Social Class Inequalities in Cause-Specific Adult Mortality in a Long-Term Perspective

Evidence from Southern Sweden 1813-2015

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Abstract

In recent years, higher social classes have been characterized by a lower mortality. This has been confirmed using different socioeconomic indicators across several geographical settings. Nevertheless, the mechanisms behind such phenomenon are still under debate. The timing of the emergence of the socioeconomic gradient is still open for discussion as well. In this paper, we study the relation between social class and cause specific mortality for a regional population in the south of Sweden from the early nineteenth century until today. We apply a cause-specific hazard model to estimate mortality differentials among social classes. Firstly, our results confirm that with respect to all-cause mortality, the social gradient is a recent phenomenon emerged in the second half of the twentieth century. Secondly, the analysis of specific causes of death highlights that the magnitude and significance of the social gradient varies across different causes of death. Diseases of the circulatory system, respiratory systems and lung cancer, and external causes present larger social differences than other causes. Thirdly, there are gender differences particularly for death related to circulatory system and external causes. For men the social gradient in cardiovascular mortality developed from being significantly reversed in the first period to a substantial advantage for higher social classes in the last decades. This does not hold for women who show a statistically significant social gradient as early as the 1920s that gradually become larger in magnitude and significance.

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Introduction

The relation between socioeconomic status (SES) and mortality has been well documented in the literature, showing how in recent decades a social gradient has emerged (Cutler, Lleras-Muney, & Vogl, 2008; Elo, 2009). One of the most striking facts is that the effect of SES on mortality is found also in egalitarian societies with a developed welfare state (Erikson & Torssander, 2008; Fritzell & Lundberg, 2007), and not only between the richest and the poorest (Marmot, 2005). The importance of diminishing socioeconomic inequalities is a high priority in public health (Marmot et al., 2014). As some studies show, decreasing the health gap for disadvantage groups could improve life expectancy at a national level potentially more than eliminating cardiovascular diseases or cancer (Veugelers & Guernsey, 1999; Veugelers, Yip, & Kephart, 2001).

Which factors are driving SES differentials in mortality is still under debate. While several studies have been looking at all-cause mortality (Mackenbach, Kunst, Cavelaars, Groenhof, & Geurts, 1997; Torssander & Erikson, 2010), focusing on specific causes of death can give a valuable insight in understanding the mechanisms (Erikson & Torssander, 2008; Toch-Marquardt et al., 2014). Different causes of deaths are driven by different proximate and contextual factors. Contextual factors are in some instances traceable back to characteristics of socioeconomic positions. By studying which causes of death are more likely to occur in each socioeconomic segment of a society, it is possible to highlight plausible pathways that characterize, for example, environment, habits, and resources of high/low social groups that are reflected into different health outcomes.

In addition, particularly when looking at long time periods spanning over centuries, a much argued matter in the literature relates to the timing of the emergence of such SES gradient in mortality (Tommy Bengtsson & Dribe, 2011; Tommy Bengtsson & Van Poppel, 2011; Dribe & Eriksson, 2018; Edvinsson & Lindkvist, 2011). While some studies have found mortality gradient by SES also in historical contexts, mounting evidence for different settings points to a rather late emergence. In Sweden, it was not until the 1970s that a full SES gradient emerged in adult mortality for both men and women. For men in particular, high SES was associated with shorter adult life span around the turn of the 20th century (Dribe & Eriksson 2018)

The aim of this paper is to advance our understanding of mortality inequalities by analyzing SES differences in cause-specific adult mortality for men and women. We cover a period of two hundred years and we put special emphasis on the timing of emergence of the SES gradient by cause of death. To our knowledge, this is the first paper that attempts to analyze and describe the effect of socioeconomic status on cause-specific mortality and the development of such effect over such a long time period. Our analysis is based on a unique regional population, followed longitudinally over 200 years. We use data on occupation-based social class, family context and cause of death from population registers and vital event records, and event-history analysis with competing outcomes (causes of death).

Theories and Mechanisms

In this paper, we measure socioeconomic status by using a social class scheme based on occupation. The advantage of using social class is that it is related, beside occupation, both to education and income (higher managers are, on average, more educated and richer/wealthier than unskilled laborers). It is an indicator relatively stable in the short term and able to combine both social and economic characteristics that are common among individuals in the same class and that have an impact on health (Cambois, Robine, & Hayward, 2001; Elo, 2009; Martikainen, Blomgren, & Valkonen, 2007).

There are several mechanisms through which such social class scheme might have an effect on mortality. They are related to working conditions, social position, educational level and income.

Working conditions include job characteristics and material benefits connected to paid work. Occupational risks clearly differ between unskilled workers and higher managers exposing the two social classes to different health outcomes reflecting the effect of the working environment. Social structure position, instead, reflects characteristics such as prestige, social status and power related to one’s occupation. Working conditions, for example, affect the risk for accidents, injuries and other occupational hazards (Brand, Warren, Carayon, & Hoonakker, 2007). Social status, on the other hand, relates with control over the workplace (e.g. job related stress, job satisfaction, self-esteem) and social networks (stronger and wider social ties allow for potentially more help in case of need) (Fujishiro, Xu, & Gong, 2010; M. Marmot, 2005).

Other mechanisms behind the relation between social class and mortality may go through several advantages (for instance, better income), that individuals with a higher social position have, which influence health such as easier access to a better health care or other health related resources (e.g. better housing or health devices) (Cutler et al., 2008). Another pathway is through the higher level of education of people in higher social classes. It gives knowledge about health threats and preventive actions that eventually decreases their mortality risk (Lleras-Muney, 2005).

Social class may also have an indirect effect on mortality through lifestyle and behaviors, that change from one class to the other (Cutler et al., 2008). Marmot and colleagues (1978; 1991), for instance, found that officials with a higher ranking had a lower obesity rate (with a higher propensity to have a healthy diet and to do physical exercise) and a lower propensity to smoke.

It is also known that social class inequalities in mortality vary greatly among causes of death in which some shows a more marked gradient than others (Elo, Martikainen, & Myrskylä, 2014; Kunst, Leon, Groenhof, & Mackenbach, 1998).

Cardiovascular mortality, particularly ischemic heart disease, and occupational class are strongly linked with the association being mainly relevant for the northern part of Europe (Kunst et al., 1998) and it has been confirmed that it is mostly related to conventional risk factors such as smoking, hypertension, and cholesterol – which are in turn related to behavior, diet, alcohol consumption and physical activity (Lynch, Smith, Harper, & Bainbridge, 2006).

Mental and nutritional/metabolic disorders, and respiratory system diseases are also distinctly sensible to social class (Erikson & Torssander, 2008). Such results may be explained by differences in behavior and consumption of drugs, alcohol, and smoking. A strong association is also found for accidental poisoning, accidental falls and homicide assaults which might be connected with the working class being exposed to more dangerous habits and conditions (Erikson & Torssander, 2008).

Social class is also linked to death from cancer; more specifically mortality rates from lung, stomach, and esophageal cancers have been repeatedly found in more disadvantaged groups (G. D. Smith, Leon, Shipley, & Rose, 1991).

Development over time

While for the recent period the SES gradient in mortality is quite consistent across different studies, results from the past are mixed. As a consequence, it is still not clear whether socioeconomic differences have always been present (staying constant through time or diverging/converging), or if they are a recent phenomenon and in such case when they have emerged (Bengtsson & Van Poppel, 2011).

As stated earlier in the introduction, the main objective of this paper is to understand how the effect of social class and cause specific mortality changed over a long period of time. More specifically, we aim at shedding light over three questions. Firstly, on which cause of death could the SES gradient be first established? Secondly, has the pattern changed over time? Thirdly, how do our results compare with the Fundamental Cause Theory (if the FCT theory is verified, we should see SES differences in all periods for different causes of death)? In the following paragraphs we review previous findings related to changes through time of SES inequalities in all-cause and cause-specific mortality.

Some scholars argue that the level of SES differences in mortality has changed over time. On one hand there is the argument that inequalities have been narrowing thanks to the increase of welfare reforms and public health measures (Antonovsky, 1967). On the other hand some authors have been arguing that mortality differentials by SES have been diverging with time: the idea is that when the prevalence of infectious diseases was high, all social classes were exposed in the same way and therefore there was no mortality differences between higher and lower socioeconomic classes (D. S. Smith, 1983). Some studies found that, indeed, there were no differences in mortality by SES before the second part of the twentieth century (Tommy Bengtsson & Dribe, 2011; Tommy Bengtsson, Dribe, & Helgertz, 2018; Edvinsson & Broström, 2012; Edvinsson & Lindkvist, 2011) or that there was a reverse gradient around the turn of the twentieth century (Dribe & Eriksson 2018).

