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# Family's socioeconomic profile at birth and offspring mortality until midlife – the Northern Finland Birth Cohort 1966 study

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Abstract

Family's socioeconomic profile collected prenatally is known to predict offspring mortality during early life, but it remains unclear whether it has the potential to predict offspring mortality until later life. In this study, 12063 individuals belonging to the Northern Finland Birth Cohort 1966 were followed up from mid-pregnancy for 52 years (570 000 person years). Five distinct socioeconomic profiles were identified by latent class analysis based on mother's marital status, education, and occupation; father's occupation; number of family members; location of residence, room count, and utilities; and family's wealth. The classes were highest status families (15.4% of the population), small families (22.1%), larger families (15.4%), average wealth families (23.4%), and rural families (23.3%). Their associations to offspring mortality, via linkage to national offspring death records, were analysed by Cox regression, stratified by sex and age groups (0—19, 20—38 and 40–52 years). In total, mortality was 9.2% among male and 5.0% among female offspring. Risk for midlife mortality was higher among male offspring from larger families (hazard ratio 2.19, 95% confidence interval 1.32—3.63), average wealth families (1.66, 1.02—2.73) and rural families (1.63, 1.00—2.68), relative to offspring from highest status families. It seems that family's socioeconomic profile constructed prenatally has predictive value for midlife mortality among male offspring. Premature mortality of men and women seem to be two distinct phenomena with differing underlying factors as socioeconomic profile was not associated with mortality among female offspring.

Highlights:

- Five distinct socioeconomic profiles of families were identified from general Finnish population in the 1960s.

- Family's socioeconomic profile had predictive value for premature mortality in male offspring but not in female offspring.
- Premature mortality of men and women seem to be two distinct phenomena with differing underlying socioeconomical factors.

Key words

Cohort studies, Birth cohort, Socioeconomic status, Mortality, Latent class analysis, Parent-offspring linkage

## Introduction

The socioeconomic status of an individual is a key predictor of health and mortality throughout the life course[1-4]. Strikingly, the influence of low socioeconomic status on the risk of premature mortality seems to be comparable to that of tobacco use, alcohol consumption, physical inactivity, raised blood pressure, obesity, and diabetes[3]. Despite reducing health inequalities being an important policy objective[5], socioeconomic disparities persist even in welfare states[4,6].

Socioeconomic status is usually comprised of education, occupation, and income[7]. Also, housing conditions, household amenities, house location, family wealth, and family size have been used as socioeconomic measures[8,9]. Because of the complexity of the construct, there is no single indicator of socioeconomic status, but multiple indicators need to be combined[10]. Furthermore, the interpretation of socioeconomic measures might differ between sexes[11].

The socioeconomic environment one is exposed to in early life is known to influence health-related behaviour and mortality across the life course[12,13]. A recent study[14] suggested that parental and family-related socioeconomic factors have a prominent role in setting the environment during the formative years and are thus strongly associated with health-related behaviour throughout the offspring's life course[12,15]. Moreover, there is evidence that socioeconomic variables collected prenatally or at birth predict offspring's future health and mortality in the early years[16-18]. However, it remains unclear whether not just individual variables but comprehensive profiles of background families' socioeconomic status during pregnancy have potential to predict offspring premature mortality later in life.

In this study, we first aimed to identify distinct socioeconomic profiles of families using cluster analysis in a Finnish birth cohort of 12 063 individuals. Second, we aimed to evaluate the association between family's socioeconomic profile at birth and offspring mortality until midlife. We

hypothesized that profiles of lower socioeconomic status would associate with increased mortality in both female and male offspring compared to highest socioeconomic profile families. The association was hypothesized to be seen throughout the life-course.

