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## Epidemiology in History

# Social Class and Excess Mortality in Sweden During the 1918 Influenza Pandemic

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Consensus is lacking in the literature about the role of socioeconomic factors on influenza-associated deaths during the 1918 pandemic. Although some scholars have found that social factors were important, others have not. In this study, we analyzed differences in excess mortality by social class in Sweden during the 1918 pandemic. We analyzed individual-level mortality of the entire population aged 30–59 years by combining information from death records with census data on occupation. Social class was measured by an occupation-based class scheme. Excess mortality during the pandemic was measured as the number of deaths relative to the number occurring in the same month the year before. Social class differences in numbers of deaths were modeled using a complementary log-log model that was adjusted for potential confounding at the family, the residential (urban/rural), and the county levels. We found notable class differences in excess mortality but no perfect class gradient. Class differences were somewhat larger for men than for women.

1918 pandemic; individual level; influenza; longitudinal study; mortality; occupation; social class; Sweden

Abbreviation: CI, confidence interval.

Although the influenza pandemic of 1918 affected millions of people worldwide over a short period, it did not strike blindly. Women were more likely to contract influenza, but the influenza death rate in men was slightly higher (1, 2). A specific feature was the dramatic death rate among young adults (3, 4). Moreover, it is commonly believed that in the 1918 pandemic, "the flu hit the rich and the poor alike" (5). Indeed, many contemporary scientists claimed there was no social gradient associated with influenza during the pandemic (6). Based on surveys on sickness among all the employed, in some cases including their families, physicians working at factories in different parts Sweden found similar influenza incidence rates for different groups of employees (7–9). They found that age, but not occupation and housing, was an important factor. However, other contemporary scientists found socioeconomic differences in death rates during the pandemic (5, 10, 11). In an analysis of 2 socially contrasting parishes in Oslo, Norway, the working classes and those living in small apartments had the highest influenza-related death rate (12). In Chicago, Illinois, social factors at the local level, such as literacy, homeownership, and unemployment, were associated with influenza and pneumonia mortality rates in 1918 (13). Thus, we are faced with contrasting views on the role of socioeconomic factors in determining influenza-related death rates during the 1918 pandemic.

In this study, we analyzed differences in excess mortality during the pandemic by social class, using individual-level data for the entire population of Sweden aged 30–59 years. We combined information from the death records for the period 1915–1921 on precisely when the deaths occurred with data on occupation, family characteristics, and residence from the population census of 1910.

Almost 35,000 people, out of a population of 5.8 million, died of influenza and pneumonia during the 3 waves of the pandemic (2, 14–16). The first reports of influenza came in the last week of June 1918; in the following month, 52 persons died of the disease (2, 17). Although the number of deaths was higher, and the increase started earlier, than for the seasonal influenza, the first wave of influenza was still considered very mild by the medical authorities (2). The second wave, which started in September, was far more violent, and the number of deaths quickly increased to reach a peak in October to November. A third, and milder, wave came in April 1919 and then gradually vanished (17).

At the time of the pandemic, Sweden was in the middle of its industrial transition and had higher rates of economic growth than most other Western countries (18). Still, the number of people employed in agriculture was larger than in the industrial sector and the degree of urbanization was low, with only 4 towns having a

population of more than 50,000 (19). This means that most industrial workers also lived in rural areas.

## METHODS

### Data sources

The 1910 census (20) provided individual-level demographic, geographic, and occupational information on the entire population residing in Sweden on December 31, 1910. Data on deaths were taken from the Swedish death index (21), including all deaths recorded in Sweden between 1901 and 2013, which corresponded almost exactly with the official numbers published by Statistics Sweden (22). The index provided names and the dates and places of birth and death. The linking of individuals between the census and the death index was done by matching people based on parish and year of birth, sex, and names, because personal identification numbers were not introduced until much later. The selection of identifying variables followed well-established best practices and only included time-invariant variables to avoid introducing bias into the linked sample (23). To match an individual between the death index and the census, he or she had to be recorded with the same sex, birth parish, and year of birth. We allowed for some differences in spelling of names, using the Jaro-Winkler algorithm (24, 25). Using this algorithm, we compared the text strings and allocated a score between 0 (no similarity) and 1 (exact match) based on the number of single-character transpositions required to turn 1 text string into another. Furthermore, the algorithm penalized differences occurring in the beginning relative to the end of the compared strings more severely. To be considered a match, we required the similarity scores of first names and surnames to exceed 0.85. This threshold was chosen on the basis of the achieved match rate and evaluations of how many of the matches could be confirmed as true on the basis of comparisons of auxiliary identifying characteristics that were not themselves used to identify matches (26). An individual matched to more than 1 other individual in either the death index or the census was deemed an ambiguous match and was not retained as a link between the sources. In total, this procedure linked 72% of all deaths for men and 68% for women in our sample. We analyzed 81,867 linked deaths in the period 1915–1921, of which 18,691 occurred between July 1, 1918, and June 30, 1919.

