Sibling rank and sibling number in relation to cardiovascular disease and mortality risk: a nationwide cohort study

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ABSTRACT

Background The number and rank order of siblings could be of importance for risk of cardiovascular disease and mortality. Previous studies have used only fatal events for risk prediction. We, therefore, aimed to use also non-fatal coronary and cardiovascular events in fully adjusted models.

Methods From the Multiple-Generation Register in Sweden, data were used from 1.36 million men and 1.32 million women (born 1932–1960), aged 30–58 years at baseline and with follow-up from 1990 to 2015. Mean age at follow-up was 67 years (range 55–83 years). Fatal and non-fatal events were retrieved from national registers.

Results Compared with men with no siblings, those with 1–2 siblings had a lower, and those with four or more siblings had a higher adjusted risk of cardiovascular events. Again, compared with men with no siblings, those with more than one sibling had a lower total mortality risk, and those with three or more siblings had an increased risk of coronary events. Correspondingly, compared with women with no siblings those with three siblings or more had an increased risk of cardiovascular events, and those with two siblings or more had an increased risk of coronary events. Women with one sibling or more were at lower total mortality risk, following full adjustment.

Conclusion Being first born is associated with a favourable effect on non-fatal cardiovascular and coronary events for both men and women. The underlying biological mechanisms for this should be studied in a sociocultural context.

Strengths and limitations of this study

- This national register linkage study across generations includes data on both fatal and, for the first time, non-fatal cardiovascular and coronary events, as well as total mortality in relation to sibling number and rank.
- Adjustment has been made for confounders including markers of social background (educational level, occupation) of the individual, but not for parental socioeconomic status. Competing risk analyses have been applied.
- Limitations of the study include the lack of data from primary healthcare visits and that the historical register data do not fully reflect the ethnical diversity of Sweden today.

INTRODUCTION

A positive family history of disease is a well-established variable to be used in risk algorithms for cardiovascular disease (CVD), even if it may be hard to quantify based on subjective recall only. An alternative is to use register-based data for a more objective appraisal of the family burden of CVD. One special feature of family structure is the number of siblings and sibling rank that can also be mapped by use of national registers such as the Multiple-Generation Register (MGR) of Sweden. So far this register has been mostly used to describe the risk of some selected CVD manifestations of individuals in relation to the risk of their siblings, for example, for thromboembolic disease or other diseases.

In a previous report based on the MGR, it was shown that increased number of sibling reflecting family size was not associated with increased total and cause-specific mortality risk in ages 40–74 years, but no analyses were made for risk of non-fatal CVD or coronary disease. However, another corresponding study based on MGR data could show that total and cause-specific mortality in ages 30–69 years increased with increasing birth order.

The influence of sibling rank has been less well studied in relation to non-fatal cardiovascular and coronary risk. Previous studies have indicated a worse cardiovascular risk factor burden in first borns, for example, increased body mass index (BMI) and systolic blood pressure, but lower insulin sensitivity, than later born siblings. On the other hand, first borns seem to have a better physical fitness at military conscript testing, less
family income was calculated at start of 23 families in 1990 as annual family income divided by the number of members in the family, as previously reported.23 The income calculation was weighted, taking the ages of the family members into account. For example, children were given lower consumption weights than adults. The calculation was performed as follows: the sum of all family members’ incomes was multiplied by the individual’s consumption weight divided by the family members’ total consumption weight. The final variable was calculated as empirical quartiles from the distribution and classified as low, middle-low, middle-high and high.

**Definitions**

**Family income**: family income was calculated at start of follow-up (1990) as annual family income divided by the number of members in the family, as previously reported.23 The income calculation was weighted, taking the ages of the family members into account. For example, children were given lower consumption weights than adults. The calculation was performed as follows: the sum of all family members’ incomes was multiplied by the individual’s consumption weight divided by the family members’ total consumption weight. The final variable was calculated as empirical quartiles from the distribution and classified as low, middle-low, middle-high and high.

**Immigration status**: born in Sweden or in other countries.

**Marital status**: individuals were classified as married/cohabitating or never married, widowed or divorced.

**Socioeconomic status (SES)**: was divided into four categories: the self-employed/farmers/all others, blue collar workers, white collar workers or professionals, as previously reported.24

**Education**: was based on educational level, which was classified into three categories: ≤9 years, 10–11 years and ≥12 years.

**Geographical region**: was divided into large cities (cities with a population of more than 200 000 inhabitants), Southern Sweden and Northern Sweden.24

**Comorbidity**: was defined as the first hospitalisation during the follow-up period of: chronic obstructive pulmonary disease, Chronic Obstructive Pulmonary Disease (COPD) (both hospitalisation and mortality were included) (ICD-9 490–496 and ICD-10 J40-J49), obesity (ICD-9 278A and ICD-10 E65-E68), alcoholism-related liver disease (both hospitalisations and mortality were included) (ICD-9 291, 303, 571 and ICD-10 F10 and K70), hypertension (ICD-9 401–405 and ICD-10 I10–I15), and diabetes (both hospitalisations and mortality were included) (ICD-9 250 and ICD-10 E10-E14) and cancer (cancer were included both from cancer register and mortality, ICD-9 140–239 and ICD-10 C00-D48).

**Statistical methods**

Person-years at risk were calculated from the start of follow-up on 1 January 1990 until hospitalisation or death from CVD, death from other causes, emigration or the end of the follow-up, 31 December 2015. Age-adjusted incidence rates for first hospitalisation and mortality were calculated for the entire follow-up period. We used the Cox’s proportional hazard model to calculate the HR with 95% CIs for total (fatal and non-fatal) CVD and CHD event risk, and for total mortality, for both men and women) in relation to number siblings and birth order. This was done after adjustment for age at start, individual characteristics (family income, marital status, immigrant background and educational level, region of residence, socioeconomic status) and finally for comorbidities in order to adjust for competing mortality risk. Individuals without sibling was used as the reference. The proportionality assumptions were checked by plotting the incidence rates over time and by calculating Schoenfeld (partial) residuals and these assumptions were fulfilled. We used SAS V.9.4 (SAS Institute) for all statistical analyses.

A further adjustment was made for total number of siblings in relation to birth order when the risk for different outcomes was calculated, using the category ‘first birth’ as reference. A competing risk model used for mortality as a competing risk for incident CVD. A p<0.05 was considered significant.
RESULTS
With an average of 20 years (Q1–Q3 16–25 years) follow-up, in 1 358 647 men we used data on 592 863 CVD events, 131 533 coronary events and 240 371 total deaths. For 1 315 037 women, the corresponding numbers were 486 147 CVD events, 55 933 coronary events and 160 269 deaths, respectively. The mean age of the study population at the end of the follow-up was 67 years (range 55–83 years). The number of siblings and birth order of men and women are depicted in table 1.

Risk associated with number of siblings in men and women
Compared with men with no siblings, those with 1–2 siblings had a lower, and those with four or more siblings had a higher risk of cardiovascular events. Again, compared with men with no siblings, those with more than one sibling had a lower total mortality risk, and those with three or more siblings had an increased risk of coronary events, following full adjustment (table 2).

Correspondingly, compared with women with no siblings those women with three siblings or more had an increased risk of cardiovascular events, and those with two siblings or more had an increased risk of coronary events. Women with one sibling or more were at lower total mortality risk, following full adjustment, table 3.

Risk associated with sibling rank in men and women
According to sibling rank, first-born men had a lower risk of both cardiovascular and coronary events than their later-born siblings, but higher total mortality than second and third-born siblings, following full adjustment (table 2).

For first-born women the risks of cardiovascular and coronary events were also lower than in their later-born siblings. The mortality risk was higher than for second-born siblings, but equal to higher numbered siblings, following full adjustment (table 3).

### Table 1 Distribution of population, number of CVD, CHD and mortality events

|               | Population | CVD events | CHD events | Mortality events |
|---------------|------------|------------|------------|-----------------|
|               | No (%)     | No (%) of population | % | No (%) of population | % | No (%) of population | % |
| **Men**       |            |            |            |                 |
| No of sibling |            |            |            |                 |
| Non-sibling   | 1 358 647  | 592 863 (43.6) | 131 533 (9.7) | 240 371 (17.7) |
| One sibling   | 214 700    | 105 516 (49.1) | 23 671 (11.0) | 50 709 (23.6) |
| Two siblings  | 443 877    | 189 839 (42.8) | 39 729 (9.0) | 73 140 (16.5) |
| Three siblings| 338 812    | 140 361 (41.4) | 30 184 (8.9) | 52 790 (15.6) |
| Four or more siblings | 183 067 | 77 378 (42.3) | 17 663 (9.6) | 30 266 (16.5) |
| Birth order   |            |            |            |                 |
| First         | 684 765    | 318 341 (46.5) | 70 238 (10.3) | 140 857 (20.6) |
| Second        | 402 879    | 166 757 (41.4) | 36 654 (9.1) | 62 267 (15.5) |
| Third         | 164 540    | 65 853 (40.0) | 14 736 (9.0) | 23 081 (14.0) |
| Fourth        | 62 765     | 24 729 (39.4) | 5737 (9.1) | 8425 (13.4) |
| Fifth+        | 43 698     | 17 183 (39.3) | 4168 (9.5) | 5741 (13.1) |
| **Women**     |            |            |            |                 |
| No of sibling |            |            |            |                 |
| Non-sibling   | 1 315 037  | 486 147 (37.0) | 55 933 (4.3) | 160 269 (12.2) |
| One sibling   | 210 121    | 87 261 (41.5) | 10 289 (4.9) | 34 521 (16.4) |
| Two siblings  | 324 379    | 113 739 (35.1) | 12 500 (3.9) | 34 843 (10.7) |
| Three siblings| 176 631    | 63 871 (36.2) | 7512 (4.3) | 19 766 (11.2) |
| Four or more siblings | 173 591 | 67 122 (38.7) | 9352 (5.4) | 22 007 (12.7) |
| Birth order   |            |            |            |                 |
| First         | 664 459    | 262 015 (39.4) | 30 342 (4.6) | 94 779 (14.3) |
| Second        | 388 391    | 136 263 (35.1) | 15 191 (3.9) | 40 984 (10.6) |
| Third         | 159 311    | 53 711 (33.7) | 6231 (3.9) | 15 205 (9.5) |
| Fourth        | 60 676     | 20 264 (33.4) | 2379 (3.9) | 5558 (9.2) |
| Fifth+        | 42 200     | 13 894 (32.9) | 1790 (4.2) | 3743 (8.9) |

CHD, coronary heart disease; CVD, cardiovascular disease.
For HRs of CHD, CVD and total mortality by number of siblings and birth order in men and women, respectively (see figures 1–3).

Supplemental material
For detailed data on the distribution of the study population, number of CVD, CHD and mortality events in men and women (see online supplemental table S1). For detailed data on the risk associated with factors adjusted (see online supplemental tables S2–S4), for men and women, respectively.

DISCUSSION
In this very large observational study based on a national MGR, it was found that first-born men and women are at lower risk of both cardiovascular and coronary events than their later-born siblings, but had higher total mortality risk than second and third-born siblings (men). For women the mortality risk for first-born women was higher than for second-born siblings, following full adjustment for a number of background factors.

For total mortality in relation to sibling number our data are at odds with a previous study using the same register in Sweden, showing no increased mortality associated until 74 years with a higher number of siblings. However, we used higher numbers, longer follow-up and more extensive adjustment.

For the influence of sibling rank, a previous study could show higher risk of total and cause-specific mortality with increasing sibling rank until 69 years. This was similar in

Table 2  HR and 95% CI of CVD, CHD and mortality in men

|                  | CVD   |                  | CHD   |                  | Mortality |                  |
|------------------|-------|------------------|-------|------------------|-----------|------------------|
|                  | HR*†  | 95% CI           | HR*   | 95% CI           | HR*       | 95% CI           |
| No of siblings   |       |                  |       |                  |           |                  |
| (ref. Non sibling)|       |                  |       |                  |           |                  |
| One sibling      | 0.98  | 0.97 to 0.99     | 0.99  | 0.97 to 1.01     | 0.93      | 0.92 to 0.94     |
| Two siblings     | 0.97  | 0.97 to 0.98     | 1.01  | 0.99 to 1.03     | 0.91      | 0.9 to 0.92      |
| Three siblings   | 0.98  | 0.97 to 0.99     | 1.04  | 1.02 to 1.07     | 0.93      | 0.92 to 0.94     |
| Four or more     | 1.00  | 0.99 to 1.01     | 1.1   | 1.07 to 1.12     | 0.96      | 0.94 to 0.97     |
| Birth order      |       |                  |       |                  |           |                  |
| (ref. first birth)|       |                  |       |                  |           |                  |
| Second           | 1     | 1 to 1.01        | 1.08  | 1.06 to 1.09     | 0.96      | 0.95 to 0.97     |
| Third            | 1.02  | 1.02 to 1.03     | 1.13  | 1.11 to 1.15     | 0.98      | 0.96 to 0.99     |
| Fourth           | 1.04  | 1.02 to 1.05     | 1.17  | 1.14 to 1.21     | 0.98      | 0.95 to 1        |
| Fifth+           | 1.07  | 1.05 to 1.09     | 1.23  | 1.19 to 1.28     | 1.01      | 0.98 to 1.05     |

*Full adjusted model: Adjusted for age at start, individual characteristics of family income, marital status, educational attainment, immigrant status, socioeconomic status, region of residence, comorbidities, number of siblings and birth order.
†Multivariable competing risk survival analysis.
CHD, coronary heart disease; CVD, cardiovascular disease.

Table 3  HR and 95% CI of CVD, CHD and mortality in women

|                  | CVD   |                  | CHD   |                  | Mortality |                  |
|------------------|-------|------------------|-------|------------------|-----------|------------------|
|                  | HR*†  | 95% CI           | HR*   | 95% CI           | HR*       | 95% CI           |
| No of siblings   |       |                  |       |                  |           |                  |
| (ref. non-sibling)|       |                  |       |                  |           |                  |
| One sibling      | 0.98  | 0.98 to 0.99     | 0.99  | 0.97 to 1.02     | 0.94      | 0.93 to 0.95     |
| Two siblings     | 0.99  | 0.98 to 1        | 1.03  | 1 to 1.06        | 0.92      | 0.91 to 0.94     |
| Three siblings   | 1     | 0.99 to 1.01     | 1.07  | 1.04 to 1.11     | 0.93      | 0.91 to 0.95     |
| Four or more     | 1.01  | 1 to 1.03        | 1.17  | 1.13 to 1.21     | 0.95      | 0.93 to 0.96     |
| Birth order      |       |                  |       |                  |           |                  |
| (ref. first birth)|       |                  |       |                  |           |                  |
| Second           | 1.01  | 1 to 1.02        | 1.07  | 1.05 to 1.09     | 0.96      | 0.95 to 0.98     |
| Third            | 1.02  | 1.01 to 1.03     | 1.14  | 1.11 to 1.18     | 0.98      | 0.96 to 1        |
| Fourth           | 1.04  | 1.02 to 1.05     | 1.14  | 1.09 to 1.2      | 1         | 0.98 to 1.03     |
| Fifth+           | 1.05  | 1.03 to 1.07     | 1.22  | 1.15 to 1.29     | 1.03      | 0.99 to 1.07     |

*Full adjusted model: Adjusted for age at start, individual characteristics of family income, marital status, educational attainment, immigrant status, socioeconomic status, region of residence, comorbidities, number of siblings, and birth order.
†Multivariable competing risk survival analysis.
CHD, coronary heart disease; CVD, cardiovascular disease.
our study for risk of non-fatal cardiovascular and coronary events during longer follow-up and extensive adjustment. These findings of lower cardiovascular risk in first borns are at contrast to previous reports of a higher level of cardiovascular risk factors in such individuals followed until adolescence or young adulthood.12–16 The burden of risk factors might have been compensated for by a better physical fitness, as noticed in first-born men coming for military conscript testing at the age of around 18 years.17 In contrast to these observations, our extensive data indicate a lower cardiovascular risk in first borns. Other unmeasured factors linked to being first born, such as cognition or bodily development, could have contributed to our findings of a relative protection, even if we adjusted for a long list of potential confounders such as educational level, socioeconomic status, marital status and comorbidities.

Besides filling a knowledge gap, this is of public health interest as different countries endorse different policies to support families and number of children. Our findings

Figure 1  HRs of CHD by number of siblings and birth order in men (A, B) and women (C, D). CHD, coronary heart disease.

