The question whether socioeconomic status gradients in adult mortality have changed over a broad historical period has become an important political and theoretical issue but is hard to test. In this article we study long-term trends in social inequality in adult mortality by using data for 2 (of the 11) provinces of the Netherlands for the period 1812–1922. We apply indirect estimation techniques, which have been developed for the analysis of mortality patterns in countries with deficient data. Our article shows that indeed there was a clear social class gradient in mortality, with the elite having higher survival chances between ages 35 and 55 than the middle class and farmers. Differences were even more apparent in comparison with workers. Over time there was a strong convergence among social classes in mortality levels. The implications of our results for the dominant views on the change in living standards in the past are discussed.

A number of studies have reported widening socioeconomic inequalities in mortality since the 1960s; as a consequence, trends over time in socioeconomic differences in mortality became an important political issue and a booming business for epidemiologists and demographers (see, e.g., Mackenbach et al. 2003; Kunst et al. 2004). The interest in the development over time of the link between socioeconomic status (SES) and mortality was further stimulated by Bruce G. Link and J. C. Phelan’s theory of “fundamental
social causes” (Link and Phelan 1995, 1996, 2002; Link et al. 1998), which is founded on the assumption that there is a persistent association between SES and mortality over historical time. The empirical question whether SES gradients in mortality indeed have persisted at essentially the same level over a broad historical period and over a variety of places is hard to test. Most of the studies that contain information on trends in SES inequalities in mortality have a limited time horizon. In this article we add to the knowledge of the long-term trends in social inequality in adult mortality by studying data for the Netherlands for a much longer time period than is usually possible. We do this by applying various indirect estimation techniques, some of which have been developed to permit the analysis of mortality patterns in countries where the data on mortality are defective. By studying 2 of the 11 Dutch provinces, each with its particular ecological and economic structure, we are able to distinguish the effects of the environment from those of social class. As the methods proposed make use of data available for various European countries over a long time span, our article offers a way out of the current deadlock that affects research into historical trends in SES-related mortality.

Long-Term Trends in SES Gradients in Mortality

In the early nineteenth century medical doctors and statisticians started collecting data on social class differences in mortality to judge how the deterioration in socioeconomic conditions following from urbanization and industrialization processes affected the health of the working classes (Davey Smith et al. 2001). Reinhard Spree (1988: 51) characterized these studies as follows:

Although a large amount of information on the effects of social differences on health is available it was almost exclusively gathered for a specific point in time, generally applies to narrowly defined geographical areas and, as a rule, was obtained by using non-comparable differential criteria. It is therefore impossible to chart any clear developments or patterns from the existing mass of relevant data.

Various authors have nonetheless tried to map long-term trends in social class differences in mortality, making use of these and other data.
In a pioneering and much-cited study based on rudimentary data for the period before 1900 from a variety of places, Aaron Antonovsky (1967) suggested that in the Western world three stages can be identified in the long-term pattern of class mortality differences. Until around 1650 no substantial differences in life expectancy could be found. Between 1650 and 1850 an increasing gap in life expectancy emerged due to the improvement of the positions of the middle and upper strata and a slower increase or even a decrease in the position of the lower strata as an industrial proletariat emerged. After 1850 this trend reversed, and the class gap began to diminish; in the 1960s it narrowed to the smallest differential in history. Later tests of the Antonovsky model relied on data from different time periods in countries as diverse as France, the United Kingdom, and Switzerland (Woods and Williams 1995). Robert Woods and Naomi Williams concluded that the decline in the death rate did not by implication lead to declines in the class differences, but in general their findings were consistent with those of Antonovsky.

For epidemiologists, these studies on the changing association between social class and adult mortality are highly relevant. Historical trends in socioeconomic mortality differences are essential pieces of information for the present-day debates on the widening SES mortality gap since the 1980s (Whitehead 1998). They are also important as a test of an essential assumption in Link and Phelan’s fundamental social causes theory, which has attracted much attention recently. Its central principle is that SES gradients in mortality have persisted over a broad historical period and over a variety of places (Link and Phelan 1995, 1996, 2002; Link et al. 1998; Phelan et al. 2004). For example, it is argued that between 1840 and 1995 “the persistence of the association between SES and mortality stands as an important fact in need of explanation” (Link et al. 1998: 375–76) and that between the nineteenth century and the present “socioeconomic inequalities in mortality have remained undiminished” (Phelan et al. 2004: 268). The empirical question whether SES gradients in mortality indeed have persisted over a long historical period and over a variety of places has not been answered in a satisfactory way (Phelan et al. 2004).

The most obvious problem in testing the theory is that information on trends in SES inequalities in mortality has a limited time horizon. Thus the association between SES and mortality before the advent of public health initiatives, such as improved sanitation, cannot be studied. Much of the work on the development of the SES mortality gradient relies heavily on British
evidence, but there are sufficient indications that it is not possible to generalize from the British experience (Preston and Haines 1991: 196).

Historians in a variety of countries have in the past decade taken up again the study of social class mortality differences by going back to the original sources to make new estimates of mortality levels of various social classes. They have used the conventional methods to measure mortality according to SES: unlinked and linked cross-sectional study designs, backward-linked studies (matched-record studies), and prospective studies. Most of the studies limit themselves to a single community and do not study changes in the social gradient in mortality over time (see, e.g., for Belgium, Neven 2000; for Italy and Sweden, Breschi et al. 2004 and Bengtsson 2004; for the United States, Ferrie 2003 and Currie and Stabile 2002), but on a small scale, time trends were studied for France (Blum 1990; Bourdieu and Kesztenbaum 2004) and the Netherlands (van Poppel, Deerenberg, et al. 2005). As a consequence, information on long-term trends in social class mortality differences is still scarce. In particular, we lack information that makes it possible to study trends during the pretransition and the transition periods of mortality, that is, the period from the second quarter of the nineteenth century until the second quarter of the twentieth.

Most of the historical studies limit themselves to a single community. In light of the fact that various authors have argued that social class differences in the past largely reflect the influence of environmental factors, such as the quality of the sewage system or the water supply (Spree 1988: 99–100), it is important to disentangle the effects of social class and geographical variation. This idea has a parallel in present-day epidemiological studies that have demonstrated that socioenvironmental characteristics of areas, such as the presence of public health facilities, are strongly related to the mortality experience of individuals, independent of the characteristics of those individuals (Krieger et al. 1997; Kunst 1997; Robert 1999; Yen and Syme 1999).