Other authors, instead, argue that inequalities in mortality by social determinants have persisted throughout time leading to the labeling of socioeconomic status as the “Fundamental Cause” of mortality differentials (Link & Phelan, 1995). In sociology, the fundamental cause theory has been explained as based on a “metamechanism”; the idea is that, while several discussions of SES differences in mortality are based on specific factors (e.g. material resources or lifestyle), the FCT embodies a variety of mechanisms that ensure its theoretical relevance through space and time (Freese & Lutfey, 2011; Lutfey & Freese, 2005). Several studies have provided partial support for such theory, depending on the geographical context, a higher socioeconomic status indeed is protective for a large set of preventable diseases that can be associated with higher education or larger resources (Mackenbach et al., 2015; Phelan, Link, & Tehranifar, 2010). Most of the investigations testing the fundamental cause theory, however, have been done using contemporary data (see Phelan et al., 2010). Some empirical support from the end of the nineteenth and beginning of the twentieth centuries is provided by Pamuk (1985), Blum and colleagues (1990), and Chapin (1924) who found a social gradient in mortality in, respectively, Britain, Paris, and Rhode Island. However, in these studies, the time period does not stretch over more than a few decades and therefore it is difficult to draw conclusions over the development of SES differences in time.

When looking at cause specific mortality the fundamental cause theory finds further theoretical support. Even though the pattern of diseases has changed dramatically, from a larger prevalence of infectious diseases to mainly man-made diseases (Omran, 1971) the socioeconomic gradient has not been affected and the advantage of higher social classes have persisted through population and environmental changes (Clouston et al., 2016). Such theory puts great emphasis on studying mortality related to specific causes of death. The level of SES inequalities changes from one disease to another based on the stage of medical innovation and knowledge related to each specific health conditions. For example, on one hand, differences in multiple sclerosis mortality are expected to be narrow and accidental because the cause behind the disease are still unknown; on a similar note, also differences in cholera are expected to be negligible, but in this case it is because medical interventions have reduced mortality to extremely low levels. On the other hand there are diseases like colorectal cancer which shows increasing inequalities due to the fact that information about risk factors is not homogenously distributed across SES groups, leading to different attitude in the uptake of screenings and treatments (Clouston et al., 2016). However, empirical findings about the socioeconomic gradient in cause specific mortality, particularly in the past, are still scarce.

Some studies about the nineteenth century found that there was no socioeconomic gradient when looking at infectious diseases regardless of whether the social status was determined based on wealth, occupation, or income (Leonard, Robinson, Swedlund, & Anderton, 2015).

Other studies looking at the second half of 1800 provide evidence for a wealth gradient in mortality from pulmonary tuberculosis but no association was found with mortality from cholera; with regard to tuberculosis it seems that the association is related to the quality of housing while for cholera the lack of association is driven by the fact that the mechanisms behind the transmission of the disease (through contaminated water) had not been uncovered yet (Ferrie, 2001, 2003).

Further evidence from the US at the turn of the twentieth century shows that higher income was associated with lower mortality risk particularly from cardiovascular, respiratory, and digestive conditions. (Costa, 2000; Eli, 2015; for a review see Costa, 2015). These findings are at odds with an analysis of Northern Sweden where in the first half of 1900 men in the elite group had higher mortality level for cardiovascular diseases than middle and working classes; such relation eventually overturns from the 1950s onwards (Edvinsson & Broström, 2017).

Turning at the period between 1900 and 1950 no relation between occupational socioeconomic status and cardiovascular disease or even a reversed gradient highlighting a disadvantage for sedentary jobs. (Breslow & Buell, 1960; Logan, 1952; Stamler et al., 1960) The same pattern confirmed using a dataset from Baltimore between 1949 and 1951 (Lilienfeld, 1956).

In this phase, the reversed gradient has been found also for cirrhosis mortality: in the 1920s male managers and professionals had a risk of dying from cirrhosis that was double the one of skilled and partly skilled occupations (Crombie & Precious, 2011). Such results provide ground for more speculative findings that had been proposed for the Swedish context by Norström and Romelsjö, (1998).

(Kitagawa & Hauser, 1968) found a strong inverse association between mortality and education for deaths aged 25 and over in 1960; they estimated an excess mortality in the less educated groups that was particularly large for accidents, stomach cancer, and tuberculosis in men and for stomach cancer, diabetes mellitus, hypertensive, arteriosclerotic and degenerative heart disease in women.

For the period around mid-1900, other studies confirmed an emerging socioeconomic gradient in heart diseases (Bainton & Peterson, 1963; Pell & Fayerweather, 1985; Rogot & Hrubec, 1989; for a review see Dow & Rehkopf, 2010). A study based on the 1960 Swedish census revealed higher cardiovascular mortality among men in higher social classes in the eight years following the census which is likely to be related to heavy smoking being more frequent in individuals with non-manual occupations (Vågerö & Norell, 1989). Weires et al. (2008) extended the follow up to 2004 and found a significant socioeconomic gradient in mortality from cardiovascular, respiratory, cancer, and nutritional and metabolic diseases providing further evidence for the overturn of the social gradient already mentioned above during the more recent decades.

While overall this brief review of previous studies do not point to any definite pattern for the nineteenth century, we can highlight some commonalities from the twentieth century onwards. Firstly, the widely confirmed SES gradient that we see today seem to have start rising from the mid of 1900. Secondly, the first half of the twentieth century seem to have been dominated by a reverse social gradient particularly for men and particularly for causes of death related to alcohol consumption and smoking.

Data

We use individual-level, longitudinal data from the south of Sweden (T. Bengtsson, Dribe, Quaranta, & Svensson, 2017). The dataset contains information for five rural parishes and a port town in Skåne, the southernmost region of Sweden, in which individuals are followed across generations from 1813 until 2015. The data for the port town of Landskrona start in 1922, for the period before only data for the five parishes is available.

The database includes detailed information about several socioeconomic indicators at different point in one's life as well as demographic variable (e.g. births, marriages, migration). Since migration in and out the studied area is continuously recorded, we are able to precisely calculate the population at risk.

For the period up to 1968 information about demographic events and socioeconomic attainment relies on parish registers, births and deaths certificates, as well as population registers (continuously updated with individual level information for each household), vital events registers, poll-tax registers, and annual income and taxation registers. For the modern period (1969-2015) the source of data are several administrative registers managed by Statistics Sweden and the National Board of Health and Welfare.

The population under study is not representative of Sweden in statistical terms, but it reproduces an environment similar to most of rural and semi-urban areas at the time of study (Dribe et al. 2015). Moreover, previous studies of overall mortality have indicated similar patterns of class differences as in Sweden as a whole (Bengtsson et al. 2018; Dribe & Eriksson 2018).

The linkage of the historical and contemporary sources of data allows, firstly, to continuously follow individuals present in the area under study, and secondly, starting from 1969 to follow them even after migrating outside the area under study to another place within Sweden. Moreover, after 1969 we are also able to follow children and grandchildren to those who ever lived in the region throughout Sweden.

The period is divided into four sub-periods mainly capturing changes in data sources and availability: 1813-1921, 1922-1967, 1968-1989, 1990-2015. The four periods also capture changes in the epidemiological environment of the studied population. In the first part mortality from infectious diseases was the more common. The second period is characterized by an increase in tobacco consumption and circulatory diseases. As shown in previous research the third period is where the mortality gradient starts to appear and grow coinciding with a spread of knowledge and technologies that might have favored the higher social classes first.

Exposure

As socioeconomic measure, we use a social class scheme constructed on occupation. Occupational status was updated annually between 1815 and 1968 and between 2001 and 2015; in the period in between occupation is available at census years (1970, 1975, 1980, 1985, 1990). Occupational notations were coded in the coding system for historical occupations HISCO (Van Leeuwen, Maas, & Miles, 2002). For the period after 1968 occupational observations were translated in HISCO from the coding system NYK/SSYK followed by Statistics Sweden (occupational status was converted from NYK/SSYK to ISCO-88, then ISCO-68, and finally in HISCO) (Hendrickx, 2002). In the next step, occupations were grouped into a 12-categories classification following the HISCLASS scheme. HISCLASS categorization takes into account whether the occupation is manual or non-manual, rural or urban, as well as the required skill level and the degree of supervision (Leeuwen & Maas, 2011). Finally, in the analysis, we aggregate HISCLASS categories into a six classes grouping (higher managers/professionals; lower managers/professionals/clerical and sales; foreman and medium skilled workers; lower skilled workers/farm workers; farmers and fisherman; unknown). This categorization will help in avoiding a possible underestimation of mortality differentials that occurs when comparing manual vs non-manual (Erikson & Torssander, 2008).

Occupation is considered as time varying variable until the age of 65. Between 65 and 90 as occupation we consider the highest recorded occupation between the age of 50 and the age of 65. This is because it should represent the occupation at a point in time in which the peak in terms of socioeconomic status has been reached. Moreover, occupations after the age of 60 could be misleading because of retirement.

