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## Supplemental Material

# Long-Term Exposure to Transportation Noise and Ischemic Heart Disease: A Pooled Analysis of Nine Scandinavian Cohorts

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**Figure S2.** Distribution of road traffic and railway noise exposure during five years prior to the baseline in the study cohorts and overall (only levels of 40 dB $L_{den}$ and above are displayed; X-axis – dB $L_{den}$, Y-asix – % of the population with noise exposure level 40 dB $L_{den}$ and above).

**Figure S3.** Hazard ratios and 95 % confidence intervals for IHD excluding angina pectoris in relation to exposure to road traffic (A) and railway noise (B) per 10 dB $L_{den}$ five years prior to the event in each of the included cohorts. Results are presented per cohort, adjusted for age (by design), sex (men/women), calendar year (in 5-y periods), educational level (low/medium/high), marital status (single/married), area-income (quartiles), and other noise sources indicator (yes/no: road, railway, and aircraft noise; for the three cohorts without aircraft noise information, all cohort members were assigned as no exposure).

**Figure S4.** Hazard Ratio (HR) and 95 % confidence interval for IHD excluding angina pectoris, in relation to aircraft noise during five years prior to the event. Cohort specific results are from separate analysis where a cohort indicator was included as an interaction term with the categorical aircraft noise variable (dB $L_{den}$), and adjusted for age (by design), cohort (strata), sex (men/women), calendar year (in 5-y periods), educational level (low/medium/high), marital status (single/married), area-income (quartiles), and other noise sources indicator (yes/no: road and railway noise). The analysis is conducted only among cohorts with aircraft noise exposure (thus excluding the MDC, PPS, and GOT-MONICA cohorts) with remaining 7821 cases of IHD without angina pectoris.

**Figure S5.** Hazard ratio and 95 % confidence interval for ischemic heart disease in relation to exposure to noise from road traffic (Left) and railways (Right) per 10 dB $L_{den}$ during five years prior to the event according to covariates and air pollution exposure. P-values are Wald $p_{Interaction}$ terms. Results are presented according to strata of potential effect modifiers based on separate models with interaction terms between transportation noise and each potential modifier, adjusted for age (by design), cohort (strata), sex (men/women), calendar year (in 5-y periods), educational level (low/medium/high), marital status (single/married), area-income (quartiles), and other noise sources indicator (yes/no: road, railway, and aircraft noise; for the three cohorts without aircraft noise information, all cohort members were assigned as no exposure).

**Figure S6.** Hazard ratios and 95 % confidence interval for IHD excluding angina pectoris in relation to road traffic (Left) and railway (Right) noise exposure per 10 dB $L_{den}$ during five years prior to the event for different adjustment models and leaving out of studies.

**References**

**Additional File-** Excel Document

Table S1 Detailed information on the cohorts included in the study.

| Cohort | Full name of cohort | Recruitment | Sex | End of follow-up | Key references | Funding |
|---|---|---|---|---|---|---|
| DCH (Denmark) N=57,053 | The Danish Diet Cancer and Health cohort | 1993 to 1997 in the greater Copenhagen or Aarhus area | Men and women | Dec 2016 | Tjonneland et al 2007[1]. | The Danish Cancer Society. |
| DNC (Denmark) N=33,704 | The Danish Nurse Cohort | 1993 and 1999 among members of the Danish Nurse Organization | Women only | Dec 2016 | Hundrup et al 2012[2] | The Danish Council for Independent Research. |
| MDC (Sweden) N=28,098 | The Malmö Diet and Cancer cohort | 1991 to 1996 in Malmö | Men and women | Dec 2017 | Berglund et al. 1993[3] Manjer et al .2001[4] | Swedish Research Council (VR) Infrastructure grant, Heart-Lung Foundation. |
| PPS (Sweden) N=7,494 | Primary Prevention Study cohort | 1970 to 1973 in Gothenburg | Men only | Dec 2011 | Wilhelmsen et al. 1972[5] | The Bank of Sweden Tercentenary Fund and the Swedish Medical Research Council. |
| GOT-MONICA (Sweden) N=3,325 | The Gothenburg cohort of the "Multinational Monitoring of Trends and Determinants in Cardiovascular Diseases" (MONICA) project | 1985, 1990, and 1995 in Gothenburg | Men and women | Dec 2011 | Wilhelmsen et al. 1997[6] | The Swedish Medical Research Council, the Swedish Heart and Lung Foundation, the Ingabritt and Arne Lundberg Research Fund, the Göteborg Medical Society and the Sahlgrenska University Hospital Funds. |
| SDPP (Sweden) N=7,949 | The Stockholm Diabetes Preventive Programme | 1992-1995 form men and 1996-1998 for women in five municipalities of Stockholm County | Men and women | Dec 2011 | Gudjonsdottir et al. 2022[7] | Swedish Environmental Protection Agency, the Swedish Council for Health, Working Life and Social Research and the Swedish Heart-Lung Foundation. The SDPP cohort was additionally funded by the Stockholm County Council, the Swedish Research Council, the Swedish Diabetes Association and Novo Nordisk Scandinavia. |

| **Cohort** | **Full name of cohort** | **Recruitment** | **Sex** | **End of follow-up** | **Key references** | **Funding** |
| --- | --- | --- | --- | --- | --- | --- |
| SIXTY (Sweden) N=4,232 | 60-years cohort | 1997-1999 in Stockholm County | Men and women | Dec 2017 | Wändell et al. 2007[8] | Swedish Environmental Protection Agency, the Swedish Council for Health, Working Life and Social Research and the Swedish Heart-Lung Foundation. The SIXTY cohort was additionally funded by the Stockholm County Council and the Swedish Research Council. |
| SNAC-K (Sweden) N=3,363 | The Swedish National Study of Aging and Care in Kungsholmen | 2001-2004 in Kungsholmen area of Central Stockholm | Men and women | Dec 2016 | Lagergren et al. 2004[9] | Swedish Environmental Protection Agency, the Swedish Council for Health, Working Life, the Swedish Research Council and Social Research and the Swedish Heart-Lung Foundation. SNAC-K was additionally funded by the Ministry of Health and Social Affairs, Sweden, Stockholm County Council and the participating Municipalities and University Departments. |
| SALT (Sweden) N=7,043 | The Screening Across the Lifespan Twin Study | 1998-2002 in Stockholm County | Men and women | Dec 2016 | Lichtenstein et al. 2006[10] | Swedish Environmental Protection Agency, the Swedish Council for Health, Working Life and Social Research and the Swedish Heart-Lung Foundation. The SALT cohort was additionally supported by NIH grant 575 AG-08724. The Swedish Twin Registry is managed by Karolinska Institutet and receives funding through the Swedish Research Council. |

Table S2 Detailed information on estimation of road, railway and aircraft noise for the cohorts included in the study.