Another limitation of historical studies is that they strongly focus on the long-term relationship between SES and infant mortality. The impact of social class might differ considerably over age groups (Garrett et al. 2001: 196; Currie and Stabile 2002; Ferrie 2003). Several authors have argued that infants are less sensitive to social conditions than children aged one or older, because differences in breast-feeding and weaning practices, which are more or less independent of socioeconomic conditions, are more important for survival in the first age group than strict economic factors, such as access to
better quality food or housing conditions (Haines 1985; Woods et al. 1993). Others, such as John Landers (1993: 139–41) and Renzo Derosas (2003), have contradicted this finding.

In this article we add to the knowledge of the long-term trends in social inequality in adult mortality by using various indirect estimation techniques. We deduce adult mortality rates by SES, measured by occupation, from routinely collected historical data on parental survival for the Netherlands from 1812 to 1922. We have chosen occupation (grouped into social classes) as an indicator of SES for practical reasons (in the period studied here, information on the educational level of the deceased is hard to get and scarcely differentiates the population) and theoretical reasons (education-related lifestyle dimensions of health are less important in historical populations than the occupational social class [Davey Smith et al. 1998]).

Our study has several distinctive traits that allow us to partly overcome the drawbacks of earlier studies. First and foremost, we can study a long time period during which the Netherlands underwent radical changes in its economic and social structures (income growth, industrialization, and urbanization). Second, our data sources make it possible to gather comparative information at the micro level on socioeconomic characteristics, allowing us to apply an identical occupational class scheme and identical mortality measures over time. Third, rather than a single community, we study a large part of a whole country: 2 of the 11 Dutch provinces (Zeeland and Limburg), each with its particular ecological, social, and economic structures, covering smaller cities and rural areas.

Indirect Estimation of Adult Mortality

The observed proportions of orphans at a given age $x$ (reference persons) depend on the survival chances of the father of the target person. To transform the information on the survival status of the parents of the reference persons into interpretable mortality measures, one needs information about that target person’s length of exposure to the risk of dying and about the age at which exposure began. The observation period for the measurement of survival is equal to the age of the reference person or to his or her age plus the gestation duration. The age at which exposure started is the age of the father at the date of birth of the child. This information suffices to estimate lifetime survivorship probabilities from one set of adult ages (ages of the
fathers at the time of birth of the reference persons) to another set (ages of
the reference persons at the time of observation).

Estimates of adult mortality derived from information on the survival
of parents of a group of reference persons represent averages of the mort-
tality of fathers experienced over the period during which the fathers were
exposed to the risk of dying. In principle, the age of the reference group
provides information on the duration of exposure. For example, proportions
orphaned in age group 35–39 refer to survival over a period between 35 and
40 years. To estimate in a more specific way the time period to which sur-

vival refers, certain assumptions have to be made about the regularity of the
mortality trends (Brass and Bamgboye 1981). If mortality has been changing
in a regular way, each estimate has a time reference; that is, there is a time
before the survey that is characterized by a mortality regime (for example,
a life table) with survivorship identical to the estimated level. However, the
age after which this risk started is usually not known, as the age of the father
at the date of birth of the child is rarely available. The distribution of starting
points for the mortality risk depends on the fertility pattern, that is, on the
age at paternity. Models of parental survival have been developed to allow for
the distributional effects of the range of ages of paternity and childbearing
in order to convert proportions with parents surviving into specific life table
survival probabilities (United Nations 1983).

Various methods have been developed to use information on survival of
father (or mother) to estimate adult mortality (Henry 1960; Brass and Hill
1973; Page and Wunsch 1976; Hill and Trussell 1977). They all rely on infor-
mation gathered by a question that is simple and easy to answer. The question
normally is, “Is your father (mother) alive?” The available methods vary
in the way they adjust for confounding factors in converting the proportions
of persons with surviving parents into mortality measures.

Ian Timaeus (1991, 1996) suggested estimating adult mortality from
information on surviving fathers at the time of marriage of their children.
Timaeus has shown that the proportion of men with living fathers at the time
of their marriage is approximately equal to their father’s life table probability
of surviving from the mean age at paternity to that age plus the mean age at
first marriage of the cohort of men concerned. Estimates of the male proba-

bility of surviving from age 35 to age 55 are made from

\[
\frac{l(55)}{l(35)} = \beta_0(n) + \beta_1(n)M_p + \beta_2(n)M_m + \beta_3(n)S_n + \beta_4(n)M_m S_n
\]  

(3)
in which \( l(35) \), respectively \( l(55) \), is the life table probability of survival from birth to age 35, respectively to age 55, \( S_n \) is the proportion of respondents aged from \( n \) to \( n + 4 \) with father alive, \( M_p \) is the mean age at paternity, \( M_m \) is the mean age at marriage of the grooms, and \( \beta_0 \) to \( \beta_4 \) are coefficients estimated from orphanhood in a set of simulated populations created from model life tables and fertility distributions.

A comparable method was proposed by Alain Blum, Jacques Houdaille, and Marc Lamouche (1990). When \( M_p \) is the mean (or median) age at paternity and \( M_m \) is the mean (or median) age at marriage of the grooms, an estimate of the ratio \( l(m + p)/l(p) \) can be obtained by calculating the proportion of fathers who have survived until the mean (median) age at marriage of their sons. Mortality estimates at various ages can then be obtained from model life tables and empirical “universal” typical mortality experiences derived from a group of observed life tables (see, e.g., Coale and Demeny 1966).

Whereas the application of indirect estimation techniques to proportions of children with surviving parents from various social classes makes it possible to calculate SES-specific standard life table measures, the effect of social class on the probability that the father of the groom was alive at the time of the wedding can also be quantified directly by applying multivariate techniques to social class–specific proportions of surviving fathers and by introducing in these models values for confounding variables, such as ages of paternity.

**Biases in Estimation Procedures**

The accuracy of estimation procedures based on information on the survival status of the parents of the bride and the groom at the time of their child’s marriage depends on whether the assumptions on which the various methods are based do apply. The orphanhood method involves the general assumption that the mortality of respondents is uncorrelated with the mortality and fertility of their parents. By definition, the probabilities of survival that are estimated reflect only the mortality experience of parents with surviving children and not that of all adults. The probability of a parent’s selection in a sample is proportional to his or her number of surviving children. Consequently, a father who survived until he had had time to have four children is four times as likely to be included in the sample as a father who died before having completed his family.
As a consequence of the fact that we use information on surviving fathers of marrying sons only, our study is based on stronger assumptions than standard applications of the technique, which usually rely on information on the general population. Class differences among fathers are studied by looking at the survival of fathers at the time of the marriage of their sons. For various reasons, not all members of each social class are included in the sample.

