Social class social mobility and mortality in the Netherlands, 1850-2004.

Niels Schenk & Frans van Poppel [1]

Introduction

Social class and mortality in the Netherlands: a historiography

In the historiographic literature an extremely dark picture is painted of the state of health of the working class in the Netherlands in the nineteenth century. Grinding poverty was an essential characteristic of the life of the masses, and that had fatal consequences for the health of this part of the population, the story has it. The Dutch medical doctors and statisticians that in the middle of the nineteenth century started to collect data on differences in mortality between social classes had the intention to find out whether the deterioration of the socioeconomic position of the laboring class brought about by the process of urbanization and industrialization had resulted in increased levels of mortality. It is these studies to which we owe the extremely negative picture of the state of health of the working class in the nineteenth century (Brugmans, 1975; Giele & Van Oenen, 1974; Romijn, 1955; Van Tijn, 1977).[2] Because most medical doctors were mainly interested in the effects on health of the working conditions that were typical for a specific profession or occupation, such as the posture during work, the working hours, the degree of physical exertion and the exposure to dangerous matter, it mostly concerned local studies among specific occupations. The nineteenth-century investigators used rather crude mortality parameters and what is more these were not infrequently incorrectly interpreted by later historians.

1 Niels Schenk is researcher at the Erasmus University Rotterdam. Frans van Poppel is researcher at the Netherlands Interdisciplinary Demographic Institute (NIDI/KNAW) in The Hague.

2 We deliberately restrict ourselves here to social class mortality differences in adult ages. Social class differences in infant and childhood mortality have been studied relatively more often (Van Poppel, Jonker, & Mandemakers, 2005) and it is clear that the effect of SES (but also that of environmental factors) might differ considerably over age groups, in any case in historical populations (Currie & Stabile, 2002; Ferrie, 2003; Garrett, Reid, Schürer, & Szreter, 2001). Infants in the past were less sensitive to social conditions than adults, because differences in breast-feeding and weaning practices, which were more or less independent of socioeconomic conditions, were more important for survival in the first age groups than strict economic factors such as access to better quality food, housing conditions,

Sometimes it remains completely obscure how the researchers involved had got hold of their data. De Sitter (1856) for example stated without any further explanation that 'the medical statistical registration learns us, that the duration of life of the needy day laborer might be stated at no more than 32 years on average, whereas for the well-to-do an average duration of life of 50 years might be assumed'. The data collected by the medical doctor Samuel Senior Coronel on the duration of life of workers in a variety of industries make up the most important source on which present-day historians base their judgment about mortality in the lowest layers of nineteenth-century society. Coronel was in particular out to detect the health risks that were directly associated with a given occupation and for that purpose he studied among other things the mortality among laborers in the Middelburg calico factories (Coronel, 1861), textile workers in the Hilversum (textile) mills (Coronel, 1862), Leiden wool-workers (Coronel, 1864b) and Amsterdam diamond workers (Coronel, 1864a) . In addition to Coronel there were other medical doctors (and statisticians) that conducted empirical studies of differences in mortality by social class. Van Hengel (1875) for example studied mortality differences by social class in the town of Hilversum. For various municipalities, medical doctors published information from vital registration on the average age at death among the most frequently exercised professions. The most famous of these studies are those by Broes van Dort (1861) on Goes in the period 1830-1859, and Buchner (1852) on Amsterdam in the years 1840-1851. Buchner was convinced that 'the average duration of life, the so diverging state of health and mortality in the various professions and ranks of society, within the same nation, within the same country, within the same town' teaches us that 'health and length of life depend uniquely and only on the favorable or unfavorable condition of our societal relationships'. 'A life free from care for daily maintenance and provided with the joys of life that the world offers lasts longer, than one in

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and more knowledge on means to control personal illnesses.

which one has to earn and eat one's living by the sweat of one's face with sorrows and hardships'. The Gouda medical doctor Büchner (1842) came on the basis of data for two funeral societies to the same conclusion: 'mortality (…) decreases, the more the inhabitants are better off.'.

It was not until the end of the nineteenth century that in the Netherland in a more solid scientific way mortality differences by social class were studied. Studies of mortality differences by occupation on a national scale were started by the Central Statistical Committee and the Central Statistical Office (Centraal Bureau voor de Statistiek, 1906; 1912; 1917; Centrale Commissie voor de Statistiek, 1898). On the basis of data collected by the vital registration officers and taken from death certificates information became available on ages at death, sex, cause of death and occupation of men, deceased in the period 1891-1895. Later on, data were also published for the years 1896-1900, 1896-1903, and 1908-1911. These data are hard to compare with each other because of the diverging age- and occupational classification that had been used in the time. Nonetheless, some authors have tried to do that with varying degrees of success (De Bie, 2006; Van Reek, 1985; Van Reek, 1993).

The limited time horizon of the studies mentioned above, their focus on a single community, the inconsistencies in the way in which the socioeconomic position was determined and their methodological shortcomings make them not very useful as a source of information on SES- differences in mortality.

In this paper we try to add to our knowledge of the long-term trends in social inequality in adult mortality by studying differences between social classes, as assessed by the occupation of the individuals. As a single indicator of socioeconomic position occupational social class in adulthood is a better discriminator of socioeconomic differentials in mortality than education (Davey Smith et al., 1998). An alternative, the educational level of the individual, is not available as in the period that we study information on the level of education is rather crude, very hard to

get, and hardly usable to differentiate the population as the the large majority of the population only had primary education. Occupational social class primarily mirrors experiences and exposures in adult life reflecting material resources relevant for health and status, partly related to the sphere of work itself (Martikainen, Blomgren, & Valkonen, 2007)

Our study has several distinctive traits, which allow us to partly overcome the drawbacks of earlier studies. First and foremost, we are able to study a long time period during which the Netherlands underwent radical changes in its economic and social structure (income growth, industrialization, and urbanization). We study birth cohorts 1850-1922, allowing us to study trends during the early and later stages of the mortality transition, which is essentially the period from the third quarter of the nineteenth till the last quarter of the twentieth century.[3] We use data that relate to the country as a whole, thus we can take into account the situation of people living in a variety of ecological, social, and economic circumstances, covering the countryside and small and big towns. The individual-level data that we use allow us to assess the social class of individuals at the time of birth as well as in adulthood, This allows us to study the relative weight in the SES-mortality association of the socioeconomic position of the family of origin versus that of the own socioeconomic position of the individual. There is a growing amount of literature that indicates that mortality at adult and older ages not only is affected by the social position during adulthood but also by risk factors that are related to the socioeconomic position of that person during childhood (Davey Smith, Blane, & Bartley, 1994; Lundberg, 1991; 1993; Power et al., 2007; Wadsworth, 1986). Various hypotheses have been formulated on the way SES in childhood and own SES is related to adult and old age mortality, arguing for cumulative effects of SES over the life-span, or a diminshing effect of experiences during childhood as time passes by (Mare, 1990; Power et al., 2007). We also have the opportunity to determine the social class in which

women are born or arrive through marriage, a topic that is rarely touched upon in historical studies (Cambois, 2004). In addition to that we use two different social class schemes making it possible to determine whether it is the chosen scheme that determines the observed level of inequality (Craig & Forbes, 2005; Leye & Joye, 1994). For part of the cohorts we can also use a (crude) indicator of the educational level, namely the level of literacy in the family of origin. We focus on mortality above age 18: from this age on, the majority of the population practiced a profession, making it possible to classify them in a specific social class.

Data

For this study we have used data collected in the framework of the Historical Sample of the Netherlands (HSN). The HSN is a national database with information on the complete life history of a 0.5 percent random sample (76,700 birth records) of men and women born in the Netherlands from 1812 until 1922. In all Dutch provinces a random sample of births was drawn which was stratified by period of birth (11 periods) and level of urbanization of the municipality (Mandemakers, 2000). For this study, data were used from a selection of this database; included are only those children that were born between 1850 and 1922 for which information from the so-called municipal population register was available (18,900 births). This implies that the mortality regime during the period 1868-2004 is covered by our data.