Figure 2  HRs of CVD by number of siblings and birth order in men (A, B) and women (C, D). CVD, cardiovascular disease.
relate to family size and the biological as well as social roles related to sibling rank with its health implications. More research is needed to understand the links between sibling number and rank with health outcomes. This could address, for example, the dilution of resources theory of special relevance for disadvantaged girls; epigenetic factors influencing the metabolic syndrome in offspring and maternal health during pregnancy, including the effects of multiple births/child rearing on maternal health and family resources, especially in deprived settings with large families.

Limitations and strengths of the study
The Swedish hospital discharge register contains no information about diagnostic procedures, which is a limitation. Moreover, specialist doctors in hospital care made the diagnosis. Another limitation is that we had no data on life style-related factors such as BMI, smoking and diet, because it would be unrealistic to gather such data for an entire national population. However, we did adjust for socioeconomic status, obesity, diabetes, COPD and alcoholism and related liver disorders, which are associated with factors such as smoking and alcohol use. Given a focus on family size, knowing that siblings who died young, and therefore not contributed to resource dilution for a proportion of the index person’s childhood, would be of interest and importance. It would also shed light (potentially) on family circumstances and health. Regrettfully, we currently lack data on parental SES to adjust for.

Strengths of the study include complete nationwide coverage from 1990 in a country with high standards of diagnosis, and with diagnoses often being made by specialists during extended examinations in clinics. Another important strength of our study is that it was based on nationwide registers and was thus free of selection and recall bias. The Swedish MGR and the Swedish Hospital Discharge Register are validated data sources that have been proven to be reliable in the study of many diseases. Data in our dataset are almost 100% complete. Generalisability (external validity) should hold at least for countries and populations similar to Sweden.

Future research should be directed to find biological or social mechanisms linking the status of being first born to lower risk of CVD, as indicated by our observational findings. A previous Norwegian study in military conscripts indicated that the role of being first born is influenced by social factors, as a second-born son may achieve characteristics of a first-born brother who died young.

In conclusion, our data indicate a favourable effect on non-fatal cardiovascular and coronary events by being first born, both for men and women.

Contributors PMN provided the original idea, and XL made the statistical analyses. PMN and XL drafted the first manuscript. All authors (PMN, XL, JS and KS) contributed to the final manuscript. PMN and XL made the revisions.

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Competing interests None declared.

Patient consent for publication Not required.

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Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. Data will not be shared, but reasonable requests may be directed to Professor KS, the PI of the registers.

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REFERENCES
1 Banerjee A. A review of family history of cardiovascular disease: risk factor and research tool. Int J Clin Pract 2012;66:536–43.
2 Tadí H, Melander O, Louis JZ, et al. Risk prediction by genetic risk scores for coronary heart disease is independent of self-reported family history. Eur Heart J 2016;37:561–7.
3 Nilsson PM, Nilsson J-A, Berglund G. Family burden of cardiovascular mortality: risk implications for offspring in a national register linkage study based upon the Malmo preventive project. J Intern Med 2004;255:229–35.
4 Ekborn A. The Swedish multi-generation register. Methods Mol Biol 2011;675:215–20.
5 Zöller B, Ji J, Sundquist J, et al. Body height and incident risk of venous thromboembolism: a Cosibing design. Circ Cardiovasc Genet 2017;10:e001651.
6 Kasiman K, Lundholm C, Sandin S, et al. Familial effects on ischemic stroke: the role of sibling kinship, sex, and age of onset. Circ Cardiovasc Genet 2012;5:226–33.
7 Martinsson A, Li X, Zöller B. Familial aggregation of aortic valvular stenosis: a nationwide study of sibling risk. Circ Cardiovasc Genet 2017;10:e001742.
8 Lindgren MP, Ji J, Smith JG, et al. Mortality risks associated with sibling heart failure. Int J Cardiol 2020;307:114–8.
9 Berntsonsson J, Li X, Zöller B, et al. Risk of stroke in patients with atrial fibrillation is associated with stroke in siblings: a nationwide study. J Am Heart Assoc 2020;9:e014132.
10 Baranowska-Rataj A, Barclay K, Park M. The effect of number of siblings on adult mortality: evidence from Swedish registers for cohorts born between 1938 and 1972. Popul Stud 2017;71:43–63.
11 Barclay K, Kolk M. Birth order and mortality: a population-based cohort study. Demography 2015;52:613–39.
12 Ayavoo O, Derraik JGB, Hofman PL, et al. Is being first-born another risk factor for metabolic and cardiovascular diseases? Future Cardiol 2013;9:447–50.
13 Theodore RF, Broadbent J, Nagin D. Childhood to Early-Midlife systolic blood pressure trajectories: life-history predictors, effect modifiers, and adult cardiovascular outcomes. Hypertension 2015;66:1108–15.
14 Albert BB, de Bock M, Derraik JGB, et al. Among overweight middle-aged men, first-borns have lower insulin sensitivity than second-borns. Sci Rep 2015;4:3906.
15 Sierra M, Horta BL, Stephan BCM, et al. First-borns carry a higher metabolic risk in early adulthood: evidence from a prospective cohort study. PLoS One 2010;5:e13907.
16 Jelenkovic A, Silventoinen K, Tynelius P, et al. Association of birth order with cardiovascular disease risk factors in young adulthood: a study of one million Swedish men. PLoS One 2013;8:e63361.
17 Barclay K, Myrskylä M. Birth order and physical fitness in early adulthood: evidence from Swedish military conscription data. Soc Sci Med 2014;123:141–8.
18 Julihn A, Soares FC, Hammarford U, et al. Birth order is associated with caries in young children: a register-based cohort study. BMC Public Health 2020;20:218.
19 Von Behren J, Spector LG, Mueller BA, et al. Birth order and risk of childhood cancer: a pooled analysis from five us states. Int J Cancer 2011;128:2709–16.
20 Saarelä J, Cederström A, Rostila M. Birth order and mortality in two ethno-linguistic groups: register-based evidence from Finland. Soc Sci Med 2016;158:8–13.
21 Ludvigsson JF, Almquist C, Bonamy A-KE, et al. Registers of the Swedish total population and their use in medical research. Eur J Epidemiol 2016;31:125–36.
22 Ludvigsson JF, Andersson E, Ekborn A, et al. External review and validation of the Swedish national inpatient register. BMC Public Health 2011;11:450.
23 Memarian E, Sundquist K, Callling S, et al. Socioeconomic factors, body mass index and bariatric surgery: a Swedish nationwide cohort study. BMC Public Health 2019;19:258.
24 Li X, Sundquist J, Zöller B, et al. Familial risks of glaucoma in the population of Sweden. J Glaucoma 2018;27:802–6.
25 Kalmijn M, van der Werfhorst HG. Sibship size and gendered resource dilution in different societal contexts. PLoS One 2016;11:e0160953.
26 Dunford AR, Sangster JM. Maternal and paternal periconceptional nutrition as an indicator of offspring metabolic syndrome risk in later life through epigenetic imprinting: a systematic review. Diabetes Metab Syndr 2017;11:5655–62.
27 Young MF, Ramakrishnan U. Maternal undernutrition before and during pregnancy and offspring health and development. Ann Nutr Metab 2021;1:1–13.
28 Kristensen P, Bjerkedal T. Explaining the relation between birth order and intelligence. Science 2007;316:1717.
**Supplementary Table 1a. Distribution of population, number of CVD, CHD, and mortality events in men.**

| Population | CVD events | CHD events | Mortality events |
|------------|------------|------------|-----------------|
| No. (% )   | No. (%)    | No. (%)    | No. (%)         |
| Total population (%) | 1358647 | 592863 | 131533 | 240371 |
| Age (years) |            |            |                |            |
| 30-39      | 531559 (39.1) | 152615 (25.7) | 25327 (19.3) | 39094 (16.3) |
| 40-49      | 554137 (40.8) | 265251 (44.7) | 59088 (44.9) | 96549 (40.2) |
| 50-58      | 272951 (20.1) | 174997 (29.5) | 47118 (35.8) | 104728 (43.6) |
| Family income |            |            |                |            |
| Low income | 334083 (24.6) | 123575 (20.8) | 26649 (20.3) | 47582 (19.8) |
| Middle–low income | 320284 (23.6) | 135148 (22.8) | 29613 (22.5) | 51243 (21.3) |
| Middle–high income | 321653 (23.7) | 152589 (25.7) | 35041 (26.6) | 66400 (27.6) |
| High income | 382627 (28.2) | 181551 (30.6) | 40230 (30.6) | 75146 (31.3) |
| Marital status |            |            |                |            |
| Married/cohabiting | 809314 (59.6) | 370633 (62.5) | 85212 (64.8) | 124039 (51.6) |
| Never married, Widowed, or divorced | 549333 (40.4) | 222230 (37.5) | 46321 (35.2) | 116332 (48.4) |
| Educational attainment |            |            |                |            |
| ≤ 9 years | 281207 (20.7) | 146179 (24.7) | 38890 (29.6) | 81428 (33.9) |
| 10–11 years | 173208 (12.7) | 67512 (11.4) | 13955 (10.6) | 26218 (10.9) |
| ≥ 12 years | 904232 (66.6) | 379172 (64.0) | 78688 (59.8) | 132725 (55.2) |
| Immigrant status |            |            |                |            |
| Sweden | 1322658 (97.4) | 580707 (97.9) | 128732 (97.9) | 235464 (98.0) |
| Other countries | 35989 (2.6) | 12156 (2.1) | 2801 (2.1) | 4907 (2.0) |
| Socioeconomic status |            |            |                |            |
| Farmers/self-employed/others | 308729 (22.7) | 129408 (21.8) | 29064 (22.1) | 71960 (29.9) |
| Blue collar workers | 494090 (36.4) | 217215 (36.6) | 50626 (38.5) | 89989 (37.4) |
| White collar workers | 351621 (25.9) | 157170 (26.5) | 34594 (26.3) | 52582 (21.9) |
| Professionals | 204207 (15.0) | 89070 (15.0) | 17249 (13.1) | 25840 (10.8) |
| Urban/rural status |            |            |                |            |
| Large cities | 495681 (36.5) | 207593 (35.0) | 41153 (31.3) | 85765 (35.7) |
| Southern Sweden | 618686 (45.5) | 274100 (46.2) | 61581 (46.8) | 108663 (45.2) |
| Northern Sweden | 244280 (18.0) | 111170 (18.8) | 28799 (21.9) | 45943 (19.1) |
| Hospitalization of alcoholism and related liver disease |            |            |                |            |
| No | 1275305 (93.9) | 548796 (92.6) | 124051 (94.3) | 202724 (84.3) |
| Yes | 83342 (6.1) | 44067 (7.4) | 7482 (5.7) | 37647 (15.7) |
| Hospitalization of diabetes |            |            |                |            |
| No | 1226642 (90.3) | 494000 (83.3) | 104716 (79.6) | 200226 (83.3) |
| Yes | 132005 (9.7) | 98863 (16.7) | 26817 (20.4) | 40145 (16.7) |
## Hospitalization of hypertension

|            | No       | Yes      |
|------------|----------|----------|
|            | 1059935  | 298712   |
| Hospitalization of obesity | 78.0 | 22.0 |
|            | 294151   | 298712   |
|            | 49.6     | 50.4     |
|            | 76609    | 54924    |
|            | 58.2     | 41.8     |
|            | 183958   | 56413    |
|            | 76.5     | 23.5     |

## Hospitalization of obesity

|            | No       | Yes      |
|------------|----------|----------|
|            | 1338892  | 19755    |
| Hospitalization of chronic lower respiratory disease | 98.5 | 1.5 |
|            | 577543   | 15320    |
|            | 97.4     | 2.6      |
|            | 128595   | 2938     |
|            | 97.8     | 2.2      |
|            | 236644   | 3727     |
|            | 98.4     | 1.6      |

## Hospitalization of chronic lower respiratory disease

|            | No       | Yes      |
|------------|----------|----------|
|            | 1288108  | 70539    |
| Cancer     | 94.8     | 5.2      |
|            | 546393   | 46470    |
|            | 92.2     | 7.8      |
|            | 120575   | 10958    |
|            | 91.7     | 8.3      |
|            | 216522   | 23849    |
|            | 90.1     | 9.9      |

## Cancer

|            | No       | Yes      |
|------------|----------|----------|
|            | 1109571  | 249076   |
| Number of sibling | 81.7 | 18.3 |
|            | 452446   | 140417   |
|            | 76.3     | 23.7     |
|            | 103202   | 28331    |
|            | 78.5     | 21.5     |
|            | 139486   | 100885   |
|            | 58.0     | 42.0     |

## Number of sibling

|            | Non sibling | One sibling | Two siblings | Three siblings | Four or more siblings |
|------------|-------------|-------------|--------------|-----------------|-----------------------|
|            | 214700      | 443877      | 338812       | 183067          | 178191                |
|            | 15.8        | 32.7        | 24.9         | 13.5            | 13.1                  |
|            | 105516      | 189839      | 140361       | 77378           | 79769                 |
|            | 17.8        | 32.0        | 23.7         | 13.1            | 13.5                  |
|            | 23671       | 39729       | 30184        | 17663           | 20286                 |
|            | 18.0        | 30.2        | 22.9         | 13.4            | 15.4                  |
|            | 50709       | 73140       | 52790        | 30266           | 33466                 |
|            | 21.1        | 30.4        | 22.0         | 12.6            | 13.9                  |

## Birth order

|            | 1st        | 2nd        | 3rd          | 4th            | 5th+                  |
|------------|------------|------------|--------------|-----------------|-----------------------|
| Hospitalization of hypertension | 684765     | 402879     | 164540       | 62765           | 43698                 |
|            | 50.4       | 29.7       | 12.1         | 4.6             | 3.2                   |
| Hospitalization of obesity | 318341     | 166757     | 65853        | 24729           | 17183                 |
|            | 53.7       | 28.1       | 11.1         | 4.2             | 2.9                   |
| Hospitalization of chronic lower respiratory disease | 70238     | 36654      | 14736        | 5737            | 4168                  |
|            | 53.4       | 27.9       | 11.2         | 4.4             | 3.2                   |
| Cancer     | 140857     | 62267      | 23081        | 8425            | 5741                  |
|            | 58.6       | 25.9       | 9.6          | 3.5             | 2.4                   |
### Supplementary Table 1b. Distribution of population, number of CVD, CHD, and mortality events in women.