All individuals are under observation until death, emigration (outside the parishes before 1968 and outside Sweden afterwards), or end of 2015.

Outcome

As outcome we consider cause specific adult mortality (ages 30 to 90). For the historical period the causes of death, that were originally recorded as string on the parish registers, have been translated in ICD10 coding (Hiltunen & Edvinsson, 2018). The causes of death for the period after 1968 contained in the administrative register "*Dodsorsakregistret*" are coded in ICD8 for the years between 1969 and 1986, in ICD9 for the years between 1987 and 1996, and in ICD10 for the years from 1997 onwards (the ICD coding refers to the international version) (we harmonized the codes from different ICD versions using the Eurostat reference for nomenclatures (Eurostat, 2012)).

We categorize the causes of death into groups mainly following the ICD chapters: (1) infectious and parasitic diseases, (2) circulatory diseases (3) respiratory diseases, and lung cancer (4) other cancers (5) external causes (6) old age and (7) other, undefined, and unknown causes of death (a detailed description of the ICD codes included in each group is provided in the appendix).

Exceptions from following the ICD chapter were made for the first and the third groups. The first group includes infectious and parasitic diseases and it also contains influenza and pneumonia that, in the ICD code, are classified as respiratory diseases. This group mostly contains communicable diseases that are associated, for example, with poor housing and/or crowding (Krieger & Higgins, 2002; *WHO*, 2010). In the third group (respiratory diseases and lung cancer), we have included diseases of the respiratory system and lung, larynx, trachea, bronchus, lip, oral cavity, pharynx cancers. This category should capture deaths that are related, for example, to smoking.

The deviations from the ICD chapters in grouping the causes of death followed both theoretical considerations and data restrictions. On one hand, the categories should capture changes in the disease pattern that took place in the period under study; at the same time, each group should reflect different aspects of socioeconomic status, as this would help in understanding potential mechanisms behind mortality differentials. On the other hand, the limited number of events for some causes of death implies that different types of diseases have to be considered together.

Taken together, group (1), (2), and (3) partially reflect the shift from infectious diseases to man-made diseases that has been mentioned in the section above. Indeed when looking at the descriptive tables 1.1 and 1.2 the first group represents the larger share of identified diseases in the first period, but it turns into the smallest in the last period. Vice versa for group (2) and (3) which sharply increases and accounts for 50-60% of the deaths in the last two periods for both men and women.

Method

To estimate the differences in cause specific mortality by social class and how they have developed through time, we use a competing risks regression framework. More specifically, we use a cause specific hazard model. Such method estimates the effect of covariates on the mortality rate from a specific cause for those individuals who are currently still alive (event-free). Each model represents a separate Cox regression in which the event (failure) corresponds to a specific cause of death. Individuals who die from a different cause are treated as right censored.

The cause specific hazard λ_k (*k* represents the cause of death under study) at time *t* is a function of a baseline hazard λ_{0k} and of a set of covariates X.

$$\lambda_k(age) = \lambda_{0k}(age)\exp(\beta X)$$

The exponential of the regression coefficients will represent the relative change in cause specific mortality rate due to a one unit change in the independent variable (Austin & Fine, 2017). In other words, results can be interpreted as a rate ratio reporting the change in the rate of mortality from the disease of interest due to a change in a given covariate among subjects who are still alive.

The cause specific hazard model has been shown to be well suited for etiological studies (Austin, Lee, & Fine, 2016; Koller, Raatz, Steyerberg, & Wolbers, 2012; Lau, Cole, & Gange, 2009). Since we are interested in the effect of social class as a cause of mortality, we implement this type of method.

The analysis is carried out by period separately for men and women. In each model, we further control for birth year, civil status, migration status, and parish of residence.

Results

In table 1.1 and 1.2, we show the descriptive statistics of the analyzed sample by sex. Firstly, when looking at the social class categories, it is possible to notice the large societal changes that happened throughout the period under consideration: Sweden developed from an agricultural into a modern welfare society. The share of higher and lower managers increased from about 9% to about 50% and at the same time unskilled workers and farmers decreased from 27% and 24% in the first period to 4% and 1% for men in the last decades. The pattern in terms of social class and occupation for women is similar.

TABLE 1.1 HERE

Secondly, the parishes of residence have been grouped according to geographical neighborhood. Since 1922, the industrial city Landskrona is included in the sample and it incorporates the largest portion of individuals. Lastly, the migration indicator shows, particularly for the last two periods, how Sweden changed into a country of immigration with an increasing number of subjects born in another country.

TABLE 1.2 HERE

Table 2 and 3 report the estimations of the cause specific hazard models respectively for men and women representing social class mortality differentials with respect to the reference category (unskilled workers/farm workers).

For *all-cause mortality* results are similar to previous studies done for the same area (Bengtsson et al., 2018). Some discrepancies in the size and significance of the effect are due to a different period grouping, but the overall pattern stays the same. In the first period we do not find a clear pattern; only unskilled workers show a statistically significant higher mortality hazard than lower skilled workers. In the second period the gradient is somewhat reversed with lower managers and farmers having a 17% higher mortality hazard than lower skilled workers. In the last two period, after 1968, a clear social class gradient emerges and becomes even stronger in the last decades. While this holds for men, for women the social gradient is throughout the whole period and it increases in statistical significance as we approach more recent years. Higher and lower manager seem to be a consistently advantageous position with respect to lower skilled and unskilled workers.

TABLE 2 HERE

When turning to *infectious and parasitic diseases*, for the last period we find some evidence for lower hazards for higher social classes (HR=0.56, p=0.06 for higher managers and HR=0.53, p<0.01 for lower managers) compared to lower skilled. Such result is in line with previous findings: Erikson & Torssander (2008) found a similar pattern using data covering the whole country (we cannot directly compare the point estimates as the occupational categories and the reference group are different). Our results are also in line with another Swedish study that found an hazard ratio for white collar workers and employers between 0.75 and 0.81; however in they studied the period

1960-2004 and only mortality from influenza and pneumonia (Weires et al. 2008). In the earlier periods unskilled workers show the highest mortality risk while there seem to be no strong differences among the other social classes with the exception of farmers in the first half of 1900. Women do not show any clear significant effect of social class on infectious and parasitic mortality throughout the four periods. According to the coefficients, women with higher status have a lower mortality risk than the reference category, but the effect is only seldom statistically significant. While in the last period the coefficients would indicate a social gradient also found in the two studies mentioned above, in our analysis we do not have statistical significance; such discrepancy is likely to be due to a smaller sample size.

TABLE 3 HERE

Results for *circulatory diseases* for men show that in the last period there is a clear and significant gradient by social class. The effect increase from higher managers (HR=0.51, p<0.01) to unskilled workers (HR=1.29, p<0.01). For the period between 1968 and 1989 the picture is similar with more moderate effect. These results may indicate that the shift of men in higher social classes to a healthier lifestyle was on the way during the third period and that the differences further increased in the final decades. Other studies of the entire country for the same period show a comparable overall pattern (Kunst et al., 1998; Toch-Marquardt et al., 2014; Weires et al., 2008). By looking at the situation in the past, the gradient is significantly reversed, with effects being larger for the first period than for the years between 1922 and 1967. Higher and lower managers had a mortality hazard that was between two and three times as high as the one of lower skilled workers in the nineteenth century. Women display a similar outcome for the most recent period. The difference with respect to men is that already from 1922 women in the highest social class had a significantly lower risk of dying of women in lower strata.

Lastly, we present the results for death related to *external causes* such as accidents, violence, and suicides. In the last period the difference between the highest and the lowest social class is particularly evident, but generally a clear social gradient is present throughout the whole time span of the analysis. Kunst et al. (1998) found that for men between 45 and 59 years old, in the 1980s manual classes had almost 80% higher mortality from external causes with respect to non-manual classes (similar pattern was also documented for the early 2000s by Toch-Marquardt et al. (2014)).

For the earliest period, the number of events was too small for a meaningful analysis. For women we do not find any effect of social class on mortality from external causes with the exception of unskilled workers after 1968 who present a significant mortality disadvantage. Interestingly for this cause of death group is the large protective effect of being married for men and the higher hazard for leaving in a more urban area (Landskrona) in the first half of 1900. These findings are in line with the fact that single men living in cities had a remarkable health disadvantage from poor living conditions to a substantial alcohol consumption (Sundin & Willner, 2007).

Conclusion

In this paper, we analyzed how cause specific mortality inequalities by social class for a regional population in the south of Sweden developed in the last two hundred years.