The restriction to children born in the period 1850–1922 is motivated by the fact that information on the life course of these children is the most complete. This information can be deduced not only from the vital registration system, but also from the population register, available from 1850 on and from the personal cards (from 1939 on) and the Municipal Basis Administration (from 1994 on).

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3 Whereas in birth cohort 1850 the expectation of life of a 20-year old Dutch men was 42.97 years, and for a

Population registers combine census listings with vital registration in an already linked format for the entire population of a municipality. Continuous population registers in the sense of bound documents with non-removable pages were enforced in the Netherlands by the Royal Decree of December 22, 1849. The registers had to record the population legally residing within the municipality. The starting point for the first registers was the census of 1849. The returns from this census were copied into the population register, and from then on all changes occurring in the population in the next decade were recorded in the register. In most municipalities, this procedure was repeated with each subsequent 10-year-census, so that in principle every register covers a time span of 10 years between the censuses. For each individual, date and place of birth, relation to the head of the household, sex, marital status, occupation, and religion were recorded. New household members arriving after the registration had started were added to the list of individuals already recorded, and those moving out by death or migration were deleted with reference to place and date of migration or date of death. Residents were required by law to report migration between communes at both the origin and destination. The registers thus present information on demographic events leading to changes in composition and size of households, including the characteristics of the person undergoing that event. In most municipalities, population registers remained in use until 1910 or 1920, after which date a new form of continuous registration was introduced, consisting of loose sheets, so-called *gezinskaarten* or family cards. The registration unit was then no longer the household but the family. In the 1930s, the population register was replaced by the personal card; from that date on, the individual person became the registration unit. Since then, the population register in each municipality consisted of a collection of personal cards, containing nearly the same information as the population register. All persons who were alive in 1939 or were born after that year received a Personal Card. At the moment of death,

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Dutch woman of that age 43.83 years, in birt cohort 1922 it had increased to 53.09, respectively 60.04 years.

this card was removed from the files and sent to the Central Bureau of Statistics, where the data on the card were used for statistical purposes, and after that sent to the Central Genealogical Bureau. At this bureau, personal cards of all people who died between 1 January 1940 and 30 September 1994 are available for research. For persons who died after that date, extracts from the so-called Municipal Basic Administration can be collected, containing almost the same information.

For this paper only a selection of the HSN-database could be used. Only for three of the eleven Dutch provinces (Zeeland, Friesland, and Utrecht) and for the city of Rotterdam data have been entered for birth cohorts 1850 to 1922. From birth cohort 1883 on, information is available for all 11 provinces. Of the 18,900 persons in the sample 13,308 were still alive at age 18 and could be used in the analysis.

The dependent variable in which we are interested is the date at death of those selected children who had reached adulthood, here indicated by age 18. Information about the date of death is derived from death certificates, from the date of death as mentioned in the population register or on the family card, and from the personal cards and the extracts from the Municipal Basic Administration. Both these last sources by definition only relate to deceased sampled individuals. About those persons in the sample which were still alive in 1939, and for whom a personal card was made up, but for whom as yet no information on their date of death is available, no information about their survival status after 1939 could be collected. This has important consequences for the assessment of the mortality risks, as we will make clear later on.

To determine the social class of each individual in the sample use has been made of information on occupations as mentioned on the birth certificate, the marriage certificate and the population register. The social class in the family of origin was established on the basis of the occupation of the father of the subjects, as mentioned on the birth certificate of the sampled persons. The occupations of the subjects themselves at adult ages have been determined on the

basis of the highest-achieved occupation: for the selected subjects this was deduced from the population register, the death or marriage certificate in case the person involved was a man, and on the basis of the occupation of the husband, as mentioned in population register or marriage certificate, in case the person was a married woman.

We classified all occupations of individuals in a social class system applicable for the whole period. The social class categorization that we applied is based on the HISCO-coding scheme (*Historical International Standard Classification of Occupations*) (Van Leeuwen, Maas, & Miles, 2002). HISCO translates occupational descriptions covering a long historical time into a common code, compatible with the International Labour Organisation's *International Standard Classification of Occupations* (ISCO68) scheme. Starting point of HISCO are the activities related to a certain historical occupational title. The five-digit code that every occupation in HISCO received refers to the tasks associated with the occupation involved. This code is supplemented where possible with supplementary codes to accommodate residual information about employment status, educational qualification and social position (status) and about people for whom no current occupational title is given but for whom nevertheless a relationship to the formal labor market is mentioned (relation).

These HISCO-codes were classified according to two different social class schemes: the SOCPO-scheme proposed by Van de Putte and Miles (2005), and the HISCLASS-scheme, developed by Van Leeuwen and Maas (2005). The SOCPO- (Social Power) scheme has as leading principle social power, defined as the potential to influence one's 'life chances' through control of (scarce) resources. It is based on economic and cultural resources. Economic power is based on factors such as self-employment, skill and authority (command). The economic power is determined on the basis of information on the tasks and activities associated with an occupation, the economic sector in which these tasks are fulfilled and the hierarchical position. Cultural

power is defined on the basis of the distinction between 'non-manual versus manual occupations' and on pure status characteristics such as nobility and prestige titles. The merging of economic and cultural power dimensions leads to a scheme with five levels. In level five are included executives, having general policy tasks, supra-local businessmen, non-manual super-skilled and members of the nobility. In level four are the supervisors of skilled workers, local businessmen, and manual super skilled and non-manual skilled people. Farmers, originally part of this group, were classified in a separate group. Level three includes supervisors of semi- and unskilled workers, and manual skilled workers. In level two are the self-employed who are locally oriented and have a minimal capital, and the semi-skilled workers. Level one comprises the unskilled workers. We denote these groups as respectively the upper and middle class (level 4 and 5), the farmers, the skilled workers, the semi-skilled workers, and the unskilled workers.

The scheme by Van Leeuwen and Maas is based on a social class categorization of which the distinction between manual and non-manual labor, the level of skill, hierarchy and economic sector are the dimensions. HISCLASS distinguishes 12 social classes. In view of the small number of cases these have been grouped into six categories: Higher managers, higher professionals, lower managers, lower professionals and clerical and sales personnel, Foremen and skilled workers; Farmers; Lower skilled workers; Unskilled workers; Lower skilled and unskilled farm workers Here as well we add a group of which the father or the occupation is unknown.

By comparing the social class of the family of origin of the subject with that of the subject, or that of their husband in case of married women, we constructed a social mobility indicator. Upward social mobility means that persons that originated from a family that belonged to a given class raised at least one step on the social ladder in either the SOCPO- or HISCO-scheme. We also devised a crude indicator of literacy in the family of origin by including information on the father's ability to sign the birth certificate of his child.

In the analysis we have grouped the data for the eleven provinces into three categories on the basis of the development of the expectation of life in the periods 1840-51, 1901-02, 1956-60 and 1990-91 (Van Poppel & Beekink, 2003) and on the basis of their geographic contiguity. The provinces of Utrecht and North- and South-Holland, constituting the economic and cultural centre of the country, were characterized by rather high mortality until the last quarter of the nineteenth century. After 1880 the expectation of life here increased much stronger than elsewhere. We have called this category West. Friesland, Groningen and Zeeland were part of the concentric circle of productive agrarian areas, directly around the economic kernel and are indicated as North-West. The provinces North-Brabant, Limburg and Gelderland, Overijssel and Drenthe were all part of the more peripheral category South-East. In these provinces the expectation of life at the start of the period was reasonably high but later on their position worsened relatively speaking.

Although we have information about the whole migration history of the sample, we only used information about the place of birth. We classified places of birth as urban and rural on the basis of the number of inhabitants of the largest residential area in a municipality (urban: more than 20 thousand inhabitants). Previous studies have shown that in the Netherlands – as was the case elsewhere – urban areas in the nineteenth century had a strongly increased mortality level whereas in a later stage mortality in urban areas was lower than in the countryside (Van Poppel, 1989).

To depict the changes over time in social class mortality differences we distinguish three birth cohorts: the first one more or less coincides with the group that witnessed the first stage of the increase in life expectancy among adults (expectation of life at age 20 rising from around 43 to 49 years among men and from 44 to 50 years among women) (1850-82), the second one (1883-99) experienced a further increase of seven years among men and of 5.5 years among women, the

last group (1900-22) was born in a period in which the expectation of life at age 20 had hardly further increased (around two years among men and 4.5 years among women:1900-22) (see below).