Members of social classes in which it is common not to live long enough to find a spouse will not be included in the sample, but as we restrict ourselves to mortality among people who reached adult ages, that is not a real problem. Members of social classes with higher celibacy rates are underrepresented in the sample. In Limburg and Zeeland provinces the overwhelming majority of male adults ultimately married (88–90 percent in Zeeland, 81–85 percent in Limburg), but there were differences among social classes: in general, among agricultural laborers a lower proportion married (around 75 percent) than among casual workers (80–85 percent), skilled and semi-skilled workers (around 90 percent), and artisans and employers (90–92 percent) (Frinking and van Poppel 1979: 80–81). This will have led to an underrepresentation of members of the lower class with supposed higher mortality. Grooms who were born out of wedlock are excluded from the study, as they could not offer information about their fathers. Illegitimacy was rare in the Netherlands, however, although it was more frequent in lower social classes. Members of those social classes in which there were fewer children, or fewer children who survived to the age of marriage and had less chance to contract a marriage, also had less chance to be included in the sample. Family limitation in the Netherlands, which started only in the 1880s, hardly had an effect on the generations marrying before 1922 (van Poppel and Röling 2003). Although one’s social class had much less effect than the province in which one lived, infant and child mortality in the Netherlands differed by social class (van Poppel, Jonker, et al. 2005), and children from the lowest social classes will for that reason be underrepresented among those reaching marriageable age. As unhealthy fathers will have less chance to survive until the end of the reproductive period, they might also have less chance to produce children. One might therefore expect that, from some low-mortality families, several respondents are surveyed, leading to an overrepresentation of families with low mortality, whereas families with no surviving children (including those not marrying) are not represented in the sample at all, biasing mortality downward (Palloni et al. 1984; Gakidou and King 2006). It can
safely be assumed that as several of the selection processes mentioned above are at least partly driven by health, our sample will tend to underestimate class differences in mortality: in several cases the healthy individuals have more chance to be included in the sample than the unhealthy ones. If one assumes that there are health differences among social classes in the expected direction, class differences in health and mortality will be underestimated.

A further assumption is that the probability that a man marries at any age is unaffected by his father’s survival and that his age at marriage is uncorrelated with his father’s age at the time the respondent was born (Timaeus 1991). At first glance, one would expect that the death of a father and the marriage of his son are not independent events and that the probability that a man married at a given age might have been affected by his father’s survival. Having a dead father may greatly influence the chances of a son marrying, owing to his inheritance (Hollingsworth 1969: 158). George Alter and Michel Oris (1999) studied in a detailed way the effects of the deaths of the father and the mother on the timing of marriage of their children. They observed that marriage was much more likely if both parents had died in the preceding three years. Surprisingly enough, parental deaths had larger effects on the marriages of women than on those of men. Alter and Oris found almost no effect on marriage of the son when only the father had died.

Deaths of parents could have occurred at any point during the life of the respondent. The estimated probabilities of survival do not refer to specific time periods, since they represent average measures over an interval of exposure to the risk of dying in the target population. For cohorts of men of a given age who have married, the ages at which the fathers are exposed to the risk of dying are concentrated between the mean age at paternity and the sum of that age and their sons’ mean age at marriage. Data on these parameters for historical cohorts are extremely rare, but, as will be shown later, detailed information on ages at marriage and ages at parenthood for the Netherlands in the past is available.

Using indirect methods of estimation to provide indicators of the level and trend in SES differentials in adult mortality further complicates the issue. The information we use consists of information on the respondents themselves, whereas in fact we are interested in information on their parents. For example, the information we collect on social class refers to the groom, and the information on parental survival thus relates to the social class of the son. Parents may not necessarily have belonged to the same social class as
their son. If health status is a factor systematically affecting the probability of upward or downward social mobility for an individual, then an increase in the rate of social mobility may well result in constant or widening social class mortality differentials by social class of the groom even if the differentials narrow when measured by social class of origin (that is, the social class of the father). This might result in a biased measure of trends in health inequalities when the absolute rate of social mobility varies over time (Nystrom Peck 1992). Intergenerational social mobility was marginally affected by the death of the father before the time of a person’s marriage. Sons whose fathers had died before the son’s marriage were disadvantaged, the more so if their fathers had died at an early age (van Poppel et al. 1998). This downward social mobility of the son would imply that orphaned sons would be included in a lower social class than that of the father; as a consequence, lower class mortality would be overestimated. Differing amounts of and trends in social mobility over time might lead to biased estimations of mortality differences. If the results for the Dutch province of Utrecht are typical for the country as a whole, relative intergenerational social mobility in the Netherlands did not change much during the period 1850–1940 (van Leeuwen and Maas 1997). That would lend support to our use of the method. But as long as we do not know what the underlying social class mortality patterns are and cannot identify trends in upward and downward intergenerational social mobility, we can estimate these effects only by introducing a number of untested assumptions.

A systematic and technical test of the effects that (changing) levels of intergenerational social mobility might have had on social class mortality estimates based on parental survival can be done only by using realistic parameters deduced from individual-level information on social class of origin and social class in adulthood of individuals in relation to their own and their fathers’ mortality. Information of this kind will become available with the completion of historical databases in Sweden, the Netherlands, and other countries.

It thus remains to be seen whether our indirect estimation methods can stand these tests and provide a satisfactory picture of mortality differentials, both geographic and social, during the nineteenth and early twentieth centuries (Blum et al. 1990: 181). In any case, it is important to keep in mind that our methods are applied only to married males under specific fertility conditions as specified by the given paternal ages at parenthood and in a society with restricted intergenerational social mobility.
Marriage Certificates as a Source for Indirect Mortality Estimation

Information on the numbers of men and women of a particular age with a mother or a father alive is usually included in marriage certificates, which are available for many European countries from the beginning of the nineteenth century on. The vital registration system was introduced nationwide in the Netherlands in 1811–12. The quality of the data in the marriage certificates was more or less ensured by the rules laid down in the civil codes in effect in the Netherlands from 1811 on. The civil codes included regulations concerning parental consent for marriage, on the basis of which the survival status of both parents could in principle be deduced (Vaillant 1893: 320–40). The age of the respondent can be considered reliably registered, as the bride and groom had to present copies of their baptismal or birth certificates to the vital registration officer. We were able to use marriage records for two provinces: Zeeland and Limburg. Our dataset contains 10 percent of all marriages contracted in the period 1812–1922 in the Netherlands as a whole, making the sample large enough for meaningful mortality estimates.