| Cohort | Description | Calculation years | Key references |
|---|---|---|---|
| | **Road traffic noise estimation** | | |
| DCH | Calculations were conducted using the Nordic prediction method implemented in SoundPLAN (version 8.0). Various input variables were used in the model, most importantly geocode and height (floor) for each address, information on travel speed, light/heavy vehicle distributions, road type, annual average daily traffic for all Danish road links (Jensen et al 2019) and 3D information on all Danish buildings. Screening effects from buildings, terrain, and noise barriers were included. All road traffic sources within 1500 m from the receivers were included. The parameters were set to allow 2 reflections. | 1995, 2000, 2005, 2010, 2015 | Thacher JD, Poulsen AH, Raaschou-Nielsen O, et al. High-resolution assessment of road traffic noise exposure in Denmark. Environ Res 2019; 182:109051.<br>Jensen SS, Plejdrup MS, Hillig K. GIS-based National Road and Traffic Database 1960-2020. Aarhus University, Danish Centre for Environment and Energy 2019; Report 151. |
| DNC | Same method as for DCH. | | |
| MDC | Estimated using the Nordic Prediction Method implemented in SoundPLAN (version 8.0, SoundPLAN Nord ApS). Input variables included geocode, information on annual average daily traffic for all road links in Malmö municipality, distribution of light/heavy traffic, signposted travel speed and road type and polygons for all buildings in Malmö. All road traffic sources within 1000 m from the receivers were included. Traffic data were retrieved from a regional emission database (Rittner et al. 2020). The screening effects from buildings were included and ground softness considered. The parameters in the models were set to allow 2 reflections and receivers placed at 2 m height. Estimation of road traffic noise exposure between years with models was based on the model closest in time or the year of major changes in infrastructure, i. e. the model from 1990 was used for residential coordinates 1985-1999, the model from 2000 used for coordinates 2000-2005 and the model from 2010 for coordinates between 2006 and 2016. | 1990, 2000, 2010 | Rittner R, Gustafsson S, Spanne M, Malmqvist E. Particle concentrations, dispersion modelling and evaluation in southern Sweden, SN Applied Sciences 2020;2:1013. |
| PPS, GOT-MONICA | Yearly average road traffic flows, speed and percentage of heavy vehicles were obtained from the environmental office of the municipality of Gothenburg and the traffic office of the municipality of Mölndal. The traffic flow estimations were based on measurements for all major and medium links but used a standard default flow for very small streets. Terrain data and building footprints were obtained from Lantmäteriet and road links from the Swedish | 1975-2010, yearly | Ögren M, Barregard L. Road traffic noise exposure in Gothenburg1975-2010. PLoS One 2016;11:e015532. |

| Cohort | Description | Calculation years | Key references |
|---|---|---|---|
| | National Traffic Administration. Noise barriers of at least 2 m height and 100 m length were also included, and earth berms were included in the terrain model. To save calculation time and reduce demands on detailed input data a simplified methodology was used for multiple reflections in dense urban areas. | | |
| SDPP, SIXTY, SNAC-K, SALT | To assess long-term individual transportation noise exposure a noise database for Stockholm County was developed representing the period from 1990 and onwards, with detailed estimation every fifth year. The database includes 3D terrain data as well as information on ground surface, road net, daily traffic flows, speed limits and percentage of heavy vehicles. To calculate noise levels for road traffic a modification of the Nordic prediction method was used, where possible reflection and shielding were taken into account by a Ground Space Index based on building density. The methodology has been further developed from the one described by Ögren and Barregard (2016), which was validated against the full Nordic prediction method modelled with SoundPlan and showed coherent estimates. | 1990, 1995, 2000, 2005, 2010, 2015 | Ögren M, Barregard L. Road traffic noise exposure in Gothenburg1975-2010. PLoS One 2016;11:e015532. |
| | **Railway noise estimation** | | |
| DCH | Calculations were conducted using the Nord 2000 method implemented in SoundPLAN (version 8.0). Various input variables were used in the model, most importantly geocode and height (floor) for each address, information on train speed and type, annual average trains for the day, evening and night and 3D information on all Danish buildings within 1000 m of the railway. Screening effects from buildings, terrain, and noise barriers were included. All rail traffic sources within 1500 m from the receivers were included. The parameters were set to allow 2 reflections. | 1997, 2012 | Kristine Hillig. Health effects of air pollution components, noise and socio-economic status. Rambøll MEMO 1100039156, 2019. |
| DNC | Same method as for DCH. | | |
| MDC | Estimated using the Nordic Prediction Method implemented in SoundPLAN (version 8.0, SoundPLAN Nord ApS). Input variables included geocode, information on annual average daily traffic and speed for all railways, train types and polygons for all buildings in Malmö. All railway traffic sources within 1000 m from the receivers were included. Screening effects from buildings were included and ground softness was considered. The parameters in the models were set to allow 2 reflections and receivers placed at 2 m height. Estimation of railway noise exposure between years with models was based on the model closest in time or | 1990, 2000, 2010 | Liasjø, K. H., & Granøien, I. L. N. (1993). *Sammenligning av flystøyberegningsprogrammerne INM-2/6*. INM-3/9, INM-3/10, DANSIM og NOISEMAP (Beregninger og målinger vedr. Fomebu …. |

| Cohort | Description | Calculation years | Key references |
|---|---|---|---|
| | the year of major changes in infrastructure. Level day-evening-night was estimated from the equivalent level using an adjustment of 6 dB. | | |
| PPS, GOT-MONICA | Yearly traffic counts (separate for day, evening and night), train speed and composition of different train types were obtained from the environmental office of the municipality of Gothenburg and the traffic office of the municipality of Mölndal for trams. For standard rail traffic, the same information was obtained from the Swedish traffic administration. Before 1997 regional and national rail transport statistics and published timetables were used to estimate traffic counts. Noise barriers of at least 2 m height and 100 m length were also included, as well as earth berms in the terrain model. To save calculation time and reduce demands on detailed input data a simplified methodology was used for multiple reflections in dense urban areas. All receivers were assumed to be at 2 m height above ground at the address coordinate. | 1975-2010, yearly | Ögren M, Barregard L. Road traffic noise exposure in Gothenburg1975-2010. PLoS One 2016;11:e015532. |
| SDPP, SIXTY, SNAC-K, SALT | Estimations were based on a noise database for Stockholm County which represented the period from 2010 and retrospectively until 1997, with detailed annual estimates. The database includes 3D terrain data as well as information on ground surface, railway net, speed limits and annual average daily train flows separately for light and heavy trains. To calculate noise levels for railway traffic a modification of the Nordic prediction method was used, where possible reflection and shielding were taken into account by a Ground Space Index based on building density. The methodology has been adopted and further developed from the one for road traffic noise described by Ögren and Barregard (2016), which was validated against the full Nordic prediction method modelled with SoundPlan and showed coherent estimates. Level day-evening-night was estimated from the equivalent level using an adjustment of 6 dB. | 1997-2010 | Ögren M, Barregard L. Road traffic noise exposure in Gothenburg1975-2010. PLoS One 2016;11:e015532. |
| | | | |
| | **Aircraft noise estimation** | | |
| DCH | The noise impact from all Danish airports and airfields was calculated by local authorities using the programs DANSIM (Danish Airport Noise Simulation Model) and INM3 (Integrated Noise Model), which meet joint Nordic criteria for air traffic noise calculations. | 1986-2009 | Liasjø, K. H., & Granøien, I. L. N. Sammenligning av flystøyberegningsprogrammerne INM-2/6, INM-3/9, INM-3/10, DANSIM og NOISEMAP (Beregninger og målinger vedr. Fomebu) [in Norwegian]. 1993. |