Finally, we introduce several control variables in the analysis: Sex of the subjects, religion of the parents, and household situation at the time the subjects were 15 years of age. In Dutch historical research (Van Poppel, Schellekens, & Liefbroer, 2002) and in studies elsewhere (Hummer, Rogers, Nam, & Ellison, 1999; Levin, 1994) it has been shown that Catholics had higher mortality than Protestants and Jews. We distinguished the subjects on the basis of the religion of both their father and mother, as mentioned in the population register, into five different groups. Research has shown that the household situation in which children grew up could have long-lasting effects on mortality, even at adult ages (Van Poppel & Van Gaalen, 2008). To determine the household situation in which the child grew up, we distinguished between families in which both parents were still present at age 15 and those in which at least one of the parents were missing. Finally we included the number of other kin present in the family of origin of the subject at age 15. We did not have specific hypotheses on the effect of this variable on mortality at adult ages but the literature suggests the potential role of this variable when both mortality and number of kin are measured at the same time (Tsuya & Nystedt, 2004).

Descriptive outcomes

Table 1 describes the main characteristics of the sample. The cohorts studied were in majority born in a rural area, were almost all coming from a family in which the father was literate, and in which both parents were alive at age 15 of the subject. The social class of the father of the sampled subjects was known in almost all cases. A large proportion of the children were born in

a family that earned its living in agriculture. Although the majority was born in a working class family, middle classes were also represented fairly well. The own social class of the male sampled subjects was not known or not classifiable in almost one third of the cases. Given the large size of this category we have treated it as a separate group. Depending on the social class classification scheme, the HISCLASS- categorization counted a larger percentage upward mobile men. Female sample subjects were only scaled in case they were married, on the basis of the social class of their husband. This proved to be impossible in only a small percentage of cases.

Table 1 around here

For the study of social class mortality differences a very important question is whether the HSN-data represent in a satisfactory way the mortality pattern of the Dutch population as a whole. For the large majority of the sampled persons that had reached age 18 a date of death could be determined: 80 percent. Characteristics of subjects for whom no date of death could be determined are shown in Table 2. That percentage varied only little by sex, but was a little bit higher in the most recent cohort. Important is that the differences by social class were relatively small and this applied to the social class of the family of origin, the social class of the selected persons themselves and that of the husband of the married female subjects. For both classifications, the highest percentages of missing dates of death were observed in the highest social class. Given that the date of death in many cases is deduces from the same source that provides information on the last occupation (personal card, death record) it stands to reason that high percentages missing dates of death were observed for those persons for whom no occupation could be ascertained. In case no date of death was available, the date of last observation was used as date of censoring.

Table 2 around here.

The question is whether the outcomes of the HSN can be considered as valid indicators for the level and trend of mortality in the Netherlands. Two issues are relevant here, one having to do with the limitations of the sources, leading to differences in the percentage of missing dates of death, the other with the fact that data collection has progressed differently in the various provinces.

For a relatively high percentage of persons from cohort 1900-22 no date of death was found. According to cohort life tables in this group some 11 percent was still alive in 2005.[4] Using the date of last observation for this group as it is given in the municipal population registers, does not automatically lead to correct estimates of the survival process. By definition this date is not later than 1939. Whereas before 1939 the sources used (population registers) give information about all sampled persons, the data sources used after 1939 give information only about deceased persons. Thus, the method of data collection implies that the chances to find a trace of a person dying at a relatively young age are higher than for a person dying late.[5] Missing survival data therefore are not randomly distributed: the chance that we have no information on a person after 1939 – the end of the observation window for the survivors – is much higher for survivors than for the cohort as a whole.[6] Being censored around 1939 is therefore not independent from the substantive process under study., i.e. mortality (Blossfeld & Rohwer, 1995,

4 Based on cohort life tables available at the Central Bureau of Statistics.
5 This tendency is less visible in older cohorts as the population registers that can be used as a source until 1939, include information on all persons whereas the personal cards are only available for the deceased.
6 The number of censored subjects is rather high in birth cohorts 1900-22 at ages 19-23, ages that are reached around 1939 by persons born in the early 1920s.

35-36).[7] The consequence is that we might overestimate the actual mortality risk.[8]

It is not only the design of the data collection process that might have an effect on the validity of the HSN-data. Important is also that for cohorts born before 1883 only information is available for three provinces that by and large had lower mortality levels than the rest of the country. This could lead to biased (under) estimates of mortality in the HSN for the earliest birth cohorts.

The effects of the missing dates of death can be assessed when we compare the survival curve of the various HSN-cohorts with comparable data for identical birth cohorts for the Netherlands as a whole, based on data from Statistics Netherlands.[9] Figure 1 shows that on the whole the HSN-cohorts[10] conform to the expected pattern, characterized by increased survival in the consecutive cohorts. There is however a relative downswing at the highest ages in cohort 1900-22 relative to cohort 1883-99 which can be ascribed to the limitations of the data sources, that is the higher chances to find information about subjects dying at younger ages. Relative to the Dutch population as a whole, the HSN-data underestimate the mortality level in particular in the youngest birth cohort. This underestimation can be assessed by comparing the expectation of life at age 18 for the various HSN-cohorts with that of the Dutch population as a whole. In the oldest cohort, the HSN-data give a value of 51.20 years whereas the national life tables result in 48.42 years; for birth cohort 1883-99 the difference is minimal (53.75 against 53.4) whereas in the oldest cohort the difference is small as well (55.77 against 56.88 years). The conclusion thus

7 This process is called informative censoring, a topic in biostatistics that has attracted a lot of attention recently. Informative censoring means that censoring variables carry information about or depend on response variables of interest.

8 The assumption that all individuals for which we do not have yet a date of death are still alive of course leads to an underestimation of the mortality levels.

9 We calculated life tables for the HSN-data and compared them with unpublished cohort life tables available at the Central Bureau of Statistics. The national life tables are unweighted averages of the male and female life tables.

10 The HSN cohorts slightly differ from those used for the population data because of data limitations of HSN data mentioned in the methods section. Using the same cohorts for both calculations was not possible.

is that as far as the temporal development is concerned, the HSN-mortality data are in general representative for the Netherlands as a whole but they slightly underestimate the increase in expectation of life.

Here figure 1.

Methods

We estimate the mortality risk by social class (according to two different class schemes) of persons that have survived till age 18, making use of *event history analysis* (Blossfeld & Rohwer, 2002; Cox, 1972). One of the advantages of this method, compared for example to ordinary least squares regression, is that it enables us to use information about right censored cases – persons of which we only have life course information until a certain point in time. As we were mainly interested in the effects of social class on survival, and not in the effect of the age as such, we applied the Cox-model (Cox, 1972). The Cox-model is a proportional hazard model and can be written as:

$$r(t)=h(t)\exp(A(t)\alpha)$$

The mortality rate r(t) is the product of an unspecified baseline rate h(t) and a second term specifying possible influences of a covariate vector A(t) on the mortality rate. Strictly speaking this rate is not a probability—it can have a value higher than 1—and cannot be empirically measured as such. In this case, it is a local description of the possible development of the survival process of persons under varying structural conditions, with the proviso that the event has not yet occurred.

We focus on the survival of persons that have reached age 18. We computed the age at death in days. In case this age was not known we use the age at last observation, that is the age at the time of departure from the last known household in which the individual lived.

We estimated models for both sexes taken together, and separate models for men and women. Our models were first run on the entire sample as a whole. An important assumption of a proportional hazards model (PH) is that reported hazards are proportional across time. This did not turn out to be the case for a number of variables. Proportionality was achieved by estimating models separately for ages between 18 and 35 (exact ages), and for those older than 35. Even when estimating separate models for these age groups, our coefficient representing the research persons from the youngest cohort was not proportional across age groups. The differences between cohorts in hazard rates were greater at older ages than at younger ages. This discrepancy between differences at various age groups caused non-proportionality of our coefficient. We therefore also estimate our models for each of the cohorts separately. The choice of cut off points for our cohort definition was guided by the data collection process. Since we only have information from three provinces in the Netherlands until 1882, and have information on all provinces in the Netherlands afterwards, we chose to define our cohort in such a way that we would only have data from these three provinces in our first cohort. Analyses run separately for the first cohort therefore only include subjects from Zeeland, Friesland, Utrecht and the city of Rotterdam.