The province of Limburg is located in the southeastern Netherlands. It was mainly an agricultural province, but at the end of the nineteenth century coal mining became an important economic activity. The first large-scale industries in the Netherlands developed in Limburg’s provincial capital, Maastricht, and contemporary observers were struck by the adverse effects this had on the working population. Zeeland is situated in the southwestern coastal zone and was for a long time a rural area. In the second half of the nineteenth century agricultural modernization eroded the position of farm laborers, resulting in a classic rural proletariat whose health condition was painted in black.

As table 1 shows, the two provinces experienced markedly different levels of mortality. The sharp divide between the high mortality levels of the coastal and low-lying riverine provinces and the much lower mortality levels of the provinces in the east and south, characteristic of the Netherlands until late in the nineteenth century, is clearly visible in the life expectancy at age 15. In Limburg men and women aged 15 could expect to live six to nine years longer than their age peers in Zeeland. It was only in the last decades of the nineteenth century that western provinces such as Zeeland reached higher values of life expectancy. The high mortality in the west during the nineteenth century was largely due to ecological conditions.
Variables

We calculated for each age of the groom at the time of marriage the proportion of grooms with surviving fathers. We classified all occupations of the grooms in a social class system applicable for the whole period. The social class categorization that we applied is based on the Historical International Standard Classification of Occupations (HISCO; see van Leeuwen et al. 2002). HISCO translates occupational descriptions covering a long historical time, languages, and countries into a common code that is compatible with the International Labour Organization’s International Standard Classification of Occupations (ISCO-68) scheme. These historical occupational titles were classified according to the social power scheme proposed by Bart van de Putte and Andrew Miles (2005). Social power is defined as the potential to influence one’s “life chances” through control of (scarce) resources and is based on economic and cultural resources. Economic power is derived from factors such as self-employment, skill, and authority (command). Sources of cultural power were non-manual versus manual occupations and nobility and prestige titles. The merging of economic and cultural power dimensions leads to a scheme with five levels. Level 5 includes executives who perform general policy tasks, supralocal businesspeople, nonmanual superskilled people, and members of the nobility. Level 4 comprises the supervisors of skilled workers, local businesspeople, manual superskilled people, and nonmanual skilled people. Level 3 includes supervisors of semi- and unskilled workers and manual skilled workers. Level 2 comprises the self-employed who are locally oriented and who have minimal capital as well as semiskilled workers. Level 1 comprises unskilled workers. We denote these groups as the elite, the middle class, the skilled workers, the semiskilled workers, and the unskilled

Table 1  Expectation of life at age 15 by province and sex, 1827–1930

<table>
<thead>
<tr>
<th>Years</th>
<th>Limburg Male</th>
<th>Limburg Female</th>
<th>Zeeland Male</th>
<th>Zeeland Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>1827–28</td>
<td>42.59</td>
<td>42.84</td>
<td>33.83</td>
<td>35.77</td>
</tr>
<tr>
<td>1850–59</td>
<td>44.49</td>
<td>44.16</td>
<td>39.11</td>
<td>40.59</td>
</tr>
<tr>
<td>1901–2</td>
<td>48.94</td>
<td>49.88</td>
<td>51.79</td>
<td>53.07</td>
</tr>
<tr>
<td>1928–30</td>
<td>54.29</td>
<td>53.65</td>
<td>56.59</td>
<td>56.16</td>
</tr>
</tbody>
</table>

Source: Calculations by the authors derived from analyses of data on age and sex structure by provinces at census dates and numbers of deaths by age and sex from vital registration.


workers, respectively. In view of the specific position occupied by farmers in contemporary social class mortality studies, we excluded them from the middle class and placed them in a separate category. Marriages were also classified according to the rural or urban character of the place where the marriage was contracted.

Table 2 presents descriptive statistics for the relevant variables. The marriages in the database numbered 334,481, of which 176,110 took place in Limburg and 158,371 in Zeeland. For almost 6 percent in Limburg and 3 percent in Zeeland, the social class could not be determined. Zeeland and Limburg differed in landscape, soil, and accessibility, and that caused differences in composition by social class between the two regions (and in the relative frequency of some specific occupations). Because of soil differences (marine clay in Zeeland, sand in Limburg), farms in Zeeland were larger than those in Limburg, and farmers in Zeeland employed more laborers. Hence in Limburg farmers accounted for some 27 percent of all grooms, in Zeeland only for 9 percent. Farmworkers, on the other hand, were very numerous in Zeeland. They were classified among the unskilled workers and were by far the largest group within the working classes. They alone made up around 19 percent of the grooms in Zeeland, against only 2 percent in Limburg. Around 50 percent of the Zeeland grooms were classified as unskilled workers; in Limburg that percentage was only 18. A large part of Zeeland was below sea level and was protected by river and sea dikes; the construction and maintenance of these offered employment to numerous excavators (1.3 percent of the grooms). Communication and transport in Zeeland mainly took place by water, and this also raised the number of unskilled workers in Zeeland. Seamen and barge crews (unskilled workers) made up 3 percent of the grooms in Zeeland but were hardly present in Limburg. Semiskilled workers composed 22 percent of the grooms in Limburg and 11 percent of those in Zeeland. Here again differences were visible. Miners made up almost 5 percent of the grooms in Limburg, and potters were well represented there as well. One percent of the population of Zeeland was fishermen (semiskilled). Skilled workers such as shoemakers, weavers, bakers, carpenters, and butchers were almost equally numerous in both provinces (21 percent in Limburg, 15 percent in Zeeland), and that applied to the middle class as well (10 and 12 percent, respectively). Shipmasters (middle class) were overrepresented in Zeeland (making up some 4 percent of the grooms), but in both provinces working proprietors, clerical workers, clerks, and policemen were
<table>
<thead>
<tr>
<th>Table 2</th>
<th>Descriptive statistics for control and dependent variables</th>
<th>Number of marriages</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Limburg</td>
<td>176,110</td>
<td>53.00</td>
</tr>
<tr>
<td></td>
<td>Zeeland</td>
<td>158,371</td>
<td>47.00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>334,481</td>
<td>100.00</td>
</tr>
<tr>
<td>Period of marriage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1812–39</td>
<td>64,884</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>1840–69</td>
<td>81,494</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>1870–99</td>
<td>90,689</td>
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</tr>
<tr>
<td></td>
<td>1900–1922</td>
<td>97,404</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>334,471</td>
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</tr>
<tr>
<td>Age at marriage of men</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;25</td>
<td>81,462</td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>25–29</td>
<td>113,892</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>30–34</td>
<td>63,135</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>35–39</td>
<td>31,169</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>40+</td>
<td>38,695</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>328,353</td>
<td>1.00</td>
</tr>
<tr>
<td>Place of marriage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>105,694</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>228,787</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>334,481</td>
<td>1.00</td>
</tr>
<tr>
<td>Social class groom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unknown or not given</td>
<td>15,381</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Unskilled worker</td>
<td>106,168</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td>Semiskilled worker</td>
<td>54,535</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>Skilled worker</td>
<td>57,922</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>Middle class</td>
<td>34,149</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>Farmer</td>
<td>59,222</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>Elite</td>
<td>7,172</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>334,549</td>
<td>1.00</td>
</tr>
<tr>
<td>Survival status of father of groom</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alive</td>
<td>167,266</td>
<td>50.00</td>
</tr>
<tr>
<td></td>
<td>Deceased</td>
<td>163,858</td>
<td>49.00</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>3,357</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>334,481</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Sources: GENLIAS and ISIS.
present in equal proportions. The upper classes made up almost 3 percent in Limburg, 1 percent in Zeeland. Manufacturers, army officers, ministers of religion, physicians, and head teachers were most frequently mentioned.