| Cohort | Description | Calculation years | Key references |
|---|---|---|---|
| DNC | Same method as for DCH. | | |
| SDPP, SIXTY, SNAC-K, SALT | Noise contours for years the 1995 to 2013 for both Stockholm airports have been estimated by Swedavia in accordance with Swedish and international methods using the aircraft noise modelling software INM. Although local conditions such as arrival and departure procedures have been taken into account, it is particularly difficult to calculate accurate levels as low as 45 dB (A). Results show that the changes of noise footprints throughout the years are principally due to changes in aircraft fleet or flight paths. | 1995, 2000, 2005, 2010, 2013 | Swedavia technical report D 2015-003915<br><br>Integrated noise model (INM) version 7.0 technical manual, Report Number : FAA-AEE-08-01 https://rosap.ntl.bts.gov/view/dot/12188 |

<u>Table S3</u> Detailed information on estimation of air pollution for the cohorts included in the study.

| **Cohort** | **Air pollution estimation** | **Key references** |
|---|---|---|
| DCH | In the DCH cohort, we used the DEHM-UBM-AirGIS modelling system to calculate $PM_{2.5}$ and $NO_2$ at all Danish addresses for the years 2000, 2010 and 2015, which was then extrapolated to yearly means for each address, based on changes in yearly urban background levels. This multi-scale dispersion modelling system calculates air pollutants at each address as the sum of: a) $PM_{2.5}/NO_2$ from the nearest street, calculated based on traffic, car fleet emission factors, streets and building geometry, and meteorology; b) urban background, calculated based on city dimensions, emission density, and heights of buildings; and c) regional background, calculated based on all emissions in the northern hemisphere. | Khan J, Kakosimos K, Raaschou-Nielsen O, et al. Development and performance evaluation of new AirGIS – A GIS based air pollution and human exposure modelling system. Atmos Environ 2019;198:102-121.<br>Ketzel M, Berkowicz R, Hvidberg M, Jensen SS and Raaschou-Nielsen O. Evaluation of AirGIS - a GIS-based air pollution and human exposure modelling system. Int J Environ Pollution 2011;47:226–238.<br>Brandt, J, Christensen JH, Frohn LM and Berkowicz R, Air pollution forecasting from regional to urban street scale – implementation and validation for two cities in Denmark. Physics and Chemistry of the Earth, 2003.;28:335-344. |
| DNC | Same method as for DCH. | |
| MDC | Air pollutants ($PM_{2.5}$, and nitrogen oxides converted to $NO_2$) were modelled using EnviMan (Opsis AB, Sweden) by the Environmental Department, City of Malmö, using a Gaussian dispersion model (AERMOD) combined with an emission database for the county of Scania in Sweden. The 18 × 18 km modelling area covered the city of Malmö and the closest surroundings. Separate emission databases were compiled for 1992, 2000 and 2011 using existing local and regional bottom-up inventories provided by the municipality, and then supplemented to be consistent for the whole area and time-period. Yearly mean concentrations were stored as grids with a spatial resolution of 50 m × 50 m. The years in between the modelled years were interpolated linearly with adjustment for year-to-year variations in the local meteorology using a ventilation factor estimated from calculations over the whole time-period, and exposure for the years 1990 and 1991 extrapolated. Exposure data was combined with geocoded addresses to assign each participant annual residential exposures. | Hasslöf H, Molnár P, Andersson EM, et al. Long-term exposure to air pollution and atherosclerosis in the carotid arteries in the Malmö Diet and Cancer Cohort. Environ Res 2020:110095 |
| PPS | The exposure assessment was performed similarly for Gothenburg and Stockholm as part of the Swedish Clean air and Climate Research program (SCAC). For Gothenburg, high-resolution dispersion modelling of source-specific particulate matter <2.5 µm ($PM_{2.5}$), and nitrogen oxides converted to $NO_2$ was performed over an area of 93 × 112 km for the years 1990, 2000 and 2011. Emission inventories were compiled using local and regional bottom-up inventories provided by the municipality, and | Segersson D, Eneroth K, Gidhagen L et al. Health impact of $PM_{10}$, $PM_{2.5}$ and black carbon exposure due to different source sectors in Stockholm, Gothenburg and Umea, Sweden. Int J Environ Res Public Health, 2017;14:E742.<br>Stockfelt L, Andersson EM, Molnár P, et al. Long-term effects of total and source-specific particulate air pollution on |

| | | |
|---|---|---|
| | supplemented to be consistent for the whole time-period. Intervening years were interpolated so that each participant could be assigned annual residential air pollutant exposures. | incident cardiovascular disease in Gothenburg, Sweden. Environ Res 2017;158:61-71. |
| GOT-MONICA | Same method as for PPS. | |
| SDPP, SIXTY, SNAC-K, SALT | In the Stockholm County cohorts, a high-resolution Gaussian dispersion model was used to estimate individual residential levels of $PM_{2.5}$ and $NO_x/NO_2$ using local emission inventories every fifth year from 1990 and onwards. The emission inventory contains detailed information on local emissions from road and ferry traffic, industrial areas and households. Meteorological input to the modelling includes measurements of wind velocity and direction, solar radiation and temperature. Further, a street canyon contribution is added for addresses in the most polluted street segments of the inner city of Stockholm with multi-storey houses on both sides. Annual averaged long-range contributions were added to the locally modelled concentrations based on continuous measurements at regional background monitoring stations. | Segersson D, Eneroth K, Gidhagen L, et al. Health impact of $PM_{10}$, $PM_{2.5}$ and black carbon exposure due to different source sectors in Stockholm, Gothenburg and Umea, Sweden. Int J Environ Res Public Health 2017;14:E742.<br>Ljungman PLS, Andersson N, Stockfelt L, et al. Long-term exposure to particulate air pollution, black carbon, and their source components in relation to ischemic heart disease and stroke. Environ Health Perspect 2019;127:107012 |

Table S4. Results from testing the proportional hazard assumption by a correlation test between scaled Schoenfeld residuals and the rank order of event time

| **Variable** | **Chi2** | **p-value** |
|---|---|---|
| Road traffic noise indicator | 0.14 | 0.7043 |
| Railway traffic noise indicator | 0.16 | 0.6890 |
| Aircraft noise indicator | 0.43 | 0.5117 |
| Sex | 98.02 | <0.0001 |
| Calendar year | 73.91 | <0.0001 |
| Educational level | 15.23 | 0.0004 |
| Marital status | 4.12 | 0.0423 |
| Area-income | 10.59 | 0.0011 |
| Smoking status | 51.57 | <0.0001 |
| Physical activity | 22.21 | <0.0001 |