| Category                          | Population No. | CVD events No. | CHD events No. | Mortality events No. |
|-----------------------------------|----------------|----------------|----------------|----------------------|
| Total population (%)              | 1315037        | 486147         | 55933          | 160269               |
| Age (years)                       |                |                |                |                      |
| 30-39                             | 507872         | 125326         | 9681           | 24571                |
| 40-49                             | 537035         | 210113         | 23738          | 64055                |
| 50+                               | 270130         | 150708         | 22514          | 71643                |
| Family income                     |                |                |                |                      |
| Low income                        | 343296         | 100542         | 10467          | 29723                |
| Middle–low income                 | 340837         | 121716         | 13432          | 37773                |
| Middle–high income                | 347955         | 142924         | 17579          | 50537                |
| High income                       | 282949         | 120965         | 14455          | 42236                |
| Marital status                    |                |                |                |                      |
| Married/cohabiting                | 887258         | 331886         | 38106          | 96533                |
| Never married, Widowed, or divorced| 427779        | 154272         | 17827          | 63736                |
| Educational attainment            |                |                |                |                      |
| ≤ 9 years                         | 232824         | 102037         | 15415          | 48455                |
| 10–11 years                       | 165367         | 60209          | 6867           | 20489                |
| ≥ 12 years                        | 916846         | 323901         | 33651          | 91325                |
| Immigrant status                  |                |                |                |                      |
| Sweden                            | 1281472        | 476075         | 54756          | 157515               |
| Other countries                   | 33565          | 10072          | 1177           | 2754                 |
| Socioeconomic status              |                |                |                |                      |
| Farmers/self-employed/others      | 272189         | 96279          | 12450          | 45553                |
| Blue collar workers               | 437324         | 174549         | 21821          | 55960                |
| White collar workers              | 496782         | 178249         | 18324          | 49169                |
| Professionals                     | 108742         | 37070          | 3338           | 9587                 |
| Urban/rural status                |                |                |                |                      |
| Large cities                      | 495097         | 173872         | 17499          | 57794                |
| Southern Sweden                   | 591636         | 223375         | 25965          | 72872                |
| Northern Sweden                   | 228304         | 88900          | 12469          | 29603                |
| Hospitalization of alcoholism and related liver disease | | | | |
| No                                | 1283561        | 471088         | 54416          | 149212               |
| Yes                               | 31476          | 15059          | 1517           | 11057                |
| Hospitalization of diabetes       |                |                |                |                      |
| No                                | 1234361        | 429522         | 45537          | 139644               |
| Yes                               |                |                |                |                      |
|                                | Yes          | 1067928 | 81.2 | 239038 | 49.2 | 31364 | 56.1 | 124898 | 77.9 |
|--------------------------------|--------------|---------|------|--------|------|-------|------|--------|------|
|                               | No           | 247109  | 18.8 | 247109 | 50.8 | 24569 | 43.9 | 35371  | 22.1 |
| Hospitalization of obesity    | Yes          | 1286838 | 97.9 | 468228 | 96.3 | 54003 | 96.5 | 156771 | 97.8 |
|                               | No           | 28199   | 2.1  | 17919  | 3.7  | 1930  | 3.5  | 3498   | 2.2  |
| Hospitalization of chronic low respiratory disease | Yes | 1226846 | 93.3 | 433906 | 89.3 | 48084 | 86.0 | 137028 | 85.5 |
|                               | No           | 88191   | 6.7  | 52241  | 10.7 | 7849  | 14.0 | 23241  | 14.5 |
| Cancer                        | Yes          | 1051617 | 80.0 | 364226 | 74.9 | 43617 | 78.0 | 70300  | 43.9 |
|                               | No           | 263420  | 20.0 | 121921 | 25.1 | 12316 | 22.0 | 89969  | 56.1 |
| Number of sibling             | Yes          | 210121  | 16.0 | 87261  | 17.9 | 10289 | 18.4 | 34521  | 21.5 |
|                               | No           | 430315  | 32.7 | 154154 | 31.7 | 16280 | 29.1 | 49132  | 30.7 |
|                               | One sibling  | 324379  | 24.7 | 113739 | 23.4 | 12500 | 22.3 | 34843  | 21.7 |
|                               | Two siblings | 176631  | 13.4 | 63871  | 13.1 | 7512  | 13.4 | 19766  | 12.3 |
|                               | Three siblings | 173591  | 13.2 | 67122  | 13.8 | 9352  | 16.7 | 22007  | 13.7 |
|                               | Four or more siblings | 664459  | 50.5 | 262015 | 53.9 | 30342 | 54.2 | 94779  | 59.1 |
| Birth order                   | First        | 388391  | 29.5 | 136263 | 28.0 | 15191 | 27.2 | 40984  | 25.6 |
|                               | Second       | 159311  | 12.1 | 53711  | 11.0 | 6231  | 11.1 | 15205  | 9.5  |
|                               | Third        | 60676   | 4.6  | 20264  | 4.2  | 2379  | 4.3  | 5558   | 3.5  |
|                               | Fourth       | 42200   | 3.2  | 13894  | 2.9  | 1790  | 3.2  | 3743   | 2.3  |
|                               | Fifth+       | 127x549 | 80676 | 6.1    | 56625 | 11.6  | 10396 | 18.6   | 20625  | 12.9 |

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### Supplementary Table 2a. Hazard ratio (HR) and 95% confidence interval of CVD in men, using multivariable competing risk survival analysis

|                          | Model 1 |          |          | Model 2 |          |          | Model 3 |          |          |
|--------------------------|---------|----------|----------|---------|----------|----------|---------|----------|----------|
|                          | HR*     | 95% CI   |          | HR*     | 95% CI   |          | HR*     | 95% CI   |          |
| Number of siblings (ref. No sibling) |         |          |          |         |          |          |         |          |          |
| One sibling              | 0.97    | 0.97     | 0.98     | 0.98    | 0.97     | 0.99     | 0.98    | 0.97     | 0.99     |
| Two siblings             | 0.97    | 0.96     | 0.98     | 0.97    | 0.96     | 0.97     | 0.98    | 0.97     | 0.99     |
| Three siblings           | 0.99    | 0.98     | 1.00     | 0.98    | 0.97     | 0.99     | 0.98    | 0.97     | 0.99     |
| Four or more children    | 1.04    | 1.03     | 1.05     | 1.00    | 0.99     | 1.01     | 1.00    | 0.99     | 1.01     |
| Age (years)              | 1.07    | 1.07     | 1.07     | 1.08    | 1.07     | 1.08     | 1.06    | 1.06     | 1.06     |
| Family income (ref. High) |         |          |          |         |          |          |         |          |          |
| Low income               | 0.92    | 0.92     | 0.93     | 0.99    | 0.98     | 1.00     |         |          |          |
| Middle–low income        | 1.02    | 1.01     | 1.03     | 1.05    | 1.04     | 1.06     |         |          |          |
| Middle–high income       | 1.04    | 1.03     | 1.05     | 1.05    | 1.04     | 1.06     |         |          |          |
| Educational level (ref. > 12 years) |         |          |          |         |          |          |         |          |          |
| 10–11 years              | 1.11    | 1.10     | 1.12     | 1.06    | 1.05     | 1.07     |         |          |          |
| ≥ 12 years               | 1.00    | 1.00     | 1.01     | 1.00    | 0.99     | 1.00     |         |          |          |
| Socioeconomic status (ref. professionals) |         |          |          |         |          |          |         |          |          |
| Farmers/self-employed/others | 1.22    | 1.21     | 1.23     | 1.17    | 1.16     | 1.18     |         |          |          |
| Blue collar workers      | 1.15    | 1.14     | 1.16     | 1.09    | 1.08     | 1.10     |         |          |          |
| White collar workers     | 1.08    | 1.07     | 1.08     | 1.04    | 1.04     | 1.05     |         |          |          |
| Region of residence (ref. Large cities) |         |          |          |         |          |          |         |          |          |
| Southern Sweden          | 1.00    | 1.00     | 1.01     | 1.03    | 1.02     | 1.03     |         |          |          |
| Northern Sweden          | 1.04    | 1.03     | 1.05     | 1.05    | 1.04     | 1.06     |         |          |          |
| Immigrant status (ref. Born in Sweden) | 0.95    | 0.93     | 0.97     | 0.96    | 0.95     | 0.98     |         |          |          |
| Marital status (ref. Not married) | 1.18    | 1.17     | 1.19     | 1.17    | 1.16     | 1.18     |         |          |          |
| Birth order              | 1.01    | 1.01     | 1.01     | 1.01    | 1.01     | 1.02     |         |          |          |
| Hospitalization of chronic lower respiratory disease (ref. Non) |         |          |          |         |          |          |         |          |          |
| Hospitalization of alcoholism and related liver disease (ref. Non) |         |          |          |         |          |          |         |          |          |
| Hospitalization of diabetes (ref. Non) |         |          |          |         |          |          |         |          |          |
| Hospitalization of obesity (ref. Non) |         |          |          |         |          |          |         |          |          |
| Hospitalization of hypertension (ref. Non) |         |          |          |         |          |          |         |          |          |
| Cancer (ref. Non)        | 1.36    | 1.35     | 1.36     |         |          |          |         |          |          |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.

*: Multivariable competing risk survival analysis
Supplementary Table 2b. Hazard ratio (HR) and 95% confidence interval of CVD in men, using multivariable competing risk survival analysis

| Birth order (ref. First birth) | Model 1  | Model 2  | Model 3  |
|-------------------------------|----------|----------|----------|
|                               | HR* 95% CI | HR* 95% CI | HR* 95% CI |
| Second                        | 0.99 0.99 1.00 | 0.99 0.98 1.00 | 1.00 1.00 1.01 |
| Third                         | 1.02 1.01 1.03 | 1.01 1.00 1.02 | 1.02 1.02 1.03 |
| Fourth                        | 1.05 1.03 1.06 | 1.03 1.01 1.04 | 1.04 1.02 1.05 |
| Fifth+                        | 1.10 1.08 1.12 | 1.07 1.05 1.08 | 1.07 1.05 1.09 |

| Age (years)                   | Model 1  | Model 2  | Model 3  |
|-------------------------------|----------|----------|----------|
|                               | HR* 95% CI | HR* 95% CI | HR* 95% CI |
|                               | 1.07 1.07 1.07 | 1.08 1.07 1.08 | 1.06 1.06 1.06 |

| Family income (ref. High)     | Model 1  | Model 2  | Model 3  |
|-------------------------------|----------|----------|----------|
| Low income                    | 0.92 0.92 0.93 | 0.99 0.98 1.00 |          |
| Middle–low income             | 1.02 1.01 1.03 | 1.05 1.04 1.06 |          |
| Middle–high income            | 1.04 1.03 1.05 | 1.05 1.04 1.06 |          |

| Educational level (ref. > 12 years) | Model 1  | Model 2  | Model 3  |
|-------------------------------------|----------|----------|----------|
| 10–11 years                         | 1.11 1.10 1.12 | 1.06 1.05 1.07 |          |
| ≥ 12 years                          | 1.00 1.00 1.01 | 1.00 0.99 1.00 |          |

| Socioeconomic status (ref. professionals) | Model 1  | Model 2  | Model 3  |
|------------------------------------------|----------|----------|----------|
| Farmers/self-employed/others            | 1.22 1.21 1.23 | 1.17 1.16 1.18 |          |
| Blue collar workers                      | 1.15 1.14 1.16 | 1.09 1.08 1.10 |          |
| White collar workers                     | 1.08 1.07 1.08 | 1.04 1.04 1.05 |          |

| Region of residence (ref. Large cities) | Model 1  | Model 2  | Model 3  |
|----------------------------------------|----------|----------|----------|
| Southern Sweden                         | 1.00 1.00 1.01 | 1.03 1.02 1.03 |          |
| Northern Sweden                         | 1.04 1.03 1.05 | 1.05 1.04 1.06 |          |

| Immigrant status (ref. Born in Sweden)  | Model 1  | Model 2  | Model 3  |
|----------------------------------------|----------|----------|----------|
| 0.95 0.93 0.97                          | 0.97 0.95 0.98 |          |          |

| Marital status (ref. Not married)       | Model 1  | Model 2  | Model 3  |
|----------------------------------------|----------|----------|----------|
| 1.18 1.17 1.19                          | 1.17 1.16 1.18 |          |          |

| Number of siblings                      | Model 1  | Model 2  | Model 3  |
|----------------------------------------|----------|----------|----------|
| 1.00 1.00 1.00                          | 1.00 1.00 1.00 |          |          |

| Hospitalization of chronic lower respiratory disease (ref. Non) | Model 1  | Model 2  | Model 3  |
|----------------------------------------------------------------|----------|----------|----------|
| Hospitalization of alcoholism and related liver disease (ref. Non) | 1.26 1.25 1.28 |          |          |
| Hospitalization of diabetes (ref. Non)                           | 1.74 1.73 1.76 |          |          |
| Hospitalization of obesity (ref. Non)                            | 1.39 1.38 1.40 |          |          |
| Hospitalization of hypertension (ref. Non)                        | 3.72 3.70 3.74 |          |          |
| Cancer (ref. Non)                                                 | 1.36 1.35 1.36 |          |          |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.

*: Multivariable competing risk survival analysis
Supplementary Table 2c. Hazard ratio (HR) and 95% confidence interval of CVD in women, using multivariable competing risk survival analysis

|                                      | Model 1 |          | Model 2 |          | Model 3 |          |
|--------------------------------------|---------|----------|---------|----------|---------|----------|
|                                      | HR*     | 95% CI   | HR*     | 95% CI   | HR*     | 95% CI   |
| Number of siblings (ref. No sibling) |         |          |         |          |         |          |
| One sibling                          | 0.98    | 0.97     | 0.98    | 0.97     | 0.98    | 0.99     |
| Two siblings                         | 0.99    | 0.98     | 0.98    | 0.97     | 0.99    | 1.00     |
| Three siblings                       | 1.01    | 1.00     | 1.02    | 1.00     | 1.00    | 1.01     |
| Four or more children                | 1.06    | 1.05     | 1.07    | 1.03     | 1.01    | 1.03     |
| Age (years)                          | 1.06    | 1.06     | 1.07    | 1.06     | 1.04    | 1.04     |
| Family income (ref. High)            |         |          |         |          |         |          |
| Low income                           | 0.87    | 0.86     | 0.87    | 0.95     | 0.94    | 0.96     |
| Middle–low income                    | 1.01    | 1.00     | 1.02    | 1.04     | 1.03    | 1.05     |
| Middle–high income                   | 1.02    | 1.01     | 1.03    | 1.03     | 1.02    | 1.03     |
| Educational level (ref. > 12 years)  |         |          |         |          |         |          |
| 10–11 years                          | 1.13    | 1.12     | 1.14    | 1.08     | 1.06    | 1.09     |
| ≥ 12 years                           | 1.04    | 1.03     | 1.05    | 1.03     | 1.02    | 1.04     |
| Socioeconomic status (ref. professionals) |        |          |         |          |         |          |
| Farmers/self-employed/others         | 1.30    | 1.28     | 1.31    | 1.20     | 1.19    | 1.22     |
| Blue collar workers                  | 1.25    | 1.24     | 1.27    | 1.12     | 1.11    | 1.13     |
| White collar workers                 | 1.08    | 1.07     | 1.10    | 1.03     | 1.02    | 1.04     |
| Region of residence (ref. Large cities) |        |          |         |          |         |          |
| Southern Sweden                      | 1.03    | 1.03     | 1.04    | 1.03     | 1.03    | 1.04     |
| Northern Sweden                      | 1.06    | 1.06     | 1.07    | 1.04     | 1.03    | 1.05     |
| Immigrant status (ref. Born in Sweden) | 0.97  | 0.96     | 0.99    | 0.98     | 0.96    | 1.00     |
| Marital status (ref. Not married)    | 1.13    | 1.12     | 1.14    | 1.10     | 1.09    | 1.11     |
| Birth order                          | 1.00    | 1.00     | 1.01    | 1.01     | 1.01    | 1.01     |
| Hospitalization of chronic lower respiratory disease (ref. Non) | 1.38 | 1.36 | 1.39 | 1.38 | 1.37 | 1.39 |
| Hospitalization of alcoholisms and related liver disease (ref. Non) | 1.67 | 1.65 | 1.69 | 1.38 | 1.37 | 1.39 |
| Hospitalization of diabetes (ref. Non) | 1.32 | 1.30 | 1.34 | 4.86 | 4.83 | 4.89 |
| Hospitalization of obesity (ref. Non) | 1.62 | 1.61 | 1.63 |          |          |          |
| Hospitalization of hypertension (ref. Non) |        |          |         |          |         |          |
| Cancer (ref. Non)                    |         |          |         |          |         |          |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.

*: Multivariable competing risk survival analysis
Supplementary Table 2d. Hazard ratio (HR) and 95% confidence interval of CVD in women, using multivariable competing risk survival analysis

| Model 1 | Model 2 | Model 3 |
|---------|---------|---------|
| HR*     | 95% CI  | HR*     | 95% CI  | HR*     | 95% CI  |
| Birth order (ref. First birth) | | | | | |
| Second  | 1.00    | 0.99    | 1.01    | 0.99    | 0.98    | 1.00    | 1.01    | 1.00    | 1.02 |
| Third   | 1.03    | 1.02    | 1.04    | 1.00    | 0.99    | 1.01    | 1.02    | 1.01    | 1.03 |
| Fourth  | 1.06    | 1.04    | 1.07    | 1.01    | 1.00    | 1.03    | 1.04    | 1.02    | 1.05 |
| Fifth+  | 1.09    | 1.07    | 1.10    | 1.01    | 0.99    | 1.03    | 1.05    | 1.03    | 1.07 |
| Age (years) | | | | | |
| Family income (ref. High) | | | | | |
| Low income | 1.07    | 1.07    | 1.07    | 1.06    | 1.06    | 1.06    | 1.04    | 1.04    | 1.04 |
| Middle–low income | 0.87    | 0.86    | 0.87    | 0.95    | 0.94    | 0.96    | | | |
| Middle–high income | 1.01    | 1.00    | 1.02    | 1.04    | 1.03    | 1.05    | | | |
| Educational level (ref. > 12 years) | | | | | |
| 10–11 years | 1.13    | 1.12    | 1.14    | 1.08    | 1.06    | 1.09    | | | |
| ≥ 12 years | 1.04    | 1.03    | 1.05    | 1.03    | 1.02    | 1.04    | | | |
| Socioeconomic status (ref. professionals) | | | | | |
| Farmers/self-employed/others | 1.30    | 1.28    | 1.31    | 1.21    | 1.19    | 1.22    | | | |
| Blue collar workers | 1.26    | 1.24    | 1.27    | 1.12    | 1.11    | 1.13    | | | |
| White collar workers | 1.09    | 1.07    | 1.10    | 1.03    | 1.02    | 1.05    | | | |
| Region of residence (ref. Large cities) | | | | | |
| Southern Sweden | 1.03    | 1.03    | 1.04    | 1.03    | 1.03    | 1.04    | | | |
| Northern Sweden | 1.06    | 1.06    | 1.07    | 1.04    | 1.03    | 1.05    | | | |
| Immigrant status (ref. Born in Sweden) | | | | | |
| 0.97    | 0.96    | 0.99    | 0.98    | 0.96    | 1.00    | | | |
| Marital status (ref. Not married) | 1.13    | 1.13    | 1.14    | 1.10    | 1.09    | 1.11    | | | |
| Number of siblings | 1.01    | 1.01    | 1.01    | 1.00    | 1.00    | 1.01    | | | |
| Hospitalization of chronic lower respiratory disease (ref. Non) | 1.38    | 1.36    | 1.39    | | | | | | |
| Hospitalization of alcoholisms and related liver disease (ref. Non) | 1.67    | 1.65    | 1.69    | | | | | | |
| Hospitalization of diabetes (ref. Non) | 1.38    | 1.37    | 1.39    | | | | | | |
| Hospitalization of obesity (ref. Non) | 1.32    | 1.30    | 1.34    | | | | | | |
| Hospitalization of hypertension (ref. Non) | 4.86    | 4.83    | 4.89    | | | | | | |
| Cancer (ref. Non) | 1.62    | 1.61    | 1.63    | | | | | | |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.