The type of social class included in the model depended on gender and age group. For both men and women aged between 18 and 35, social class of origin was used since we were unable to classify the own social class of a large number of subjects in young adult ages. In the older age groups social class of origin was not used because (not reported) analyses showed that social class of origin did not have any effect on top of own social class. For men aged over 35, their

own social class was used whereas in the case of women their social class position was determined on the basis of the social class of their husband. For around 3,800 of the 7,020 women information on the occupation of her husband was available from marriage certificates or from population register data.

Results

Table 3a shows the relative risks of death between ages 18 and 35 (hazard ratios) for sons and daughters, whereas table 3b does the same for sons and daughters older than 35. In both tables, four models are presented. The first two are based on the HISCLASS-, and the last two on the SOCPO-classification. The first and third models are baseline models that only include gender, cohort, and social class indicators. The second and fourth models also include other control variables as mentioned in the methods section. The results in these tables provide a reference for the tables that will be discussed afterwards. Showing how estimations for sons and daughters seperately differ from the baseline and complete model where the two sexes are taken together makes clear what role our control variables have in influencing our estimations, and how these estimates differ by gender.

In the models presented in table 3a, where sons and daughters between ages 18 and 35 were jointly analysed, we found that mortality in the second cohort is clearly lower than in cohort 1883-99. In cohort 1900-22 mortality was only half of what it was in the earliest cohort. The control variables in models 2 and 4 showed the expected outcomes: mortality among young men was slightly higher (but not significantly higher) than among young women and mortality in North-Western Netherlands was lower than in the Western part of the Netherlands. Mortality was not significantly different between the South-Eastern and Western parts of the Netherlands.

Given the period that we studied (roughly the years 1870 and later) this comes not unexpected.[11] No significant differences were observed according to religion, urban/rural origin, or the number of kin. A strong effect on mortality after age 18 was found of being raised in an incomplete family: mortality was between 25 and 30 percent lower among children raised in a complete family. The direction and the strength of the effect of these control variables in the models based on the HISCLASS-schemes hardly deviated from those based on the SOCPO-scheme.

Of course we are mainly interested in the effect of social class and related variables. Being raised in a family in which the father was illiterate had a mortality-increasing effect after age 18 but that effect was not significant. In model 1 we analyzed the effect of the social class of origin (the father's social class) on the mortality of sons and daughters on the basis of the HISCLASS-scheme, in model 3 on the basis of the SOCPO-scheme. In the case of the HISCLASS-scheme, not a single social class showed significantly higher or lower mortality compared to the reference group (low and unskilled workers in agriculture). When using the SOCPO classification, we found that sons and daughters with middle/upper class fathers showed considerably lower mortality compared to the reference groups (unskilled workers). We also found that mortality is higher for those with lower-skilled fathers compared to the reference category. The latter effect was not significant any more after including the control variables, although the effect retained its maginitude.

Table 3a about here

In table 4a we show social class mortality differences among sons between ages 18 and

11 A role is also played by the fact that at the moment data collection in Southern- and Eastern-Netherlands has progressed less; given the searching procedure, this implies that among those born in this part of the country more persons still are in the category 'easy-to-find', (dying relatively short after birth in their region of birth).

35, on the basis of the father's social class. Model 1 estimates the effects for all cohorts jointly. The effects of some of the control variables change in this situation. The decrease in cohort 1883-99 was no longer statistically significant. Mortality in the North-West now also did not significantly deviate from that in other regions. We still did not find statistically significant differences in mortality when using the HISCLASS-scheme. Among the higher social classes (middle/upper class and skilled laborers) very low mortality was also observed with significant differences with the reference group in the SOCPO-classification. When using the SOCPO-classification, a clear (although not always significant) gradient was thus visible. High mortality was observed among those without or with an unclassifiable or unknown occupation and this applied to both classification schemes. Our measurement of upward social mobility also showed a strong significant effect. Without the use of the research person's own classification, this measure indicates both whether the person is actually working, as well as whether this person is in a higher social class than his or her father. Sons with upward mobility had, compared to those with stable or downward mobility, much lower mortality rates. Given the age range this might at least partly be explained by the healthy worker effect, the 'tendency for the actively employed to have a more favorable mortality experience than the population at large' (McMichael, 1976).

In models 2, 3 and 4 we analyzed the effects of the social class of origin and the control variables separately for the three cohorts in our study. Differences in the estimations between the three cohorts are mostly visible in the 1900-1922 cohort. Here we did not find, in contrast to the two older cohorts, significant effects for the SOCPO-classification described above. We did find that in this cohort sons with parents that are not of mixed or protestant religion have considerably higher mortality rates compared to sons with catholic parents. Sons in the youngest cohort raised in a complete family have considerably lower mortality, whereas this is not the case in the two

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Thus, a relatively higher percentage has been found that had died at relatively young ages, pushing mortality up a

older cohorts.

Table 4a about here

Table 3b has the same structure as table 3a but focuses on mortality for subjects after age 35. There were first of all some interesting differences as far as the effects of the control variables are concerned. Women in this age group had a substantial and statistically significant lower mortality than men, corresponding with the national pattern. In the age group above 35 years mortality in cohort 1883-99 compared with the oldest cohort showed the same pattern as for those between ages 18-35, whereas the decrease in cohort 1900-22 was now consiberably less strong (cf. the selection caused by the data collection procedure). Regional differences remain roughly the same, although the differences between the North-West and the West were now attenuated. The urban penalty showed itself above age 35 in all models. Religion still had no effect and growing up in a complete family no longer had statistically significant effects on mortality. The number of kin present at age 15 had a large and long-lasting significant decreasing effect on mortality.

What about the social class indicators? Illiteracy in the family of origin had very small and never significant long-lasting effects on mortality. Social class of origin had some effect on mortality among subjects aged 35 or over. Farmers in both schemes had lower mortality compared to unskilled workers, but this difference was only significant in the SOCPO-scheme. Also remarkable was that men with an unknown occupation in both classifications had much lower mortality than the reference group. Differences were highly significant. This effect is probably due to the fact that for a large proportion of those for which the occupation could not be

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little bit.

ascertained, the date of death could not be determined either. Many of those therefore were treated as censored observations.

In table 4b, we present models for men aged 35 or over. The first model again presents estimates for all cohorts jointly, while the other three models report estimates for the three cohorts separately. Compared to models where men and women were analysed jointly, few differences were observed. Middle/upperclass subjects born in the two youngest cohorts had higher mortality compared to the unskilled reference groups, whereas this was not the case for the oldest cohort. This pattern showed when using both classification schemes, but in the HISCLASS-scheme it was only significant for the youngest cohort. We also found that only farmers in the oldest cohort had significantly lower mortality; there were no differences in the other two cohorts. We also observed rather large differences in mortality between cohorts for subjects with no or an unclassifiable job. These patterns may have been caused by the fact that over time the meaning of this category has changed: in the youngest cohort it relates to persons for which no date of death and therefore no occupational information is available whereas in older cohorts it mainly refers to persons with a known date of death but without or with unclassifiable occupations.. The urban penalty found earlier seems more pronounced in the middle cohort, where mortality was substantially lower compared to the other cohorts. It is the only cohort with a significant difference between urban and rural areas. We also found that mortality is significantly lower in region North-West compared to West in only the oldest cohort, whereas it was higher in region South-East compared to West only in the youngest cohort. Social mobility did not have significant effect on mortality above age 35, which indicates that the effect of social mobility found for subjects between ages 18-35 was due to the fact that the social class of the subject itself was not used.

Table 3b around here

Table 4b around here

For women as well separate models have been estimated. These however only relate to married women and the 'own' social class of these women has been determined on the basis of the social class to which her husband belonged. The results are presented in table 5a for women aged 18-35 years, and in table 5b for women aged 35 and over.