Table S5 Correlation matrix between exposure to traffic noise and air pollution indicators during five years preceding the study baseline.[a]

| | Road traffic noise | Railway noise | Aircraft noise | $PM_{2.5}$ | $NO_2$ |
|---|---|---|---|---|---|
| Road traffic noise | - | | | | |
| Railway noise | 0.15 | - | | | |
| Aircraft noise [b] | -0.09 | 0.10 | - | | |
| $PM_{2.5}$ [c] | 0.41 | -0.07 | -0.32 | - | |
| $NO_2$ [c] | 0.62 | 0.22 | -0.02 | 0.31 | - |

Note: MDC, the Malmö Diet and Cancer, Sweden; PPS, the Primary Prevention Study cohort, Gothenburg, Sweden; GOT-MONICA, the Gothenburg cohort of "Multinational Monitoring of Trends and Determinants in Cardiovascular Diseases" (MONICA) project, Sweden; dB, decibel; $L_{den}$, Day-evening-night noise level based on energy equivalent noise level over a whole day with a penalty of 10 dB for night-time noise (23.00-7.00) and a penalty of 5 dB for evening noise (i.e. 19.00-23.00); $PM_{2.5}$, particulate matter with an aerodynamic diameter of≤2.5 µm (fine particulate matter); $NO_2$, nitrogen dioxide.

[a] Spearman's correlation coefficients.

[b] Only in cohorts with aircraft noise (thus excluding MDC, PPS, and GOT-MONICA), N=98,658.

[c] Only among subjects with $PM_{2.5}$ and $NO_2$ data (N=130,344 and 125,311, respectively).

Table S6 Hazard Ratio (HR) for IHD, IHD excluding angina pectoris, and myocardial infarction in relation to transportation noise exposure during one year prior to the event in pooled data of nine Scandinavian cohorts (N= 132,801).

| | Cases | Person-years | Model 1[a] HR (95% CI) | Model 2[b] HR (95% CI) | Model 3[c] HR (95% CI) | Model 4[d] HR (95% CI) |
|---|---|---|---|---|---|---|
| **Road traffic noise, per 10 dB $L_{den}$** | | | | | | |
| IHD | 22,459 | 2,263,290 | 1.04 (1.03, 1.06) | 1.03 (1.01, 1.05) | 1.02 (1.00-1.04) | 1.03 (1.01, 1.05) |
| IHD excluding angina pectoris | 12,399 | 2,263,290 | 1.08 (1.06, 1.11) | 1.06 (1.03, 1.08) | 1.05 (1.02-1.07) | 1.05 (1.02, 1.07) |
| Myocardial infarction | 7,682 | 2,263,290 | 1.04 (1.01, 1.07) | 1.02 (0.99, 1.05) | 1.01 (0.98-1.04) | 1.01 (0.98, 1.05) |
| **Railway noise, per 10 dB $L_{den}$** | | | | | | |
| IHD | 22,459 | 2,263,290 | 1.05 (1.02, 1.07) | 1.03 (1.01, 1.05) | 1.02 (1.00-1.04) | 1.03 (1.01, 1.05) |
| IHD excluding angina pectoris | 12,399 | 2,263,290 | 1.07 (1.04, 1.10) | 1.05 (1.02, 1.08) | 1.04 (1.01-1.07) | 1.05 (1.01, 1.08) |
| Myocardial infarction | 7,682 | 2,263,290 | 1.06 (1.02, 1.10) | 1.04 (1.00, 1.08) | 1.03 (0.99-1.07) | 1.04 (1.00, 1.08) |
| **Aircraft noise, $L_{den}$[e]** | | | | | | |
| IHD | | | | | | |
| ≤40 dB $L_{den}$ | 14,714 | 1,614,380 | 1 ref. | 1 ref. | 1 ref. | 1 ref. |
| 40.1–50 dB $L_{den}$ | 501 | 60,863 | 1.03 (0.93, 1.15) | 1.05 (0.95, 1.17) | 1.06 (0.95-1.18) | 1.06 (0.95, 1.18) |
| >50 dB $L_{den}$ | 234 | 32,856 | 0.90 (0.79, 1.03) | 0.93 (0.81, 1.06) | 0.92 (0.81-1.06) | 0.93 (0.81, 1.07) |
| IHD without angina pectoris | | | | | | |
| ≤40 dB $L_{den}$ | 7,344 | 1,614,380 | 1 ref. | 1 ref. | 1 ref. | 1 ref. |
| 40.1–50 dB $L_{den}$ | 326 | 60,863 | 1.15 (1.01, 1.32) | 1.18 (1.04, 1.35) | 1.20 (1.05-1.37) | 1.19 (1.04, 1.36) |
| >50 dB $L_{den}$ | 151 | 32,856 | 1.02 (0.86, 1.21) | 1.06 (0.90, 1.27) | 1.06 (0.89-1.26) | 1.07 (0.90, 1.28) |
| Myocardial infarction | | | | | | |
| ≤40 dB $L_{den}$ | 3,843 | 1,614,380 | 1 ref. | 1 ref. | 1 ref. | 1 ref. |
| 40.1–50 dB $L_{den}$ | 192 | 60,863 | 1.10 (0.93, 1.31) | 1.13 (0.95, 1.35) | 1.14 (0.96-1.36) | 1.14 (0.96, 1.36) |
| >50 dB $L_{den}$ | 90 | 32,856 | 0.99 (0.79, 1.24) | 1.03 (0.82, 1.30) | 1.02 (0.82-1.28) | 1.04 (0.83, 1.30) |

Note: The HRs are estimated using Cox proportional hazards models with age as underlying timescale. IHD, ischemic heart disease; BMI, body mass index; CI, confidence interval; HR, hazard ratio; $PM_{2.5}$, particulate matter with an aerodynamic diameter of ≤2.5 µm (fine particulate matter); dB, decibel; $L_{den}$, Day-evening-night noise level based on energy equivalent noise level over a whole day with a penalty of 10 dB(A) for night time noise (23.00-7.00) and a penalty of 5 dB(A) for evening noise (i.e. 19.00-23.00).

[a] Adjusted for age (by design), cohort (strata), sex (men/women), and calendar year (in 5-y periods).

[b] Model 1 plus adjustment for educational level (low/medium/high), marital status (single/married), area-income (quartiles), and other noise sources (yes/no: road, railway, and aircraft noise indicators; for the three cohorts without aircraft noise information, all cohort members were assigned as no exposure).

[c] Model 2 plus adjustment for smoking status (current/former/never), physical activity (low/medium/high).

[d] Model 2 plus adjustment for time-weighted $PM_{2.5}$ exposure; 20,825 IHD, 11,245 IHD excluding angina pectoris and 6,846 myocardial infarction cases during 2,120,816 person-years. Since the first year of $PM_{2.5}$ modelling was 1990, while it was 1975 for noise, relevant air pollution data for the model including both noise and $PM_{2.5}$ were missing at baseline for most of the PPS cohort.

[e] Only among cohorts with aircraft noise exposure (thus excluding MDC, PPS, and GOT-MONICA) with remaining 15,499 IHD cases, 7821 IHD without angina pectoris cases, 4,125 myocardial infarction cases.