The occupational titles in the 1910 census were encoded according to the Historical International Standard Classification of Occupations (27), which allowed for the transformation of occupations into social classes, using the Historical International Social Class Scheme, which, in turn, is based on skill level, degree of supervision, and whether work was manual (28). Because most married women had no recorded occupation in the census, we used the occupation of the husband to assign class to a married woman. For unmarried women and women whose husbands had no occupational title, we used women's own occupations. From the Historical International Social Class Scheme, we constructed 5 aggregated classes: white collar (Historical International Social Class Scheme 1–5), skilled manual (6, 7), low-skilled manual (9, 10), unskilled manual (11, 12), and farmers (8). Frequent occupations among the different classes included, for the white-collar class, proprietors, bookkeepers, and teachers. The skilled workers included carpenters, blacksmiths, and tailors, for example. The class of low-skilled workers included loggers, painters, and fishermen; among the unskilled workers were farmworkers, laborers, and unspecified workers. Farmers were difficult to put in the class scheme because we lacked information on the size of their landholdings or number of employees. The group included anything from small subsistence farmers to big landowners. For this reason, we put this group outside the hierarchal class scheme, leaving white-collar workers at the top and unskilled workers at the bottom. Social class in this way reflected life chances related to such factors as wealth, education, income, and social status (28, 29).

The death certificates did not include information on cause of death, which made it impossible to study death resulting directly from influenza. Instead, we analyzed the pattern of deaths by month for people aged 30–59 years, separately for men and women, for the prepandemic, pandemic, and postpandemic periods, starting in 1915 and ending in 1921. We also measured monthly excess mortality by comparing the number of deaths in a certain month with the number occurring in the same month of the preceding year in each social class. In this way, we could estimate the excess mortality during the pandemic and to remove seasonal variation in mortality. The argument for this approach was that although the occupational structure changed profoundly in the long term, the change from 1 year to the next was limited, especially when compared with the great increase in the number of deaths related to influenza. Because the timing of the excess-mortality peaks differed slightly across social classes, we also analyzed the cumulative monthly excess death rates.

### Statistical models

We studied differences in excess mortality among social classes in the prepandemic and pandemic periods using discrete event history analysis. We followed all individuals aged 30–59 years from January 1, 1915, through June 30, 1919. The period between January 1915 and June 1918 was our control period, and the 12 months from July 1, 1918, to June 30, 1919, was the pandemic period. This periodization of the pandemic was based on reports on the distribution of deaths due to influenza in the period (17). The result would be the same using information on the morbidity of the disease (2, 15, 16). Data were structured by month, with a binary variable indicating whether the individual died during the month or not. All covariates except age and pandemic period were time invariant and referred to information in the 1910 census.

The probability of dying was modeled using a complementary log-log model (estimated using the cloglog command in Stata, version 14 (StataCorp LP, College Station, Texas)), which is suitable for binary data with an asymmetric distribution of the dependent variable (30). The complementary log-log model takes the following form:

$$\Pr(y = 1|\mathbf{x}) = 1 - \exp\{\exp(-\mathbf{x}'\boldsymbol{\beta})\},$$

where y is an indicator variable with the value of 1 if the individual died during the month, or zero otherwise; x is a vector of covariates; and β is the vector of parameters to be estimated. Results were reported as relative mortality risks, which were derived by exponentiating the parameter estimates. In a sensitivity analysis, we calculated clustered standard errors to account for repeated monthly observations for each individual, which gave almost identical confidence intervals. We also estimated logit models,

which gave highly similar results (see Web Table 1, available at https://academic.oup.com/aje).

In the analysis, we adjusted the model for marital status, presence of children, and migration history, because these are known to influence risk for death and are associated with social class (31, 32). Moreover, we adjusted the model for urban residence, which may have affected overall death rate, social class–specific death rate, and the timing and incidence of the influenza deaths during the pandemic (2, 31).