## Material and methods

### Study population

We used the extensive Northern Finland Birth Cohort 1966 (NFBC1966) dataset as our material[19]. It is a prospective cohort study initiated in 1965—1966, when pregnant mothers who had expected delivery dates during the calendar year of 1966 and were residing in the Northern Finnish provinces of Oulu and Lapland were asked to participate in the data collections[20]. Originally, the NFBC1966 included 12 055 mothers and 12 231 deliveries, with a coverage of 96.3% against all deliveries in the region in 1966. Although the current focus of the NFBC1966 study is on the offspring, the data collections initially comprised both the parents and children born into the cohort. The data collections started during the 10—16th gestational week and are still ongoing with periodical follow-ups.

The data used in this study were collected from questionnaires issued to the mothers during the 24—28th weeks of pregnancy, from maternity cards and birth certificates of the offspring, and from the official death records of Statistics Finland from 1965—2018. Of the 12 231 individuals born into the cohort, excluded were 96 individuals that had completely missing pregnancy data, two individuals that had undetermined sex, and 70 individuals that declined the use of their data at later stages of the follow-up. Thus, the present analysis was based on 12 063 individuals (98.6% of the initial cohort base).

The study protocol follows the Declaration of Helsinki and has been approved by the Ethics Committee of the Northern Ostrobothnia Hospital District. Mothers of the NFBC1966 members gave informed verbal consent in the beginning of the NFBC1966 in 1965—1966. In the later stages of the study, written informed consent has been obtained from NFBC1966 members participating in the follow-ups. The NFBC1966 data are administered by the NFBC Project Center,

and researchers who have been granted access to the data are allowed to handle it in a pseudonymized format.

Parental, family, and offspring characteristics

Offspring's sex (male/female) and birthweight (in grams) were documented from maternity cards and birth certificates. Mother's marital status was selected from the following response alternatives: married, single, widow, divorced. As most mothers were married, the responses were dichotomized as 'married' or 'unmarried'.

Mother's education level was reported according to the following alternatives: no education or itinerant school; primary school for 1—4 years; primary school for 5—8 years; vocational school for ½—2 years; vocational school for > 2 years; secondary school; matriculation examination; matriculation examination and further studies. As most mothers had completed 5—8 years of primary school and/or secondary school, the responses were combined into three categories as follows: 'high' (matriculation examination), 'medium' (> 4 years of studies but not matriculation examination), or 'low' (≤ 4 years of primary school).

Mother's and father's occupational status were asked from participants and classified as following alternatives: entrepreneur or employer; manager or clerk; labourer; unpaid family worker; no occupation. A separate question also enquired the size and type of farm if applicable; these responses were used to identify farmer families as they were common in the 1960s Northern Finland. To ensure sufficient group sizes, occupational status was recategorized as 'high' (entrepreneur, employer, manager, or clerk), 'manual work' (labourer, or unpaid family worker), 'farmer' (farmers and their partners), or 'low' (no occupation).

Total number of family members, and the number of family members aged ≤ 15 years, were reported as raw numbers. We categorized both variables into tertiles (total family members: ≤ 2, 3—4, or ≥ 5; family members aged ≤ 15: 0, 1—2, or ≥ 3).

Residential characteristics and wealth

Location of the residence was selected from the following alternatives: city, market town, village centre or other population centre, periphery. The responses were re-grouped as 'city', 'population centre' (including market town), and 'periphery'.

Total number of rooms in the family's residence was enquired by the following question: "How many rooms are available for the family to utilize (including kitchen but excluding kitchenette, sleeping alcove, bathroom, toilet, and the rooms that are rented out)?" The responses were categorized into tertiles as follows: 1, 2, or ≥ 3.

The questionnaire elicited whether several utilities were available at the family's residence. Electricity, telephone, running water, and television were each elicited separately (yes/no). Additionally, the families were asked whether they owned a residence, a car, or a summerhouse (yes/no for each separately).

Offspring mortality

In Finland, cause-of-death investigation is required for all deaths (the Act relating to cause-of-death investigation 459/1973). Once the investigation is completed, a death certificate is issued, stating the date and causes of death. An independent review of the certificates is conducted by forensic pathologists at the Finnish Institute for Health and Welfare; accepted certificates are forwarded to

Statistics Finland for archiving. The Finnish death certification practice has been concluded to function accurately and appropriately[21].