Firstly, our results suggest that the socioeconomic gradient in all-cause mortality that we see today across different settings has not been there the entire time. Only in the last fifty years higher social classes showed a clear advantage with respect to lower social groups. Such pattern is clearer for men than for women. In the first period of our analysis, the gradient for men is reversed and this is in line with previous findings (Dribe & Eriksson, 2018; Edvinsson & Broström, 2017).

Secondly, our analysis highlights that whether the social gradient is present and more or less strong, depends on the cause of death under study. Furthermore, the effect of socioeconomic status on mortality developed through time differently depending on the disease group under consideration. Even if with a varying degree of significance, for infectious and parasitic diseases and for external causes the gradient is present in all periods; for respiratory diseases it is a recent phenomenon similarly to circulatory diseases which present a unique reverse gradient in the past.

Housing quality could explain the higher mortality, for both men and women, among lower social strata, especially for the earlier periods. A possible explanations for the trends in circulatory and respiratory mortality is related to behavioral and life style differences that characterized the different social classes and that sharply changed throughout the period. A healthy diet, smoking, and drinking are often referred, in the literature, for being potential causes of the gradient that we see today, as unhealthy habits are more common in lower social classes (Elo, 2009; M. Marmot, 2005). The same logic can be applied to historical societies. The difference is that the unhealthy behavior such as a heavy diet, tobacco smoking, and inactive lifestyle were more common among the well-off in the higher social classes (Dribe & Eriksson, 2018). Similarly, Razzell and Spence

(2006) focused on behavioral characteristics to explain health differences among social classes in pre twentieth century England. Moreover, men were more exposed to these risks than women (Edvinsson & Lindkvist, 2011) and this could explain the gender differences that we find in mortality from circulatory and respiratory diseases, and lung cancer.

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TABLE 1.1: Descriptive statistics for men

	1813-1921	1922-1967	1968-1989	1990-2015
SES (%)				
Higher managers/professionals	2.4	8	7.8	11
Lower managers/professionals/clerical	6.2	20.4	38.3	38.9
Foremen and medium skilled workers	10	26.7	20.5	15.1
Lower skilled workers/farm workers	26	24.1	24	22.7
Unskilled workers/farm workers	27.5	15.5	3.8	3.9
Farmers and fishermen	24.2	4.5	3	1.4
NA	3.7	0.8	2.6	7.1
OCCUPATION (%)				
Non-manual	8.7	28.4	46.1	49.9
Manual	87.7	70.8	51.2	43
NA	3.7	0.8	2.6	7.1
CIVIL STATUS (%)				
Never married	16.1	19.0	13.7	22.8
Currently married	73.4	75.0	73.1	57.8
Previously married	10.4	6.0	13.3	19.4
MIGRANT (%)				
Residing in county of birth	80.1	75.1	66.1	60.9
Residing outside county of birth	8.4	20.2	21.3	19.8
Born outside Sweden	1.1	4.4	12.6	18.8
NA	10.3	0.3	0.1	0.4
PARISH OF RESIDENCE (%)				
Hög, Kävlinge	28.4	12.6	11.2	14.7
Halmstad, Sireköpinge, Kågeröd	71.6	11.7	6.6	6.2
Landskrona		75.8	82.2	79.1
COHORT (mean)				
Birth year	1826.837	1897.585	1926.057	1948.827
CAUSE OF DEATH (n)				
Infectious and parasitic	296	500	158	233
Circulatory system	96	1843	2485	2609
Respiratory system and lung cancer	137	205	390	719
Other cancers	49	794	906	1333
External causes	81	394	364	311
Old age	273	185	12	16
Other/unknown/undefined	1058	731	471	1118
CAUSE OF DEATH (%)				
Infectious and parasitic	14.9	10.7	3.3	3.7
Circulatory system	4.8	39.6	51.9	41.2
Respiratory system and lung cancer	6.9	4.4	8.1	11.3
Other cancers	2.5	17.1	18.9	21
External causes	4.1	8.5	7.6	4.9
Old age	13.7	4	0.3	0.3
Other/unknown/undefined	53.2	15.7	9.8	17.6
Time at risk (person-years)	97556.86	346439	274127.3	396729.4
Deaths	1990	4652	4786	6339

TABLE 1.2: Descriptive statistics for women

WOMEN	1813-1921	1922-1967	1968-1989	1990-2015
SES (%)				
Higher managers/professionals	2.4	7.6	7.6	9.5
Lower managers/professionals/clerical	5.3	23.4	39.8	41.9
Foremen and medium skilled workers	9.1	23.1	17.1	9.9
Lower skilled workers/farm workers	34.6	26.3	23.3	24.2
Unskilled workers/farm workers	23	12.3	6.4	7.3
Farmers and fishermen	20.4	3.9	2.6	1.2
NA	5.1	3.6	3.2	6
OCCUPATION (%)				
Non-manual	7.8	30.9	47.4	51.5
Manual	87.1	65.5	49.4	42.5
NA	5.1	3.6	3.2	6
CIVIL STATUS (%)				
Never married	17.9	23.3	9.1	15.0
Currently married	65.5	66.0	63.9	52.4
Previously married	16.7	10.7	27.0	32.6
MIGRANT (%)				
Residing in county of birth	82.6	73.4	67.2	61.1
Residing outside county of birth	7.7	22.2	21.4	19.9
Born outside Sweden	0.8	4.1	11.3	18.7
NA	8.8	0.2	0.0	0.3
PARISH OF RESIDENCE (%)				
Hög, Kävlinge	27.9	12.2	11.1	15.1
Halmstad, Sireköpinge, Kågeröd	72.1	10.3	5.8	5.6
Landskrona		77.4	83.1	79.3
COHORT (mean)				
Birth year	1826.9	1896.5	1924.0	1946.6
CAUSE OF DEATH (n)				
Infectious and parasitic	297	473	158	241
Circulatory system	99	1752	1820	2193
Respiratory system and lung cancer	113	142	180	508
Other cancers	88	867	920	1267
External causes	15	146	167	176
Old age	296	247	14	52
Other/unknown/undefined	1202	722	440	1091
CAUSE OF DEATH (%)				
Infectious and parasitic	14.1	10.9	4.3	4.4
Circulatory system	4.7	40.3	49.2	39.7
Respiratory system and lung cancer	5.4	3.3	4.9	9.2
Other cancers	4.2	19.9	24.9	22.9
External causes	0.7	3.4	4.5	3.2
Old age	14	5.7	0.4	0.9
Other/unknown/undefined	57	16.6	11.9	19.7
Time at risk (person-years)	102858.5	367915.2	291286.1	417111.5
Deaths	2110	4349	3699	5528