We estimated 5 different models separately by sex. Model 1 was adjusted only for age in 5-year categories. Model 2 was adjusted for age and social class. To model 3 were added interaction effects between pandemic period and social class. To model 4 were added the following individual-level control variables: marital status, presence of children, migrant status, and urban residence. To model 5 were added county-level fixed effects, which accounted for unobserved heterogeneity at the county level (25 counties). Of main interest was the interaction of the variables social class and pandemic period (July 1918 to June 1919), from which we could determine the differential excess mortality during the pandemic by social class.

## RESULTS

### Descriptive results

The linked sample captured a constant share of the deceased throughout the period, as did the linked sample with information on occupation (as an indicator of socioeconomic status), as shown in Figure 1. The timing and number of deaths were similar for men and women, and similar in the pre- and postpandemic periods. There were some variations in the pre- and postpandemic periods, with a higher death rate during the winter. Figure 2 shows excess mortality where these seasonal variations were removed by dividing the monthly number of deaths by the value for the same month in the preceding year. The low death rate calculated for the fall of 1919 was the result of dividing the number of deaths in these months by the many deaths during the same months of 1918, during the pandemic. The similarity in the mortality patterns between the death index and the linked samples reassured us that the linking procedure was a credible method for reconstructing a historical population register.

Figure 3 displays excess mortality by social class. The first wave, in July and August, was very mild. The number of deaths was too low to identify any class differences. Excess mortality started to emerge in all classes by September 1918 for men and women. It peaked in different months for different classes (October or November), and there were sex differences in these patterns.

Figure 4 shows the cumulative monthly deaths by class and sex. For men, there were marked class differences but no perfect gradient (Figure 4A). Farmers had the lowest excess mortality in the pandemic period, followed, in order, by white-collar workers, and skilled, unskilled, and low-skilled workers.

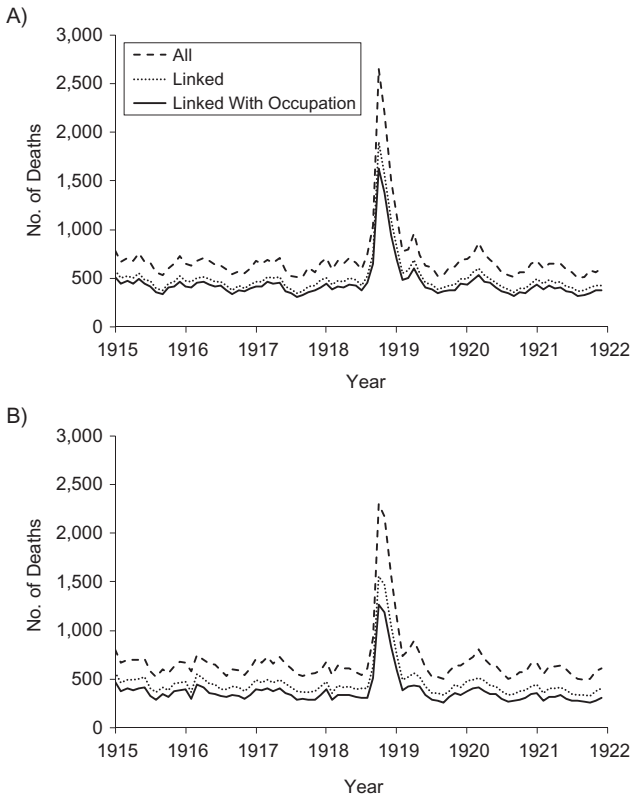


**Figure 1.** Number of deaths in Sweden among persons aged 30–59 years, 1915–1921. A) Men; B) women.

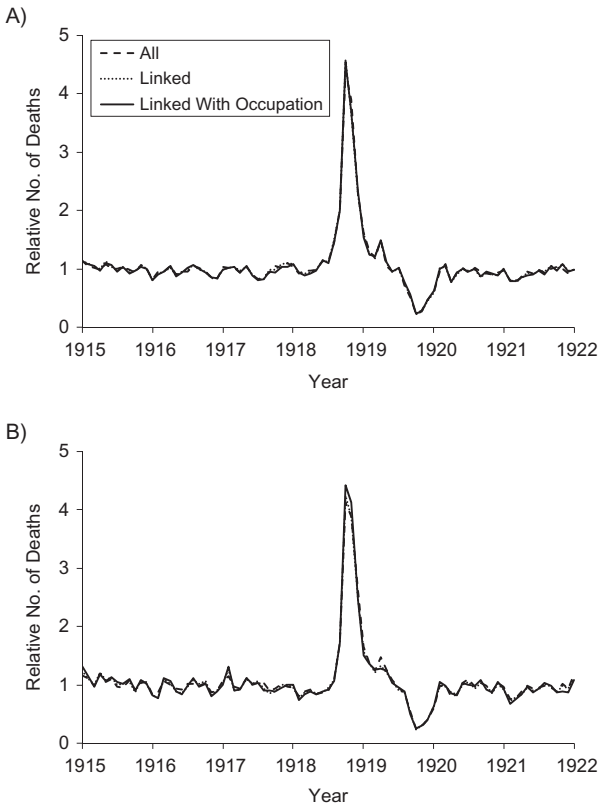


**Figure 2.** Number of deaths in Sweden among persons aged 30–59 years relative to the same month in the preceding year, 1915–1921. A) Men; B) women.

