  |
| **PM2.5 Si** | .25 | .83 | .22 | .49 | .16 | 1 |  |
| **PM2.5 V** | .04 | .15 | .56 | .71 | .01 | .42 | 1 |
| **PM2.5 Zn** | .16 | .52 | .59 | .68 | -.06 | .63 | .73 |
|  | ***CEANS-SIXTY*** | | | | | | |
| **PM2.5 Fe** | .93 | 1 |  |  |  |  |  |
| **PM2.5 K** | -.43 | -.36 | 1 |  |  |  |  |
| **PM2.5 Ni** | .55 | .63 | -.18 | 1 |  |  |  |
| **PM2.5 S** | .37 | .44 | .17 | .29 | 1 |  |  |
| **PM2.5 Si** | .75 | .86 | -.25 | .62 | .38 | 1 |  |
| **PM2.5 V** | -.25 | -.18 | .21 | .17 | -.08 | .10 | 1 |
| **PM2.5 Zn** | .54 | .64 | .11 | .65 | .36 | .73 | .27 |
|  | ***CEANS-SALT*** | | | | | | |
| **PM2.5 Fe** | .94 | 1 |  |  |  |  |  |
| **PM2.5 K** | -.42 | -.38 | 1 |  |  |  |  |
| **PM2.5 Ni** | .55 | .61 | -.21 | 1 |  |  |  |
| **PM2.5 S** | .36 | .41 | .16 | .26 | 1 |  |  |
| **PM2.5 Si** | .77 | .87 | -.28 | .62 | .34 | 1 |  |
| **PM2.5 V** | -.23 | -.15 | .23 | .19 | -.08 | .11 | 1 |
| **PM2.5 Zn** | .54 | .62 | .10 | .64 | .32 | .72 | .29 |
|  | ***CEANS-SNACK*** | | | | | | |
| **PM2.5 Fe** | .98 | 1 |  |  |  |  |  |
| **PM2.5 K** | .44 | .50 | 1 |  |  |  |  |
| **PM2.5 Ni** | .52 | .60 | .28 | 1 |  |  |  |
| **PM2.5 S** | .51 | .43 | -.02 | -.03 | 1 |  |  |
| **PM2.5 Si** | .83 | .88 | .47 | .59 | .37 | 1 |  |
| **PM2.5 V** | .64 | .73 | .61 | .81 | .07 | .72 | 1 |
| **PM2.5 Zn** | .62 | .71 | .58 | .86 | .01 | .69 | .97 |
|  | ***DCH*** | | | | | | |
| **PM2.5 Fe** | .98 | 1 |  |  |  |  |  |
| **PM2.5 K** | -.40 | -.36 | 1 |  |  |  |  |
| **PM2.5 Ni** | .60 | .61 | .10 | 1 |  |  |  |
| **PM2.5 S** | .57 | .61 | .17 | .71 | 1 |  |  |
| **PM2.5 Si** | .74 | .82 | -.09 | .66 | .73 | 1 |  |
| **PM2.5 V** | .31 | .35 | .45 | .84 | .71 | .53 | 1 |
| **PM2.5 Zn** | .69 | .72 | .04 | .86 | .83 | .82 | .74 |
|  | ***DNC-1993*** | | | | | | |
| **PM2.5 Fe** | .91 | 1 |  |  |  |  |  |
| **PM2.5 K** | -.07 | -.08 | 1 |  |  |  |  |
| **PM2.5 Ni** | .47 | .51 | -.04 | 1 |  |  |  |
| **PM2.5 S** | .57 | .54 | .44 | .39 | 1 |  |  |
| **PM2.5 Si** | .76 | .88 | .05 | .55 | .55 | 1 |  |
| **PM2.5 V** | .13 | .17 | .21 | .63 | .32 | .32 | 1 |
| **PM2.5 Zn** | .67 | .66 | .32 | .57 | 0.81 | .67 | .38 |
|  | ***DNC-1999*** | | | | | | |
| **PM2.5 Fe** | .90 | 1 |  |  |  |  |  |
| **PM2.5 K** | -.02 | -.03 | 1 |  |  |  |  |
| **PM2.5 Ni** | .48 | .53 | -.02 | 1 |  |  |  |
| **PM2.5 S** | .55 | .52 | .47 | .39 | 1 |  |  |
| **PM2.5 Si** | .75 | .88 | .07 | .56 | .52 | 1 |  |
| **PM2.5 V** | .14 | .18 | .20 | .60 | .30 | .32 | 1 |
| **PM2.5 Zn** | .66 | .64 | .35 | .57 | .79 | .65 | .38 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***EPIC-MORGEN*** | | | | | | |
| **PM2.5 Fe** | .99 | 1 |  |  |  |  |  |
| **PM2.5 K** | -.34 | -.29 | 1 |  |  |  |  |
| **PM2.5 Ni** | .83 | .81 | -.36 | 1 |  |  |  |
| **PM2.5 S** | .34 | .34 | .16 | .25 | 1 |  |  |
| **PM2.5 Si** | .74 | .82 | -.15 | .59 | .23 | 1 |  |