TABLE 2: Men, ages 30-90, 5 parishes + Landskrona, family social class

	All-cause mortality				Infectious and parasitic diseases				Circulatory diseases				Respiratory diseases and lung cancer				Other cancers				External causes				Other/unknown/ undefined causes			
	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015
Higher managers/professionals	1.085	1.082	0.600***	0.496***	0.978	0.996	0.413*	0.557*	3.364***	1.240**	0.690***	0.512***	1.605	0.677	0.347***	0.354***		1.414**	0.673**	0.656***		0.475***	0.315***	0.282***	1.088	0.945	0.565**	0.401***
	(0.583)	(0.217)	(0)	(0)	(0.958)	(0.986)	(0.0640)	(0.0566)	(0.00216)	(0.0254)	(3.88e-05)	(0)	(0.317)	(0.244)	(0.000316)	(2.81e-08)		(0.0185)	(0.0103)	(0.000152)		(0.00360)	(0.000151)	(0.000174)	(0.686)	(0.736)	(0.0164)	(8.63e-10)
Lower managers/professionals/clerical	0.815	1.176***	0.698***	0.561***	0.937	1.107	0.862	0.534***	1.978*	1.235***	0.727***	0.547***	0.207	1.198	0.581***	0.489***		1.322**	0.805**	0.612***		0.711**	0.405***	0.594***	0.732	1.210*	0.724**	0.576***
	(0.116)	(0.000316)	(0)	(0)	(0.837)	(0.493)	(0.512)	(0.000557)	(0.0624)	(0.00240)	(5.94e-09)	(0)	(0.120)	(0.365)	(8.74e-05)	(0)		(0.0119)	(0.0159)	(0)		(0.0280)	(3.95e-09)	(0.000957)	(0.119)	(0.0850)	(0.0143)	(0)
Foremen and medium skilled workers	0.864	0.971	0.926*	0.854***	1.195	0.991	1.141	0.962	1.214	0.972	0.905*	0.805***	0.866	0.940	0.979	0.864		1.101	0.924	0.833**		0.774*	0.806	1.082	0.823	0.922	1.013	0.888
	(0.127)	(0.494)	(0.0536)	(2.15e-05)	(0.445)	(0.949)	(0.552)	(0.835)	(0.580)	(0.675)	(0.0738)	(0.000151)	(0.711)	(0.757)	(0.872)	(0.170)		(0.373)	(0.403)	(0.0321)		(0.0641)	(0.122)	(0.625)	(0.166)	(0.452)	(0.921)	(0.178)
Farmers and fishermen	0.923	1.169**	0.739***	0.676***	1.223	1.578**	0.874	0.958	0.664	0.952	0.730***	0.654***	0.826	1.056	0.578*	0.337***		1.242	0.834	0.801		0.997	0.738	1.384	0.936	1.246	0.697	0.600***
	(0.202)	(0.0414)	(0.000254)	(1.53e-07)	(0.226)	(0.0457)	(0.744)	(0.890)	(0.225)	(0.703)	(0.00533)	(0.000117)	(0.400)	(0.884)	(0.0911)	(0.000480)		(0.232)	(0.316)	(0.161)		(0.993)	(0.367)	(0.324)	(0.451)	(0.260)	(0.217)	(0.00967)
Lower skilled workers/farm workers (ref)																												
Unskilled workers/farm workers	1.165**	1.052	1.123**	1.394***	1.346*	1.517***	1.487	1.370	0.827	0.920	1.014	1.289***	1.174	0.839	1.063	1.414**		1.300**	1.234	1.542***		0.969	1.204	1.512*	1.283***	0.872	1.460**	1.450***
	(0.0117)	(0.271)	(0.0356)	(6.58e-10)	(0.0715)	(0.00184)	(0.153)	(0.259)	(0.543)	(0.276)	(0.865)	(0.00304)	(0.489)	(0.457)	(0.764)	(0.0242)		(0.0218)	(0.110)	(0.000455)		(0.830)	(0.316)	(0.0640)	(0.00225)	(0.253)	(0.0141)	(0.00227)
NA	1.163	1.101	0.805	1.052	1.348	1.972**	0.855	1.364	1.061	0.762	0.713	0.799	1.126	0.587	0.952	1.137		0.780	0.701	1.196		0.390	0.766	1.304	1.159	1.563	1.164	1.193
	(0.237)	(0.487)	(0.123)	(0.502)	(0.351)	(0.0238)	(0.835)	(0.386)	(0.915)	(0.321)	(0.138)	(0.103)	(0.787)	(0.600)	(0.917)	(0.523)		(0.587)	(0.332)	(0.312)		(0.188)	(0.415)	(0.294)	(0.423)	(0.114)	(0.670)	(0.257)
Birth year	0.991***	0.990***	0.994**	0.983***	0.992***	0.963***	1.050***	0.974***	1.013***	1.005**	0.996	0.958***	0.968***	1.020***	1.005	0.982***		0.991***	0.994	0.987***		1.002	0.975***	0.993	0.989***	0.978***	0.972***	1.040***
	(0)	(0)	(0.0116)	(0)	(0.000305)	(0)	(0.000361)	(0.00399)	(0.00608)	(0.0138)	(0.175)	(0)	(0)	(0.00172)	(0.511)	(0.000208)		(0.00425)	(0.296)	(0.000281)		(0.674)	(0.00315)	(0.368)	(0)	(0)	(0.000153)	(0)
Residing outside county of birth	0.969	0.971	1.056	1.030	1.266	1.071	1.143	1.024	1.814**	0.886**	1.006	1.036	1.374	1.139	0.881	1.044		0.962	1.014	1.100		1.375***	1.609***	1.018	0.760*	0.960	1.151	0.932
	(0.744)	(0.435)	(0.138)	(0.343)	(0.273)	(0.542)	(0.507)	(0.886)	(0.0478)	(0.0438)	(0.914)	(0.470)	(0.394)	(0.446)	(0.352)	(0.655)		(0.666)	(0.874)	(0.153)		(0.00682)	(9.15e-05)	(0.904)	(0.0562)	(0.666)	(0.217)	(0.369)
Born outside Sweden	0.960	0.713***	0.960	1.052	0	0.652	1.558	1.314	0.837	0.654***	0.865	1.078	0	0.715	0.999	1.283**		0.751	1.139	0.849*		1.060	0.974	0.740*	0.988	0.869	0.895	1.156
	(0.904)	(0.000202)	(0.520)	(0.205)		(0.150)	(0.177)	(0.186)	(0.862)	(0.00476)	(0.138)	(0.248)		(0.427)	(0.998)	(0.0219)		(0.202)	(0.349)	(0.0835)		(0.812)	(0.884)	(0.0975)	(0.982)	(0.505)	(0.592)	(0.105)
NA	1.080	1.259	5.122***	1.098	1.325*	0.950	22.45***	0	0.926	1.035	6.738***	2.264	1.207	1.276	0	0		1.906*	0	2.865		0	10.69***	0	1.026	1.104	4.589	0.574
	(0.232)	(0.174)	(8.90e-08)	(0.854)	(0.0925)	(0.920)	(0.00258)		(0.834)	(0.914)	(7.10e-07)	(0.418)	(0.373)	(0.810)				(0.0583)		(0.149)		(1.000)	(0.00102)		(0.775)	(0.827)	(0.132)	(0.584)
Currently married	0.724***	0.742***	0.696***	0.693***	0.802	0.519***	0.466***	0.438***	0.462***	0.883*	0.807***	0.662***	1.707	1.255	1.047	0.807*		1.098	0.985	1.182*		0.336***	0.330***	0.413***	0.676***	0.626***	0.372***	0.555***
	(2.06e-05)	(0)	(0)	(0)	(0.219)	(3.43e-09)	(0.000905)	(3.46e-05)	(0.00706)	(0.0614)	(0.00135)	(1.48e-10)	(0.140)	(0.289)	(0.795)	(0.0853)		(0.368)	(0.895)	(0.0973)		(0)	(0)	(1.18e-08)	(0.000126)	(5.99e-07)	(0)	(9.01e-11)
Previously married	1.003	1.088*	0.831***	0.844***	1.204	1.084	0.610**	0.676**	0.636	1.204**	0.901	0.823***	2.284**	1.291	1.060	0.986		1.317**	0.930	1.085		0.995	0.714**	0.831	0.930	0.848	0.710**	0.753***
	(0.973)	(0.0759)	(0.000221)	(4.49e-05)	(0.408)	(0.554)	(0.0434)	(0.0481)	(0.201)	(0.0149)	(0.153)	(0.00299)	(0.0409)	(0.327)	(0.767)	(0.913)		(0.0297)	(0.574)	(0.441)		(0.975)	(0.0256)	(0.232)	(0.526)	(0.178)	(0.0119)	(0.00222)
Halmstad, Sireköpinge, Kågeröd	0.951	0.886*	0.876*	0.918	0.878	0.677**	1.270	2.158**	0.429***	0.928	0.931	0.891	0.351***	0.621	0.713	0.870		0.880	0.982	0.810		0.800	0.513**	1.003	1.555***	0.995	0.745	0.952
	(0.352)	(0.0510)	(0.0706)	(0.173)	(0.338)	(0.0357)	(0.514)	(0.0110)	(7.23e-05)	(0.458)	(0.474)	(0.248)	(2.82e-08)	(0.107)	(0.236)	(0.471)		(0.375)	(0.910)	(0.121)		(0.395)	(0.0254)	(0.991)	(4.00e-07)	(0.976)	(0.227)	(0.733)
Landskrona		1.540***	1.081	1.070*		1.694***	1.100	1.646**		1.551***	1.101	1.140**		0.947	1.185	1.044		1.249**	1.002	0.937		1.787***	0.959	1.127		2.026***	1.097	0.997
		(0)	(0.102)	(0.0625)		(0.000327)	(0.721)	(0.0286)		(1.03e-08)	(0.149)	(0.0245)		(0.787)	(0.318)	(0.690)		(0.0448)	(0.988)	(0.396)		(0.00158)	(0.799)	(0.476)		(6.47e-08)	(0.550)	(0.972)
N of subjects	8024	25445	24369	34626	8024	25445	24369	34626	8024	25445	24369	34626	8024	25445	24369	34626		25445	24369	34626		25445	24369	34626	8024	25445	24369	34626
N of failures	1990	4652	4786	6339	296	500	158	233	96	1843	2485	2609	137	205	390	719		794	906	1333		394	364	311	1058	731	471	1118
Time at risk (person-years)	97557	346439	274127	396729	97557	346439	274127	396729	97557	346439	274127	396729	97557	346439	274127	396729		346439	274127	396729		346439	274127	396729	97557	346439	274127	396729