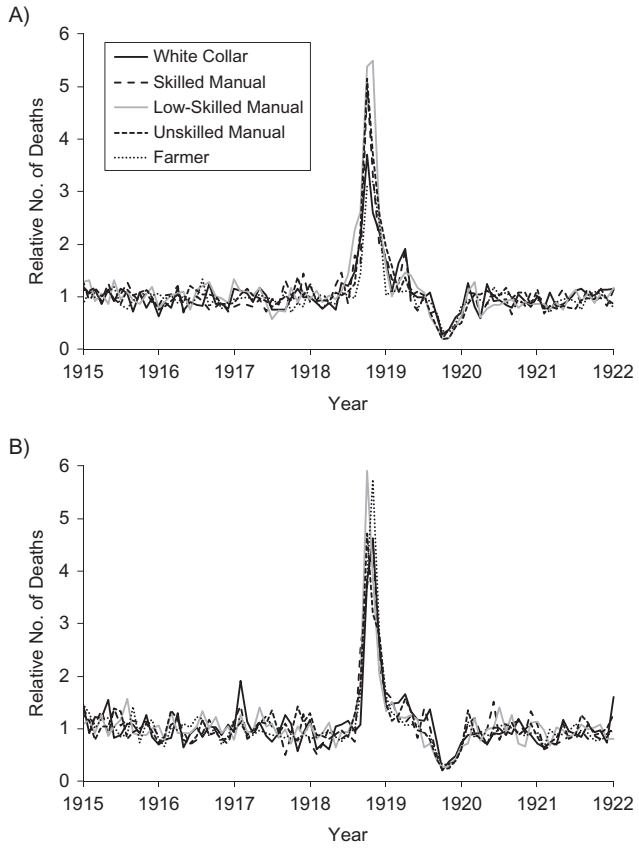


**Figure 3.** Number of deaths in Sweden among persons aged 30–59 years, by social class, relative to the same month in the preceding year, 1915–1921. A) Men; B) women.

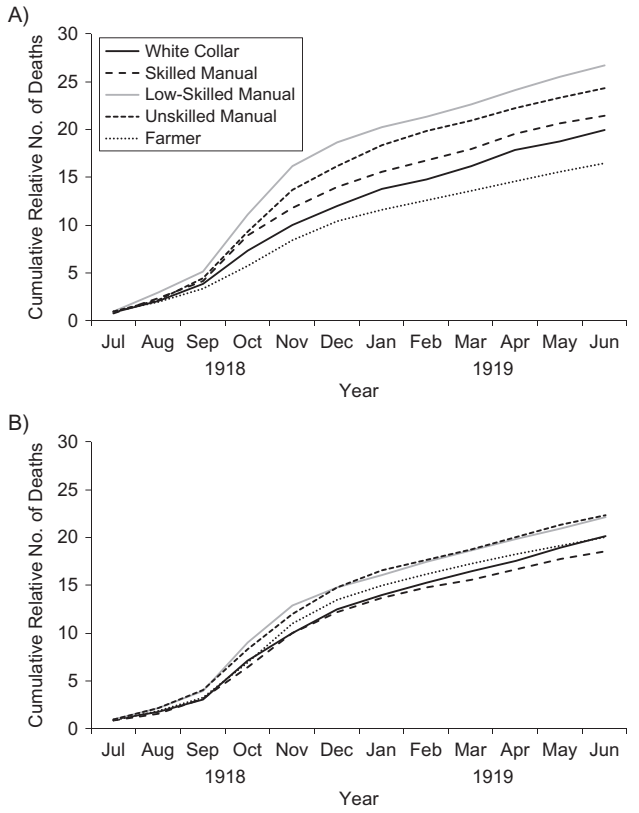


**Figure 4.** Cumulative monthly deaths in Sweden among persons aged 30–59 years, by social class, from July 1918 to June 1919 relative to the average of same month in the period July 1915 to June 1918. A) Men; B) women.