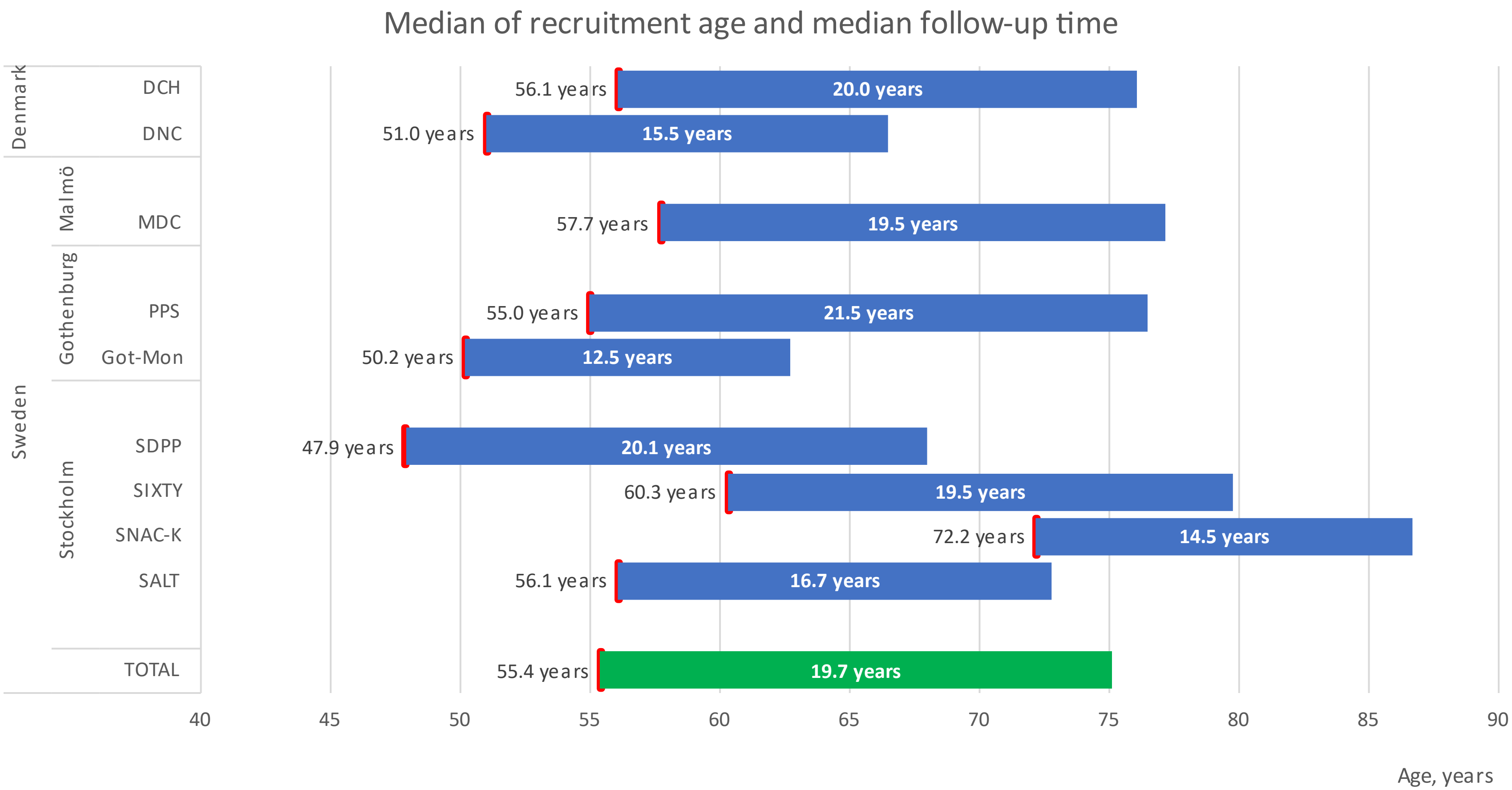
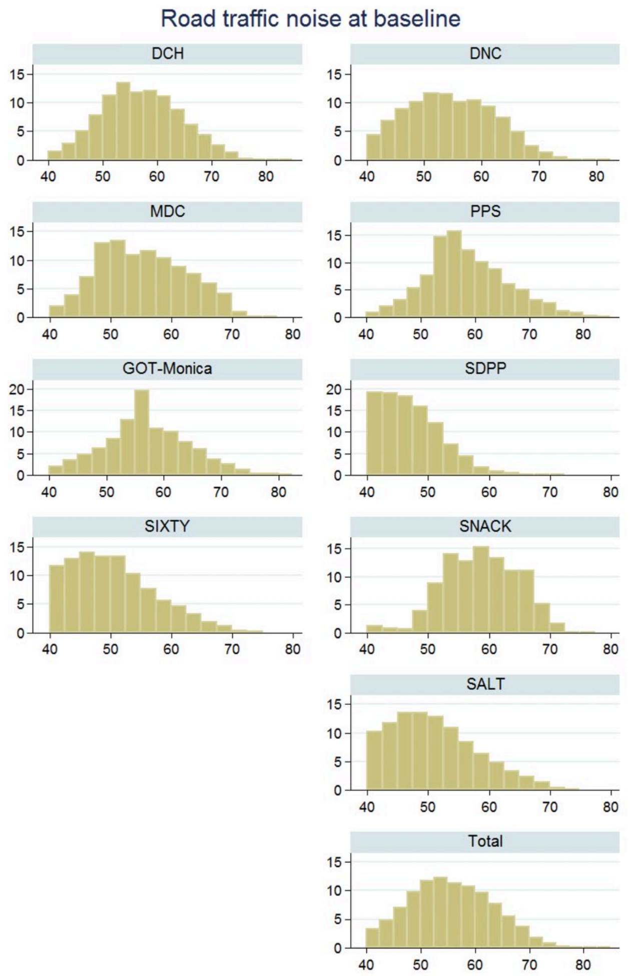
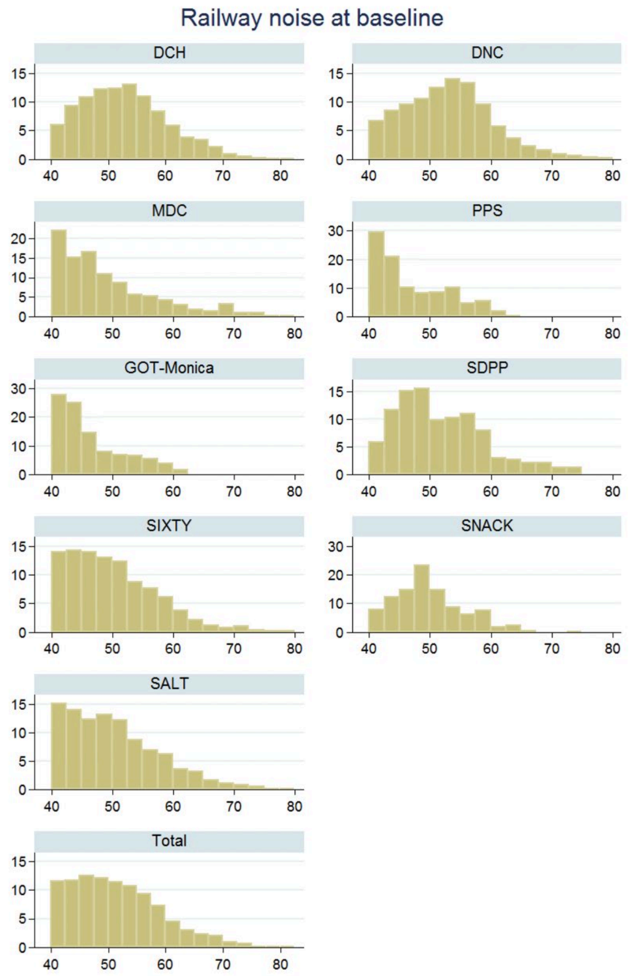