| **PM2.5 V** | .53 | .53 | -.59 | .68 | .02 | .51 | 1 |
| **PM2.5 Zn** | .48 | .52 | .35 | .58 | .39 | .45 | .08 |
|  | ***EPIC-Prospect*** | | | | | | |
| **PM2.5 Fe** | .99 | 1 |  |  |  |  |  |
| **PM2.5 K** | -.12 | -.15 | 1 |  |  |  |  |
| **PM2.5 Ni** | .61 | .64 | -.03 | 1 |  |  |  |
| **PM2.5 S** | .44 | .41 | .45 | .24 | 1 |  |  |
| **PM2.5 Si** | .85 | .90 | -.06 | .71 | .35 | 1 |  |
| **PM2.5 V** | .25 | .30 | .28 | .55 | .21 | .47 | 1 |
| **PM2.5 Zn** | .76 | .78 | .19 | .82 | .43 | .79 | .63 |
|  | ***HNR*** | | | | | | |
| **PM2.5 Fe** | .95 | 1 |  |  |  |  |  |
| **PM2.5 K** | .17 | .15 | 1 |  |  |  |  |
| **PM2.5 Ni** | .43 | .42 | .22 | 1 |  |  |  |
| **PM2.5 S** | .58 | .62 | .11 | .57 | 1 |  |  |
| **PM2.5 Si** | .74 | .85 | .19 | .42 | .55 | 1 |  |
| **PM2.5 V** | .35 | .39 | .02 | .60 | .35 | .37 | 1 |
| **PM2.5 Zn** | .27 | .29 | -.17 | .73 | .49 | .29 | .59 |
|  | ***E3N*** | | | | | | |
| **PM2.5 Fe** | .95 | 1 |  |  |  |  |  |
| **PM2.5 K** | .46 | .38 | 1 |  |  |  |  |
| **PM2.5 Ni** | .68 | .66 | .16 | 1 |  |  |  |
| **PM2.5 S** | .69 | .65 | .37 | .77 | 1 |  |  |
| **PM2.5 Si** | .84 | .88 | .48 | .63 | .63 | 1 |  |
| **PM2.5 V** | .42 | .37 | .08 | .83 | .64 | .41 | 1 |
| **PM2.5 Zn** | .79 | .81 | .48 | .76 | .70 | .78 | .53 |
|  | ***VHM&PP*** | | | | | | |
| **PM2.5 Fe** | .96 | 1 |  |  |  |  |  |
| **PM2.5 K** | .91 | .84 | 1 |  |  |  |  |
| **PM2.5 Ni** | .85 | .82 | .82 | 1 |  |  |  |
| **PM2.5 S** | .89 | .81 | .88 | .77 | 1 |  |  |
| **PM2.5 Si** | .73 | .83 | .61 | .67 | .57 | 1 |  |
| **PM2.5 V** | .90 | .86 | .89 | .93 | .82 | .70 | 1 |
| **PM2.5 Zn** | .93 | .88 | .96 | .90 | .85 | .70 | .94 |

|  |  |  |
| --- | --- | --- |
| **Table S5. HR of PM2.5 mass (per 5 µg/m3 increment), NO2 (per 10 µg/m3 increment) and lung cancer in two-pollutant models adjusted for PM2.5 components (N=306,104)** | | |
| **Component** | **PM2.5 mass in two-pollutant model**  **HR (95% CI)a,b** | **NO2 in two-pollutant model**  **HR (95% CI)a,c** |
| **PM2.5 Cu** | 1.20 (1.08, 1.34) | 1.00 (0.92, 1.09) |
| **PM2.5 Fe** | 1.19 (1.07, 1.31) | 1.01 (0.92, 1.11) |
| **PM2.5 K** | 1.06 (0.96, 1.17) | 1.00 (0.95, 1.05) |
| **PM2.5 Ni** | 1.10 (1.01, 1.21) | 0.98 (0.92, 1.04) |
| **PM2.5 S** | 1.01 (0.90, 1.14) | 0.94 (0.88, 0.99) |
| **PM2.5 Si** | 1.13 (1.04, 1.24) | 0.99 (0.92, 1.06) |
| **PM2.5 V** | 1.11 (1.02, 1.21) | 0.99 (0.94, 1.05) |
| **PM2.5 Zn** | 1.16 (1.05, 1.27) | 1.01 (0.95, 1.07) |
| HR, hazard ratio; CI, confidence interval  aAdjusted for study (strata), age (time-scale), sex (strata), year of baseline visit, smoking status, duration, intensity, intensity², BMI, marital status, employment status, and 2001 mean income at the neighborhood level  bSingle-pollutant HR (95% CI): 1.14 (1.05, 1.23)  cSingle-pollutant HR (95% CI): 1.02 (0.97, 1.07) | | |