*: Multivariable competing risk survival analysis
### Supplementary Table 3a. Hazard ratio (HR) and 95% confidence interval of CHD in men

|                     | Model 1 | Model 2 | Model 3 |
|---------------------|---------|---------|---------|
|                     | HR      | 95% CI  | HR      | 95% CI  | HR      | 95% CI  |
| Number of siblings  |         |         |         |         |         |         |
| (ref. No sibling)   |         |         |         |         |         |         |
| One sibling         | 1.00    | 0.98    | 1.02    |         | 0.99    | 0.97    | 1.01    |
| Two siblings        | 1.04    | 1.03    | 1.06    | 1.00    | 0.98    | 1.02    | 1.07    |
| Three siblings      | 1.12    | 1.10    | 1.14    | 1.04    | 1.02    | 1.06    | 1.07    |
| Four or more children | 1.27    | 1.25    | 1.30    | 1.10    | 1.08    | 1.12    | 1.07    |
| Age (years)         |         |         |         |         |         |         |
| (ref. Not married)  |         |         |         |         |         |         |
| Family income       |         |         |         |         |         |         |
| Low income          | 0.93    | 0.91    | 0.94    | 0.96    | 0.95    | 0.98    |
| Middle–low income   | 1.00    | 0.98    | 1.01    | 1.02    | 1.00    | 1.03    |
| Middle–high income  | 1.01    | 1.00    | 1.03    | 1.02    | 1.00    | 1.03    |
| Educational level   |         |         |         |         |         |         |
| (ref. > 12 years)   |         |         |         |         |         |         |
| 10–11 years         | 1.05    | 1.03    | 1.07    | 1.04    | 1.02    | 1.07    |
| ≥ 12 years          | 0.94    | 0.93    | 0.95    | 0.95    | 0.94    | 0.96    |
| Socioeconomic status (ref. professionals) |         |         |         |         |         |         |
| Farmers/self-employed/others | 1.23    | 1.20    | 1.25    | 1.18    | 1.16    | 1.21    |
| Blue collar workers | 1.26    | 1.24    | 1.28    | 1.21    | 1.19    | 1.23    |
| White collar workers | 1.18    | 1.16    | 1.20    | 1.15    | 1.13    | 1.17    |
| Region of residence (ref. Large cities) |         |         |         |         |         |         |
| Southern Sweden     | 1.11    | 1.10    | 1.12    | 1.12    | 1.11    | 1.14    |
| Northern Sweden     | 1.32    | 1.30    | 1.34    | 1.31    | 1.29    | 1.33    |
| Immigrant status (ref. Born in Sweden) |         |         |         |         |         |         |
| Marital status      |         |         |         |         |         |         |
| (ref. Not married)  | 1.00    | 0.99    | 1.01    | 0.99    | 0.98    | 1.01    |
| Birth order         | 1.05    | 1.04    | 1.05    | 1.05    | 1.05    | 1.06    |
| Hospitalization      |         |         |         |         |         |         |
| of chronic lower respiratory disease (ref. Non) | 1.29    | 1.26    | 1.31    |         |         |         |
| of alcoholism and related liver disease (ref. Non) | 1.01    | 0.99    | 1.04    |         |         |         |
| of diabetes (ref. Non) | 1.75    | 1.73    | 1.78    |         |         |         |
| of obesity (ref. Non) | 1.13    | 1.09    | 1.17    |         |         |         |
| of hypertension (ref. Non) | 1.86    | 1.84    | 1.88    |         |         |         |
| Cancer (ref. Non)   | 0.91    | 0.89    | 0.92    |         |         |         |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
**Supplementary Table 3b. Hazard ratio (HR) and 95% confidence interval of CHD in men**

| Birth order (ref. First birth) | Model 1 |  | Model 2 |  | Model 3 |  |
|-------------------------------|---------|---|---------|---|---------|---|
|                               | HR      | 95% CI | HR      | 95% CI | HR      | 95% CI |
| Second                        | 1.09    | 1.08, 1.10 | 1.06    | 1.05, 1.07 | 1.08    | 1.06, 1.09 |
| Third                         | 1.19    | 1.17, 1.21 | 1.11    | 1.09, 1.13 | 1.13    | 1.11, 1.15 |
| Fourth                        | 1.28    | 1.25, 1.32 | 1.15    | 1.12, 1.19 | 1.17    | 1.14, 1.21 |
| Fifth+                        | 1.44    | 1.39, 1.48 | 1.22    | 1.17, 1.26 | 1.23    | 1.19, 1.28 |
| Age (years)                   |         |         |         |         |         |         |
|                               | 1.08    | 1.08, 1.09 | 1.08    | 1.08, 1.09 | 1.07    | 1.07, 1.07 |
| Family income (ref. High)     |         |         |         |         |         |         |
| Low income                    | 0.93    | 0.91, 0.94 | 0.96    | 0.95, 0.98 |         |         |
| Middle–low income             | 1.00    | 0.98, 1.01 | 1.02    | 1.00, 1.03 |         |         |
| Middle–high income            | 1.01    | 1.00, 1.02 | 1.02    | 1.00, 1.03 |         |         |
| Educational level (ref. > 12 years) |         |         |         |         |         |         |
| 10–11 years                   | 1.05    | 1.03, 1.08 | 1.05    | 1.03, 1.07 |         |         |
| ≥ 12 years                    | 0.94    | 0.93, 0.95 | 0.95    | 0.94, 0.97 |         |         |
| Socioeconomic status (ref. professionals) |         |         |         |         |         |         |
| Farmers/self-employed/others | 1.23    | 1.20, 1.25 | 1.18    | 1.16, 1.21 |         |         |
| Blue collar workers           | 1.26    | 1.24, 1.28 | 1.21    | 1.19, 1.23 |         |         |
| White collar workers          | 1.18    | 1.16, 1.20 | 1.15    | 1.13, 1.17 |         |         |
| Region of residence (ref. Large cities) |         |         |         |         |         |         |
| Southern Sweden               | 1.11    | 1.10, 1.13 | 1.12    | 1.11, 1.14 |         |         |
| Northern Sweden               | 1.32    | 1.30, 1.34 | 1.31    | 1.29, 1.33 |         |         |
| Immigrant status (ref. Born in Sweden) |         |         |         |         |         |         |
| Marital status (ref. Not married) | 1.09    | 1.05, 1.13 | 1.10    | 1.06, 1.14 |         |         |
| Number of siblings            | 1.00    | 0.99, 1.01 | 0.99    | 0.98, 1.01 |         |         |
| Hospitalization of chronic lower respiratory disease (ref. Non) | 1.02    | 1.02, 1.02 | 1.02    | 1.02, 1.02 |         |         |
| Hospitalization of alcoholisms and related liver disease (ref. Non) |         |         |         |         |         |         |
| Hospitalization of diabetes (ref. Non) | 1.29    | 1.26, 1.31 | 1.29    | 1.26, 1.31 |         |         |
| Hospitalization of obesity (ref. Non) | 1.13    | 1.09, 1.17 | 1.13    | 1.09, 1.17 |         |         |
| Hospitalization of hypertension (ref. Non) | 1.86    | 1.84, 1.88 | 1.86    | 1.84, 1.88 |         |         |
| Cancer (ref. Non)             | 0.91    | 0.89, 0.92 | 0.91    | 0.89, 0.92 |         |         |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
Supplementary Table 3c. Hazard ratio (HR) and 95% confidence interval of CHD in women

|                        | Model 1 |          |          |          | Model 2 |          |          |          | Model 3 |          |          |          |
|------------------------|---------|----------|----------|----------|---------|----------|----------|----------|---------|----------|----------|----------|
|                        | HR      | 95% CI   | HR       | 95% CI   | HR      | 95% CI   | HR       | 95% CI   | HR      | 95% CI   | HR       | 95% CI   |
| Number of siblings (ref. No sibling) |         |          |          |          |         |          |          |          |         |          |          |          |
| One sibling             | 0.99    | 0.97     | 1.02     | 0.98     | 0.96    | 1.01     | 0.99     | 0.97     | 1.02     |          |          |          |
| Two siblings            | 1.07    | 1.04     | 1.10     | 1.03     | 1.00    | 1.05     | 1.03     | 1.00     | 1.06     |          |          |          |
| Three siblings          | 1.17    | 1.13     | 1.20     | 1.08     | 1.04    | 1.11     | 1.07     | 1.04     | 1.11     |          |          |          |
| Four or more children   | 1.40    | 1.36     | 1.44     | 1.20     | 1.16    | 1.24     | 1.17     | 1.13     | 1.21     |          |          |          |
| Age (years)             | 1.09    | 1.09     | 1.09     | 1.09     | 1.08    | 1.09     | 1.07     | 1.07     | 1.07     |          |          |          |
| Family income (ref. High) |         |          |          |          |         |          |          |          |          |         |          |          |
| Low income              | 0.85    | 0.83     | 0.88     | 0.91     | 0.88    | 0.93     |          |          |          |          |          |          |
| Middle–low income       | 1.00    | 0.98     | 1.03     | 1.00     | 0.98    | 1.03     |          |          |          |          |          |          |
| Middle–high income      | 1.02    | 1.00     | 1.05     | 1.02     | 0.99    | 1.04     |          |          |          |          |          |          |
| Educational level (ref. > 12 years) |         |          |          |          |         |          |          |          |          |         |          |          |
| 10–11 years             | 1.07    | 1.04     | 1.10     | 1.06     | 1.03    | 1.09     |          |          |          |          |          |          |
| ≥ 12 years              | 0.92    | 0.90     | 0.94     | 0.94     | 0.92    | 0.96     |          |          |          |          |          |          |
| Socioeconomic status (ref. professionals) |         |          |          |          |         |          |          |          |          |         |          |          |
| Farmers/self-employed/others | 1.52    | 1.46     | 1.59     | 1.37     | 1.31    | 1.42     |          |          |          |          |          |          |
| Blue collar workers     | 1.47    | 1.42     | 1.53     | 1.33     | 1.28    | 1.38     |          |          |          |          |          |          |
| White collar workers    | 1.19    | 1.14     | 1.23     | 1.14     | 1.10    | 1.18     |          |          |          |          |          |          |
| Region of residence (ref. Large cities) |         |          |          |          |         |          |          |          |          |         |          |          |
| Southern Sweden         | 1.14    | 1.12     | 1.16     | 1.15     | 1.13    | 1.17     |          |          |          |          |          |          |
| Northern Sweden         | 1.40    | 1.37     | 1.44     | 1.38     | 1.34    | 1.41     |          |          |          |          |          |          |
| Immigrant status (ref. Born in Sweden) |         |          |          |          |         |          |          |          |          |         |          |          |
| Marital status (ref. Not married) |         |          |          |          |         |          |          |          |          |         |          |          |
| Birth order             | 1.04    | 1.03     | 1.05     | 1.05     | 1.04    | 1.06     |          |          |          |          |          |          |
| Hospitalization of chronic lower respiratory disease (ref. Non) |         |          |          |          |         |          |          |          |          |         |          |          |
| Hospitalization of alcoholisms and related liver disease (ref. Non) |         |          |          |          |         |          |          |          |          |         |          |          |
| Hospitalization of diabetes (ref. Non) |         |          |          |          |         |          |          |          |          |         |          |          |
| Hospitalization of obesity (ref. Non) |         |          |          |          |         |          |          |          |          |         |          |          |
| Hospitalization of hypertension (ref. Non) |         |          |          |          |         |          |          |          |          |         |          |          |
| Cancer (ref. Non)       | 0.94    | 0.93     | 0.96     |          |          |          |          |          |          |          |          |          |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
### Supplementary Table 3d. Hazard ratio (HR) and 95% confidence interval of CHD in women

|                                | Model 1          | Model 2          | Model 3          |
|--------------------------------|------------------|------------------|------------------|
|                                | HR   | 95% CI | HR   | 95% CI | HR   | 95% CI |
| Birth order (ref. First birth) |      |        |      |        |      |        |
| Second                         | 1.10 | 1.07   | 1.12 | 1.02   | 1.07 | 1.05   |
| Third                          | 1.24 | 1.21   | 1.28 | 1.08   | 1.14 | 1.11   |
| Fourth                         | 1.33 | 1.27   | 1.38 | 1.11   | 1.16 | 1.09   |
| Fifth+                         | 1.56 | 1.48   | 1.63 | 1.17   | 1.24 | 1.15   |
| Age (years)                    |      |        |      |        |      |        |
| Family income (ref. High)      |      |        |      |        |      |        |
| Low income                     | 0.85 | 0.83   | 0.88 | 0.91   | 0.88 | 0.93   |
| Middle–low income              | 1.00 | 0.98   | 1.03 | 1.01   | 0.98 | 1.03   |
| Middle–high income             | 1.02 | 1.00   | 1.05 | 1.02   | 0.99 | 1.04   |
| Educational level (ref. > 12 years) |      |        |      |        |      |        |
| 10–11 years                    | 1.07 | 1.04   | 1.10 | 1.06   | 1.03 | 1.09   |
| ≥ 12 years                     | 0.92 | 0.90   | 0.94 | 0.94   | 0.92 | 0.96   |
| Socioeconomic status (ref. professionals) |      |        |      |        |      |        |
| Farmers/self-employed/others   | 1.52 | 1.46   | 1.59 | 1.37   | 1.31 | 1.42   |
| Blue collar workers            | 1.47 | 1.42   | 1.53 | 1.33   | 1.28 | 1.38   |
| White collar workers           | 1.19 | 1.14   | 1.23 | 1.14   | 1.10 | 1.18   |
| Region of residence (ref. Large cities) |      |        |      |        |      |        |
| Southern Sweden                | 1.14 | 1.12   | 1.17 | 1.15   | 1.13 | 1.17   |
| Northern Sweden                | 1.40 | 1.37   | 1.44 | 1.38   | 1.34 | 1.41   |
| Immigrant status (ref. Born in Sweden) |      |        |      |        |      |        |
| Marital status (ref. Not married) | 1.12 | 1.10   | 1.14 | 1.08   | 1.06 | 1.10   |
| Number of siblings             | 1.04 | 1.03   | 1.04 | 1.03   | 1.03 | 1.04   |
| Hospitalization of chronic lower respiratory disease (ref. Non) |      |        |      |        |      |        |
| Hospitalization of alcoholisms and related liver disease (ref. Non) |      |        |      |        |      |        |
| Hospitalization of diabetes (ref. Non) | 2.20 | 2.15   | 2.25 | 2.17   | 2.11 | 2.23   |
| Hospitalization of obesity (ref. Non) | 1.11 | 1.06   | 1.17 | 1.10   | 1.06 | 1.17   |
| Hospitalization of hypertension (ref. Non) | 2.22 | 2.18   | 2.26 | 2.17   | 2.11 | 2.23   |
| Cancer (ref. Non)              | 0.94 | 0.93   | 0.96 | 0.94   | 0.93 | 0.96   |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
**Supplementary Table 4a. Hazard ratio (HR) and 95% confidence interval of mortality in men**