For this study, we linked the NFBC1966 database with death records accumulated from 1965 until the most recent update of the Statistics Finland official archive in the end of 2018. As the Finnish authorities are generally informed of deaths occurring abroad, individuals with no death records within the Statistics Finland database were assumed to be alive in Finland or abroad. As our aim was to investigate all-cause mortality, we did not assess specific causes of death.

## Statistical analysis

The data were accessed and analysed using SPSS version 27 (IBM, Armonk, NY, USA) unless otherwise specified. Reclassifications relative to the original variables are presented above. Distributions of the final variables were presented as percentages with frequencies (categorical variables) or means with standard deviations after visual inspection for normality (continuous variables).

To obtain a comprehensive view of the families' socioeconomic profiles, we applied LCA to the socioeconomic data. The overall number of classes needed to sufficiently explain the differences in response patterns is *a priori* unknown. Beginning with a one-class solution, several models are systematically tested, gradually increasing the number of classes in the model, to find the most parsimonious model which sufficiently discriminates between the individuals in each different class.

We performed LCA using Mplus version 8.4 (Muthén & Muthén, Los Angeles, CA, USA). All socioeconomic variables - mother's marital status, education, occupation; father's occupation;

total number of family members and those aged ≤ 15 years; location of residence, room count, utilities; family's wealth - were included in the models. Offspring sex was omitted in the LCA procedure to ensure equal class structure and class definitions for both sexes. Models with one to six classes were tested as decided *a priori*, and model fit parameters were documented from the data output. The choice of the best-fitting model was primarily based on the statistical significance of the Lo-Mendell-Rubin and Vuong-Lo-Mendell-Rubin tests[22-24], entropy, Bayesian Information Criterion, log-likelihood values, and adequate class sizes. Once the best-fitting solution was selected, individuals were assigned to classes according to highest posterior membership probability. Lastly, the classes were named to reflect the distributions of the studied variables in each class.

The full sample of 12 063 individuals contributed to LCA and received class assignment, regardless of missing data. Percentages of missing data are shown for each variable in the results section (0.0—10.1%). Assuming data to be missing at random, Mplus used the full information maximum likelihood (FIML) method to compute parameter estimates based on all available data.

Finally, Cox regression was used to study the association between socioeconomic class and offspring mortality. In order to comply with the proportional hazards assumption, piecewise Cox regression models were separately fitted for three age intervals, namely 0—19 years ("childhood and adolescence"), 20—39 years ("early adulthood"), and 40—52 years ("midlife"). As there is clear discrepancy in mortality between the men and women of this population[25], the analyses were stratified by sex. Hazard ratios (HRs) and their 95% confidence intervals (CIs) were documented from the regression output. Stillbirths (n = 174) were excluded from the survival analysis. Additional survival analyses were performed with adjustment for birthweight to test if the associations were irrespective from birth characteristics.

## Data availability statement

NFBC1966 data is available from the University of Oulu, Infrastructure for Population Studies. Permission to use the data can be applied for research purposes via electronic material request portal. In the use of data, we follow the EU general data protection regulation (679/2016) and Finnish Data Protection Act. The use of personal data is based on cohort participant's written informed consent at his/her latest follow-up study, which may cause limitations to its use. Please, contact NFBC project center (NFBCprojectcenter@oulu.fi) and visit the cohort website (www.oulu.fi/nfbc) for more information.

## Results

### Study population

The background characteristics of the study population (N = 12 063) are presented in **Table 1**. Of the offspring, 48.7% were female. Most mothers were married when pregnant (95.5%) and had attended school for > 4 years but did not complete matriculation examination (84.7%). Most mothers and fathers had manual occupation (35.1% and 53.1%, respectively). A typical family during the mother's pregnancy included ≥ 3 members (74.5%), of whom 1—2 were aged ≤ 15 years (42.3%). The family's residence was commonly located in periphery (40.7%), had ≥ 3 rooms (49.4%), and was equipped with electricity (83.8%) and running water (50.3%). A minority of the families owned their residence (44.0%), a car (35.9%), or a summerhouse (3.3%).