For women, the pattern was somewhat different (Figure 4B). Overall, the social class differences in excess mortality were smaller among women than among men. Low-skilled and unskilled manual workers had the highest excess mortality and the skilled manual workers had the lowest. Excess mortality for farmers and white-collar workers was between those of the manual workers, but the difference between these 2 classes was small.

## Regression results

The descriptive statistics of the analytical sample are presented in Table 1. Farmers composed 22%–23% of the study population, unskilled manual workers composed 20%–21%, and white-collar workers composed approximately 12%. Information about social class was not found for 10% of men and 16% of women. Approximately 65% of men and 68% of women in the sample were married, and a majority (about 60%–65%) had children at home. Approximately 25% were migrants, and slightly more than 20% lived in urban areas.

Tables 2 and 3 show relative risks from complementary log-log models for the age group 30–59 years at risk from January 1915 through June 1919. Results for men are listed in Table 2; those for women are listed in Table 3. There was a clear excess mortality in the pandemic period: approximately 80% higher mortality for men and 70% higher for women when the model was adjusted only for age (model 1). The excess mortality in the pandemic period was only slightly reduced when the model was adjusted for additional variables and interactions between class and pandemic period (models 2–5). For men, the relative risks declined from 1.79 (95% confidence interval (CI): 1.74, 1.83), according to model 1, to 1.69 (95% CI: 1.58, 1.80) in model 5 (Table 2). For women, the corresponding change was from 1.69 (95% CI: 1.65, 1.74) in model 1 to 1.55 (95% CI: 1.43, 1.67) in model 5 (Table 3).

Overall, the death rate was lower for men in the farmer group; there were only small differences among the other classes (see model 2, Table 2). For women the pattern was quite different, with a higher death rate for unskilled workers and somewhat lower death rate in the white-collar class (see model 2, Table 3). More importantly, there were also social class differences in the excess mortality during the pandemic, when the model was adjusted for all the potential confounders, as shown by the interaction effects. Among men, low-skilled manual workers had the largest excess mortality (models 3–5, Table 2; see also Web Table 2), and farmers the lowest. Unskilled workers had the second highest excess mortality. For the other classes, there were no statistically significant differences in excess mortality during the pandemic. Women in the low-skilled and unskilled classes had the greatest excess mortality; there were no statistically

**Table 1.** Descriptive Statistics of Men and Women Aged 30–59 Years, Sweden, January 1915 to June 1919

| Characteristic | Men, % ($n$ = 736,604)[a] | Women, % ($n$ = 716,185)[b] |
|---|---|---|
| Age group, years | | |
| 30–34 | 21.3 | 18.4 |
| 35–39 | 19.7 | 19.5 |
| 40–44 | 17.7 | 18.1 |
| 45–49 | 15.0 | 15.8 |
| 50–54 | 15.0 | 16.1 |
| 55–59 | 11.2 | 12.1 |
| Social class | | |
| White collar | 12.5 | 12.5 |
| Skilled manual | 15.4 | 13.4 |
| Low-skilled manual | 17.7 | 16.0 |
| Unskilled manual | 21.8 | 20.3 |
| Farmer | 23.1 | 21.5 |
| Missing | 9.6 | 16.4 |
| Marital status | | |
| Unmarried | 33.0 | 28.3 |
| Married | 64.7 | 67.5 |
| Previously married | 2.2 | 4.2 |
| Children | | |
| 0 | 41.8 | 35.2 |
| 1 | 12.8 | 13.4 |
| 2 | 13.3 | 14.3 |
| 3 | 10.7 | 11.9 |
| 4 or more | 21.4 | 25.1 |
| Migrant | 23.1 | 24.5 |
| Urban resident | 21.4 | 23.7 |

[a] For men: 33,864,311 person-months, 27,916 deaths.
[b] For women: 33,552,942 person-months, 26,033 deaths.

significant differences among the other classes (models 3–5, Table 3; see also Web Table 3).

Figure 5 shows the net effects of the interactions between social class and pandemic period (based on model 5 in Tables 2 and 3). The reference category was skilled manual workers in the prepandemic period (1915–1917). Men and women in the farmer group, and women in the white-collar class, had lower death rates than the other classes in the prepandemic period. There were only small differences among the other classes in this period, and none of them was statistically significant. As is clear from the data in Tables 2 and 3, there was substantial excess mortality in all social classes in the pandemic period.