|                                | Model 1          | Model 2          | Model 3          |
|--------------------------------|------------------|------------------|------------------|
|                                | HR    | 95% CI | HR    | 95% CI | HR    | 95% CI |
| Number of siblings (ref. No sibling) |       |        |       |        |       |        |
| One sibling                     | 0.91  | 0.90   | 0.92  | 0.91   | 0.93  | 0.92   |
| Two siblings                    | 0.92  | 0.91   | 0.93  | 0.91   | 0.91  | 0.90   |
| Three siblings                  | 0.96  | 0.94   | 0.97  | 0.93   | 0.93  | 0.92   |
| Four or more children           | 1.03  | 1.01   | 1.04  | 0.96   | 0.94  | 0.97   |
| Age (years)                     |       |        |       |        |       |        |
| Family income (ref. High)       |       |        |       |        |       |        |
| Low income                      | 1.05  | 1.04   | 1.07  | 1.08   | 1.07  | 1.10   |
| Middle–low income               | 1.17  | 1.15   | 1.18  | 1.14   | 1.13  | 1.15   |
| Middle–high income              | 1.18  | 1.17   | 1.19  | 1.15   | 1.14  | 1.16   |
| Educational level (ref. > 12 years) |       |        |       |        |       |        |
| 10–11 years                     | 1.12  | 1.10   | 1.13  | 1.08   | 1.06  | 1.09   |
| ≥ 12 years                      | 0.91  | 0.90   | 0.91  | 0.89   | 0.88  | 0.90   |
| Socioeconomic status (ref. professionals) |     |        |       |        |       |        |
| Farmers/self-employed/others    | 1.73  | 1.71   | 1.76  | 1.63   | 1.60  | 1.65   |
| Blue collar workers              | 1.38  | 1.36   | 1.40  | 1.34   | 1.32  | 1.36   |
| White collar workers             | 1.15  | 1.13   | 1.17  | 1.14   | 1.12  | 1.16   |
| Region of residence (ref. Large cities) |       |        |       |        |       |        |
| Southern Sweden                  | 0.94  | 0.93   | 0.95  | 0.99   | 0.98  | 1.00   |
| Northern Sweden                  | 0.98  | 0.97   | 0.99  | 1.08   | 1.07  | 1.09   |
| Immigrant status (ref. Born in Sweden) | 1.04  | 1.01   | 1.07  | 1.06   | 1.03  | 1.09   |
| Marital status (ref. Not married) | 1.88  | 1.87   | 1.90  | 1.71   | 1.70  | 1.73   |
| Birth order                      | 1.00  | 1.00   | 1.01  | 0.99   | 0.99  | 1.00   |
| Hospitalization of chronic lower respiratory disease (ref. Non) | 1.28  | 1.26   | 1.30  |       |       |        |
| Hospitalization of alcoholisms and related liver disease (ref. Non) | 3.02  | 2.98   | 3.05  |       |       |        |
| Hospitalization of diabetes (ref. Non) | 1.43  | 1.41   | 1.45  |       |       |        |
| Hospitalization of obesity (ref. Non) | 1.09  | 1.06   | 1.13  |       |       |        |
| Hospitalization of hypertension (ref. Non) | 0.66  | 0.65   | 0.67  |       |       |        |
| Cancer (ref. Non)                | 2.62  | 2.60   | 2.65  |       |       |        |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
Supplementary Table 4b. Hazard ratio (HR) and 95% confidence interval of mortality in men

| Birth order (ref. First birth) | Model 1 |          |          |          | Model 2 |          |          |          | Model 3 |          |          |
|-------------------------------|---------|----------|----------|----------|---------|----------|----------|----------|---------|----------|----------|
|                               | HR      | 95% CI   |          |          | HR      | 95% CI   |          |          | HR      | 95% CI   |          |          |
| Second                         | 0.98    | 0.97     | 0.99     | 0.97     | 0.96    | 0.95     | 0.97     | 0.96     | 0.95    | 0.97     |          |          |
| Third                          | 1.01    | 0.99     | 1.02     | 0.99     | 0.98    | 0.96     | 0.99     | 0.98     | 0.96    | 0.99     |          |          |
| Fourth                         | 1.04    | 1.01     | 1.06     | 1.00     | 1.02    | 1.01     | 1.00     | 1.01     | 1.00    | 1.05     |          |          |
| Fifth+                         | 1.11    | 1.08     | 1.14     | 1.06     | 1.02    | 1.09     | 1.01     | 0.98     | 1.05    |          |          |          |
| Age (years)                    | 1.10    | 1.10     | 1.10     | 1.11     | 1.11    | 1.11     | 1.10     | 1.10     | 1.10    | 1.10     |          |          |
|                                | Family income (ref. High) |          |          |          |          |          |          |          |          |          |          |
| Low income                     | 1.17    | 1.15     | 1.18     | 1.14     | 1.13    | 1.16     |          |          |          |          |          |
| Middle–low income              | 1.18    | 1.17     | 1.19     | 1.15     | 1.14    | 1.16     |          |          |          |          |          |
| Middle–high income             | 1.12    | 1.10     | 1.13     | 1.07     | 1.06    | 1.09     |          |          |          |          |          |
| Educational level (ref. > 12 years) |          |          |          |          |          |          |          |          |          |          |          |
| 10–11 years                    | 0.90    | 0.90     | 0.91     | 0.89     | 0.88    | 0.90     |          |          |          |          |          |
| ≥ 12 years                     | 1.73    | 1.71     | 1.76     | 1.63     | 1.60    | 1.66     |          |          |          |          |          |
| Socioeconomic status (ref. professionals) |          |          |          |          |          |          |          |          |          |          |          |
| Farmers/self-employed/others  | 1.38    | 1.36     | 1.40     | 1.34     | 1.32    | 1.36     |          |          |          |          |          |
| Blue collar workers            | 1.15    | 1.13     | 1.17     | 1.14     | 1.13    | 1.16     |          |          |          |          |          |
| White collar workers           | 0.94    | 0.93     | 0.95     | 0.99     | 0.98    | 1.00     |          |          |          |          |          |
| Region of residence (ref. Large cities) |          |          |          |          |          |          |          |          |          |          |          |
| Southern Sweden                | 0.98    | 0.97     | 0.99     | 1.08     | 1.07    | 1.09     |          |          |          |          |          |
| Northern Sweden                | 1.05    | 1.02     | 1.08     | 1.06     | 1.03    | 1.09     |          |          |          |          |          |
| Immigrant status (ref. Born in Sweden) |          |          |          |          |          |          |          |          |          |          |          |
| Marital status (ref. Not married) | 1.88    | 1.87     | 1.90     | 1.71     | 1.70    | 1.73     |          |          |          |          |          |
| Number of siblings             | 1.00    | 0.99     | 1.00     | 1.00     | 0.99    | 1.00     |          |          |          |          |          |
| Hospitalization of chronic lower respiratory disease (ref. Non) |          |          |          |          |          |          |          |          |          |          |          |
| Hospitalization of alcoholisms and related liver disease (ref. Non) |          |          |          |          |          |          |          |          |          |          |          |
| Hospitalization of diabetes (ref. Non) |          |          |          |          |          |          |          |          |          |          |          |
| Hospitalization of obesity (ref. Non) |          |          |          |          |          |          |          |          |          |          |          |
| Hospitalization of hypertension (ref. Non) |          |          |          |          |          |          |          |          |          |          |          |
| Cancer (ref. Non)              | 2.62    | 2.60     | 2.64     |          |          |          |          |          |          |          |          |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
| Model 1 | Model 2 | Model 3 |
|---------|---------|---------|
| HR | 95% CI | HR | 95% CI | HR | 95% CI |
| **Number of siblings (ref. No sibling)** | | | | | |
| One sibling | 0.92 | 0.91 | 0.94 | 0.93 | 0.92 | 0.95 | 0.94 | 0.93 | 0.95 |
| Two siblings | 0.92 | 0.91 | 0.94 | 0.91 | 0.90 | 0.93 | 0.92 | 0.91 | 0.94 |
| Three siblings | 0.95 | 0.93 | 0.96 | 0.92 | 0.90 | 0.93 | 0.93 | 0.91 | 0.95 |
| Four or more children | 1.01 | 0.99 | 1.03 | 0.94 | 0.92 | 0.95 | 0.95 | 0.93 | 0.96 |
| **Age (years)** | | | | | |
| | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.09 | 1.08 | 1.09 |
| **Family income (ref. High)** | | | | | |
| Low income | 0.84 | 0.83 | 0.86 | 0.94 | 0.93 | 0.96 |
| Middle–low income | 1.03 | 1.01 | 1.05 | 1.06 | 1.04 | 1.07 |
| Middle–high income | 1.05 | 1.04 | 1.06 | 1.05 | 1.04 | 1.07 |
| **Educational level (ref. > 12 years)** | | | | | |
| 10–11 years | 1.08 | 1.06 | 1.10 | 1.01 | 1.00 | 1.03 |
| ≥ 12 years | 0.85 | 0.84 | 0.87 | 0.82 | 0.81 | 0.83 |
| **Socioeconomic status (ref. professionals)** | | | | | |
| Farmers/self-employed/others | 1.97 | 1.93 | 2.02 | 1.88 | 1.84 | 1.93 |
| Blue collar workers | 1.36 | 1.33 | 1.39 | 1.35 | 1.32 | 1.38 |
| White collar workers | 1.12 | 1.10 | 1.15 | 1.11 | 1.09 | 1.14 |
| **Region of residence (ref. Large cities)** | | | | | |
| Southern Sweden | 1.00 | 0.99 | 1.01 | 1.03 | 1.02 | 1.04 |
| Northern Sweden | 1.03 | 1.02 | 1.05 | 1.11 | 1.09 | 1.12 |
| Immigrant status (ref. Born in Sweden) | | | | | |
| | 0.89 | 0.86 | 0.92 | 0.95 | 0.92 | 0.99 |
| Marital status (ref. Not married) | 1.63 | 1.62 | 1.65 | 1.48 | 1.47 | 1.50 |
| Birth order | 1.01 | 1.00 | 1.01 | 1.00 | 0.99 | 1.01 |
| Hospitalization of chronic lower respiratory disease (ref. Non) | | | | | |
| | 1.61 | 1.58 | 1.63 |
| Hospitalization of alcoholisms and related liver disease (ref. Non) | 3.26 | 3.20 | 3.32 |
| Hospitalization of diabetes (ref. Non) | 1.58 | 1.56 | 1.61 |
| Hospitalization of obesity (ref. Non) | 0.96 | 0.93 | 0.99 |
| Hospitalization of hypertension (ref. Non) | 0.66 | 0.65 | 0.67 |
| Cancer (ref. Non) | 4.86 | 4.81 | 4.91 |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
| Birth order (ref. First birth) | Model 1 | Model 2 | Model 3 |
|-------------------------------|---------|---------|---------|
| Second                        | 0.98    | 0.97    | 0.96    |
| Third                         | 1.01    | 1.00    | 1.00    |
| Fourth                        | 1.05    | 1.02    | 1.00    |
| Fifth+                        | 1.11    | 1.08    | 1.03    |

| Age (years)                   | Model 1 | Model 2 | Model 3 |
|-------------------------------|---------|---------|---------|
| Family income (ref. High)     |         |         |         |
| Low income                    | 0.84    | 0.83    | 0.94    |
| Middle–low income             | 1.03    | 1.02    | 1.06    |
| Middle–high income            | 1.05    | 1.04    | 1.05    |

| Educational level (ref. > 12 years) | Model 1 | Model 2 | Model 3 |
|-------------------------------------|---------|---------|---------|
| 10–11 years                         | 1.08    | 1.06    | 1.01    |
| ≥ 12 years                          | 0.85    | 0.84    | 0.82    |

| Socioeconomic status (ref. professionals) | Model 1 | Model 2 | Model 3 |
|-------------------------------------------|---------|---------|---------|
| Farmers/self-employed/others              | 1.98    | 1.93    | 1.88    |
| Blue collar workers                       | 1.36    | 1.33    | 1.35    |
| White collar workers                      | 1.12    | 1.10    | 1.11    |

| Region of residence (ref. Large cities)   | Model 1 | Model 2 | Model 3 |
|-------------------------------------------|---------|---------|---------|
| Southern Sweden                            | 1.00    | 0.99    | 1.03    |
| Northern Sweden                            | 1.03    | 1.02    | 1.05    |

| Immigrant status (ref. Born in Sweden)    | Model 1 | Model 2 | Model 3 |
|-------------------------------------------|---------|---------|---------|
| Marital status (ref. Not married)         | 1.63    | 1.62    | 1.48    |
| Number of siblings                        | 0.99    | 0.99    | 0.99    |

| Hospitalization of chronic lower respiratory disease (ref. Non) | Model 1 | Model 2 | Model 3 |
|----------------------------------------------------------------|---------|---------|---------|
| Hospitalization of alcoholisms and related liver disease (ref. Non) |         |         |         |
| Hospitalization of diabetes (ref. Non)                        |         |         |         |
| Hospitalization of obesity (ref. Non)                         | 0.96    | 0.93    | 0.99    |
| Hospitalization of hypertension (ref. Non)                    | 0.66    | 0.65    | 0.67    |

| Cancer (ref. Non)                                             | 4.86    | 4.81    | 4.91    |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
8,842,466 alive children at baseline in Sweden

Excluded: 6,168,782 subjects aged <30 years at baseline

Study population: 2,673,684
### Supplementary Table 1a. Distribution of population, number of CVD, CHD, and mortality events in men.

| Population | CVD events | CHD events | Mortality events |
|------------|------------|------------|------------------|
|            | No. (%)    | No. (%)    | No. (%)          |
| Total population (%) | 1358647 | 592863 | 131533 | 240371 |
| Age (years)             |          |          |          |        |
| 30-39                   | 531559 | 39.1 | 152615 | 25.7 | 25327 | 19.3 | 39094 | 16.3 |
| 40-49                   | 554137 | 40.8 | 265251 | 44.7 | 59088 | 44.9 | 96549 | 40.2 |
| 50-58                   | 272951 | 20.1 | 174997 | 29.5 | 47118 | 35.8 | 104728 | 43.6 |
| Family income           |          |          |          |        |
| Low income              | 334083 | 24.6 | 123575 | 20.8 | 26649 | 20.3 | 47582 | 19.8 |
| Middle–low income       | 320284 | 23.6 | 135148 | 22.8 | 29613 | 22.5 | 51243 | 21.3 |
| Middle–high income      | 321653 | 23.7 | 152589 | 25.7 | 35041 | 26.6 | 66400 | 27.6 |
| High income             | 382627 | 28.2 | 181551 | 30.6 | 40230 | 30.6 | 75146 | 31.3 |
| Marital status          |          |          |          |        |
| Married/cohabiting      | 809314 | 59.6 | 370633 | 62.5 | 85212 | 64.8 | 124039 | 51.6 |
| Never married, Widowed, or divorced | 549333 | 40.4 | 222230 | 37.5 | 46321 | 35.2 | 116332 | 48.4 |
| Educational attainment  |          |          |          |        |
| ≤ 9 years               | 281207 | 20.7 | 146179 | 24.7 | 38890 | 29.6 | 81428 | 33.9 |
| 10–11 years             | 173208 | 12.7 | 67512 | 11.4 | 13955 | 10.6 | 26218 | 10.9 |
| ≥ 12 years              | 904232 | 66.6 | 379172 | 64.0 | 78688 | 59.8 | 132725 | 55.2 |
| Immigrant status        |          |          |          |        |
| Sweden                  | 1322658 | 97.4 | 580707 | 97.9 | 128732 | 97.9 | 235464 | 98.0 |
| Other countries         | 35989 | 2.6 | 12156 | 2.1 | 2801 | 2.1 | 4907 | 2.0 |
| Socioeconomic status    |          |          |          |        |
| Farmers/self-employed/others | 308729 | 22.7 | 129408 | 21.8 | 29064 | 22.1 | 71960 | 29.9 |
| Blue collar workers     | 494090 | 36.4 | 217215 | 36.6 | 50626 | 38.5 | 89989 | 37.4 |
| White collar workers    | 351621 | 25.9 | 157170 | 26.5 | 34594 | 26.3 | 52582 | 21.9 |
| Professionals           | 204207 | 15.0 | 89070 | 15.0 | 17249 | 13.1 | 25840 | 10.8 |
| Urban/rural status      |          |          |          |        |
| Large cities            | 495681 | 36.5 | 207593 | 35.0 | 41153 | 31.3 | 85765 | 35.7 |
| Southern Sweden         | 618686 | 45.5 | 274100 | 46.2 | 61581 | 46.8 | 108663 | 45.2 |
| Northern Sweden         | 244280 | 18.0 | 111170 | 18.8 | 28799 | 21.9 | 45943 | 19.1 |
| Hospitalization of alcoholism and related liver disease |          |          |          |        |
| No                      | 1275305 | 93.9 | 548796 | 92.6 | 124051 | 94.3 | 202724 | 84.3 |
| Yes                     | 83342 | 6.1 | 44067 | 7.4 | 7482 | 5.7 | 37647 | 15.7 |
| Hospitalization of diabetes |          |          |          |        |
| No                      | 1226642 | 90.3 | 494000 | 83.3 | 104716 | 79.6 | 200226 | 83.3 |
| Yes                     | 132005 | 9.7 | 98863 | 16.7 | 26817 | 20.4 | 40145 | 16.7 |
### Hospitalization of hypertension

|         | No       | Yes     |
|---------|----------|---------|
| No      | 1059935  | 298712  |
| Yes     | 298712   | 298712  |