For women aged 18-35, the control variables showed some very strong effects, in particular for cohorts and regions of birth. Married female subjects in birth cohorts 1883-99 and 1900-22 had much lower mortality than married subjects in cohort 1850-82. The differences were however only significant for the 1900-22 cohort. Region of birth also had a very strong effect with again the North-West and the South-East doing much worse than the West. Religion, urbanity, household situation and number of kin did not have significant effects on mortality, in none of the four models.

Hardly any effects of the social class of the father on the mortality of their daughters in ages 18-35 years were found. Only in the last cohort we observed that women born to fathers from HISCLASS classes managers/professionals, middle/upper class origin, and farmers had substantial lower mortality compared to unskilled workers. A comparable pattern was found for the SOCPO-scheme but none of the differences were significant here. We did find that the upward mobility indicator, which measures if the husband has a higher social than the daughter's father, had a significant effect in case of the SOCPO-scheme. The effect shows that in case of upward mobility, women had considerably lower mortality. The same but not significant patterns emerged when using the HISCLASS-scheme. No effect of literacy was observed. We did not find any effects of growing up in a complete family, or the number of kin living in the household at

age 15. Finally we found that women living in rural areas had considerably higher levels of mortality compared to those living in urban areas. We presume that this is related to higher TB- and maternal mortality rates in rural regions among women (Van Poppel, 1989), Differences between cohorts other than those found for social class of the father for women aged 18-35 were minor. We found no significant differences between regions in the youngest cohort, while they did show for the two earlier cohorts. Protestant women in the oldest cohort have a considerably higher risk of mortality compared to catholic women. This was the only significant effect of religion found.

Table 5a around here

Table 5b presents data on mortality of married female subjects at ages above 35. This table again shows very strong time and region effects in the expected direction. More recent cohorts and women born in the North-West did much better than earlier cohorts and than women born in the West. Again the regional effects were not found in the two youngest cohorts. None of the other selected control variables had an effect on mortality, exception made for the number of kin at age 15. We observe here the same phenomenon as earlier on for males.

In both schemes women married to men from the middle and upper class had the lowest mortality. In both schemes this difference was significant, although the effect was only significant in the middle cohort. A clear social gradient seemed absent when using both schemes, and upward mobility showed a mortality decreasing effect in the oldest cohort.

Table 5b around here

Discussion

The central question of this paper was whether social class differences in mortality could be observed among adult men and women from the third quarter of the nineteenth century until now, and if so, how these differences have developed over time. We first of all examined whether the social class of origin (measured via the occupation of the father, classified according to two class schemes) had an effect on adult mortality (ages 18 to 35), and whether social class of the person himself (in the case of males over 35) or social class of the husband (in the case of females over 35) had an effect on mortality. Such an effect was not observed among the younger adults and only to a restricted degree among the older adults and the aged. There was a clearly lower mortality among the middle/upper classes in the early adult ages but a slightly higher mortality among the better off in the highest age range. The group with unknown social class occupied a very special position, partly a real phenomenon, partly caused by data problems. Social mobility only had an effect for subjects in young adult ages when using the social class of the father.

For female subjects we again observed an effect of social class effect on mortality, with the middle/upper class, farmers and more skilled laborers generally doing better, although the effects were not always significant. The specific social class scheme that was used did partly have an effect on these outcomes. A recurrent finding for both male and female subjects was that we did not find statistical significant effects of the social class in which the child was born on his or her mortality later in life. The own class position mattered more than that of the family in which the child was raised.

For both sexes we found that the family in which people grow up has a rather large impact

on survival changes. For subjects who deceased before the age of 35, we find that it matters only for men whether they grow up in a complete family with both mother and father present. When men and women live beyond age 35, we found that an increasing number of siblings at age 15 increases survival changes rather substantially. What this seems to indicate is that for survivors into older ages, people's access to a large family network, providing a potential for social support, is an important determinant for survival changes (Dykstra, 2006) .

Our findings about social class differences in mortality among adults in various Dutch historical cohorts show rather large differences. The overall findings are partly in line with findings from cross-sectional studies in the late nineteenth century. In these studies farmers and intermediate social classes did generally well whereas the professions did not occupy the favorable position that they have now (Van Reek, 1993). We do however find that social class differences in mortality are especially apparent in the oldest cohort. In this respect our study is at odds with the conclusions of Razzell and Spence (2006) and Smith (1983) who argued respectively for the UK and the US that before the twentieth century there was no association between socioeconomic status and mortality in adult ages.

The question remains how firm our findings are. The study of trends in social class mortality differences on the basis of the actual, still incomplete HSN-dataset is not without problems. Although the direction of the mortality parameters deduced from the HSN-data is in line with those based on national statistical data for the same cohorts (for example as far as the trend over time and the regional and sex differences in mortality are concerned), in particular the amount of change over time is not correctly captured. The HSN-data result in an underestimate of mortality in the oldest cohort, as it was based on three provinces only. For a considerable number of subjects dates of death are still missing, in particular in the most recent cohort. Social class information is still lacking for a large number of sampled males. Although we have no reason to

assume that there were fundamental differences in the degree to which the various social classes were affected by the process of selection that took place as a consequence of the method of data collection, intensification of the data collection process is needed to give our findings a firmer base. Another option is to extract information on the survival status of persons that might still be alive from the *Sociaal-Statistisch Bestand* of the Central Bureau of Statistics, a database that is based on the Municipal Basic Administration, containing information on all persons that have lived in the Netherlands from 1995 on. It might also be possible to make use of recently developed statistical methods to study the effects of the dependency in the HSN-data between the failure (death) and the censoring process (see for example Siannis, Copas, & Lu, 2005).

Our results shed new light on the development of the standard of living and well-being during industrialization in the Netherlands. In the ongoing discussion about the conceptualization and measurement of the standard of living a variety of (correlated) measures has been proposed, ranging from income and consumption to height and life expectancy. The measures for the standard of living used here – survival rates – cover a large geographical area and a large population. What is relevant in particular is that they allow us to get a better understanding of the historical well-being of various social groups over time, so that one does not have to rely on fragmentary quantitative data or qualitative sources (Allen, Bengtsson, & Dribe, 2005). Our preliminary conclusion from our analysis is that the widely held view of the disastrous effects of the processes of industrialization and urbanization during the late nineteenth and early twentieth centuries on the health and the expectation of life of the working population seem not to apply to the Netherlands. At least we did not find strong indications that the condition of the laboring classes – whether it were those employed in agriculture or the industrial workers – in these cohorts differed strongly with those of the middle and upper classes. It is possible that in some specific sectors of the industry mortality of workers was high and the expectation of life lower

than that of persons in middle or higher strata but by and large that did not apply to the working classes. The absence of large social class differences in mortality might of course have to do with the specific situation of the Netherlands: high wages and relatively generous poor relief could in this case have mitigated the deterioration of the standard of living. Compared to the UK, France or Germany, there seems to have been little evidence of a classic proletariat forming in the towns in the Netherlands during the late nineteenth century. One has to keep in mind of course that even our oldest cohort spent a large part of its life in the twentieth century.

Our findings are supported by several other recently published studies which, on the basis of macro-data on height and mortality also have shown that a deterioration in health was not an inevitable concomitant of nineteenth-century industrialization and urbanization processes (Sandberg & Steckel, 1997; Weir, 1997). The economic development in the Netherlands showed continuous improvement from 1864 (Van Zanden & Van Riel, 2004), and policies intended to improve public health and reducing health differences were launched after 1875, in part stimulated by these same economic factors (Mackenbach, 1992). It is exactly this period in which our first birth cohort reached adulthood. For other countries as well, it has been concluded that during the nineteenth and early twentieth centuries the lower social classes in particular took advantage of the new possibilities created by increased medical knowledge, improved sanitary standards, which in their turn were not independent of the increased economic growth (Ferrie, 2003; Rogers Hollingsworth, 1981).

More refined regional analyses, to find out whether the place where one lived had an effect on life chances by social class also have to be undertaken. In principle a more differentiated regional classification and/or the introduction in the analysis of contextual variables (mortality levels of the municipalities in which the selected individuals lived during their life) would make it possible to analyze the effect of spatial context. Unfortunately we did

not have enough subjects in our data to perform such analyses.