### Latent class analysis and families' socioeconomic profiles

Goodness-of-fit statistics of LCA models with 1—6 classes are presented in **Table 2**. The five-class model was selected as the best-fitting solution. In contextual evaluation of the detected classes against the background variables, each of the classes was found to represent a distinct socioeconomic profile and named accordingly as follows:

a) Highest status families (relative class size 15.4% of the population): Families characterized by high occupational status of the mother (41.9%) and the father (75.5%), located in cities or population centres (83.1%). Large residences with ≥ 3 rooms (86.5%) and utilities widely available (≥ 65.1%). Above-average wealth (own residence 40.6%, car 82.3%, summerhouse 15.7%).

b) Small families (22.1%): Families with ≤ 2 members (95.4%) and no individuals aged ≤ 15 at time of pregnancy (92.8%). Living in a residence with 1—2 rooms (79.2%) in a city or population centre (81.9%).
c) Larger families (15.4%): Families with ≥ 5 members (98.3%) and ≥ 3 individuals aged ≤ 15 (77.0%).
d) Average wealth families (23.4%): Medium-sized families living in medium-sized residences with average utilities and wealth.
e) Rural families (23.3%): Relatively large families located in periphery (86.9%), with farming as the most common occupation among mothers (93.9%) and fathers (74.8%).

Association between family's socioeconomic profile and offspring mortality

During the follow-up of 52 years, a total of 862 deaths occurred among the offspring. Males had higher mortality (9.2%) than females (5.0%). Among male offspring, premature death in early adulthood was associated with average wealth families (HR 1.93, 95% CI 1.15—3.24) relative to highest status families **(Table 3)**. Premature death during midlife was associated with background in larger families (HR2.19, 95% CI 1.32—3.63), average wealth families (HR 1.66, 95% CI 1.02—2.73) and rural families (HR 1.63, 95% CI 1.00—2.68). Socioeconomic profile was not associated with mortality in childhood and adolescence. The results remained highly similar after adjustment for offspring's birthweight **(Supplementary Table 1)**.

Among female offspring, socioeconomic profile was not associated with premature mortality in early adulthood or midlife **(Table 3)**. Mortality in childhood and adolescence was higher among females from rural families (HR 2.91, 95% CI 0.99—8.61) compared to highest status families, however, the association did not quite reach statistical significance.

Associations between individual socioeconomic factors and offspring's premature mortality stratified by sex and age categories are seen in **Supplementary Table 2**. Beyond the clusters, also mother's marital status and occupation, father's occupation, family size, residency, utilities, and wealth all associated separately with offspring's premature mortality.

Sensitivity analyses

In addition to the primary analysis that adjusted for missing data by means of FIML (n = 12 063), we also performed a complete-case analysis (n = 9422) as a sensitivity approach (data not shown). The final class structure of LCA and associations with mortality were similar in both approaches. Moreover, there was no statistically significant difference in overall mortality between the complete-case sample and those with missing data (6.9% vs. 7.9%, P = 0.10).

## Discussion

In this large birth cohort study, we found five distinct prenatal family socioeconomic profiles. Having been born to families with more than five members, medium-sized families with average wealth, and relatively large families living in rural areas associated with increased midlife mortality in male offspring. Socioeconomic profile was not associated with mortality among female offspring.

Although previous literature has described the association between background family's socioeconomic variables and offspring health and mortality during the early life course[12,15-18], studies addressing the association in later life have been lacking. The findings of this study suggest that family characteristics collected prenatally have predictive value for premature mortality among males until midlife. One possible mechanism to this association is the family socioeconomic environment during offspring's formative years influencing later health-related behaviour across the life course[14]. Family socioeconomic environment may also be linked to differential vulnerability to stressors during the life course. It should be noted that this analysis did not include any life course data as we specifically aimed to characterize the role of family's socioeconomic characteristics at birth, and all life course variables were seen as potential effect mediators. Future studies are encouraged to further investigate the potential mediating pathways during the life course.