TABLE 3: Women, ages 30-90, 5 parishes + Landskrona, family social class

	All-cause mortality				Infectious and parasitic diseases				Circulatory diseases			
	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015
Higher managers/professionals	0.861	0.844**	0.583***	0.459***	0.827	1.063	0.933	0.521	1.901	0.796*	0.612***	0.582***
	(0.351)	(0.0298)	(8.88e-11)	(0)	(0.682)	(0.783)	(0.843)	(0.103)	(0.193)	(0.0780)	(3.53e-05)	(9.23e-06)
Lower managers/professionals/clerical	0.801*	0.927*	0.666***	0.667***	1.172	0.747*	0.592**	0.735*	1.542	1.001	0.671***	0.684***
	(0.0960)	(0.0951)	(0)	(0)	(0.597)	(0.0531)	(0.0276)	(0.0621)	(0.316)	(0.984)	(1.63e-09)	(0)
Foremen and medium skilled workers	0.878	0.969	0.714***	0.832***	0.895	1.066	0.765	0.780	1.820*	1.002	0.773***	0.871*
	(0.186)	(0.482)	(0)	(0.000101)	(0.670)	(0.635)	(0.282)	(0.281)	(0.0681)	(0.977)	(0.000301)	(0.0579)
Farmers and fishermen	0.917	0.985	0.597***	0.596***	1.156	1.208	0.615	0.256*	1.301	1.306**	0.789	0.662***
	(0.184)	(0.847)	(1.41e-05)	(7.19e-07)	(0.376)	(0.375)	(0.323)	(0.0579)	(0.390)	(0.0250)	(0.128)	(0.00699)
Lower skilled/farm workers (ref)												
Unskilled workers/farm workers	0.959	1.071	1.359***	1.301***	1.027	1.228	1.544*	1.043	0.905	1.068	1.289***	1.168**
	(0.468)	(0.156)	(3.07e-10)	(1.03e-10)	(0.867)	(0.146)	(0.0516)	(0.831)	(0.748)	(0.393)	(0.000210)	(0.0164)
NA	1.185	1.090	0.836*	1.202***	1.198	0.944	0.782	1.705*	2.173*	1.056	0.890	1.266**
	(0.109)	(0.193)	(0.0756)	(0.00792)	(0.517)	(0.783)	(0.640)	(0.0835)	(0.0803)	(0.604)	(0.417)	(0.0294)
Birth year	0.991***	0.986***	0.981***	0.994***	0.989***	0.963***	1.010	0.980**	1.029***	0.993***	0.976***	0.966***
	(0)	(0)	(0)	(0.00213)	(2.39e-07)	(0)	(0.422)	(0.0258)	(7.49e-08)	(0.000644)	(1.47e-10)	(0)
Residing outside county of birth	0.911	0.895***	1.001	1.003	0.883	0.964	0.927	0.967	1.081	0.898*	0.961	0.990
	(0.383)	(0.00356)	(0.980)	(0.932)	(0.657)	(0.745)	(0.711)	(0.837)	(0.837)	(0.0717)	(0.497)	(0.859)
Born outside Sweden	0.619	0.930	1.116	1.113**	0.664	0.544	0.835	0.729	1.035	1.001	1.101	1.194**
	(0.285)	(0.452)	(0.128)	(0.0157)	(0.684)	(0.113)	(0.674)	(0.229)	(0.973)	(0.996)	(0.395)	(0.0163)
NA	1.312***	1.103	4.682***	1.657	1.605***	0.811	0	0	0.968	0.804	2.485	10.61***
	(3.87e-05)	(0.610)	(0.00227)	(0.386)	(0.00336)	(0.719)			(0.940)	(0.540)	(0.365)	(0.00108)
Currently married	0.992	0.860***	0.941	0.782***	1.073	0.855	0.861	0.384***	1.023	0.868**	1.048	0.797**
	(0.914)	(0.000222)	(0.277)	(7.85e-06)	(0.704)	(0.204)	(0.588)	(0.000182)	(0.944)	(0.0301)	(0.564)	(0.0140)
Previously married	1.103	1.060	0.887**	0.819***	1.198	0.995	0.861	0.591***	1.135	1.024	0.992	0.909
	(0.190)	(0.167)	(0.0172)	(9.86e-05)	(0.402)	(0.970)	(0.513)	(0.00986)	(0.711)	(0.716)	(0.906)	(0.247)
Halmstad, Sireköpinge, Kågeröd	1.065	1.073	1.015	0.948	1.164	1.205	1.560	0.725	0.744	1.057	0.962	0.983
	(0.246)	(0.250)	(0.865)	(0.452)	(0.302)	(0.280)	(0.175)	(0.365)	(0.171)	(0.573)	(0.752)	(0.878)
Landskrona		1.270***	1.069	1.021		1.290*	0.805	0.896		1.383***	1.131	1.094
		(7.92e-07)	(0.217)	(0.590)		(0.0841)	(0.375)	(0.530)		(3.25e-05)	(0.118)	(0.152)
N of subjects	8035	24314	23252	33351	8035	24314	23252	33351	8035	24314	23252	33351
N of failures	2110	4349	3699	5528	297	473	158	241	99	1752	1820	2193
Time at risk (person-years)	102859	367915	291286	417112	102859	367915	291286	417112	102859	367915	291286	417112

	Respiratory diseases and lung cancer			Other cancers			Extarnal causes			Other/unknown/undefined causes			
	1922-1967	1968-1989	1990-2015	1922-1967	1968-1989	1990-2015	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015
Higher managers/professionals	0.395*	0.482*	0.229***	0.816	0.471***	0.381***	1.162	0.913	0.623	0.586**	0.913	0.540**	0.423***
	(0.0752)	(0.0539)	(3.16e-06)	(0.219)	(1.93e-05)	(1.33e-09)	(0.678)	(0.782)	(0.225)	(0.0368)	(0.611)	(0.0124)	(4.95e-06)
Lower managers/professionals/clerical	0.789	0.581***	0.627***	0.981	0.685***	0.658***	0.919	0.619**	0.638**	0.763	0.818*	0.647***	0.655***
	(0.306)	(0.00610)	(4.72e-05)	(0.848)	(1.39e-05)	(6.98e-09)	(0.739)	(0.0275)	(0.0341)	(0.137)	(0.0788)	(0.000910)	(2.06e-07)
Foremen and medium skilled workers	0.796	0.684*	0.763*	1.018	0.604***	0.640***	1.017	0.671	1.224	0.670***	0.827*	0.717**	1.004
	(0.329)	(0.0927)	(0.0963)	(0.853)	(2.76e-06)	(2.37e-05)	(0.948)	(0.122)	(0.423)	(0.00649)	(0.0944)	(0.0232)	(0.972)
Farmers and fishermen	0.353*	0.148*	0.567	0.683*	0.375***	0.573**	0.887	0.577	1.173	0.840**	0.691*	0.562	0.518**
	(0.0939)	(0.0600)	(0.147)	(0.0895)	(0.000469)	(0.0107)	(0.832)	(0.369)	(0.765)	(0.0427)	(0.0909)	(0.105)	(0.0111)
Lower skilled/farm workers (ref)													
Unskilled workers/farm workers	0.516**	1.061	1.543***	0.939	1.590***	1.358***	1.215	1.646**	1.913***	0.882*	1.224*	1.271*	1.476***
	(0.0298)	(0.800)	(0.000803)	(0.582)	(3.45e-06)	(0.000615)	(0.469)	(0.0349)	(0.00284)	(0.0885)	(0.0706)	(0.0940)	(1.56e-05)
NA	1.001	0.428	0.616*	1.283*	0.730	1.035	1.841*	1.291	0.776	1.010	1.276	0.867	1.637***
	(0.997)	(0.107)	(0.0966)	(0.0963)	(0.145)	(0.823)	(0.0674)	(0.489)	(0.526)	(0.945)	(0.122)	(0.606)	(0.000499)
Birth year	1.004	1.033***	1.022***	0.997	0.985***	0.987***	1.006	0.974**	1.001	0.989***	0.982***	0.967***	1.049***
	(0.605)	(0.00841)	(0.000423)	(0.241)	(0.00389)	(0.000684)	(0.438)	(0.0313)	(0.931)	(0)	(2.06e-08)	(7.37e-06)	(0)
Residing outside county of birth	0.872	1.328	1.022	0.873	1.038	0.905	1.066	1.142	1.203	0.820	0.870	0.963	1.147*
	(0.512)	(0.115)	(0.847)	(0.110)	(0.648)	(0.176)	(0.749)	(0.484)	(0.339)	(0.188)	(0.137)	(0.757)	(0.0701)
Born outside Sweden	0.729	1.805**	0.984	0.850	0.953	0.964	1.677	1.148	1.713**	0.756	0.998	1.378*	1.248**
	(0.592)	(0.0202)	(0.909)	(0.438)	(0.733)	(0.691)	(0.164)	(0.616)	(0.0103)	(0.629)	(0.992)	(0.0983)	(0.0198)
NA	0	0	0	1.552	9.575***	0	2.081	14.11**	0	1.437***	2.239**	0	1.411
				(0.332)	(0.00184)	(1.000)	(0.471)	(0.0110)	(1.000)	(1.70e-05)	(0.0184)	(1.000)	(0.734)
Currently married	0.751	0.901	0.827	0.873	0.903	1.072	0.732	0.679	0.541**	1.009	0.972	0.763*	0.650***
	(0.213)	(0.700)	(0.318)	(0.122)	(0.344)	(0.540)	(0.164)	(0.139)	(0.0219)	(0.927)	(0.782)	(0.0795)	(0.000345)
Previously married	1.411	1.018	1.088	1.111	0.709***	0.797**	1.042	1.033	0.751	1.232**	1.173	0.746**	0.707***
	(0.123)	(0.944)	(0.645)	(0.295)	(0.00116)	(0.0436)	(0.863)	(0.897)	(0.259)	(0.0355)	(0.139)	(0.0336)	(0.00184)
Halmstad, Sireköpinge, Kågeröd	0.985	0.904	0.934	0.756*	1.014	0.934	0.778	1.101	1.392	1.612***	1.189	0.979	0.967
	(0.967)	(0.811)	(0.776)	(0.0638)	(0.934)	(0.634)	(0.516)	(0.813)	(0.397)	(4.75e-09)	(0.261)	(0.931)	(0.828)
Landskrona	1.113	1.066	1.090	1.026	1.029	0.955	1.290	1.074	1.364		1.392***	1.007	0.934
	(0.681)	(0.795)	(0.491)	(0.800)	(0.791)	(0.552)	(0.342)	(0.782)	(0.196)		(0.00726)	(0.964)	(0.409)
N of subjects	24314	23252	33351	24314	23252	33351	24314	23252	33351	8035	24314	23252	33351
N of failures	142	180	508	867	920	1267	146	167	176	1202	722	440	1091
Time at risk (person-years)	367915	291286	417112	367915	291286	417112	367915	291286	417112	102859	367915	291286	417112