Figure S1. Median recruitment age and median length of follow-up in nine cohorts from Scandinavia included in the study.

Note: Corresponding numeric data are available in the supplementary excel file "Numeric data for Figures EHP10745" and correspond to Table 1. DCH, the Danish Diet Cancer and Health cohort; DNC, the Danish Nurse Cohort; MDC, the Malmö Diet and Cancer cohort, Sweden; PPS, the Primary Prevention Study cohort, Gothenburg, Sweden; GOT-MONICA, the Gothenburg cohort of "Multinational Monitoring of Trends and Determinants in Cardiovascular Diseases" (MONICA) project, Sweden; SDPP, the Stockholm Diabetes Preventive Programme, Sweden; SIXTY, the 60-years cohort, Stockholm, Sweden; SNAC-K, the Swedish National Study of Aging and Care in Kungsholmen, Stockholm, Sweden.



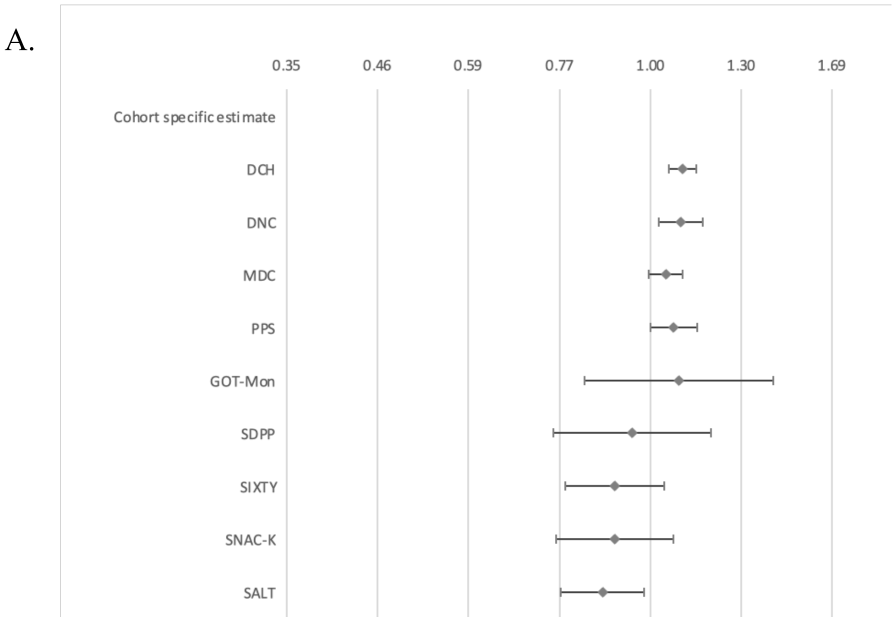
Road traffic noise at baseline
DCH
DNC
MDC
PPS
GOT-Monica
SDPP
SIXTY
SNACK
SALT
Total

Railway noise at baseline
DCH
DNC
MDC
PPS
GOT-Monica
SDPP
SIXTY
SNACK
SALT
Total

Figure S2 Distribution of road traffic and railway noise exposure during five years prior to the baseline in the study cohorts and overall (only levels of 40 dB $L_{den}$ and above are displayed; X-axis – dB $L_{den}$, Y-asix – % of the population with noise exposure level 40 dB $L_{den}$ and above).

Note: Corresponding numeric data are available in the supplementary excel file "Numeric data for Figures EHP10745". DCH, the Danish Diet Cancer and Health cohort; DNC, the Danish Nurse Cohort; MDC, the Malmö Diet and Cancer cohort, Sweden; PPS, the Primary Prevention Study cohort, Gothenburg, Sweden; GOT-MONICA, the Gothenburg cohort of "Multinational Monitoring of Trends and Determinants in Cardiovascular Diseases" (MONICA) project, Sweden; SDPP, the Stockholm Diabetes Preventive Programme, Sweden; SIXTY, the 60-years cohort, Stockholm, Sweden; SNAC-K, the Swedish National Study of Aging and Care in Kungsholmen, Stockholm, Sweden; dB, decibel; $L_{den}$, Day-evening-night noise level based on energy equivalent noise level over a whole day with a penalty of 10 dB(A) for night time noise (23.00-7.00) and a penalty of 5 dB(A) for evening noise (i.e. 19.00-23.00).



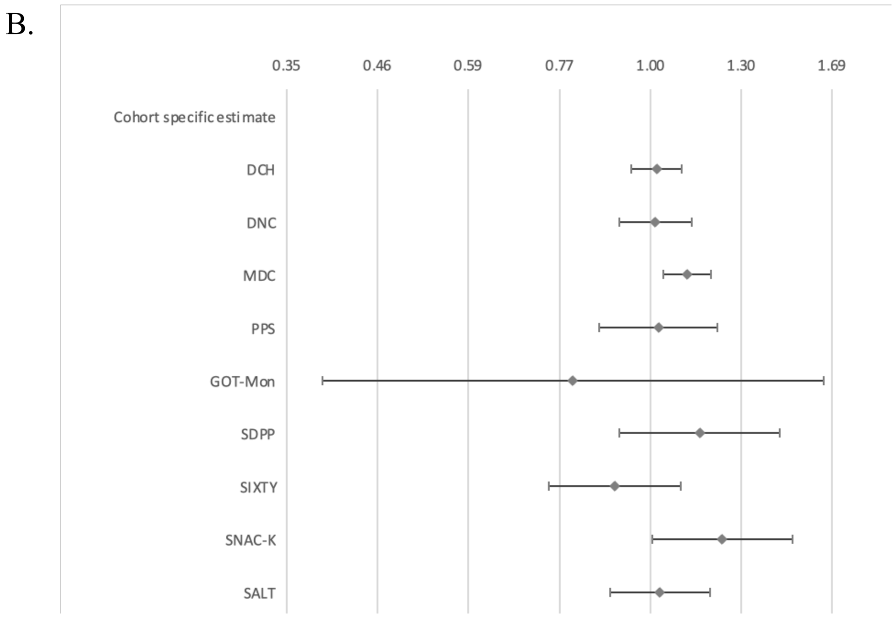




Figure S3 Hazard ratios and 95 % confidence intervals for IHD excluding angina pectoris in relation to exposure to road traffic (A) and railway noise (B) per 10 dB $L_{den}$ five years prior to the event in each of the included cohorts. Results are presented per cohort, adjusted for age (by design), sex (men/women), calendar year (in 5-y periods), educational level (low/medium/high), marital status (single/married), area-income (quartiles), and other noise sources indicator (yes/no: road, railway, and aircraft noise; for the three cohorts without aircraft noise information, all cohort members were assigned as no exposure).