The fathers of around half of all of the grooms and brides were alive at the time of the marriage, but that proportion varied over time and by region. Figure 1 presents the percentage of surviving parents of brides and grooms for the two provinces by period of marriage. To take into account the differences in age distribution between the provinces and over time, data are (directly) standardized by age of marriage; the weights used in this standardization are the numbers of marriages by age for the two provinces combined for the whole period 1812–1922. Figure 1 shows that the differences between the two provinces fit into the pattern of regional mortality differences characteristic of the Netherlands, whereas the time trends as well correspond to what is known about the mortality transition in the provinces concerned.

**Figure 1** Percentages of brides and grooms with surviving fathers by province, standardized by age at marriage

Sources: GENLIAS and ISIS.
Logistic Regression Models

We first used regression models to quantify the effect of social class on our proxy of adult mortality, the probability that the father of the groom was alive at the time of the marriage, in the period 1812–1922. The independent variables in these analyses are year of the marriage, social class of the groom, place of residence (urban or rural), and province. The distribution of the starting points for the mortality risk of the father depends on the age at paternity. To take the variation in starting points and in length of exposure among social classes and over time into account, we combined information on ages of paternity of the fathers and on ages at marriage of the sons into one measure and included it in the regression models of parental survival. We calculated this value as the sum of the individual age at marriage of the groom and a matching mean age of the father at the birth of a child. This latter information was derived from the so-called Historical Sample of the Netherlands (see Mandemakers 2000).

The mean age at paternity did not vary much over time but did vary between provinces, places of residence (urban or rural), and social classes. We therefore ignored the variation over time but used separate values of the age at paternity by social class and province. Together with the age of each groom at the time of the marriage, we used the mean ages at paternity to estimate the age of the father of the groom at the time of the marriage.

Given the sizes of the various groups and the differences observed in the proportions of surviving parents, we grouped the six social classes into four more-encompassing ones: workers, farmers, middle class, and elite. We estimated three standard binary logistic regression models with the probability that the father of the groom was alive at the time of the marriage as the dependent variable for the period 1812–1922. Model 1 does not include interaction effects. Model 2 includes interaction effects of year of the marriage and social class. Finally, model 3 comprises, in addition to the aforementioned interaction variable, the interaction effects of province and year and of province and social class. The results of the regression models are presented in table 3.

The results of the three models, as well as the comparison of the results of the models, provide evidence that social class had a significant impact on the probability that the father of the groom was alive at the time of the marriage. They also show that the impact of social class on this probability decreased during the period we studied.
The results of model 1 show that both the age of the father at the time of the marriage and the year of the marriage had significant effects with the expected sign on the probability that the father of the groom was alive at the time of the marriage. This model also shows that this probability was the highest for grooms who belonged to the elite, followed by grooms belonging to the peasant and middle classes. Grooms belonging to the working class had the lowest probability that their fathers were still alive at the time of the marriage. Furthermore, the regression analyses reveal that urban-rural character and province had a significant effect. The chance that the father of the groom was alive, corrected for the other independent variables,
was much larger in Limburg than in Zeeland. Differences between urban and rural areas were relatively small, as in both provinces the countryside was in many aspects closely linked to the cities and was also rather densely populated, whereas the urban areas were not comparable at all with the large industrial cities of England, the United States, Germany, or France. This may explain the relatively small effect of place of residence compared to social class.

Models 2 and 3 contain interaction effects of the year of marriage and social class. The coefficients of these interaction variables are all negative. This and the fact that the interaction effect “elite × year” has the largest and the interaction effect “middle class × year” the smallest negative coefficient imply that the effect of social class was larger in the beginning than in the end of the period. In other words, the effect of social class on the probability that the father of the groom was alive at the time of the marriage decreased in the nineteenth and early twentieth centuries. A visual representation, based on model 3 of the main effects of year of marriage and social class, together with the interaction effect of these variables is depicted in figures 2–3 for 60-year-old fathers in rural areas in Zeeland and Limburg. The level of the trends of the probability that the father of the groom was still alive at the time of the marriage differs between the various ages of the fathers of the grooms and whether the marriage was registered in an urban or in a rural area. Therefore the extent to which these trends converged will differ.

Figures 2 and 3 show that working-class men made the largest progress in their probability of being alive when their sons married. For men belonging to the middle class, the peasantry, and the elite, this probability also increased, although the increase was considerably smaller for these classes than for the working class. Farmers and men of the middle class made more progress in their probability of being alive when their sons married than men of the elite. The difference in the probability of being alive when the son married between farmers and middle-class men in Zeeland increased, whereas farmers in Limburg outran their fellow provincials of the middle class with respect to this probability. The mechanism behind this shifting class difference was probably a change in the Dutch economic structure in the first half of the nineteenth century. In this era the Dutch economy changed from one that heavily relied on trade to one dominated by market-oriented agriculture (Paping 1996). Moreover, the Dutch countryside experienced a scaling up of agriculture in the second half of the nineteenth century. This scaling
up increased the wealth of those farmers who persisted in this social class until the end of the period of our study. In conclusion we might state that the different probabilities that the father of the groom was alive at the time of the marriage clearly converged during the nineteenth and early twentieth centuries.