The present data underline the predictive role of high socioeconomic status in lower premature mortality among men in particular. Among women, family's socioeconomic background does not seem to influence the risk for premature mortality until midlife. Contradictory, a previous French study has found that parental socioeconomic status, namely paternal occupation, predicts mortality in adult age among female offspring but not among males, most likely due to effects of the World Wars[26]. When concerning the lifetime socioeconomic status, men in low social classes

have higher mortality than women in same classes[27,28]. There is a smaller sex difference in higher social classes suggesting that men are more vulnerable to adverse effects of low socioeconomical status. Although we did not find significant associations between low socioeconomic status and premature mortality in female offspring, our current results suggest that having rural background might heighten the risk for premature mortality in childhood and adolescence in women. However, further studies with a higher number of outcome events are needed to confirm this potential association. Overall, our findings indicate that premature mortality of men and women are clearly two distinct phenomena with potentially substantially differing underlying socioeconomic factors. Patterns of timing and causes of premature mortality differ between women and men[25], which may explain the current findings.

This study had several strengths, one being the use of a large, unselected, representative, population-based birth cohort containing >12 000 families with nearly 570 000 person years of follow-up of the offspring. A wide range of socioeconomic variables was collected prospectively during the second trimester of pregnancy. The follow-up of offspring lasted up to 52 years of age and was complete in terms of mortality without any loss to follow-up. The validity of the Finnish cause-of-death register is proven to be excellent. The NFBC1966 dataset is highly valuable in the context of the present research question. Another strength is the use of LCA methodology which identified five distinct socioeconomic family profiles. LCA was used not only due to the strong intercorrelations between the individual socioeconomic variables, but also to reduce the number of statistical tests performed and thus minimize the risk for type 1 error. Supplemental analyses confirmed that several socioeconomic factors associate with premature mortality also when studied individually, indicating that the observed associations between latent profiles and mortality are not driven by just one or a few variables.

There were some limitations to this study. Despite the long follow-up and large sample size, the number of deaths accumulated in each class was relatively low. Additionally, the socioeconomic factors were collected in 1960s and represent the Finnish society more than 50 years ago. The family socioeconomic factors related to increased mortality might be different for future generations.

In summary, the present results highlight the importance of considering early life predictors of mortality and suggest that family's socioeconomic profile constructed prenatally has predictive value for premature mortality among male offspring until midlife. This study provides further evidence that premature mortality of men and women of Northern Finnish origin seem to be two distinct phenomena with differing underlying factors. Future studies are encouraged to shed light on the potential life-course mediators of this difference.

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The authors declare no competing interests.

Tables

**Table 1**. Socioeconomic characteristics of the full sample and the five classes. Values are percentages and frequencies unless otherwise specified.