For men, low-skilled workers had the highest death rate in the pandemic period and farmers the lowest. This difference was also highly statistically significant. White-collar workers had a lower death rate in the pandemic period than did the manual workers, but not as low as the farmers. The difference was only statistically significant in relation to the low-skilled workers. The skilled workers had a statistically significantly lower death rate in the pandemic period than did the low-skilled and unskilled workers. The difference between the low-skilled and the unskilled was not statistically significant. The data from the group with missing information on social class were similar to that of the low-skilled workers in the pandemic period, but the former had a higher death rate than the other social classes in the prepandemic period.

For women, the pattern was similar, but the differentials were narrower. In the pandemic period, the death rate was highest among low-skilled and unskilled workers compared with all other groups. There were no statistically significant differences among women in white-collar, skilled manual, or farmer classes. The group with missing information on social class had a death risk similar to those of low-skilled and unskilled workers in the pandemic period and a higher death rate than other classes in the prepandemic period. Hence, class differences in death rates during the pandemic were more consistent than during the prepandemic period, but there was no perfect social class gradient in excess mortality in the pandemic or prepandemic periods.

## DISCUSSION

We lack a clear understanding of the role of socioeconomic factors in the 1918 influenza pandemic. There are different hypotheses in the literature about likely differences and their explanations. According to our findings, there were notable social class differences in excess mortality for men and women during the pandemic period of July 1918 to June 1919. Among women, the social class differences were smaller than those among men. Among men, farmers were least affected by the pandemic and low-skilled manual workers were most affected. Unskilled workers had lower excess mortality than did the low-skilled workers but higher excess mortality than did skilled and white-collar workers. For women, there was a similar pattern, with the highest excess mortality in the pandemic for low-skilled and unskilled workers and no differences among the other classes. In other words, there was no perfect social class gradient in excess mortality during the pandemic, where higher class was associated with lower excess mortality in a hierarchical way.

Class differences among women were more pronounced in the prepandemic period than they were for men but less distinctive during the pandemic. Specifically, white-collar men did not have a mortality advantage compared with the working classes, which may seem surprising but is well in line with other research in which a larger number of cohorts in the first half of the 20th century was studied. An explanation of the sex differences in class-specific death risks during this period is lacking, but it has been hypothesized that they were related to lifestyle factors (31).

These results point to other mechanisms than pure income and standard of living as the main explanations behind the social class differentials in excess mortality during the pandemic. If differences in nutrition or housing conditions were the only explanations, we would have expected to see a clear social class gradient and not just a difference between unskilled or low-skilled workers and the other classes. It was impossible to draw firm conclusions about what explained the observed social class differences in excess mortality, but possibly work-related differences in the

**Table 2.** Relative Risks for Death Using a Complementary Log-Log Model Among Men Aged 30–59 Years ($n$ = 33,864,311 Person-Months), Sweden, January 1915 to June 1919

| Period and Social Class | Model 1[a] | | Model 2[a] | | Model 3[a] | | Model 4[b] | | Model 5[c] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI |
| Period | | | | | | | | | | |
| Prepandemic | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent |
| Pandemic | 1.79 | 1.74, 1.83 | 1.77 | 1.73, 1.81 | 1.71 | 1.61, 1.83 | 1.69 | 1.59, 1.80 | 1.69 | 1.58, 1.80 |
| Social class | | | | | | | | | | |
| White collar | | | 1.04 | 0.99, 1.09 | 1.05 | 1.00, 1.11 | 1.02 | 0.97, 1.08 | 1.00 | 0.94, 1.05 |
| Skilled manual | | | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent |
| Low-skilled manual | | | 1.03 | 0.99, 1.08 | 0.96 | 0.91, 1.01 | 0.96 | 0.92, 1.01 | 0.97 | 0.92, 1.02 |
| Unskilled manual | | | 1.06 | 1.02, 1.10 | 1.03 | 0.99, 1.09 | 1.00 | 0.96, 1.05 | 1.04 | 0.99, 1.09 |
| Farmer | | | 0.75 | 0.72, 0.78 | 0.79 | 0.75, 0.83 | 0.82 | 0.78, 0.86 | 0.89 | 0.85, 0.93 |
| Missing data | | | 1.26 | 1.20, 1.32 | 1.23 | 1.16, 1.30 | 1.12 | 1.06, 1.19 | 1.20 | 1.13, 1.27 |
| Pandemic × social class | | | | | | | | | | |
| Pandemic × white collar | | | | | 0.96 | 0.87, 1.06 | 0.96 | 0.87, 1.05 | 0.96 | 0.87, 1.05 |
| Pandemic × skilled manual | | | | | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent |
| Pandemic × low-skilled manual | | | | | 1.25 | 1.14, 1.36 | 1.24 | 1.14, 1.35 | 1.24 | 1.14, 1.35 |
| Pandemic × unskilled manual | | | | | 1.08 | 0.99, 1.17 | 1.08 | 0.99, 1.17 | 1.08 | 1.00, 1.17 |
| Pandemic × farmer | | | | | 0.85 | 0.78, 0.92 | 0.85 | 0.78, 0.93 | 0.85 | 0.78, 0.93 |
| Pandemic × missing data | | | | | 1.07 | 0.98, 1.18 | 1.08 | 0.98, 1.18 | 1.08 | 0.98, 1.19 |