The effect of the year of the marriage is larger in model 2 than in model 1. This is another indication that the impact of social class decreased in the nineteenth and early twentieth centuries as the effect of year of the marriage in model 1 refers to all social classes and the corresponding effect in model 2 to the working class only. The main effect of the year of marriage represents the total effect of the year of marriage in case the value of the interaction variable is 0; that is, the reference social class is the working class. Finally, the fact that the effects of social class are larger in model 2 than in model 1 shows that the effect of social class was larger in 1812 (the value of the interaction variable is zero in this year for all cases) than in the overall period.

We conducted regression analyses on the separate decades of the period of our study to detect potential fluctuations in the decrease of the effect of social class. Table 4 shows that the probability that the father of the groom

Figure 2  Probability that a 60-year-old father of the groom was alive at the time of the marriage by social class and year of marriage in rural Zeeland
Source: ISIS.
was alive at the time of the marriage was the lowest for the working class in all decades. This probability was higher for grooms from the middle class and farmers. The elite had the largest probability of being alive when their sons married in all periods. The gaps among the social classes seem to have diminished after 1850. The change in the effects of social class follows an erratic pattern in the first half of the nineteenth century. Therefore we cannot make firm statements for this period.

The difference between the mortality trends of the two provinces concerned (see also figure 1) induced us to include the interaction effect of province and the year of marriage in model 3. The significant negative effect of the variable “Limburg × year” supports the supposition that the province of Zeeland outran the province of Limburg in life expectancy at adult ages. As mentioned above, we also included interaction effects of province and social class. We included these interaction effects to correct for regional differences in the class-ridden society. The regression analysis revealed a significant small negative interaction effect of being a farmer in Limburg. The fact that farms in Zeeland were on average larger than farms in Limburg might be the cause of this significant interaction effect. The other two interaction effects
of province and social class were not significant. Hence we may argue that the effect of social class on the father of the groom being alive when his son married did not differ much between the two provinces.

**Indirect Estimation Using the Blum-Houdaille-Lamouche Expressions**

The logistic regression model shows that there were indeed mortality differences among social classes, but it was not possible to translate these into the usual mortality measures, such as probabilities of survival or life expectancies. To calculate these we have to use the indirect estimation methods discussed above. We present here the results of two of these methods.

Blum et al. (1990) took as the basis of their estimation the proportion of fathers surviving until the median age at the marriage of their sons. They showed that this proportion is a reasonable approximation of the probability of survival of fathers between the age at paternity and the age of the father when his son married, that is, between the median age at parenthood and the age calculated by adding this age to the median age at the marriage of the son. We applied this indirect estimation technique to combinations of social classes, provinces, and time periods. A classification into four periods—1812–39, 1840–69, 1870–89, and 1890–1922—covered the changes in

<table>
<thead>
<tr>
<th>Years</th>
<th>Worker (ref.)</th>
<th>Farmer</th>
<th>Middle class</th>
<th>Elite</th>
</tr>
</thead>
<tbody>
<tr>
<td>1812–19</td>
<td>1.00</td>
<td>1.37</td>
<td>1.59</td>
<td>1.82</td>
</tr>
<tr>
<td>1820–29</td>
<td>1.00</td>
<td>1.40</td>
<td>1.47</td>
<td>1.91</td>
</tr>
<tr>
<td>1830–39</td>
<td>1.00</td>
<td>1.37</td>
<td>1.36</td>
<td>2.35</td>
</tr>
<tr>
<td>1840–49</td>
<td>1.00</td>
<td>1.63</td>
<td>1.36</td>
<td>2.35</td>
</tr>
<tr>
<td>1850–59</td>
<td>1.00</td>
<td>1.39</td>
<td>1.47</td>
<td>2.48</td>
</tr>
<tr>
<td>1860–69</td>
<td>1.00</td>
<td>1.34</td>
<td>1.31</td>
<td>2.12</td>
</tr>
<tr>
<td>1870–79</td>
<td>1.00</td>
<td>1.35</td>
<td>1.33</td>
<td>2.07</td>
</tr>
<tr>
<td>1880–89</td>
<td>1.00</td>
<td>1.32</td>
<td>1.24</td>
<td>1.62</td>
</tr>
<tr>
<td>1890–99</td>
<td>1.00</td>
<td>1.35</td>
<td>1.12</td>
<td>1.64</td>
</tr>
<tr>
<td>1900–1909</td>
<td>1.00</td>
<td>1.36</td>
<td>1.16</td>
<td>1.49</td>
</tr>
<tr>
<td>1910–22</td>
<td>1.00</td>
<td>1.32</td>
<td>1.24</td>
<td>1.54</td>
</tr>
</tbody>
</table>

Note: All odds ratios are significant ($p < .001$).
ages at paternity and ages at marriage as well as those in the proportions surviving reasonably well.

The variation in the proportion of surviving fathers according to the age of the groom is not a monotonous decreasing function. Irregularities due to random fluctuations and deviations from the demographic assumptions are responsible for this. To estimate the proportion of surviving parents at the median age at marriage of the son, we therefore smoothed the data by fitting a function using nonlinear least-squares estimation of the parameters of a nonlinear model. The estimates were derived from the proportions of surviving parents in the age range 20–45. For each time period, province, and social class, the survival proportion might in principle refer to a different age range (the range between age at paternity and age of the father at the time of the son’s marriage); for example, whereas for semiskilled workers the estimate refers to survival between ages 25 and 59, for the elite the estimate refers to survival between ages 34 and 75. To make these varying age ranges comparable, we identified the mortality levels that were consistent with survivorship ratios over the corresponding age range in the West family of model life tables by interpolating in the male probabilities of surviving according to these tables. The resulting expectations of life at age 30 are presented in table 5. A comparison of the estimated values of the expectation of life at age 30 from table 5 with the values deduced from vital registration systems shows a close correspondence. For example, the expectation of life at age 30 in 1827–28 as deduced from the published life tables is 30.99 years in Limburg and 24.43 years in Zeeland; the indirectly estimated values for 1812–39 were 30.3 and 23.3 years, respectively. Our indirect estimates for 1840–69 were 32.0 and 26.7 years, respectively; published life tables for 1850–59 gave 33.86 and 28.84 years, respectively. For 1890–1922 we estimated values of 32.0 and 32.3 years; here the differences were larger, as the life tables for 1901–2 gave 36.23 and 38.83 years.