| | ALL (N = 12 063) | | Highest status families (n = 1855) | | Small families (n = 2660) | | Larger families (n = 1857) | | Average wealth families (n = 2877) | | Rural families (n = 2814) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Offspring characteristics** | | | | | | | | | | | | |
| Female sex | 48.7 | 5880 | 48.2 | 894 | 49.2 | 1310 | 47.6 | 884 | 48.6 | 1399 | 49.5 | 1393 |
| Birth weight (kg)* | 3.44 | 0.59 | 3.53 | 0.59 | 3.33 | 0.56 | 3.46 | 0.64 | 3.43 | 0.59 | 3.49 | 0.59 |
| *Missing (at least one)* | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| **Maternal characteristics** | | | | | | | | | | | | |
| Mother's marital status | | | | | | | | | | | | |
| Married | 95.5 | 11 519 | 98.7 | 1831 | 91.7 | 2439 | 92.5 | 1717 | 97.5 | 2804 | 96.9 | 2728 |
| Not married | 4.4 | 528 | 1.1 | 20 | 8.1 | 215 | 7.5 | 139 | 2.5 | 72 | 2.9 | 82 |
| *Missing* | 0.1 | 16 | 0.2 | 4 | 0.2 | 6 | 0.1 | 1 | 0.0 | 1 | 0.1 | 4 |
| Mother's education level | | | | | | | | | | | | |
| High | 4.5 | 543 | 20.7 | 384 | 5.1 | 136 | 0.2 | 4 | 0.5 | 14 | 0.2 | 5 |
| Medium | 84.7 | 10 222 | 75.9 | 1386 | 92.6 | 2398 | 82.6 | 1534 | 94.9 | 2685 | 78.9 | 2219 |
| Low | 9.0 | 1087 | 3.1 | 57 | 2.1 | 55 | 15.5 | 287 | 4.5 | 129 | 19.9 | 559 |
| *Missing* | 1.7 | 211 | 1.5 | 28 | 2.7 | 71 | 1.7 | 32 | 1.7 | 49 | 1.1 | 31 |
| Mother's occupational status | | | | | | | | | | | | |
| High | 9.9 | 1192 | 41.9 | 777 | 11.2 | 298 | 1.0 | 19 | 2.8 | 80 | 0.6 | 18 |
| Manual work | 35.1 | 4240 | 30.0 | 557 | 61.1 | 1625 | 36.2 | 672 | 44.1 | 1270 | 4.1 | 116 |
| Farmer | 22.4 | 2702 | 0.6 | 12 | 0.8 | 20 | 0.1 | 2 | 0.9 | 25 | 93.9 | 2643 |
| Low | 30.4 | 3668 | 25.3 | 469 | 23.4 | 623 | 61.0 | 1133 | 49.9 | 1437 | 0.2 | 6 |
| *Missing* | 2.2 | 261 | 2.2 | 40 | 3.5 | 94 | 1.7 | 31 | 2.3 | 65 | 1.1 | 31 |
| **Paternal characteristics** | | | | | | | | | | | | |
| Father's occupational status | | | | | | | | | | | | |
| High | 20.4 | 2455 | 75.5 | 1400 | 15.7 | 418 | 11.6 | 216 | 11.6 | 334 | 3.1 | 87 |
| Manual work | 53.1 | 6410 | 17.7 | 329 | 67.0 | 1781 | 78.5 | 1458 | 81.2 | 2336 | 18.0 | 506 |
| Farmer | 18.2 | 2199 | 2.4 | 45 | 1.6 | 42 | 0.0 | 0 | 0.2 | 7 | 74.8 | 2105 |
| Low | 2.6 | 313 | 1.5 | 27 | 5.9 | 157 | 1.8 | 34 | 2.9 | 83 | 0.4 | 12 |
| *Missing* | 5.7 | 686 | 2.9 | 54 | 9.8 | 262 | 8.0 | 149 | 4.1 | 117 | 3.7 | 104 |
| **Family characteristics** | | | | | | | | | | | | |
| Family member count | | | | | | | | | | | | |