### Hospitalization of obesity

|         | No       | Yes     |
|---------|----------|---------|
| No      | 1338892  | 19755   |
| Yes     | 298712   | 15320   |

### Hospitalization of chronic lower respiratory disease

|         | No       | Yes     |
|---------|----------|---------|
| No      | 1288108  | 70539   |
| Yes     | 70539    | 46470   |

### Cancer

|         | No       | Yes     |
|---------|----------|---------|
| No      | 1109571  | 249076  |
| Yes     | 249076   | 15320   |

### Number of sibling

|         | Non sibling | One sibling | Two siblings | Three siblings | Four or more siblings |
|---------|-------------|-------------|--------------|----------------|-----------------------|
| No      | 214700      | 443877      | 338812       | 183067         | 178191                |
| Yes     | 249076      | 15320       | 46470        | 28331          | 23849                 |

### Birth order

|          | First     | Second    | Third      | Fourth     | Fifth+     |
|----------|-----------|-----------|------------|------------|-----------|
|          | 684765    | 402879    | 164540     | 62765      | 43698     |
|          | 50.4      | 29.7      | 12.1       | 4.6        | 3.2       |

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**Supplementary Table 1b. Distribution of population, number of CVD, CHD, and mortality events in women.**

|                                  | Population | CVD events | CHD events | Mortality events |
|----------------------------------|------------|------------|------------|-----------------|
|                                  | No.        | No. (%)    | No. (%)    | No. (%)         |
| Total population (%)             | 1315037    | 486147     | 55933      | 160269          |
| Age (years)                      |            |            |            |                 |
| 30-39                            | 507872     | 125326     | 9681       | 24571           |
|                                  | 38.6%      | 25.8%      | 17.3%      | 15.3%           |
| 40-49                            | 537035     | 210113     | 23738      | 64055           |
|                                  | 40.8%      | 43.2%      | 42.4%      | 40.0%           |
| 50+                              | 270130     | 150708     | 22514      | 71643           |
|                                  | 20.5%      | 31.0%      | 40.3%      | 44.7%           |
| Family income                    |            |            |            |                 |
| Low income                       | 343296     | 100542     | 10467      | 29723           |
|                                  | 26.1%      | 20.7%      | 18.7%      | 18.5%           |
| Middle–low income                | 340837     | 121716     | 13432      | 37773           |
|                                  | 25.9%      | 25.0%      | 24.0%      | 23.6%           |
| Middle–high income               | 347955     | 142924     | 17579      | 50537           |
|                                  | 26.5%      | 29.4%      | 31.4%      | 31.5%           |
| High income                      | 282949     | 120965     | 14455      | 42236           |
|                                  | 21.5%      | 24.9%      | 25.8%      | 26.4%           |
| Marital status                   |            |            |            |                 |
| Married/cohabiting               | 887258     | 331886     | 38106      | 96533           |
|                                  | 67.5%      | 68.3%      | 68.1%      | 60.2%           |
| Never married, Widowed, or divorced | 427779   | 154261     | 17827      | 63736           |
|                                  | 32.5%      | 31.7%      | 31.9%      | 39.8%           |
| Educational attainment           |            |            |            |                 |
| ≤ 9 years                        | 232824     | 102037     | 17827      | 63736           |
|                                  | 17.7%      | 21.0%      | 31.9%      | 39.8%           |
| 10–11 years                      | 165367     | 60209      | 6867       | 20489           |
|                                  | 12.6%      | 12.4%      | 12.3%      | 12.8%           |
| ≥ 12 years                       | 916846     | 323901     | 33651      | 91325           |
|                                  | 69.7%      | 66.6%      | 60.2%      | 57.0%           |
| Immigrant status                 |            |            |            |                 |
| Sweden                           | 1281472    | 476075     | 54756      | 157515          |
|                                  | 97.6%      | 97.9%      | 97.9%      | 98.3%           |
| Other countries                  | 33565      | 10072      | 1177       | 2754            |
|                                  | 2.6%       | 2.1%       | 2.1%       | 1.7%            |
| Socioeconomic status             |            |            |            |                 |
| Farmers/self-employed/others     | 272189     | 96279      | 12450      | 45553           |
|                                  | 20.7%      | 19.8%      | 22.3%      | 28.4%           |
| Blue collar workers              | 437324     | 174549     | 21821      | 55960           |
|                                  | 33.3%      | 35.9%      | 39.0%      | 34.9%           |
| White collar workers             | 496782     | 178249     | 18324      | 49169           |
|                                  | 37.8%      | 36.7%      | 32.8%      | 30.7%           |
| Professionals                    | 108742     | 37070      | 3338       | 9587            |
|                                  | 8.3%       | 7.6%       | 6.0%       | 6.0%            |
| Urban/rural status               |            |            |            |                 |
| Large cities                     | 495097     | 173872     | 17499      | 57794           |
|                                  | 37.6%      | 35.8%      | 31.3%      | 36.1%           |
| Southern Sweden                  | 591636     | 223375     | 25965      | 72872           |
|                                  | 45.0%      | 45.9%      | 46.4%      | 45.5%           |
| Northern Sweden                  | 228304     | 88900      | 12469      | 29603           |
|                                  | 17.4%      | 18.3%      | 22.3%      | 18.5%           |
| Hospitalization of alcoholism and related liver disease | | | | |
| No                               | 1283561    | 471088     | 54416      | 149212          |
|                                  | 97.6%      | 96.9%      | 97.3%      | 93.1%           |
| Yes                              | 31476      | 15059      | 1517       | 11057           |
|                                  | 2.4%       | 3.1%       | 2.7%       | 6.9%            |
| Hospitalization of diabetes      |            |            |            |                 |
| No                               | 1234361    | 429522     | 45537      | 139644          |
|                                  | 93.9%      | 88.4%      | 81.4%      | 87.1%           |
|                                | Yes          | 80676  | 6.1    | 56625  | 11.6   | 10396  | 18.6  | 20625  | 12.9   |
|--------------------------------|--------------|--------|--------|--------|--------|--------|-------|--------|--------|
| Hospitalization of hypertension| No           | 1067928| 81.2   | 239038 | 49.2   | 31364  | 56.1  | 124898 | 77.9   |
|                                | Yes          | 247109 | 18.8   | 247109 | 50.8   | 24569  | 43.9  | 35371  | 22.1   |
| Hospitalization of obesity     | No           | 1286838| 97.9   | 468228 | 96.3   | 54003  | 96.5  | 156771 | 97.8   |
|                                | Yes          | 28199  | 2.1    | 17919  | 3.7    | 1930   | 3.5   | 3498   | 2.2    |
| Hospitalization of chronic lower respiratory disease | No | 1226846 | 93.3  | 433906 | 89.3   | 48084  | 86.0  | 137028 | 85.5   |
|                                | Yes          | 88191  | 6.7    | 52241  | 10.7   | 7849   | 14.0  | 23241  | 14.5   |
| Cancer                         | No           | 1051617| 80.0   | 364226 | 74.9   | 43617  | 78.0  | 70300  | 43.9   |
|                                | Yes          | 263420 | 20.0   | 121921 | 25.1   | 12316  | 22.0  | 89969  | 56.1   |
| Number of sibling              | Non sibling  | 210121 | 16.0   | 87261  | 17.9   | 10289  | 18.4  | 34521  | 21.5   |
|                                | One sibling  | 430315 | 32.7   | 154154 | 31.7   | 16280  | 29.1  | 49132  | 30.7   |
|                                | Two siblings | 324379 | 24.7   | 113739 | 23.4   | 12500  | 22.3  | 34843  | 21.7   |
|                                | Three siblings| 176631 | 13.4   | 63871  | 13.1   | 7512   | 13.4  | 19766  | 12.3   |
|                                | Four or more siblings | 173591 | 13.2   | 67122  | 13.8   | 9352   | 16.7  | 22007  | 13.7   |
| Birth order                    | First        | 664459 | 50.5   | 262015 | 53.9   | 30342  | 54.2  | 94779  | 59.1   |
|                                | Second       | 388391 | 29.5   | 136263 | 28.0   | 15191  | 27.2  | 40984  | 25.6   |
|                                | Third        | 159311 | 12.1   | 53711  | 11.0   | 6231   | 11.1  | 15205  | 9.5    |
|                                | Fourth       | 60676  | 4.6    | 20264  | 4.2    | 2379   | 4.3   | 5558   | 3.5    |
|                                | Fifth+       | 42200  | 3.2    | 13894  | 2.9    | 1790   | 3.2   | 3743   | 2.3    |
### Supplementary Table 2a. Hazard ratio (HR) and 95% confidence interval of CVD in men, using multivariable competing risk survival analysis

| Number of siblings (ref. No sibling) | Model 1 |                      | Model 2 |                      | Model 3 |                      |
|-------------------------------------|---------|----------------------|---------|----------------------|---------|----------------------|
|                                     | HR*     | 95% CI               | HR*     | 95% CI               | HR*     | 95% CI               |
| One sibling                         | 0.97    | 0.97 0.98            | 0.98    | 0.97 0.98            | 0.98    | 0.97 0.99            |
| Two siblings                        | 0.97    | 0.96 0.98            | 0.97    | 0.96 0.97            | 0.97    | 0.97 0.98            |
| Three siblings                      | 0.99    | 0.98 1.00            | 0.98    | 0.97 0.99            | 0.98    | 0.97 0.99            |
| Four or more children               | 1.04    | 1.03 1.05            | 1.00    | 0.99 1.01            | 1.00    | 0.99 1.01            |
| Age (years)                         |         |                      |         |                      |         |                      |
|                                     | 1.07    | 1.07 1.07            | 1.08    | 1.07 1.08            | 1.06    | 1.06 1.06            |
| Family income (ref. High)           |         |                      |         |                      |         |                      |
| Low income                          | 0.92    | 0.92 0.93            | 0.99    | 0.98 1.00            |         |                      |
| Middle–low income                   | 1.02    | 1.01 1.03            | 1.05    | 1.04 1.06            |         |                      |
| Middle–high income                  | 1.04    | 1.03 1.05            | 1.05    | 1.04 1.06            |         |                      |
| Educational level (ref. > 12 years) |         |                      |         |                      |         |                      |
| 10–11 years                         | 1.11    | 1.10 1.12            | 1.06    | 1.05 1.07            |         |                      |
| ≥ 12 years                          | 1.00    | 1.00 1.01            | 1.00    | 0.99 1.00            |         |                      |
| Socioeconomic status (ref. professionals) |         |                      |         |                      |         |                      |
| Farmers/self-employed/others       | 1.22    | 1.21 1.23            | 1.17    | 1.16 1.18            |         |                      |
| Blue collar workers                 | 1.15    | 1.14 1.16            | 1.09    | 1.08 1.10            |         |                      |
| White collar workers                | 1.08    | 1.07 1.08            | 1.04    | 1.04 1.05            |         |                      |
| Region of residence (ref. Large cities) |         |                      |         |                      |         |                      |
| Southern Sweden                     | 1.00    | 1.00 1.01            | 1.03    | 1.02 1.03            |         |                      |
| Northern Sweden                     | 1.04    | 1.03 1.05            | 1.05    | 1.04 1.06            |         |                      |
| Immigrant status (ref. Born in Sweden) | 0.95    | 0.93 0.97            | 0.96    | 0.95 0.98            |         |                      |
| Marital status (ref. Not married)   | 1.18    | 1.17 1.19            | 1.17    | 1.16 1.18            |         |                      |
| Birth order                         | 1.01    | 1.01 1.01            | 1.01    | 1.01 1.02            |         |                      |
| Hospitalization of chronic lower respiratory disease (ref. Non) |         |                      | 1.26    | 1.25 1.28            |         |                      |
| Hospitalization of alcoholism and related liver disease (ref. Non) |         |                      | 1.74    | 1.73 1.76            |         |                      |
| Hospitalization of diabetes (ref. Non) | 1.39    | 1.38 1.40            | 1.37    | 1.35 1.40            |         |                      |
| Hospitalization of obesity (ref. Non) | 3.72    | 3.70 3.74            |         |                      |         |                      |
| Hospitalization of hypertension (ref. Non) | 1.36    | 1.35 1.36            |         |                      |         |                      |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.

*: Multivariable competing risk survival analysis
| Birth order (ref. First birth) | Model 1 | Model 2 | Model 3 |
|-------------------------------|---------|---------|---------|
| Second                        | 0.99    | 0.99    | 1.00    |
| Third                         | 1.02    | 1.01    | 1.01    |
| Fourth                        | 1.05    | 1.03    | 1.03    |
| Fifth+                        | 1.10    | 1.08    | 1.07    |
| Age (years)                   | 1.07    | 1.07    | 1.08    |
| Family income (ref. High)     |         |         |         |
| Low income                    | 0.92    | 0.92    | 0.99    |
| Middle–low income             | 1.02    | 1.01    | 1.05    |
| Middle–high income            | 1.04    | 1.03    | 1.05    |
| Educational level (ref. > 12 years) |    |         |         |
| 10–11 years                   | 1.11    | 1.10    | 1.06    |
| ≥ 12 years                    | 1.00    | 1.00    | 1.00    |
| Socioeconomic status (ref. professionals) |   |         |         |
| Farmers/self-employed/others | 1.22    | 1.21    | 1.17    |
| Blue collar workers           | 1.15    | 1.14    | 1.09    |
| White collar workers          | 1.08    | 1.07    | 1.04    |
| Region of residence (ref. Large cities) |     |         |         |
| Southern Sweden               | 1.00    | 1.00    | 1.03    |
| Northern Sweden               | 1.04    | 1.03    | 1.05    |
| Immigrant status (ref. Born in Sweden) |    |         |         |
| Marital status (ref. Not married) | 1.18    | 1.17    | 1.17    |
| Number of siblings            | 1.00    | 1.00    | 1.00    |
| Hospitalization of chronic lower respiratory disease (ref. Non) | 1.26    | 1.25    | 1.28    |
| Hospitalization of alcoholisms and related liver disease (ref. Non) | 1.74    | 1.73    | 1.76    |
| Hospitalization of diabetes (ref. Non) | 1.39    | 1.38    | 1.40    |
| Hospitalization of obesity (ref. Non) | 1.37    | 1.35    | 1.40    |
| Hospitalization of hypertension (ref. Non) | 3.72    | 3.70    | 3.74    |
| Cancer (ref. Non)             | 1.36    | 1.35    | 1.36    |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
*: Multivariable competing risk survival analysis
### Supplementary Table 2c. Hazard ratio (HR) and 95% confidence interval of CVD in women, using multivariable competing risk survival analysis

|                          | Model 1     | Model 2     | Model 3     |
|--------------------------|-------------|-------------|-------------|
| Number of siblings (ref. No sibling) |             |             |             |
| One sibling              | 0.98 0.97 0.98 | 0.98 0.97 0.98 | 0.98 0.98 0.99 |
| Two siblings             | 0.99 0.98 0.99 | 0.98 0.97 0.99 | 0.99 0.98 1.00 |
| Three siblings           | 1.01 1.00 1.02 | 1.00 0.99 1.01 | 1.00 0.99 1.01 |
| Four or more children    | 1.06 1.05 1.07 | 1.03 1.02 1.04 | 1.01 1.00 1.03 |
| Age (years)              | 1.06 1.06 1.07 | 1.06 1.06 1.06 | 1.04 1.04 1.04 |
| Family income (ref. High) |             |             |             |
| Low income               | 0.87 0.86 0.87 | 0.95 0.94 0.96 |          |
| Middle–low income        | 1.01 1.00 1.02 | 1.04 1.03 1.05 |          |
| Middle–high income       | 1.02 1.01 1.03 | 1.03 1.02 1.03 |          |
| Educational level (ref. > 12 years) |             |             |             |
| 10–11 years              | 1.13 1.12 1.14 | 1.08 1.06 1.09 |          |
| ≥ 12 years               | 1.04 1.03 1.05 | 1.03 1.02 1.04 |          |
| Socioeconomic status (ref. professionals) |             |             |             |
| Farmers/self-employed/others | 1.30 1.28 1.31 | 1.20 1.19 1.22 |          |
| Blue collar workers      | 1.25 1.24 1.27 | 1.12 1.11 1.13 |          |
| White collar workers     | 1.08 1.07 1.10 | 1.03 1.02 1.04 |          |
| Region of residence (ref. Large cities) |             |             |             |
| Southern Sweden          | 1.03 1.03 1.04 | 1.03 1.03 1.04 |          |
| Northern Sweden          | 1.06 1.06 1.07 | 1.04 1.03 1.05 |          |
| Immigrant status (ref. Born in Sweden) |             |             |             |
| 0.97 0.96 0.99 | 0.98 0.96 1.00 |          |
| Marital status (ref. Not married) |             |             |             |
| 1.13 1.12 1.14 | 1.10 1.09 1.11 |          |
| Birth order              | 1.00 1.00 1.01 | 1.01 1.01 1.01 |          |
| Hospitalization of chronic lower respiratory disease (ref. Non) | 1.38 1.36 1.39 |          |
| Hospitalization of alcoholisms and related liver disease (ref. Non) | 1.67 1.65 1.69 |          |
| Hospitalization of diabetes (ref. Non) | 1.38 1.37 1.39 |          |
| Hospitalization of obesity (ref. Non) | 1.32 1.30 1.34 |          |
| Hospitalization of hypertension (ref. Non) | 4.86 4.83 4.89 |          |
| Cancer (ref. Non)        | 1.62 1.61 1.63 |          |          |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.