The Zeeland data show a clear social class gradient, with the elite and farmers coming first, followed directly by the middle class and at a larger distance by the various categories of workers. Within this group, there are hardly any differences in expectation of life. According to our estimates, men from the elite and farmers have a remaining life expectancy at age 30 that is three to four years higher than that of the working class. Over time, all social groups experience a regular increase in life expectancy of around eight years. There is not a single indication that the mortality levels of the working class
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Elite</td>
<td>29.07</td>
<td>33.60</td>
<td>33.28</td>
<td>36.92</td>
<td>39.90</td>
<td>43.18</td>
<td>40.01</td>
<td>40.35</td>
</tr>
<tr>
<td>Farmer</td>
<td>27.81</td>
<td>32.82</td>
<td>34.24</td>
<td>37.55</td>
<td>32.99</td>
<td>33.32</td>
<td>35.23</td>
<td>36.16</td>
</tr>
<tr>
<td>Middle class</td>
<td>26.57</td>
<td>30.31</td>
<td>31.68</td>
<td>34.65</td>
<td>32.89</td>
<td>33.72</td>
<td>32.51</td>
<td>35.04</td>
</tr>
<tr>
<td>Skilled worker</td>
<td>23.55</td>
<td>27.93</td>
<td>31.04</td>
<td>32.89</td>
<td>31.07</td>
<td>32.26</td>
<td>32.67</td>
<td>33.91</td>
</tr>
<tr>
<td>Semiskilled worker</td>
<td>25.65</td>
<td>27.47</td>
<td>30.78</td>
<td>33.79</td>
<td>30.16</td>
<td>31.50</td>
<td>32.14</td>
<td>32.44</td>
</tr>
</tbody>
</table>
were affected by the agricultural crisis that struck Zeeland from the 1880s on. The expectation of life at age 30 was in the beginning much higher in Limburg than in Zeeland, but over time the increase was smaller (three years at the most) in Limburg than in Zeeland. There is a slight improvement in the expectation of life among the various groups of workers and farmers, but no such trend is visible among the elite. Nonetheless, the elite is characterized by a remaining life expectancy some 8 to 10 years higher than that of the working classes.

**Indirect Estimation Using the Timaeus Method for Orphanhood before Marriage**

Timaeus (1991, 1996) provided a method of estimating adult mortality from information on the proportion of men with living fathers at the time of marriage of their sons. Equation (3) shows that this proportion is approximately equal to the father’s probability of surviving from the mean age at paternity to that age plus the mean age at first marriage of the cohort of men concerned. Whereas equation (3) is based on values for mean ages at marriage and at parenthood, we have used median values. Separate estimates were made on the basis of the proportions of surviving fathers in the age groups 25–29, 30–34, 35–39, and 40–44. For all four age groups, estimates relate to the probability of survival between ages 35 and 55.

In producing the estimates, we again distinguished four periods of observation, six social classes, and two provinces. The median age at paternity was set at the same value for all periods, but we did use separate values for each combination of social class and province.

Table 6 gives the values for the resulting survival probabilities for the various social classes and periods separately for the two provinces. Again, the data show that Zeeland is characterized by a strong social class gradient. The elite and farmers have in each period slightly higher chances of surviving adulthood than the middle class and much higher chances than the various groups of workers. Within the working class, differences are only modest. Over time, convergence can be observed, mainly because survival in the working classes strongly improves. Such an improvement in survival is also visible among farmers, the elite, and the middle class, but the absolute and relative increases in survival are not as marked as among the lower parts of the class scale. Data for Limburg also substantiate the results from
Table 6  Survival probabilities between ages 35 and 55, males, by social class, period of marriage, and province

<table>
<thead>
<tr>
<th>Social class</th>
<th>Zeeland</th>
<th></th>
<th></th>
<th></th>
<th>Limburg</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Elite</td>
<td>0.587</td>
<td>0.725</td>
<td>0.731</td>
<td>0.762</td>
<td>0.861</td>
<td>0.920</td>
<td>0.818</td>
<td>0.800</td>
</tr>
<tr>
<td>Farmer</td>
<td>0.672</td>
<td>0.736</td>
<td>0.713</td>
<td>0.751</td>
<td>0.695</td>
<td>0.753</td>
<td>0.758</td>
<td>0.781</td>
</tr>
<tr>
<td>Middle class</td>
<td>0.559</td>
<td>0.673</td>
<td>0.647</td>
<td>0.701</td>
<td>0.742</td>
<td>0.768</td>
<td>0.709</td>
<td>0.716</td>
</tr>
<tr>
<td>Skilled worker</td>
<td>0.448</td>
<td>0.564</td>
<td>0.622</td>
<td>0.643</td>
<td>0.656</td>
<td>0.684</td>
<td>0.671</td>
<td>0.661</td>
</tr>
<tr>
<td>Semiskilled worker</td>
<td>0.470</td>
<td>0.548</td>
<td>0.541</td>
<td>0.616</td>
<td>0.593</td>
<td>0.661</td>
<td>0.665</td>
<td>0.622</td>
</tr>
<tr>
<td>Unskilled worker</td>
<td>0.458</td>
<td>0.542</td>
<td>0.545</td>
<td>0.629</td>
<td>0.646</td>
<td>0.678</td>
<td>0.632</td>
<td>0.646</td>
</tr>
</tbody>
</table>
the earlier estimation method. They confirm that in the nineteenth century where one lived was at least as important as the social class to which one belonged. Survival probabilities for all social classes in Limburg were higher than for their counterparts in Zeeland. Yet in Limburg as well there was a social gradient, with the elite having higher survival chances than the middle class and farmers and much higher survival chances than workers. In Limburg a slight deterioration in the position of the elite is visible. The working class remained on more or less the same level.

Conclusion and Discussion

The central question of our article was whether there were social class differences in mortality in adulthood in the nineteenth and twentieth centuries and how these differences evolved over time. Our article shows that indeed there was a clear social class gradient in mortality. The three methods we applied had comparable results. The elite had higher probabilities of being alive at the time of the marriages of their sons, higher expectation of life at age 30, and higher survival chances between ages 35 and 55 than the middle class and farmers. Differences were even more apparent in comparison with the three groups of workers that we distinguished. Within the working class, differences were relatively small. Over time there was a strong convergence between social classes in mortality levels. The results of the regression analysis as well as those of the indirect estimation techniques indicated that over time the relative and absolute advantage of the elite vis-à-vis the working classes declined. Within the working classes no such trend was visible.