| ≤ 2 | 23.5 | 2837 | 12.5 | 231 | 95.4 | 2538 | 0.0 | 0 | 0.0 | 0 | 2.4 | 68 |
| 3—4 | 37.3 | 4494 | 55.3 | 1025 | 0.0 | 0 | 0.4 | 8 | 98.4 | 2832 | 22.4 | 629 |
| ≥ 5 | 37.2 | 4484 | 31.2 | 579 | 0.0 | 0 | 98.3 | 1826 | 0.0 | 0 | 73.9 | 2079 |
| *Missing* | 2.1 | 248 | 1.1 | 20 | 4.6 | 122 | 1.2 | 23 | 1.6 | 45 | 1.4 | 38 |
| Family members aged ≤ 15 years | | | | | | | | | | | | |
| 0 | 27.5 | 3317 | 17.4 | 323 | 92.8 | 2469 | 2.9 | 54 | 5.6 | 162 | 11.0 | 309 |
| 1—2 | 42.3 | 5105 | 62.5 | 1159 | 1.4 | 37 | 17.0 | 315 | 91.1 | 2620 | 34.6 | 974 |
| ≥ 3 | 26.6 | 3211 | 17.7 | 328 | 0.0 | 0 | 77.0 | 1430 | 0.0 | 0 | 51.6 | 1453 |
| *Missing* | 3.6 | 430 | 2.4 | 45 | 5.8 | 154 | 3.1 | 58 | 3.3 | 95 | 2.8 | 78 |
| **Residential characteristics** | | | | | | | | | | | | |
| Location | | | | | | | | | | | | |
| City | 30.4 | 3670 | 41.5 | 770 | 50.6 | 1345 | 24.0 | 446 | 38.2 | 1099 | 0.4 | 10 |
| Population center | 28.8 | 3479 | 41.6 | 772 | 31.3 | 832 | 29.9 | 556 | 33.4 | 960 | 12.8 | 359 |
| Periphery | 40.7 | 4914 | 16.9 | 313 | 18.2 | 483 | 46.0 | 855 | 28.4 | 818 | 86.9 | 2445 |
| *Missing* | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 |
| Room count | | | | | | | | | | | | |
| 1 | 14.8 | 1787 | 0.6 | 11 | 41.2 | 1096 | 5.1 | 95 | 17.9 | 515 | 2.5 | 70 |
| 2 | 30.9 | 3725 | 9.4 | 175 | 38.0 | 1010 | 30.9 | 574 | 50.3 | 1448 | 18.4 | 518 |
| ≥ 3 | 49.4 | 5959 | 86.5 | 1605 | 13.3 | 354 | 59.2 | 1100 | 27.3 | 784 | 75.2 | 2116 |
| *Missing* | 4.9 | 592 | 3.5 | 64 | 7.5 | 200 | 4.7 | 88 | 4.5 | 130 | 3.9 | 119 |
| Utilities | | | | | | | | | | | | |
| Electricity | 83.8 | 10 113 | 99.0 | 1837 | 91.4 | 2430 | 80.9 | 1503 | 88.3 | 2814 | 64.1 | 1804 |
| Telephone | 20.6 | 2483 | 65.1 | 1207 | 11.3 | 301 | 12.7 | 235 | 9.9 | 285 | 16.2 | 455 |
| Running water | 50.3 | 6072 | 90.7 | 1683 | 57.9 | 1540 | 35.5 | 659 | 46.8 | 1345 | 30.0 | 845 |
| Television | 46.4 | 5598 | 78.0 | 1447 | 31.5 | 839 | 48.5 | 901 | 52.0 | 1496 | 32.5 | 915 |
| *Missing (at least one)* | 7.7 | 924 | 7.0 | 130 | 10.5 | 278 | 7.1 | 132 | 8.1 | 233 | 5.4 | 151 |
| **Wealth** | | | | | | | | | | | | |
| Own residence | 44.0 | 5312 | 40.6 | 754 | 8.8 | 233 | 56.0 | 1040 | 28.0 | 806 | 88.1 | 2479 |
| Own car | 35.9 | 4328 | 82.3 | 1527 | 31.3 | 832 | 26.9 | 499 | 32.9 | 946 | 18.6 | 524 |
| Own summerhouse | 3.3 | 393 | 15.7 | 291 | 1.0 | 27 | 1.1 | 21 | 1.3 | 37 | 0.6 | 17 |
| *Missing (at least one)* | 10.1 | 1216 | 11.5 | 213 | 10.8 | 286 | 10.7 | 199 | 8.9 | 256 | 9.3 | 262 |