TABLE 4: Men, ages 30-90, 5 parishes + Landskrona, Manual vs Non-manual

	All-cause mortality				Infectious and parasitic diseases				Circulatory diseases				Respiratory diseases and lung cancer				Other cancers				External causes				Other/unknown/undefined causes			
	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015
Non manual (ref)																												
Manual	1.110	0.877***	1.423***	1.722***	1.252	1.069	1.436**	1.872***	0.372***	0.784***	1.315***	1.694***	1.286	0.896	1.805***	2.001***		0.831**	1.255***	1.540***	1.681	1.402***	2.381***	2.047***	1.214	0.833**	1.505***	1.771***
	(0.281)	(9.53e-05)	(0)	(0)	(0.364)	(0.547)	(0.0485)	(3.25e-05)	(0.000137)	(2.93e-06)	(7.24e-10)	(0)	(0.552)	(0.483)	(3.64e-07)	(0)		(0.0202)	(0.00174)	(0)	(0.269)	(0.00690)	(5.46e-11)	(8.13e-08)	(0.175)	(0.0301)	(0.000143)	(0)
NA	1.256	0.943	1.170	1.850***	1.399	1.728*	1.096	2.500**	0.440	0.621*	0.981	1.425**	1.470	0.559	1.752	2.329***		0.565	0.888	1.865***	3.417**	0.594	1.929*	2.461***	1.303	1.369	1.648	2.115***
	(0.134)	(0.673)	(0.265)	(0)	(0.376)	(0.0692)	(0.903)	(0.0124)	(0.142)	(0.0815)	(0.933)	(0.0111)	(0.511)	(0.566)	(0.235)	(3.87e-05)		(0.210)	(0.745)	(0.000461)	(0.0476)	(0.469)	(0.0525)	(0.000593)	(0.235)	(0.265)	(0.164)	(2.34e-06)
Birth year	0.991***	0.990***	0.994***	0.984***	0.992***	0.962***	1.049***	0.975***	1.013***	1.005**	0.995	0.959***	0.968***	1.021***	1.005	0.982***		0.991***	0.994	0.987***	1.006	1.001	0.975***	0.993	0.989***	0.978***	0.971***	1.041***
	(0)	(0)	(0.00712)	(0)	(0.000375)	(0)	(0.000423)	(0.00441)	(0.00415)	(0.0104)	(0.159)	(0)	(0)	(0.00145)	(0.521)	(0.000388)		(0.00206)	(0.254)	(0.000547)	(0.200)	(0.744)	(0.00257)	(0.335)	(0)	(0)	(6.69e-05)	(0)
Residing outside county of birth	0.988	0.964	1.054	1.030	1.277	1.059	1.114	1.020	1.808**	0.885**	1.008	1.043	1.392	1.104	0.872	1.047		0.967	1.007	1.105	2.121**	1.348**	1.616***	0.984	0.779*	0.939	1.145	0.922
	(0.895)	(0.317)	(0.151)	(0.340)	(0.254)	(0.606)	(0.592)	(0.905)	(0.0481)	(0.0412)	(0.874)	(0.388)	(0.374)	(0.558)	(0.312)	(0.633)		(0.709)	(0.930)	(0.132)	(0.0261)	(0.0110)	(7.42e-05)	(0.910)	(0.0821)	(0.503)	(0.233)	(0.302)
Born outside Sweden	0.926	0.704***	0.963	1.076*	0	0.613*	1.511	1.320	0.838	0.658***	0.872	1.105	0	0.710	1.001	1.331***		0.738	1.136	0.867	2.635	1.033	0.984	0.738*	0.923	0.859	0.892	1.183*
	(0.818)	(0.000111)	(0.551)	(0.0680)		(0.0984)	(0.207)	(0.178)	(0.863)	(0.00542)	(0.160)	(0.124)		(0.416)	(0.998)	(0.00827)		(0.175)	(0.356)	(0.130)	(0.187)	(0.893)	(0.931)	(0.0922)	(0.874)	(0.472)	(0.578)	(0.0578)
NA	1.088	1.254	5.100***	1.124	1.302	0.938	23.57***	0	0.945	1.039	6.681***	2.316	1.227	1.278	0	0		1.891*	0	2.942	2.001**	0	10.45***	0	1.029	1.099	4.596	0.590
	(0.188)	(0.181)	(9.55e-08)	(0.818)	(0.114)	(0.899)	(0.00226)		(0.877)	(0.904)	(7.85e-07)	(0.406)	(0.331)	(0.808)				(0.0612)		(0.139)	(0.0275)		(0.00113)		(0.743)	(0.835)	(0.132)	(0.602)
Currently married	0.668***	0.741***	0.675***	0.650***	0.756	0.496***	0.445***	0.421***	0.458***	0.891*	0.791***	0.618***	1.499	1.283	1.027	0.744**		1.073	0.943	1.095	0.662	0.329***	0.312***	0.405***	0.597***	0.642***	0.351***	0.522***
	(3.86e-08)	(0)	(0)	(0)	(0.105)	(1.43e-10)	(0.000334)	(9.90e-06)	(0.00536)	(0.0771)	(0.000351)	(0)	(0.250)	(0.239)	(0.879)	(0.0151)		(0.493)	(0.599)	(0.363)	(0.196)	(0)	(0)	(3.86e-09)	(1.62e-07)	(1.65e-06)	(0)	(0)
Previously married	0.947	1.086*	0.819***	0.814***	1.158	1.041	0.595**	0.659**	0.614	1.213**	0.894	0.791***	2.084*	1.323	1.060	0.946		1.287**	0.910	1.034	1.350	0.987	0.697**	0.822	0.850	0.867	0.687***	0.730***
	(0.517)	(0.0793)	(6.54e-05)	(6.39e-07)	(0.511)	(0.767)	(0.0323)	(0.0338)	(0.166)	(0.0107)	(0.123)	(0.000319)	(0.0664)	(0.281)	(0.767)	(0.662)		(0.0451)	(0.460)	(0.751)	(0.456)	(0.937)	(0.0162)	(0.206)	(0.151)	(0.240)	(0.00556)	(0.000651)
Halmstad, Sireköpinge, Kågeröd	0.981	0.920	0.824***	0.874**	0.903	0.768	1.189	2.125**	0.420***	0.913	0.875	0.847*	0.359***	0.621*	0.639	0.785		0.934	0.945	0.790*	0.550**	0.814	0.492**	1.019	1.630***	1.028	0.681	0.893
	(0.719)	(0.165)	(0.00647)	(0.0298)	(0.450)	(0.146)	(0.627)	(0.0119)	(3.77e-05)	(0.352)	(0.174)	(0.0930)	(3.78e-08)	(0.0914)	(0.110)	(0.208)		(0.624)	(0.717)	(0.0797)	(0.0106)	(0.417)	(0.0157)	(0.944)	(1.46e-08)	(0.864)	(0.108)	(0.429)
Landskrona		1.517***	1.091*	1.072*		1.674***	1.130	1.652**		1.546***	1.109	1.141**		0.925	1.202	1.052		1.255**	1.007	0.938		1.739***	0.953	1.122		1.944***	1.128	0.998
		(0)	(0.0661)	(0.0562)		(0.000340)	(0.648)	(0.0269)		(8.19e-09)	(0.120)	(0.0230)		(0.691)	(0.279)	(0.639)		(0.0370)	(0.949)	(0.404)		(0.00231)	(0.767)	(0.494)		(2.29e-07)	(0.432)	(0.979)
N of subjects	8024	25445	24369	34626	8024	25445	24369	34626	8024	25445	24369	34626	8024	25445	24369	34626		25445	24369	34626	8024	25445	24369	34626	8024	25445	24369	34626
N of failures	1990	4652	4786	6339	296	500	158	233	96	1843	2485	2609	137	205	390	719		794	906	1333	81	394	364	311	1058	731	471	1118
Time at risk (person-years)	97557	346439	274127	396729	97557	346439	274127	396729	97557	346439	274127	396729	97557	346439	274127	396729		346439	274127	396729	97557	346439	274127	396729	97557	346439	274127	396729