*: Multivariable competing risk survival analysis
### Supplementary Table 2d. Hazard ratio (HR) and 95% confidence interval of CVD in women, using multivariable competing risk survival analysis

|                        | Model 1 |          | Model 2 |          | Model 3 |          |
|------------------------|---------|----------|---------|----------|---------|----------|
|                        | HR*     | 95% CI   | HR*     | 95% CI   | HR*     | 95% CI   |
| Birth order (ref. First birth) |          |          |         |          |         |          |
| Second                 | 1.00    | 0.99     | 1.01    | 0.98     | 1.02    |          |
| Third                  | 1.03    | 1.02     | 1.04    | 1.01     | 1.03    |          |
| Fourth                 | 1.06    | 1.04     | 1.07    | 1.03     | 1.05    |          |
| Fifth+                 | 1.09    | 1.07     | 1.10    | 1.03     | 1.07    |          |
| Age (years)            | 1.07    | 1.07     | 1.07    | 1.04     | 1.04    | 1.04     |
| Family income (ref. High) |          |          |         |          |         |          |
| Low income             | 0.87    | 0.86     | 0.87    | 0.95     | 0.94    | 0.96     |
| Middle–low income      | 1.01    | 1.00     | 1.02    | 1.04     | 1.03    | 1.05     |
| Middle–high income     | 1.02    | 1.01     | 1.03    | 1.03     | 1.02    | 1.03     |
| Educational level (ref. > 12 years) |          |          |         |          |         |          |
| 10–11 years            | 1.13    | 1.12     | 1.14    | 1.08     | 1.06    | 1.09     |
| ≥ 12 years             | 1.04    | 1.03     | 1.05    | 1.03     | 1.02    | 1.04     |
| Socioeconomic status (ref. professionals) |          |          |         |          |         |          |
| Farmers/self-employed/others | 1.30   | 1.28     | 1.31    | 1.21     | 1.19    | 1.22     |
| Blue collar workers    | 1.26    | 1.24     | 1.27    | 1.12     | 1.11    | 1.13     |
| White collar workers   | 1.09    | 1.07     | 1.10    | 1.03     | 1.02    | 1.05     |
| Region of residence (ref. Large cities) |          |          |         |          |         |          |
| Southern Sweden        | 1.03    | 1.03     | 1.04    | 1.03     | 1.03    | 1.04     |
| Northern Sweden        | 1.06    | 1.06     | 1.07    | 1.04     | 1.03    | 1.05     |
| Immigrant status (ref. Born in Sweden) | 0.97    | 0.96     | 0.99    | 0.98     | 0.96    | 1.00     |
| Marital status (ref. Not married) | 1.13    | 1.13     | 1.14    | 1.10     | 1.09    | 1.11     |
| Number of siblings     | 1.01    | 1.01     | 1.01    | 1.00     | 1.00    | 1.01     |
| Hospitalization of chronic lower respiratory disease (ref. Non) |          |          |         |          |         |          |
|                       | 1.38    | 1.36     | 1.39    |          |         |          |
| Hospitalization of alcoholisms and related liver disease (ref. Non) |          |          |         |          |         |          |
|                       | 1.67    | 1.65     | 1.69    |          |         |          |
| Hospitalization of diabetes (ref. Non) |          |          |         |          |         |          |
|                       | 1.38    | 1.37     | 1.39    |          |         |          |
| Hospitalization of obesity (ref. Non) |          |          |         |          |         |          |
|                       | 1.32    | 1.30     | 1.34    |          |         |          |
| Hospitalization of hypertension (ref. Non) |          |          |         |          |         |          |
|                       | 4.86    | 4.83     | 4.89    |          |         |          |
| Cancer (ref. Non)      | 1.62    | 1.61     | 1.63    |          |         |          |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.

*: Multivariable competing risk survival analysis
### Supplementary Table 3a. Hazard ratio (HR) and 95% confidence interval of CHD in men

| Category                                      | Model 1       | Model 2       | Model 3       |
|----------------------------------------------|---------------|---------------|---------------|
| Number of siblings (ref. No sibling)         |               |               |               |
| One sibling                                  | 1.00 (0.98, 1.02) | 0.99 (0.97, 1.01) | 0.99 (0.97, 1.01) |
| Two siblings                                 | 1.04 (1.03, 1.06) | 1.00 (0.98, 1.02) | 1.01 (0.99, 1.03) |
| Three siblings                               | 1.12 (1.10, 1.14) | 1.04 (1.02, 1.06) | 1.04 (1.02, 1.07) |
| Four or more children                        | 1.27 (1.25, 1.30) | 1.10 (1.08, 1.12) | 1.10 (1.07, 1.12) |
| Age (years)                                  | 1.08 (1.08, 1.08) | 1.08 (1.08, 1.08) | 1.07 (1.07, 1.07) |
| Family income (ref. High)                    |               |               |               |
| Low income                                   | 0.93 (0.91, 0.94) | 0.96 (0.95, 0.98) |               |
| Middle–low income                            | 1.00 (0.98, 1.01) | 1.02 (1.00, 1.03) |               |
| Middle–high income                           | 1.01 (1.00, 1.03) | 1.02 (1.00, 1.03) |               |
| Educational level (ref. > 12 years)          |               |               |               |
| 10–11 years                                  | 1.05 (1.03, 1.07) | 1.04 (1.02, 1.07) |               |
| ≥ 12 years                                   | 0.94 (0.93, 0.95) | 0.95 (0.94, 0.96) |               |
| Socioeconomic status (ref. professionals)    |               |               |               |
| Farmers/self-employed/others                 | 1.23 (1.20, 1.25) | 1.18 (1.16, 1.21) |               |
| Blue collar workers                          | 1.26 (1.24, 1.28) | 1.21 (1.19, 1.23) |               |
| White collar workers                         | 1.18 (1.16, 1.20) | 1.15 (1.13, 1.17) |               |
| Region of residence (ref. Large cities)      |               |               |               |
| Southern Sweden                              | 1.11 (1.10, 1.12) | 1.12 (1.11, 1.14) |               |
| Northern Sweden                              | 1.32 (1.30, 1.34) | 1.31 (1.29, 1.33) |               |
| Immigrant status (ref. Born in Sweden)       | 1.09 (1.05, 1.13) | 1.10 (1.06, 1.14) |               |
| Marital status (ref. Not married)            | 1.00 (0.99, 1.01) | 0.99 (0.98, 1.01) |               |
| Birth order                                  | 1.05 (1.04, 1.05) | 1.05 (1.05, 1.06) |               |
| Hospitalization of chronic lower respiratory disease (ref. Non) | 1.29 (1.26, 1.31) |               |               |
| Hospitalization of alcoholisms and related liver disease (ref. Non) | 1.01 (0.99, 1.04) |               |               |
| Hospitalization of diabetes (ref. Non)       | 1.75 (1.73, 1.78) |               |               |
| Hospitalization of obesity (ref. Non)        | 1.13 (1.09, 1.17) |               |               |
| Hospitalization of hypertension (ref. Non)   | 1.86 (1.84, 1.88) |               |               |
| Cancer (ref. Non)                            | 0.91 (0.89, 0.92) |               |               |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
Supplementary Table 3b. Hazard ratio (HR) and 95% confidence interval of CHD in men

|                              | Model 1     | Model 2     | Model 3     |
|------------------------------|-------------|-------------|-------------|
|                              | HR 95% CI   | HR 95% CI   | HR 95% CI   |
| Birth order (ref. First birth)|            |             |             |
| Second                       | 1.09 1.08 1.10 | 1.06 1.05 1.07 | 1.08 1.06 1.09 |
| Third                        | 1.19 1.17 1.21 | 1.11 1.09 1.13 | 1.13 1.11 1.15 |
| Fourth                       | 1.28 1.25 1.32 | 1.15 1.12 1.19 | 1.17 1.14 1.21 |
| Fifth+                       | 1.44 1.39 1.48 | 1.22 1.17 1.26 | 1.23 1.19 1.28 |
| Age (years)                  |             |             |             |
| Family income (ref. High)    |            |             |             |
| Low income                   | 0.93 0.91 0.94 | 0.96 0.95 0.98 |          |
| Middle–low income            | 1.00 0.98 1.01 | 1.02 1.00 1.03 |          |
| Middle–high income           | 1.01 1.00 1.02 | 1.02 1.00 1.03 |          |
| Educational level (ref. >12 years) |            |             |             |
| 10–11 years                  | 1.05 1.03 1.08 | 1.05 1.03 1.07 |          |
| ≥12 years                    | 0.94 0.93 0.95 | 0.95 0.94 0.97 |          |
| Socioeconomic status (ref. professionals) |             |             |             |
| Farmers/self-employed/others | 1.23 1.20 1.25 | 1.18 1.16 1.21 |          |
| Blue collar workers          | 1.26 1.24 1.28 | 1.21 1.19 1.23 |          |
| White collar workers         | 1.18 1.16 1.20 | 1.15 1.13 1.17 |          |
| Region of residence (ref. large cities) |             |             |             |
| Southern Sweden              | 1.11 1.10 1.13 | 1.12 1.11 1.14 |          |
| Northern Sweden              | 1.32 1.30 1.34 | 1.31 1.29 1.33 |          |
| Immigrant status (ref. Born in Sweden) | 1.09 1.05 1.13 | 1.10 1.06 1.14 |          |
| Marital status (ref. Not married) | 1.00 0.99 1.01 | 0.99 0.98 1.01 |          |
| Number of siblings           | 1.02 1.02 1.02 | 1.02 1.02 1.02 |          |
| Hospitalization of chronic lower respiratory disease (ref. Non) |           |             | 1.29 1.26 1.31 |
| Hospitalization of alcoholisms and related liver disease (ref. Non) | 1.01 0.99 1.04 |             |          |
| Hospitalization of diabetes (ref. Non) | 1.75 1.73 1.78 |            |          |
| Hospitalization of obesity (ref. Non) | 1.13 1.09 1.17 |            |          |
| Hospitalization of hypertension (ref. Non) | 1.86 1.84 1.88 |            |          |
| Cancer (ref. Non)            | 0.91 0.89 0.92 |            |          |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
**Supplementary Table 3c. Hazard ratio (HR) and 95% confidence interval of CHD in women**

| Number of siblings (ref. No sibling) | Model 1 | Model 2 | Model 3 |
|-------------------------------------|---------|---------|---------|
|                                     | HR      | 95% CI  | HR      | 95% CI  | HR      | 95% CI  |
| One sibling                         | 0.99    | 0.97    | 1.02    | 0.99    | 0.97    | 1.02    |
| Two siblings                        | 1.07    | 1.04    | 1.10    | 1.03    | 1.00    | 1.05    |
| Three siblings                      | 1.17    | 1.13    | 1.20    | 1.08    | 1.04    | 1.11    |
| Four or more children               | 1.40    | 1.36    | 1.44    | 1.20    | 1.16    | 1.24    |

| Age (years)                         |         |         |         |         |         |         |
|-------------------------------------|---------|---------|---------|---------|---------|---------|
| Family income (ref. High)           |         |         |         |         |         |         |
| Low income                          | 0.85    | 0.83    | 0.88    | 0.91    | 0.88    | 0.93    |
| Middle–low income                   | 1.00    | 0.98    | 1.03    | 1.00    | 0.98    | 1.03    |
| Middle–high income                  | 1.02    | 1.00    | 1.05    | 1.02    | 0.99    | 1.04    |

| Educational level (ref. > 12 years) |         |         |         |         |         |         |
|-------------------------------------|---------|---------|---------|---------|---------|---------|
| 10–11 years                         | 1.07    | 1.04    | 1.10    | 1.06    | 1.03    | 1.09    |
| ≥ 12 years                          | 0.92    | 0.90    | 0.94    | 0.94    | 0.92    | 0.96    |

| Socioeconomic status (ref. professionals) |         |         |         |         |         |         |
| Farmers/self-employed/others         | 1.52    | 1.46    | 1.59    | 1.37    | 1.31    | 1.42    |
| Blue collar workers                  | 1.47    | 1.42    | 1.53    | 1.33    | 1.28    | 1.38    |
| White collar workers                 | 1.19    | 1.14    | 1.23    | 1.14    | 1.10    | 1.18    |

| Region of residence (ref. Large cities) |         |         |         |         |         |         |
| Southern Sweden                      | 1.14    | 1.12    | 1.16    | 1.15    | 1.13    | 1.17    |
| Northern Sweden                      | 1.40    | 1.37    | 1.44    | 1.38    | 1.34    | 1.41    |

| Immigrant status (ref. Born in Sweden) |         |         |         |         |         |         |
| Marital status (ref. Not married)     | 1.12    | 1.10    | 1.14    | 1.08    | 1.06    | 1.10    |
| Birth order                           | 1.04    | 1.03    | 1.05    | 1.05    | 1.04    | 1.06    |

| Hospitalization of chronic lower respiratory disease (ref. Non) |         |         |         |         |         |         |
| Hospitalization of alcoholisms and related liver disease (ref. Non) |         |         |         |         |         |         |
| Hospitalization of diabetes (ref. Non) |         |         |         |         |         |         |
| Hospitalization of obesity (ref. Non) |         |         |         |         |         |         |
| Hospitalization of hypertension (ref. Non) |         |         |         |         |         |         |
| Cancer (ref. Non)                     | 0.94    | 0.93    | 0.96    |         |         |         |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
Supplementary Table 3d. Hazard ratio (HR) and 95% confidence interval of CHD in women