Note: Corresponding numeric data are available in the supplementary excel file "Numeric data for Figures EHP10745". DCH, the Danish Diet Cancer and Health cohort; DNC, the Danish Nurse Cohort; MDC, the Malmö Diet and Cancer cohort, Sweden; PPS, the Primary Prevention Study cohort, Gothenburg, Sweden; GOT-MONICA, the Gothenburg cohort of "Multinational Monitoring of Trends and Determinants in Cardiovascular Diseases" (MONICA) project, Sweden; SDPP, the Stockholm Diabetes Preventive Programme, Sweden; SIXTY, the 60-years cohort, Stockholm, Sweden; SNAC-K, the Swedish National Study of Aging and Care in Kungsholmen, Stockholm, Sweden; IHD, ischemic heart disease; BMI, body mass index; CI, confidence interval; HR, hazard ratio; $L_{den}$, Day-evening-night noise level based on energy equivalent noise level over a whole day with a penalty of 10 dB(A) for night-time noise (23.00-7.00) and a penalty of 5 dB(A) for evening noise (i.e. 19.00-23.00); $PM_{2.5}$, particulate matter with an aerodynamic diameter of ≤2.5μm (fine particulate matter); $NO_2$, nitrogen dioxide.

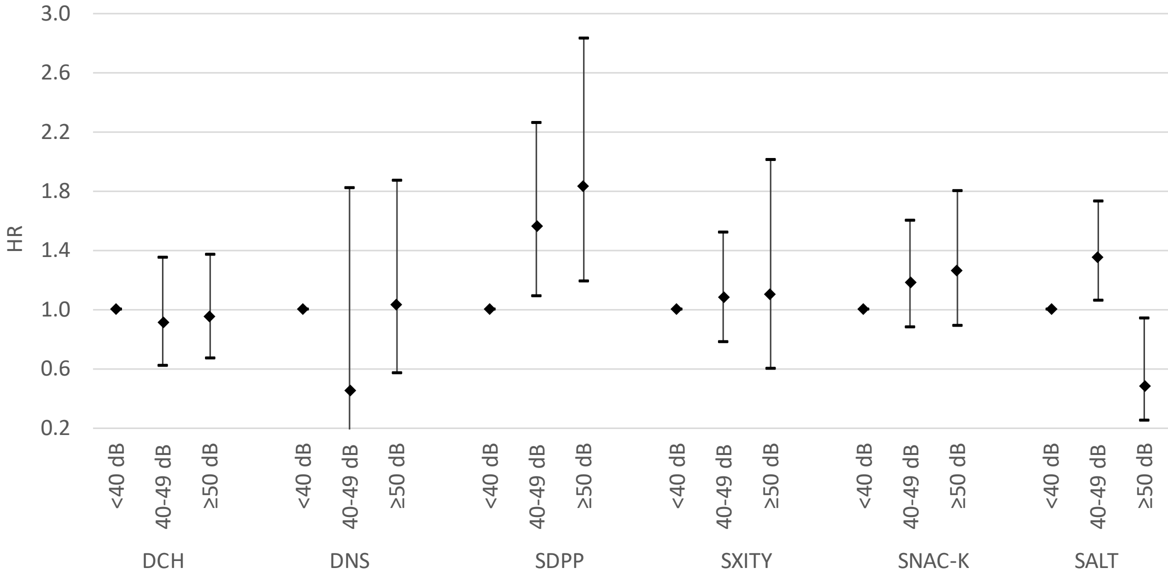



Figure S4. Hazard Ratio (HR) and 95 % confidence interval for IHD excluding angina pectoris, in relation to aircraft noise during five years prior to the event. Cohort specific results are from separate analysis where a cohort indicator was included as an interaction term with the categorical aircraft noise variable (dB $L_{den}$), and adjusted for age (by design), cohort (strata), sex (men/women), calendar year (in 5-y periods), educational level (low/medium/high), marital status (single/married), area-income (quartiles), and other noise sources indicator (yes/no: road and railway noise). The analysis is conducted only among cohorts with aircraft noise exposure (thus excluding the MDC, PPS, and GOT-MONICA cohorts) with remaining 7821 cases of IHD without angina pectoris.

Note: Corresponding numeric data are available in the supplementary excel file “Numeric data for Figures EHP10745”. DCH, the Danish Diet Cancer and Health cohort; DNC, the Danish Nurse Cohort; MDC, the Malmö Diet and Cancer cohort, Sweden; PPS, the Primary Prevention Study cohort, Gothenburg, Sweden; GOT-MONICA, the Gothenburg cohort of “Multinational Monitoring of Trends and Determinants in Cardiovascular Diseases” (MONICA) project, Sweden; SDPP, the Stockholm Diabetes Preventive Programme, Sweden; SIXTY, the 60-years cohort, Stockholm, Sweden; SNAC-K, the Swedish National Study of Aging and Care in Kungsholmen, Stockholm, Sweden; IHD, ischemic heart disease; HR, hazard ratio.