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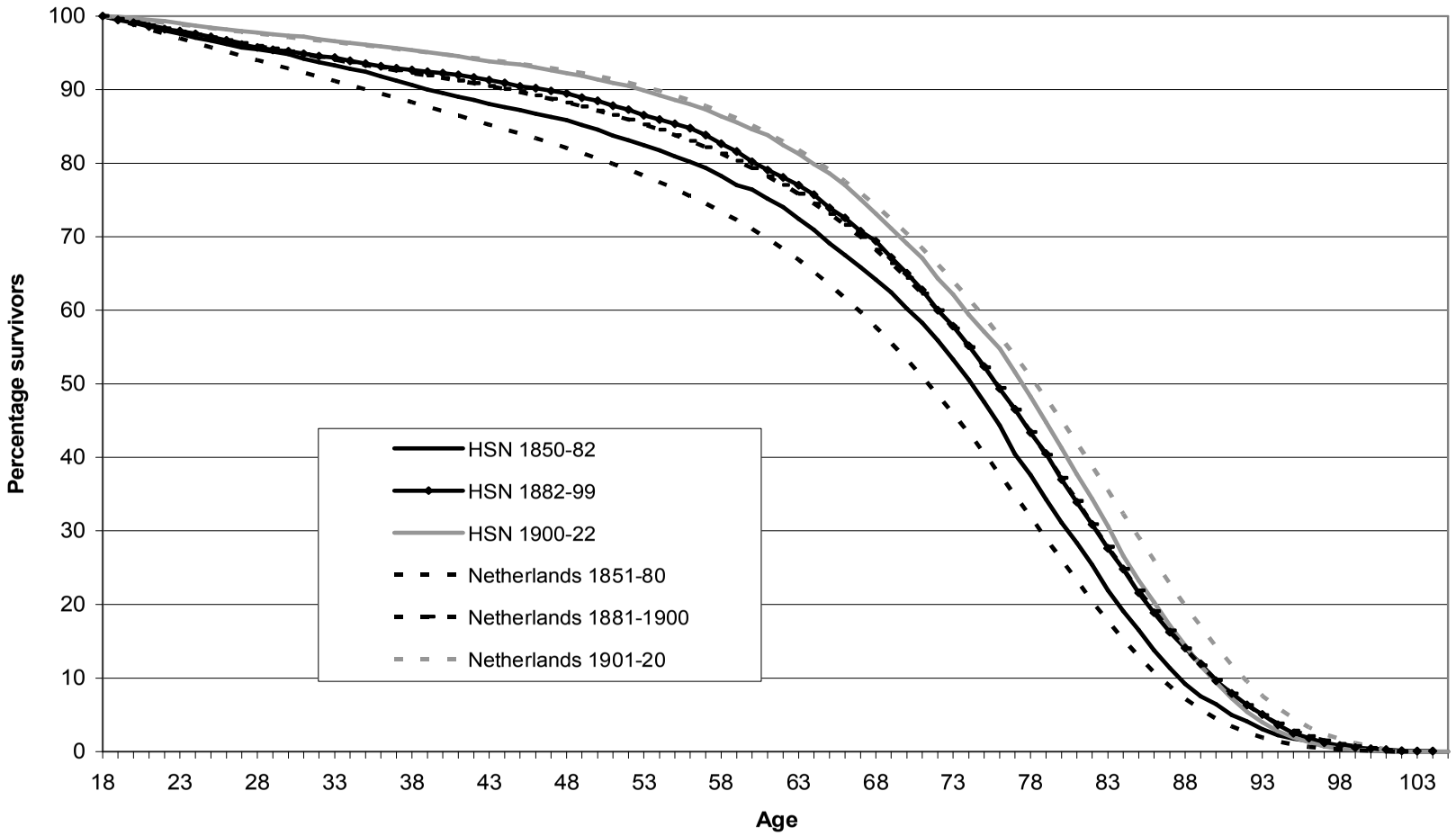

Figure 1. Survival curve for birth cohorts, age 18 and higher, HSN and national data

Table 1. Descriptive characteristics of the HSN-sample (N=13,308)

	Percentage	SOCPO-scheme	Percentage	HISCLASS-scheme	Percentage
Age at death (mean)	63.57	*Father*		*Father*	
Age at death (minimum)	18.00			Lower-/unskilled workers agriculture	17.9
Age at death (maximum)	106.99	Lower skilled workers	13.8	Unskilled workers	10.0
Period of birth (percentage)		Unskilled workers	23.7	Lower skilled workers	16.6
1850-82	24.1	Farmers	15.2	Farmers	15.0
1883-99	31.1	Skilled workers	22.0	Foremen and skilled workers	15.6
1900-22	44.8	Middle/upper class	24.4	Managers/Professionals	23.2
Sex (percentage)		Unknown/without	0.8	Unknown/without	1.7
Males	50.7				
Females	49.4	*Male research person*		*Male research person*	
Region of birth (percentage)				Lower-/unskilled workers agriculture	4.3
North-West	34.1	Lower skilled workers	25.7	Unskilled workers	6.3
South-East	18.7	Unskilled workers	10.0	Lower skilled workers	24.1
West	47.2	Farmers	5.8	Farmers	6.3
Urbanity municipality of birth (percentage)		Skilled workers	10.1	Foremen and skilled workers	7.4
Rural	64.1	Middle/upper class	19.6	Managers/Professionals	22.3
Urban	35.9	Without	14.0	Without	14.0
Religion of parents (percentage)		Unknown	14.8	Unknown	14.9
Protestant	55.5	*Upwardly mobile**	20.3	*Upwardly mobile**	31.6
Catholic	27.1				
Mixed	4.8	*Husband*		*Husband*	
Other religion	11.7			Lower -/unskilled workers agriculture	10.1
No religion/unknown	0.8	Lower skilled workers	15.6	Unskilled workers	8.2
		Unskilled workers	19.4	Lower skilled workers	15.6
Literacy father (percentage)					
Illiterate	2.8	Farmers	34.6	Farmers	10.7
Literate or unclear	97.2	Skilled workers	19.2	Foremen and skilled workers	15.5
Household situation at age 15		Middle/upper class	4.0	Managers/Professionals	32.0
Both parents present (percentage)	79.0	Without	2.9	Without	2.4
Number of kin in household	6.00	Unknown	4.4	Unknown	5.8
		*Upwardly mobile***	31.8	*Upwardly mobile***	39.1

**Relative to the social status of the father* ***Relative to the social status of the husband of the wife*

Table 2. Percentage of persons having reached age 18 for which no date of death is available, by birth cohort, sex, region of birth, urban character municipality of birth and social-class scheme (N=2726; 20.5%)

	Percentage	SOCPO-scheme	Percentage	HISCLASS-scheme	Percentage
Cohort 1850-82	21.8	*By social class father*		*By social class father*	
Cohort 1883-99	25.1	-		Lower-/unskilled workers agriculture	17.7
Cohort 1900-22	53.2	Unskilled laborers	18.8	Unskilled workers	18.0
		Lower skilled laborers	20.6	Lower skilled workers	19.2
Men	49.2	Farmers	19.1	Farmers	19.7
Women	50.8	Skilled laborers	18.3	Foremen and skilled workers	20.5
		Middle/upper class	24.8	Managers/professionals	25.4
		Unknown/without	22.7	Unknown/without	16.5
		By social class research person		*By social class research person*	
				Lower-/unskilled workers agriculture	4.2
		Unskilled laborers	9.5	Unskilled workers	6.0
		Semi-skilled laborers	23.1	Lower skilled workers	21.2
		Farmers	3.7	Farmers	4.11
		Skilled laborers	9.3	Foremen and skilled workers	7.33
		Middle/upper class	12.8	Managers/professionals	15.1
		Without	15.7	Without	15.7
		Unknown	26.0	Unknown	26.3
		By social class husband		*By social class husband*	
				Lower -/unskilled workers agriculture	5.7
		Unskilled laborers	13.9	Unskilled workers	4.9
		Semi-skilled laborers	13.2	Lower skilled workers	11.3
		Farmers	20.0	Farmers	5.0
		Skilled laborers	14.0	Foremen and skilled workers	9.6
		Middle/upper class	1.8	Managers/professionals	13.7
		Without	13.6	Without	13.4
		Unknown	23.4	Unknown	36.5