|                          | Model 1 |          |          |          |          |          |          |          |
|--------------------------|---------|----------|----------|----------|----------|----------|----------|----------|
|                          | HR      | 95% CI   | HR       | 95% CI   | HR       | 95% CI   | HR       | 95% CI   |
| Birth order (ref. First birth) |         |          |          |          |          |          |          |          |
| Second                   | 1.10    | 1.07     | 1.12     | 1.05     | 1.02     | 1.07     | 1.05     | 1.09     |
| Third                    | 1.24    | 1.21     | 1.28     | 1.11     | 1.08     | 1.14     | 1.14     | 1.18     |
| Fourth                   | 1.33    | 1.27     | 1.38     | 1.11     | 1.06     | 1.16     | 1.14     | 1.20     |
| Fifth+                   | 1.56    | 1.48     | 1.63     | 1.17     | 1.11     | 1.24     | 1.22     | 1.29     |
| Age (years)              | 1.09    | 1.09     | 1.09     | 1.09     | 1.08     | 1.09     | 1.07     | 1.07     |
| Family income (ref. High) |         |          |          |          |          |          |          |          |
| Low income               | 0.85    | 0.83     | 0.88     | 0.91     | 0.88     | 0.93     |          |          |
| Middle–low income        | 1.00    | 0.98     | 1.03     | 1.01     | 0.98     | 1.03     |          |          |
| Middle–high income       | 1.02    | 1.00     | 1.05     | 1.02     | 0.99     | 1.04     |          |          |
| Educational level (ref. > 12 years) |       |          |          |          |          |          |          |          |
| 10–11 years              | 1.07    | 1.04     | 1.10     | 1.06     | 1.03     | 1.09     |          |          |
| ≥ 12 years               | 0.92    | 0.90     | 0.94     | 0.94     | 0.92     | 0.96     |          |          |
| Socioeconomic status (ref. professionals) |       |          |          |          |          |          |          |          |
| Farmers/self-employed/others | 1.52  | 1.46     | 1.59     | 1.37     | 1.31     | 1.42     |          |          |
| Blue collar workers      | 1.47    | 1.42     | 1.53     | 1.33     | 1.28     | 1.38     |          |          |
| White collar workers     | 1.19    | 1.14     | 1.23     | 1.14     | 1.10     | 1.18     |          |          |
| Region of residence (ref. Large cities) |       |          |          |          |          |          |          |          |
| Southern Sweden          | 1.14    | 1.12     | 1.17     | 1.15     | 1.13     | 1.17     |          |          |
| Northern Sweden          | 1.40    | 1.37     | 1.44     | 1.38     | 1.34     | 1.41     |          |          |
| Immigrant status (ref. Born in Sweden) |       |          |          |          |          |          |          |          |
| 1.13                    | 1.07    | 1.20     | 1.13     | 1.07     | 1.20     |          |          |          |
| Marital status (ref. Not married) |       |          |          |          |          |          |          |          |
| 1.12                    | 1.10    | 1.14     | 1.08     | 1.06     | 1.10     |          |          |          |
| Number of siblings       | 1.04    | 1.03     | 1.04     | 1.03     | 1.03     | 1.04     |          |          |
| Number of siblings (ref. No sibling) | Model 1 | Model 2 | Model 3 |
|------------------------------------|---------|---------|---------|
| One sibling                        | 0.91    | 0.92    | 0.93    |
| Two siblings                       | 0.92    | 0.91    | 0.91    |
| Three siblings                     | 0.96    | 0.92    | 0.93    |
| Four or more children              | 1.03    | 0.94    | 0.96    |
| Age (years)                        | 1.10    | 1.10    | 1.10    |
| Family income (ref. High)          |         |         |         |
| Low income                         | 1.05    | 1.04    | 1.08    |
| Middle–low income                  | 1.17    | 1.15    | 1.14    |
| Middle–high income                 | 1.18    | 1.17    | 1.15    |
| Educational level (ref. > 12 years)|         |         |         |
| 10–11 years                        | 1.12    | 1.10    | 1.08    |
| ≥ 12 years                         | 0.91    | 0.90    | 0.89    |
| Socioeconomic status (ref. professionals) | 1.73    | 1.71    | 1.63    |
| Farmers/self-employed/others       |         |         |         |
| Blue collar workers                | 1.38    | 1.36    | 1.34    |
| White collar workers               | 1.15    | 1.13    | 1.14    |
| Region of residence (ref. Large cities) |         |         |         |
| Southern Sweden                    | 0.94    | 0.93    | 0.99    |
| Northern Sweden                    | 0.98    | 0.97    | 1.08    |
| Immigrant status (ref. Born in Sweden) | 1.04    | 1.01    | 1.06    |
| Marital status (ref. Not married)  | 1.88    | 1.87    | 1.71    |
| Birth order                        | 1.00    | 1.00    | 0.99    |
| Hospitalization of chronic lower respiratory disease (ref. Non) |        |        | 1.28    |
| Hospitalization of alcoholisms and related liver disease (ref. Non) |         |         |         |
| Hospitalization of diabetes (ref. Non) |         |         | 3.02    |
| Hospitalization of obesity (ref. Non) |         |         | 1.09    |
| Hospitalization of hypertension (ref. Non) |         |         | 0.66    |
| Cancer (ref. Non)                  | 2.62    | 2.60    | 2.65    |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
**Supplementary Table 4b. Hazard ratio (HR) and 95% confidence interval of mortality in men**

|                          | Model 1         |                      | Model 2         |                      | Model 3         |                      |
|--------------------------|-----------------|----------------------|-----------------|----------------------|-----------------|----------------------|
|                          | HR 95% CI       | HR 95% CI            | HR 95% CI       | HR 95% CI            | HR 95% CI       | HR 95% CI            |
| **Birth order (ref. First birth)** |                 |                      |                 |                      |                 |                      |
| Second                   | 0.98 0.97 0.99  | 0.97 0.96 0.98      | 0.96 0.95 0.97  |                      |                 |                      |
| Third                    | 1.01 0.99 1.02  | 0.99 0.98 1.01      | 0.98 0.96 0.99  |                      |                 |                      |
| Fourth                   | 1.04 1.01 1.06  | 1.00 0.98 1.03      | 0.98 0.95 1.00  |                      |                 |                      |
| Fifth+                   | 1.11 1.08 1.14  | 1.06 1.02 1.09      | 1.01 0.98 1.05  |                      |                 |                      |
| **Age (years)**          |                 |                      |                 |                      |                 |                      |
| Family income (ref. High)|                 |                      |                 |                      |                 |                      |
| Low income               | 1.06 1.04 1.07  | 1.08 1.07 1.10      |                 |                      |                 |                      |
| Middle–low income        | 1.17 1.15 1.18  | 1.14 1.13 1.16      |                 |                      |                 |                      |
| Middle–high income       | 1.18 1.17 1.19  | 1.15 1.14 1.16      |                 |                      |                 |                      |
| **Educational level (ref. > 12 years)** | 1.12 1.10 1.13 | 1.07 1.06 1.09 | 1.09 | 0.90 0.90 0.91 | 0.89 0.88 0.90 | 0.90 |
| 10–11 years              | 1.12 1.10 1.13  | 1.07 1.06 1.09      |                 |                      |                 |                      |
| ≥ 12 years               | 0.90 0.90 0.91  | 0.89 0.88 0.90      |                 |                      |                 |                      |
| **Socioeconomic status (ref. professionals)** | 1.73 1.71 1.76 | 1.63 1.60 1.66 | 1.00 | 1.38 1.36 1.40 | 1.34 1.32 1.36 | 1.00 |
| Farmers/self-employed/others | 1.73 1.71 1.76 | 1.63 1.60 1.66 | 1.00 | 1.38 1.36 1.40 | 1.34 1.32 1.36 | 1.00 |
| Blue collar workers      | 1.38 1.36 1.40  | 1.34 1.32 1.36      |                 |                      |                 |                      |
| White collar workers     | 1.15 1.13 1.17  | 1.14 1.13 1.16      |                 |                      |                 |                      |
| **Region of residence (ref. Large cities)** | 0.94 0.93 0.95 | 0.99 0.98 1.00 | 1.00 | 0.98 0.97 0.99 | 1.08 1.07 1.09 | 1.09 |
| Southern Sweden          | 0.94 0.93 0.95  | 0.99 0.98 1.00      |                 |                      |                 |                      |
| Northern Sweden          | 0.98 0.97 0.99  | 1.08 1.07 1.09      |                 |                      |                 |                      |
| **Immigrant status (ref. Born in Sweden)** | 1.05 1.02 1.08 | 1.06 1.03 1.09 | 1.09 | 1.88 1.87 1.90 | 1.71 1.70 1.73 | 1.00 |
| Marital status (ref. Not married) | 1.88 1.87 1.90 | 1.71 1.70 1.73 | 1.00 | 1.00 0.99 1.00 | 1.00 0.99 1.00 | 1.00 |
| Number of siblings       | 1.00 0.99 1.00  | 1.00 0.99 1.00      |                 |                      |                 |                      |
| **Hospitalization of chronic lower respiratory disease (ref. Non)** | 1.28 1.26 1.30 | 1.28 1.26 1.30 | 1.28 | 3.02 2.98 3.05 | 3.02 2.98 3.05 | 3.02 |
| **Hospitalization of alcoholisms and related liver disease (ref. Non)** | 3.02 2.98 3.05 | 3.02 2.98 3.05 | 3.02 | 1.43 1.41 1.45 | 1.43 1.41 1.45 | 1.43 |
| **Hospitalization of diabetes (ref. Non)** | 1.43 1.41 1.45 | 1.43 1.41 1.45 | 1.43 | 1.09 1.06 1.13 | 1.09 1.06 1.13 | 1.09 |
| **Hospitalization of obesity (ref. Non)** | 1.09 1.06 1.13 | 1.09 1.06 1.13 | 1.09 | 0.66 0.65 0.67 | 0.66 0.65 0.67 | 0.66 |
| **Hospitalization of hypertension (ref. Non)** | 0.66 0.65 0.67 | 0.66 0.65 0.67 | 0.66 | 2.62 2.60 2.64 | 2.62 2.60 2.64 | 2.62 |
| **Cancer (ref. Non)**    | 2.62 2.60 2.64  | 2.62 2.60 2.64      |                 |                      |                 |                      |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
### Supplementary Table 4c. Hazard ratio (HR) and 95% confidence interval of mortality in women

|                                | Model 1 HR | 95% CI  | Model 2 HR | 95% CI  | Model 3 HR | 95% CI  |
|--------------------------------|------------|---------|------------|---------|------------|---------|
| **Number of siblings (ref. No sibling)** |            |         |            |         |            |         |
| One sibling                     | 0.92       | 0.91    | 0.93       | 0.92    | 0.94       | 0.93    |
| Two siblings                    | 0.92       | 0.91    | 0.91       | 0.90    | 0.92       | 0.91    |
| Three siblings                  | 0.95       | 0.93    | 0.92       | 0.90    | 0.93       | 0.91    |
| Four or more children           | 1.01       | 0.99    | 0.94       | 0.92    | 0.95       | 0.93    |
| **Age (years)**                 | 1.10       | 1.10    | 1.10       | 1.10    | 1.09       | 1.08    |
| Family income (ref. High)       |            |         |            |         |            |         |
| Low income                      | 0.84       | 0.83    | 0.84       | 0.83    | 0.94       | 0.93    |
| Middle–low income               | 1.03       | 1.01    | 1.01       | 1.00    | 1.06       | 1.04    |
| Middle–high income              | 1.05       | 1.04    | 1.06       | 1.05    | 1.05       | 1.04    |
| **Educational level (ref. > 12 years)** |            |         |            |         |            |         |
| 10–11 years                     | 1.08       | 1.06    | 1.10       | 1.01    | 1.01       | 1.00    |
| ≥ 12 years                      | 0.85       | 0.84    | 0.87       | 0.82    | 0.81       | 0.83    |
| **Socioeconomic status (ref. professionals)** |            |         |            |         |            |         |
| Farmers/self-employed/others    | 1.97       | 1.93    | 2.02       | 1.88    | 1.84       | 1.93    |
| Blue collar workers             | 1.36       | 1.33    | 1.39       | 1.35    | 1.32       | 1.38    |
| White collar workers            | 1.12       | 1.10    | 1.15       | 1.11    | 1.09       | 1.14    |
| **Region of residence (ref. Large cities)** |            |         |            |         |            |         |
| Southern Sweden                 | 1.00       | 0.99    | 1.01       | 1.03    | 1.02       | 1.04    |
| Northern Sweden                 | 1.03       | 1.02    | 1.05       | 1.11    | 1.09       | 1.12    |
| **Immigrant status (ref. Born in Sweden)** |            |         |            |         |            |         |
| 0.89                           | 0.86       | 0.92    | 0.95       | 0.92    | 0.99       |
| **Marital status (ref. Not married)** |            |         |            |         |            |         |
| 1.63                           | 1.62       | 1.65    | 1.48       | 1.47    | 1.50       |
| **Birth order**                 | 1.01       | 1.00    | 1.01       | 1.00    | 0.99       | 1.01    |
| **Hospitalization of chronic lower respiratory disease (ref. Non)** | 1.61 | 1.58 | 1.63 |
| **Hospitalization of alcoholisms and related liver disease (ref. Non)** | 3.26 | 3.20 | 3.32 |
| **Hospitalization of diabetes (ref. Non)** | 1.58 | 1.56 | 1.61 |
| **Hospitalization of obesity (ref. Non)** | 0.96 | 0.93 | 0.99 |
| **Hospitalization of hypertension (ref. Non)** | 0.66 | 0.65 | 0.67 |
| **Cancer (ref. Non)**           | 4.86       | 4.81    | 4.91       |         |            |         |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
## Supplementary Table 4d. Hazard ratio (HR) and 95% confidence interval of mortality in women

| Model | Birth order (ref. First birth) | Age (years) | Educational level (ref. > 12 years) | Socioeconomic status (ref. professionals) | Region of residence (ref. Large cities) | Immigrant status (ref. Born in Sweden) | Marital status (ref. Not married) | Number of siblings | Hospitalization of chronic lower respiratory disease (ref. Non) | Hospitalization of alcoholism and related liver disease (ref. Non) | Hospitalization of diabetes (ref. Non) | Hospitalization of obesity (ref. Non) | Hospitalization of hypertension (ref. Non) | Cancer (ref. Non) |
|-------|-------------------------------|-------------|-----------------------------------|------------------------------------------|-----------------------------------------|----------------------------------------|-----------------------------------|-----------------|-------------------------------------------------------------|---------------------------------------------------------------|------------------|------------------|-------------------------|-----------------|-----------------|
|       | 0.98 (0.96, 0.99) | 1.10 (1.10, 1.10) | 1.08 (1.06, 1.10) | 1.98 (1.93, 2.02) | 1.00 (0.99, 1.01) | 0.89 (0.86, 0.92) | 1.63 (1.62, 1.65) | 0.99 (0.99, 0.99) | 1.61 (1.58, 1.63) | 3.26 (3.20, 3.33) | 1.58 (1.56, 1.61) | 0.96 (0.93, 0.99) | 0.66 (0.65, 0.67) | 4.86 (4.81, 4.91) |
| Model 1 | Second | Third | Fourth | Fifth+ | Farmers/self-employed/others | Blue collar workers | White collar workers | 0.98 (0.96, 0.99) | 1.01 (1.00, 1.03) | 1.05 (1.02, 1.08) | 1.11 (1.08, 1.15) | 1.03 (1.04, 1.12) | 0.94 (0.93, 0.96) | 1.05 (1.04, 1.07) | 1.09 (1.08, 1.09) |
| Model 2 | Second | Third | Fourth | Fifth+ | Low income | Middle–low income | Middle–high income | 1.07 (1.05, 1.09) | 1.02 (1.01, 1.03) | 1.05 (1.04, 1.07) | 1.08 (1.06, 1.10) | 1.01 (0.99, 1.03) | 0.94 (0.93, 0.96) | 1.05 (1.04, 1.07) | 1.09 (1.08, 1.09) |
| Model 3 | Second | Third | Fourth | Fifth+ | 10–11 years | ≥ 12 years | 1.03 (1.02, 1.05) | 1.12 (1.10, 1.15) | 1.08 (1.06, 1.10) | 1.09 (1.08, 1.10) | 0.85 (0.84, 0.86) | 0.94 (0.93, 0.96) | 1.05 (1.04, 1.07) | 0.97 (0.96, 0.99) |

Model 1. Adjusted for age at start; Model 2. Adjusted for age at start and individual characteristics; Model 3. Model 2 + comorbidities.
8,842,466 alive children at baseline in Sweden

Excluded: 6,168,782 subjects aged <30 years at baseline

Study population: 2,673,684
Number and relative age of siblings is linked to risk of cardiovascular events

First-born children have a lower risk of cardiovascular events, but having lots of siblings is associated with an increased risk

First-born children have a lower risk of cardiovascular events such as heart attacks and strokes than brothers and sisters born later, but people who are part of a large family with many siblings have an increased risk of these events, suggests the results of a large population study in Sweden, published in the online journal *BMJ Open*.

It is well-known that family history – the health of parents and grandparents – has an impact on a person’s health, including their risk of cardiovascular events, but now there is growing interest in what influence the make-up of a person’s immediate family – the number and age of siblings – might have.

The authors accessed data on 1.36 million men and 1.32 million women born between 1932 and 1960 and aged 30–58 years in 1990 from the Multiple-Generation Register in Sweden. Data on fatal and non-fatal cardiovascular and coronary events over the next 25 years were retrieved from national registers.

Analysis of the data showed that first-borns had a lower risk of non-fatal cardiovascular and coronary events than siblings born later. First-born men had a higher risk of death than second and third-born siblings, while first-born women had a higher risk of death than second-born siblings, but equal to further siblings.

When family size was looked at, compared with men with no siblings, men with one or two siblings had a lower risk of cardiovascular events, while those with four or more siblings had a higher risk.

Similarly, compared with men with no siblings, men with more than one sibling had a lower risk of death, while those with three or more siblings had an increased risk of coronary events.

A similar pattern was seen in women. Compared with those with no siblings, women with three or more siblings had an increased risk of cardiovascular events, while those with two or more siblings had an increased risk of coronary events. Women with one or more siblings had a lower risk of death.

This is an observational study, and as such, can't establish cause. The authors also highlight some limitations, including that the Swedish registers included no information on diagnostic procedures and there were no data on lifestyle factors, such as body mass index, smoking and diet.

However, socioeconomic status, obesity, diabetes, chronic lung disease (COPD) and alcoholism and related liver disorders were taken into account. They also note that some of their findings conflict with those from previous studies.
The authors point out that, as policies to support families and the number of children currently vary widely between countries, their findings could have implications for public health.

“More research is needed to understand the links between sibling number and rank with health outcomes,” they say. “Future research should be directed to find biological or social mechanisms linking the status of being first born to lower risk of cardiovascular disease, as indicated by our observational findings.”