Abbreviations: CI, confidence interval; RR, relative risk.
[a] Models 1, 2, and 3 were adjusted for age (5-year categories).
[b] Model 4 was adjusted for age (5-year categories), marital status, number of children, and migrant status.
[c] Model 5 was adjusted for age (5-year categories), marital status, number of children, migrant status, urban status, and county of residence.

**Table 3.** Relative Risks for Death Using a Complementary Log-Log Model Among Women Aged 30–59 Years ($n$ = 33,552,942 Person-Months), Sweden, January 1915 to June 1919

| Period and Social Class | Model 1[a] | | Model 2[a] | | Model 3[a] | | Model 4[c] | | Model 5[c] | |
|---|---|---|---|---|---|---|---|---|---|---|
| | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI | RR | 95% CI |
| Period | | | | | | | | | | |
| Prepandemic | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent |
| Pandemic | 1.69 | 1.65, 1.74 | 1.69 | 1.64, 1.73 | 1.55 | 1.43, 1.67 | 1.55 | 1.43, 1.67 | 1.55 | 1.43, 1.67 |
| Social class | | | | | | | | | | |
| White collar | | | 0.91 | 0.87, 0.96 | 0.90 | 0.85, 0.96 | 0.89 | 0.84, 0.95 | 0.88 | 0.83, 0.94 |
| Skilled manual | | | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent |
| Low-skilled manual | | | 1.09 | 1.04, 1.14 | 1.05 | 0.99, 1.10 | 1.03 | 0.98, 1.09 | 1.02 | 0.96, 1.07 |
| Unskilled manual | | | 1.13 | 1.08, 1.18 | 1.08 | 1.03, 1.14 | 1.05 | 1.00, 1.11 | 1.04 | 0.98, 1.09 |
| Farmer | | | 0.98 | 0.94, 1.02 | 0.96 | 0.91, 1.02 | 0.97 | 0.92, 1.02 | 0.95 | 0.90, 1.00 |
| Missing data | | | 1.26 | 1.20, 1.31 | 1.21 | 1.15, 1.28 | 1.12 | 1.06, 1.18 | 1.11 | 1.05, 1.17 |
| Pandemic × social class | | | | | | | | | | |
| Pandemic × white collar | | | | | 1.04 | 0.93, 1.16 | 1.04 | 0.93, 1.16 | 1.04 | 0.93, 1.16 |
| Pandemic × skilled manual | | | | | 1.00 | Referent | 1.00 | Referent | 1.00 | Referent |
| Pandemic × low-skilled manual | | | | | 1.15 | 1.04, 1.27 | 1.15 | 1.04, 1.27 | 1.15 | 1.04, 1.27 |
| Pandemic × unskilled manual | | | | | 1.14 | 1.04, 1.25 | 1.13 | 1.03, 1.24 | 1.13 | 1.03, 1.24 |
| Pandemic × farmer | | | | | 1.06 | 0.96, 1.16 | 1.06 | 0.96, 1.16 | 1.06 | 0.96, 1.16 |
| Pandemic × missing data | | | | | 1.11 | 1.01, 1.22 | 1.11 | 1.01, 1.22 | 1.10 | 1.00, 1.21 |

Abbreviations: CI, confidence interval; RR, relative risk.
[a] Models 1, 2, and 3 were adjusted for age (5-year categories).
[b] Model 4 was adjusted for age (5-year categories), marital status, number of children, and migrant status.
[c] Model 5 was adjusted for age (5-year categories), marital status, number of children, migrant status, urban status, and county of residence.