Table 3a. *Cox-regression-analysis of the time till death from age 18 till exact age 35 (relative risks and significance-levels), base models for males and females*

	Hisclass-scheme		Socpo-scheme	
	Model 1	Model 2	Model 3	Model 4
Gender				
Male (ref)	1.000	1.000	1.000	1.000
Female	0.733***	0.728***	0.734***	0.727***
Birth cohort				
1850-82 (ref)	1.000			
1883-99	0.795**	0.805*	0.801**	0.808*
1900-22	0.466***	0.457***	0.467***	0.455***
Region of birth				
North-West		0.806*		0.815*
South-East		0.920		0.895
West (ref)		1.000		1.000
Urbanity place of birth				
Rural		1.147		1.108
Urban (ref)		1.000		1.000
Religion				
Protestant		1.021		1.020
Catholic (ref)				
Mixed religion		0.959		0.972
Other religion		1.139		1.136
Literacy father				
Literate (ref)		1.000		1.000
Illiterate		1.055		0.956
Household situation age 15				
Both parents present		0.772**		0.772**
One or two missing (ref)		1.000		1.000
Number of kin present at age 15		1.012		1.017
Hisclass father				
Workers in agriculture (ref.)	1.000	1.000		
Unskilled workers	1.038	1.006		
Lower skilled workers	1.196	1.149		
Farmers	0.971	0.924		
Foremen and skilled workers	0.863	0.806		
Managers/professionals	0.912	0.892		
Unknown/without	0.951	0.939		
Socpo father				
Farmers			0.943	0.908
Unskilled laborers (ref)			1.000	1.000
Semi-skilled laborers			1.272*	1.214
Skilled laborers			0.869	0.826
Middle/upper class			0.763**	0.743**
Unknown/without			1.056	0.950
N	14938	14129	14610	13923
Events	830	791	808	773
Log-Likelihood	-7836.3	-7410.0	-7604.5	-7225.6
Null-model	-7881.2	-7464.4	-7654.8	-7284.0
Person years	506971.7	478456.7	495910.7	471715.8

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3b. *Cox-regression-analysis of the time till death from age 18 till exact age 35 (relative risks and significance-levels), base models for males and females*

	Hisclass-scheme		Socpo-scheme	
	Model 1	Model 2	Model 3	Model 4
	All cohorts	1850-82	1883-99	1900-22
Gender				
Male (ref)	1.000	1.000	1.000	1.000
Female	0.733***	0.728***	0.734***	0.727***
Birth cohort				
1850-82 (ref)	1.000			
1883-99	0.777***	0.747***	0.786***	0.753***
1900-22	0.832***	0.786***	0.839***	0.793***
Region of birth				
North-West		0.923**		0.915***
South-East		1.045		1.040
West (ref)		1.000		1.000
Urbanity place of birth				
Rural		0.933**		0.931**
Urban (ref)		1.000		1.000
Religion				
Protestant		0.961		0.964
Catholic (ref)				
Mixed religion		0.992		0.983
Other religion		0.998		0.994
Literacy father				
Literate (ref)		1.000		
Illiterate		1.021		1.039
Household situation age 15				
Both parents present		1.038		1.037
One or two missing (ref)		1.000		1.000
Number of kin present at age 15		0.982***		0.982***
Hisclass father				
Workers in agriculture (ref.)	1.000	1.000		
Unskilled workers	1.048	1.006		
Lower skilled workers	1.023	0.970		
Farmers	0.929*	0.923*		
Foremen and skilled workers	1.064	1.008		
Managers/professionals	1.027	0.980		
Without	0.987	0.965		
Socpo father				
Farmers			0.925*	0.927*
Unskilled laborers (ref)			1.000	1.000
Semi-skilled laborers			0.991	0.949
Skilled laborers			1.044	0.997
Middle/upper class			0.995	0.957
Without			0.959	0.893
N	12123	11390	11865	11246
Events	11032	10345	10799	10219
Log-Likelihood	-91810.2	-85398.2	-89667.8	-84256.5
Null-model	-92026.4	-85631.9	-89851.3	-84463.7
Person years	873557.5	820391.6	854871.0	810213.9

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4a. Cox-regression-analysis of the time till death from age 18 till exact age 35 (relative risks and significance-levels), males

	Hisclass-scheme				Socpo-scheme			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	All cohorts	1850-82	1883-99	1900-22	All cohorts	1850-82	1883-99	1900-22
Birth cohort								
1850-82 (ref)	1.000				1.000			
1883-99	0.823				0.847			
1900-22	0.472***				0.475***			
Region of birth								
North-West	0.957	1.006	1.164	0.750	0.982	1.073	1.194	0.761
South-East	1.172		1.247	1.162	1.137		1.165	1.120
West (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Urbanity place of birth								
Rural	0.968	0.759	1.189	0.955		1.118	0.945	0.887
Urban (ref)	1.000	1.000	1.000			1.000	1.000	1.000
Religion								
Protestant	0.910	0.710	0.879	1.156	0.895	0.707	0.880	1.141
Catholic (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Mixed religion	0.830	0.354	1.488	0.797	0.856	0.397	1.518	0.818
Other religion	1.180	0.784	0.884	1.841*	1.147	0.860	0.823	1.751*
Literacy father								
Literate (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Illiterate	1.064	0.783	0.974	1.720	0.893	0.607	0.803	1.652
Household situation age 15								
Both parents present	0.749*	0.862	0.886	0.583*	0.746*	0.810	0.941	0.589*
One or two missing (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Number of kin present at age 15	1.010	0.986	0.988	1.052	1.016	0.980	0.992	1.063
Hisclass father								
Workers in agriculture (ref.)	1.000	1.000	1.000	1.000				
Unskilled workers	1.221	1.120	1.254	1.142				
Lower skilled workers	1.265	1.618	1.182	1.099				
Farmers	1.073	1.144	1.026	0.978				
Foremen and skilled workers	1.309	1.786	1.133	1.129				
Managers/professionals	1.085	1.209	1.128	0.910				

Unknown/without	1.568	2.391	1.697	0.878				
Socpo father								
Farmers					0.780	0.755	0.691	0.866
Unskilled laborers (ref)					1.000	1.000	1.000	1.000
Semi-skilled laborers					1.049	1.407	0.731	1.078
Skilled laborers					0.707*	0.708	0.608	0.795
Middle/upper class					0.505***	0.452**	0.449**	0.618
Unknown/without					2.293	3.185	3.676	1.157
Mobility								
Downward or stable (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Upward	0.466**	0.163*	0.413*	0.775	0.679**	0.416**	0.761	0.834
N	7109	1650	2099	3355	7041	1631	2085	3321
Events	413	132	150	130	401	127	147	126
Log-Likelihood	-3584.7	-952.5	-1130.7	-1027.7	-3472.5	-912.5	-1105.5	-993.8
Null-model	-3618.9	-966.1	-1137.6	-1036.8	-3510.5	-928.3	-1113.9	-1003.9
Person years	241466.3	56433.8	72879.2	111980.2	239358.3	55853.8	72435.3	110932.2

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4b. Cox-regression-analysis of the time till death from exact age 35 (relative risks and significance-levels), males