TABLE 4: Women, ages 30-90, 5 parishes + Landskrona, Manual vs Non-manual

	All-cause mortality				Infectious and parasitic diseases				Circulatory diseases				Respiratory diseases and lung cancer				Other cancers				External causes				Other/undefined/unknown causes of death			
VARIABLES	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015	1813-1921	1922-1967	1968-1989	1990-2015
Non manual (ref)																												
Manual	1.161	1.104***	1.459***	1.554***	0.985	1.334**	1.540**	1.301*	0.697	1.070	1.477***	1.468***		1.131	1.537**	1.777***		1.038	1.403***	1.503***		1.077	1.440**	1.932***	1.291*	1.168*	1.489***	1.709***
	(0.145)	(0.00688)	(0)	(0)	(0.952)	(0.0149)	(0.0246)	(0.0666)	(0.255)	(0.240)	(0)	(0)		(0.540)	(0.0111)	(6.16e-09)		(0.633)	(3.99e-06)	(0)		(0.703)	(0.0380)	(0.000157)	(0.0843)	(0.0886)	(0.000313)	(0)
NA	1.421**	1.195***	1.257**	1.848***	1.155	1.184	1.174	2.374***	1.318	1.104	1.332**	1.869***		1.372	0.733	1.044		1.346**	1.077	1.618***		1.900*	1.840	1.199	1.414*	1.504**	1.350	2.568***
	(0.0131)	(0.00798)	(0.0248)	(0)	(0.686)	(0.435)	(0.763)	(0.00574)	(0.579)	(0.347)	(0.0479)	(1.34e-08)		(0.392)	(0.561)	(0.883)		(0.0480)	(0.733)	(0.00184)		(0.0548)	(0.103)	(0.654)	(0.0891)	(0.0115)	(0.285)	(5.98e-11)
Birth year	0.991***	0.986***	0.982***	0.995***	0.989***	0.963***	1.011	0.980**	1.031***	0.992***	0.977***	0.967***		1.005	1.034***	1.022***		0.997	0.985***	0.988***		1.006	0.974**	1.001	0.989***	0.982***	0.967***	1.050***
	(0)	(0)	(0)	(0.00555)	(1.17e-07)	(0)	(0.415)	(0.0294)	(1.54e-08)	(0.000420)	(3.88e-10)	(0)		(0.527)	(0.00749)	(0.000295)		(0.263)	(0.00474)	(0.00142)		(0.451)	(0.0347)	(0.926)	(0)	(8.65e-09)	(9.97e-06)	(0)
Residing outside county of birth	0.914	0.896***	0.992	0.993	0.871	0.975	0.942	0.965	1.058	0.892*	0.954	0.987		0.856	1.319	0.992		0.873	1.016	0.889		1.080	1.158	1.193	0.825	0.881	0.954	1.140*
	(0.402)	(0.00358)	(0.850)	(0.845)	(0.620)	(0.821)	(0.770)	(0.825)	(0.881)	(0.0540)	(0.420)	(0.813)		(0.459)	(0.122)	(0.943)		(0.110)	(0.850)	(0.108)		(0.697)	(0.438)	(0.359)	(0.204)	(0.176)	(0.702)	(0.0844)
Born outside Sweden	0.613	0.925	1.114	1.120**	0.669	0.556	0.864	0.735	1.080	0.977	1.096	1.199**		0.696	1.819**	0.992		0.849	0.953	0.973		1.714	1.173	1.742***	0.738	1.010	1.373	1.266**
	(0.275)	(0.421)	(0.134)	(0.0103)	(0.689)	(0.125)	(0.732)	(0.241)	(0.940)	(0.881)	(0.417)	(0.0137)		(0.537)	(0.0184)	(0.953)		(0.434)	(0.732)	(0.762)		(0.146)	(0.560)	(0.00790)	(0.600)	(0.963)	(0.101)	(0.0129)
NA	1.308***	1.116	3.683***	1.672	1.600***	0.823	0	0	0.955	0.822	2.157	10.32***		0	0	0		1.508	6.551***	0		2.095	12.40**	0	1.419***	2.324**	0	1.442
	(4.49e-05)	(0.566)	(0.00954)	(0.378)	(0.00359)	(0.739)		(1.000)	(0.915)	(0.583)	(0.444)	(0.00122)						(0.364)	(0.00866)			(0.467)	(0.0146)	(1.000)	(3.19e-05)	(0.0136)	(1.000)	(0.718)
Currently married	0.968	0.857***	0.876**	0.744***	1.114	0.886	0.802	0.363***	1.072	0.878**	0.996	0.772***		0.694	0.829	0.748		0.857*	0.813*	0.984		0.737	0.624*	0.528**	0.955	0.952	0.710**	0.621***
	(0.633)	(0.000128)	(0.0167)	(6.29e-08)	(0.545)	(0.314)	(0.421)	(7.03e-05)	(0.822)	(0.0424)	(0.956)	(0.00494)		(0.109)	(0.483)	(0.125)		(0.0752)	(0.0532)	(0.886)		(0.168)	(0.0688)	(0.0161)	(0.615)	(0.620)	(0.0255)	(6.67e-05)
Previously married	1.088	1.062	0.922	0.849***	1.223	1.024	0.898	0.602**	1.087	1.036	1.022	0.931		1.322	1.033	1.141		1.093	0.764**	0.840		1.053	1.093	0.782	1.178*	1.175	0.768*	0.732***
	(0.248)	(0.150)	(0.104)	(0.00138)	(0.335)	(0.858)	(0.634)	(0.0123)	(0.801)	(0.576)	(0.752)	(0.386)		(0.211)	(0.899)	(0.471)		(0.376)	(0.0101)	(0.117)		(0.826)	(0.717)	(0.330)	(0.0884)	(0.133)	(0.0539)	(0.00487)
Halmstad, Sireköpinge, Kågeröd	1.067	1.074	0.928	0.904	1.169	1.248	1.438	0.671	0.709	1.101	0.914	0.947		0.863	0.753	0.874		0.708**	0.887	0.888		0.772	1.023	1.371	1.611***	1.159	0.894	0.905
	(0.228)	(0.233)	(0.371)	(0.149)	(0.284)	(0.192)	(0.259)	(0.260)	(0.106)	(0.315)	(0.452)	(0.629)		(0.675)	(0.502)	(0.573)		(0.0193)	(0.483)	(0.405)		(0.496)	(0.954)	(0.416)	(3.38e-09)	(0.330)	(0.636)	(0.510)
Landskrona		1.276***	1.075	1.028		1.298*	0.834	0.909		1.352***	1.132	1.105		1.124	1.069	1.075		1.049	1.030	0.944		1.322	1.085	1.376		1.446***	1.010	0.949
		(3.32e-07)	(0.180)	(0.477)		(0.0728)	(0.454)	(0.587)		(8.21e-05)	(0.112)	(0.112)		(0.651)	(0.784)	(0.563)		(0.639)	(0.780)	(0.461)		(0.291)	(0.752)	(0.183)		(0.00253)	(0.947)	(0.526)
N of subjects	8035	24314	23252	33351	8035	24314	23252	33351	8035	24314	23252	33351		24314	23252	33351		24314	23252	33351		24314	23252	33351	8035	24314	23252	33351
N of failures	2110	4349	3699	5528	297	473	158	241	99	1752	1820	2193		142	180	508		867	920	1267		146	167	176	1202	722	440	1091
Time at risk (person-years)	102859	367915	291286	417112	102859	367915	291286	417112	102859	367915	291286	417112		367915	291286	417112		367915	291286	417112		367915	291286	417112	102859	367915	291286	417112