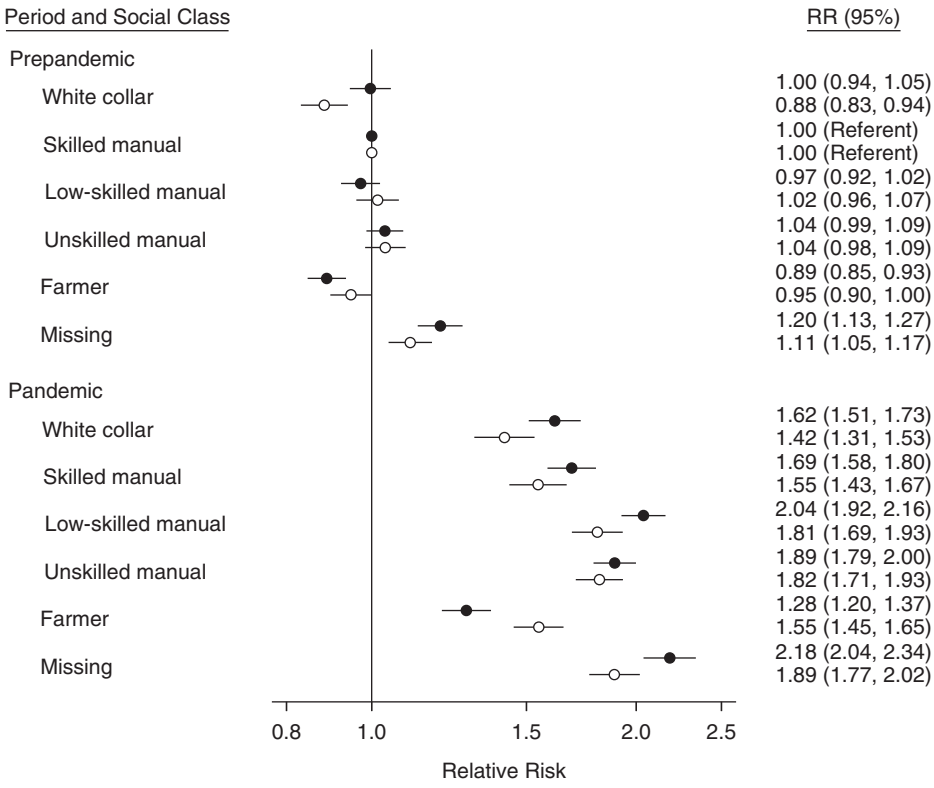


**Figure 5.** Relative risks (RR) and 95% confidence intervals (CI) for the interaction between social class and pandemic period in men (black markers) and women (white markers) aged 30–59 years, Sweden, January 1915 to June 1919. Relative risks are from a complementary log-log model adjusted for marital status, presence of children, migrant status, urban/rural residence, and county and age fixed effects (see model 5 in Table 2).

degree of interpersonal interaction could have been important. More research on occupational differences in mortality would be highly valuable to advance knowledge about this issue.

There are some important limitations to our study. We did not have access to time-varying occupational information; instead, we relied on the information given in the 1910 census, which was 5–9 years before the observations analyzed. However, because we did analyze broader social classes rather than detailed occupations, intragenerational mobility was expected to be quite limited. Data from the 1920 census were not available; therefore, we looked at intragenerational class mobility between 1900 and 1910 for the age group 35–59 years in 1910 (Web Table 3). Among white-collar, skilled workers and farmers, between 70% and almost 90% of individuals stayed in the same class, whereas this pattern applied to only approximately 50% of the low-skilled and unskilled workers. Between these 2 classes, there was considerable mobility, and when viewing them as 1 class, mobility was similar to that of the other classes. According to our results, there also was similar excess mortality for the low skilled and unskilled workers, which further indicated that the boundary between these 2 classes was not very clear.

Another possible limitation was the linking procedure. Not all individuals could be linked between the census and the death register, most often because there was more than 1 possible match. The mortality pattern before and during the pandemic was highly similar in the linked sample and among all deaths. Moreover, the distribution of social classes was also similar in the linked sample and in the 1910 census (see Web Table 4). Hence, the sample analyzed was highly representative of the death registers and the 1910 census, and for this reason, we did not expect any significant selection bias to have affected our results.

Furthermore, we relied on the husband's occupation when determining the class position of married women. Although there was some reporting of occupation among married women, most of them did not work regularly outside the household, which made the husband's occupation the best indicator of their class position (33, 34).

Finally, because the death registers did not provide information on the cause of death, we based the analysis on the estimation of excess mortality, using a method that eliminated almost completely the normal seasonality (Figure 2A and 2B). According to our estimates, there were 42,454 excess deaths in all ages in the pandemic period. The numbers of proven and likely influenza deaths in the same period, reported by Statistics Sweden (17), was 34,374, corresponding to 81% of our estimates. Thus, our excess deaths included about 8,000 deaths not diagnosed as due to influenza, of which almost 3,000 were deaths resulting from pneumonia (17).

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