	Hisclass-scheme				Socpo-scheme			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	All cohorts	1850-82	1883-99	1900-22	All cohorts	1850-82	1883-99	1900-22
Birth cohort								
1850-82 (ref)	1.000				1.000			
1883-99	0.798***				0.809***			
1900-22	0.939				0.937			
Region of birth								
North-West	0.960	0.829**	1.080	1.001	0.945	0.826**	1.053	0.982
South-East	1.126**		1.145	1.150*	1.108*		1.138	1.127*
West (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Urbanity place of birth								
Rural	0.904**	0.938	0.805***	0.957	0.892**	0.920	0.807***	0.941
Urban (ref)	1.000	1.000	1.000			1.000	1.000	1.000
Religion								
Protestant	0.967	0.971	0.981	0.946	0.970	0.980	0.968	0.974
Catholic (ref)								
Mixed religion	0.929	0.889	1.105	0.897	0.915	0.909	1.092	0.876
Other religion	1.006	0.999	0.870	1.060	1.005	1.004	0.864	1.067
Literacy father								
Literate (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Illiterate	1.075	1.011	1.092	1.168	1.107	0.975	1.183	1.220
Household situation age 15								
Both parents present	0.993	1.026	1.001	0.991	0.992	1.025	0.993	0.982
One or two missing (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Number of kin present at age 15	0.986*	0.985	0.979*	0.988	0.985**	0.985	0.979*	0.989
Hisclass father								
Workers in agriculture (ref.)	1.000	1.000	1.000	1.000				
Unskilled workers	1.033	0.898	1.026	1.215				
Lower skilled workers	1.028	0.975	1.091	1.095				
Farmers	0.903	0.705**	1.049	1.022				
Foremen and skilled workers	0.935	0.815	1.135	0.956				
Managers/professionals	1.119	0.948	1.167	1.281**				

Unknown/without	0.700**	4.334***	0.870	0.682**				
Socpo father								
Farmers					0.913	0.682***	1.030	1.059
Unskilled laborers (ref)					1.000	1.000	1.000	1.000
Semi-skilled laborers					1.014	0.880	1.054	1.133
Skilled laborers					0.967	0.831	1.053	1.051
Middle/upper class					1.095*	0.860	1.184*	1.241**
Without					0.707***	4.281***	0.854	0.701**
Unknown					0.728***	1.293	7.438***	0.760*
Mobility								
Downward or stable (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Upward	1.070	0.905	1.191*	1.057	1.072	1.145	0.978	1.126*
N	5787	1363	1836	2585	5603	1355	1797	2448
Events	5250	1200	1587	2461	5073	1193	1551	2327
Log-Likelihood	-39817.1	-7382.6	-10144.4	-16788.9	-38315.4	-7332.7	-9882.6	-15752.5
Null-model	-39893.2	-7406.7	-10170.4	-16841.7	-38377.0	-7357.0	-9904.4	-15794.3
Person years	407666.6	94184.5	129102.2	184231.9	393932.7	93611.5	126064.3	174108.9

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 5a. Cox-regression-analysis of the time till death from age 18 till exact age 35 (relative risks and significance-levels), females

	Hisclass-scheme				Socpo-scheme			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	All cohorts	1850-82	1883-99	1900-22	All cohorts	1850-82	1883-99	1900-22
Birth cohort								
1850-82 (ref)	1.000				1.000			
1883-99	0.786				0.784			
1900-22	0.438***				0.432***			
Region of birth								
North-West	0.673**	0.585**	0.620*	0.837	0.659**	0.576**	0.586*	0.911
South-East	0.669*		0.584*	0.794	0.659*		0.580*	0.762
West (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Urbanity place of birth								
Rural	1.309*	1.480	1.221	1.288	1.374*	1.477	1.275	1.404
Urban (ref)	1.000	1.000	1.000			1.000	1.000	1.000
Religion								
Protestant	1.162	1.703*	1.032	0.954	1.197	1.711*	1.070	0.981
Catholic (ref)								
Mixed religion	1.061	1.506	0.804	1.195	1.101	1.431	0.879	1.180
Other religion	1.093	1.221	0.986	1.043	1.153	1.290	1.024	1.125
Literacy father								
Literate (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Illiterate	1.026	1.118	1.022	1.564	1.010	1.008	1.022	1.493
Household situation age 15								
Both parents present	0.813	0.834	0.911	0.633	0.805	0.814	0.899	0.641
One or two missing (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Number of kin present at age 15	1.013	1.021	0.971	1.048	1.011	1.030	0.974	1.041
Hisclass father								
Workers in agriculture (ref.)	1.000	1.000	1.000	1.000				
Unskilled workers	0.811	0.994	0.725	0.609				
Lower skilled workers	1.033	1.331	1.290	0.510				
Farmers	0.817	1.019	0.950	0.462*				
Foremen and skilled workers	0.668	0.739	0.721	0.462*				
Managers/professionals	0.813	0.777	1.145	0.474*				

Unknown/without	0.451	0.546	0.267	0.598				
Socpo father								
Farmers					0.783	0.648	0.973	0.707
Unskilled laborers (ref)					1.000	1.000	1.000	1.000
Semi-skilled laborers					1.313	1.393	1.268	1.261
Skilled laborers					0.769	0.722	0.913	0.609
Middle/upper class					0.756	0.609	0.911	0.759
Without					0.666	1.036		1.117
Mobility								
Downward or stable (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Upward	0.717	1.322	0.460	0.469	0.647**	0.420***	0.768	0.823
N	7020	1645	2192	3178	6882	1603	2146	3128
Events	378	136	145	97	372	134	142	96
Log-Likelihood	-3257.5	-987.0	-1094.6	-753.7	-3195.3	-962.9	-1073.1	-747.3
Null-model	-3297.5	-995.8	-1106.6	-762.4	-3237.9	-977.6	-1080.6	-753.3
Person years	236990.5	56871.8	76678.3	103260.3	232357.5	55390.9	75057.3	101729.3

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 5b. Cox-regression-analysis of the time till death from exact age 35 (relative risks and significance-levels), females

	Hisclass-scheme				Socpo-scheme			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	All cohorts	1850-82	1883-99	1900-22	All cohorts	1850-82	1883-99	1900-22
Birth cohort								
1850-82 (ref)	1.000				1.000			
1883-99	0.719***				0.719***			
1900-22	0.671***				0.681***			
Region of birth								
North-West	0.873**	0.772**	0.865	1.059	0.888*	0.802**	0.904	1.005
South-East	0.962		0.958	1.016	0.975		0.946	1.031
West (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Urbanity place of birth								
Rural	0.944	0.955	0.924	0.935	0.956	0.965	1.026	0.969
Urban (ref)	1.000	1.000	1.000			1.000	1.000	1.000
Religion								
Protestant	0.947	1.054	0.956	0.905	0.944	1.020	0.966	0.901
Catholic (ref)								
Mixed religion	1.006	0.970	1.061	0.991	0.981	0.918	1.164	1.045
Other religion	0.978	0.889	1.080	0.970	0.958	0.881	1.024	0.972
Literacy father								
Literate (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Illiterate	0.894	0.882	0.927	0.851	0.905	1.034	0.902	0.963
Household situation age 15								
Both parents present	1.059	0.984	1.185*	0.994	1.060	1.013	1.159*	1.066
One or two missing (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Number of kin present at age 15	0.980**	0.983	0.967**	0.991	0.977***	0.973*	0.973**	0.987
Hisclass father								
Workers in agriculture (ref.)	1.000	1.000	1.000	1.000				
Unskilled workers	0.898	0.855	0.960	0.797				
Lower skilled workers	0.904	1.037	0.848	0.811				
Farmers	0.954	0.990	0.955	0.824				
Foremen and skilled workers	0.868	0.799	0.855	0.867				
Managers/professionals	0.828**	0.885	0.748*	0.831				

Unknown	1.186	1.228	1.534*	1.061				
Without	1.428**	1.501	1.254	1.361				
Socpo father								
Farmers					0.957	1.062	0.954	0.868
Unskilled laborers (ref)					1.000	1.000	1.000	1.000
Semi-skilled laborers					0.970	1.089	1.083	0.938
Skilled laborers					0.962	0.950	1.012	0.885
Middle/upper class					0.756**	0.843	0.723*	0.839
Unknown					1.089	1.102	1.087	1.063
Without					1.527***	0.880	1.119	1.124
Mobility								
Downward or stable (ref)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Upward	1.054	1.039	1.212	0.879	0.942	0.860*	0.981	0.977
N	3504	1058	1360	1084	3429	1387	1899	2029
Events	3251	943	1255	1051	3176	1213	1662	1944
Log-Likelihood	-23102.4	-5583.0	-7728.6	-6288.6	-22496.6	-7495.2	-10717.7	-12841.6
Null-model	-23159.2	-5596.7	-7747.9	-6301.1	-22552.0	-7512.0	-10732.2	-12854.6
Person years	258066.5	75316.3	101235.4	81369.8	252501.5	98309.4	138273.0	154717.8

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$