*Values are means and standard deviations.

**Table 2**. Fit statistics of the latent class analysis models with 1—6 classes.

| Number of classes | Class size | Average posterior membership probability | Log-likelihood | Bayesian information criterion | Entropy | Vuong-Lo-Mendell-Rubin likelihood ratio test | Lo-Mendell-Rubin likelihood ratio test |
|---|---|---|---|---|---|---|---|
| 1 | 1.00 | 1.00 | -129 221.7 | 258 668.9 | - | - | - |
| 2 | 0.35/0.65 | 0.93/0.97 | -117 329.5 | 235 119.5 | 0.860 | $p < 0.001$ | $p < 0.001$ |
| 3 | 0.43/0.24/0.34 | 0.96/0.98/0.95 | -111 908.1 | 224 511.7 | 0.913 | $p < 0.001$ | $p < 0.001$ |
| 4 | 0.30/0.23/0.27/0.20 | 0.95/0.98/0.89/0.87 | -109 345.9 | 219 622.2 | 0.864 | $p < 0.001$ | $p < 0.001$ |
| **5** | **0.23/0.15/0.24/0.15/0.22** | **0.97/0.85/0.95/0.94/0.98** | **-107 227.0** | **215 619.3** | **0.911** | **$p < 0.001$** | **$p < 0.001$** |
| 6 | 0.21/0.12/0.22/0.14/0.21/0.10 | 0.96/0.84/0.93/0.93/0.97/0.83 | -105 746.6 | 212 893.5 | 0.896 | $p = 0.758$ | $p = 0.758$ |

**Table 3.** Hazard ratios (HR) and 95% confidence intervals (CIs) for offspring mortality in different phases of life-course.

| | Male offspring | | Female offspring | |
|---|---|---|---|---|
| | Deaths per class | HR (95% CI) | Deaths per class | HR (95% CI) |
| **Childhood and adolescence (age 0—19)** | n=6090 | | n=5799 | |
| Highest status families | 11/947 (1.2%) | 1 (*reference*) | 4/886 (0.5%) | 1 (*reference*) |
| Small families | 17/1326 (1.3%) | 1.10 (0.52; 2.36) | 9/1284 (0.7%) | 1.56 (0.48; 5.05) |
| Larger families | 14/955 (1.5%) | 1.27 (0.57; 2.79) | 7/869 (0.8%) | 1.79 (0.52; 6.10) |
| Average wealth families | 17/1460 (1.2%) | 1.00 (0.47; 2.14) | 14/1385 (1.0%) | 2.24 (0.74; 6.81) |
| Rural families | 27/1402 (1.9%) | 1.66 (0.83; 3.35) | 18/1375 (1.3%) | 2.91 (0.99; 8.61) |
| **Early adulthood (age 20—39)** | n=5985 | | n=5733 | |
| Highest status families | 19/933 (2.0%) | 1 (*reference*) | 11/879 (1.3%) | 1 (*reference*) |
| Small families | 35/1307 (2.7%) | 1.32 (0.76; 2.31) | 11/1270 (0.9%) | 0.69 (0.30; 1.59) |
| Larger families | 33/937 (3.5%) | 1.75 (0.99; 3.07) | 9/862 (1.0%) | 0.83 (0.35; 2.01) |
| Average wealth families | 56/1436 (3.9%) | **1.93 (1.15; 3.24)** | 15/1368 (1.1%) | 0.88 (0.40; 1.91) |
| Rural families | 36/1372 (2.6%) | 1.29 (0.74; 2.25) | 13/1354 (1.0%) | 0.77 (0.34; 1.71) |
| **Midlife (age 40—52)** | n=5825 | | n=5688 | |
| Highest status families | 22/917 (2.4%) | 1 (*reference*) | 22/871 (2.5%) | 1 (*reference*) |
| Small families | 36/1274 (2.8%) | 1.18 (0.70; 2.01) | 21/1264 (1.7%) | 0.66 (0.36; 1.19) |
| Larger families | 47/908 (5.2%) | **2.19 (1.32; 3.63)** | 14/853 (1.6%) | 0.65 (0.33; 1.27) |
| Average wealth families | 55/1387 (4.0%) | **1.66 (1.02; 2.73)** | 21/1356 (1.5%) | 0.61 (0.34; 1.11) |
| Rural families | 52/1339 (3.9%) | **1.63 (1.00; 2.68)** | 22/1344 (1.6%) | 0.65 (0.36; 1.17) |