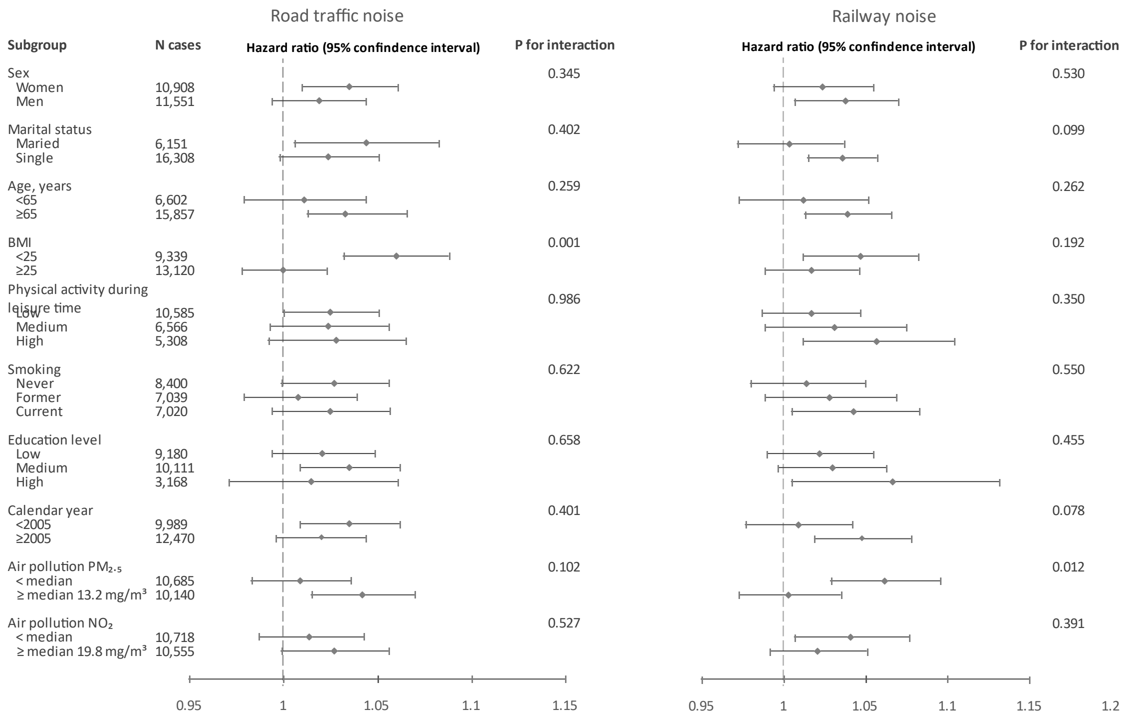



Figure S5 Hazard ratio and 95 % confidence interval for ischemic heart disease in relation to exposure to noise from road traffic (Left) and railways (Right) per 10 dB $L_{den}$ during five years prior to the event according to covariates and air pollution exposure. P-values are Wald $p_{Interaction}$ terms. Results are presented according to strata of potential effect modifiers based on separate models with interaction terms between transportation noise and each potential modifier, adjusted for age (by design), cohort (strata), sex (men/women), calendar year (in 5-y periods), educational level (low/medium/high), marital status (single/married), area-income (quartiles), and other noise sources indicator (yes/no: road, railway, and aircraft noise; for the three cohorts without aircraft noise information, all cohort members were assigned as no exposure).

Note: Corresponding numeric data are available in the supplementary excel file "Numeric data for Figures EHP10745". IHD, ischemic heart disease; BMI, body mass index; CI, confidence interval; HR, hazard ratio; $L_{den}$, Day-evening-night noise level based on energy equivalent noise level over a whole day with a penalty of 10 dB(A) for night-time noise (23.00-7.00) and a penalty of 5 dB(A) for evening noise (i.e. 19.00-23.00); $PM_{2.5}$, particulate matter with an aerodynamic diameter of ≤2.5 μm (fine particulate matter); $NO_2$, nitrogen dioxide.

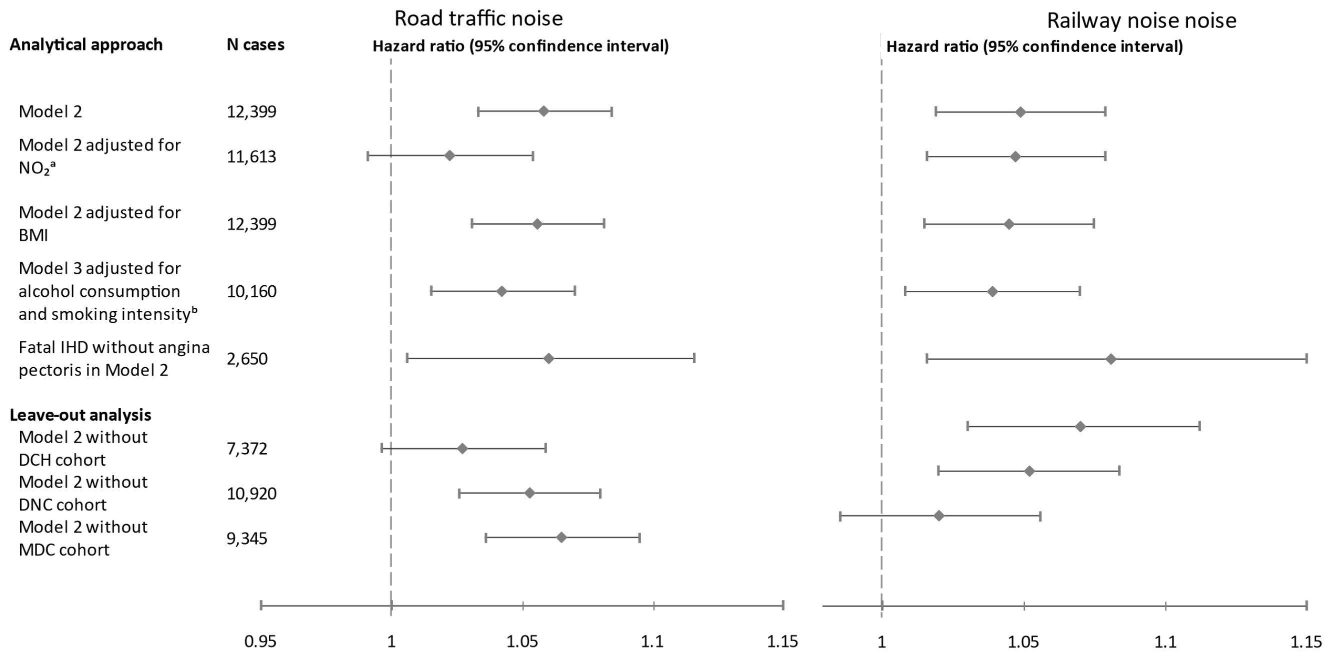



Figure S6 Hazard ratios and 95 % confidence interval for IHD excluding angina pectoris in relation to road traffic (Left) and railway (Right) noise exposure per 10 dB $L_{den}$ during five years prior to the event for different adjustment models and leaving out of studies.

Note: Corresponding numeric data are available in the supplementary excel file "Numeric data for Figures EHP10745". DCH, the Danish Diet Cancer and Health cohort; DNC, the Danish Nurse Cohort; MDC, the Malmö Diet and Cancer cohort, Sweden; PPS, the Primary Prevention Study cohort, Gothenburg, Sweden; IHD, ischemic heart disease; BMI, body mass index; CI, confidence interval; HR, hazard ratio; $L_{den}$, Day-evening-night noise level based on energy equivalent noise level over a whole day with a penalty of 10 dB(A) for night-time noise (23.00-7.00) and a penalty of 5 dB(A) for evening noise (i.e. 19.00-23.00); $NO_2$, nitrogen dioxide.

Model 2: adjusted for age (by design), cohort (strata), sex (men/women), and calendar year (in 5-y periods), educational level (low/medium/high), marital status (single/married), area-income (quartiles), and other noise sources (yes/no: road, railway, and aircraft noise indicators; for the three cohorts without aircraft noise information, all cohort members were assigned as no exposure).
Model 3: Model 2 with additional adjustment for smoking status, physical activity.
[a] $NO_2$ data were available only for 131,219 subjects with corresponding 11,613 cases of IHD without angina pectoris originated during 2,170,978 person-years.
[b] Both alcohol consumption and smoking intensity data were available only for 112,947 subjects with corresponding 10,160 cases of IHD without angina pectoris originating during 1,918,043 person-years.

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