This finding raises serious doubt about one of the fundamental elements of Link and Phelan’s “fundamental causes” theory of social class differences. We did not observe a more or less constant relationship between social class and mortality over time, nor did we find comparable levels in different provinces. Other historical studies observed the same phenomenon. Jérôme Bourdieu and Lionel Kesztenbaum (2004), for example, observed that in France for cohorts born between 1810 and 1850 differences in life expectancy at age 30 between rich and poor were relatively small and increased over time from 1.5 to 2.2 years.

Antonovsky’s theory on the development over time of the SES mortality gradient, implying that between 1650 and 1850 an increasing gap in life expectancy could be observed and that after 1850 the class gap began
to diminish, is partly confirmed by our findings. Contrary to Daniel Scott Smith (1983) and Peter Razzell and Christine Spence (2006), we found an association between SES and adult male mortality before the twentieth century, and contrary to Blum et al. (1990), we observed that mortality differentials decreased when life expectancy improved. Thus our results confirm Woods and Williams’s (1995) observation (based as it was on a mishmash of assumptions and small local studies) that social class mortality gradients are subjected to periods of divergence and convergence. In the long-run perspective offered by our historical data, it becomes clear that the SES disparities observed in the present-day Netherlands, in which life expectancy at birth for socioeconomic groups varies between 4.8 and 5.0 years (Perenboom et al. 2005), are rather large by historical standards.

Our article has three messages. First, we think that it is possible to study trends in social class differentials in mortality at adult ages by using non-standard data sources, such as marriage certificates. The resulting mortality estimates are generally in line with what we know from calculations of mortality levels based on analyses of vital registration data, for example, on differences by province and on changes in levels of life expectancies over time. These data make it possible to study long-term trends because they cover the whole nineteenth century and the first quarter of the twentieth. They allow us to measure both SES and mortality in a consistent manner over time and place. Large datasets with comparable information from marriage certificates have become available in recent years for large parts of Belgium, Italy, France, and Germany in a standard format and are thus well suited for comparative studies over long time periods. Historical occupational classifications applicable to these datasets are available as well. Indirect estimation methods therefore will make it possible to study SES mortality differentials during a crucial period of the epidemiological transition for several European countries in a strictly comparable way. A detailed comparison and evaluation of the various indirect estimation methods and an adaptation of these methods (for example, regarding the used mortality and fertility standards) to the situations of historical populations in the Western world are the first steps toward a more extensive use of these methods. More study is needed of the effect that the assumptions underlying the methods might have on the outcomes, and we need to find out whether they all indeed apply to the populations under study. A systematic and technical test of the effects that various levels of intergenerational social mobility might have on indirectly mea-
sured social class mortality differences has to rely on parameters deduced from individual-level information on social class of origin and social class in adulthood of individuals in relation to their and their fathers’ mortality. Information of this kind will become available in the next couple of years with the completion of historical databases in Sweden, the Netherlands, and other countries.

The procedures we followed to define different social groups might also have influenced the observed trends in class differences in mortality. Although the use of different measurements and classifications will often produce the same general tendencies, the precise magnitude of changes in socioeconomic inequalities in mortality can differ significantly according to the precise measure applied. One could therefore opt for another coding scheme to find out whether another class scheme would lead to different outcomes (cf. Craig and Forbes 2005). Marco H. D. van Leeuwen and Ineke Maas (2005), for example, used a classification scheme called HISCLASS that is based on the so-called Dictionary of Occupational Titles.

Second, our results shed new light on the development of the standard of living and well-being during industrialization. In the ongoing discussion about the conceptualization and measurement of the standard of living, a variety of (correlated) measures have been proposed, ranging from income and consumption to height and life expectancy. The measures for the standard of living used here—life expectancy or survival rates—cover a large geographic area and a large population. What is relevant in particular is that they allow us to understand more clearly the historical well-being of various social groups over time, so that we do not have to rely on fragmentary quantitative data or qualitative sources (Allen et al. 2005). The lesson from our analysis is that the widely held view of the disastrous effects of the processes of industrialization and urbanization during the nineteenth and twentieth centuries does not apply to all European countries when life expectancy data are used. For the Netherlands, for example, there is no sign at all that the situation of the laboring classes worsened either for those in agriculture or for those in the industrial sectors during this period, although in some special sectors of the industry mortality may have increased and expectation of life may have decreased. To check this, we compared some specific and more numerous occupational groups about which contemporary medical observers argued that their living conditions, and consequently the percentages of surviving fathers among them, had worsened during the nineteenth century.
We simply compared age-standardized percentages of grooms aged 20 to 44 with fathers alive in four consecutive periods. In general, the results confirmed the absence of trends toward an increased mortality. Factory workers in Limburg were hardly present before 1840, but in the periods thereafter the percentages of fathers alive increased from 47 percent to 50 and 57 percent. Day laborers in that same province saw the percentages of surviving fathers increase from 42 percent to 47 and 48 percent and then to 53 percent; in Zeeland the increase was from 28 percent to 41 and 44 percent and then to 65 percent. For those classified simply as laborers, increases were found from 46 percent to 53 percent and then to 56 percent in Limburg and from 33 percent to 40 and 51 percent and then to 65 percent in Zeeland. For farm laborers, increases in survival were observed from 33 percent to 40 and 44 percent and then to 54 percent in Limburg and from 36 percent to 47 and 57 percent and then to 73 percent in Zeeland. Even for fishermen, survival increased, from 52 percent to 55 and 57 percent and then to 67 percent. There were only two exceptions, miners and pottery workers. Only 27 percent of the miners in the first period had surviving fathers; in later periods that percentage first increased, to 47 percent, but then decreased to 43 percent in the period 1870–89 before increasing again after 1880 to 57 percent. For those working in the potteries, first an increase was visible (from 39 percent in 1840–69 to 47 percent in 1880–89), but in the most recent period only 42 percent of the grooms had surviving fathers.

In general, the differences among the three groups distinguished within the working class were modest for each method that we applied. These differences increased when more specific groups were studied. The main criterion distinguishing the various parts of the working class is the level of skill: skill levels are sometimes hard to determine on the basis of the job titles alone, the boundaries between the categories are fluent, and they change over time. The lack of differentiation in survival might, of course, also have to do with the specific situation of the Netherlands: high wages and generous relief in this case could have mitigated the deterioration of the standard of living. There seems to have been little evidence of a classic proletariat forming in the towns in the Netherlands during the first part of the nineteenth century. Yet a rural proletariat formed during the structural crises in the 1820s and 1830s in the capitalized marine clay farming areas and again during the structural malaise in the farming economy in the 1880s and 1890s. Modern industrial capitalism did not develop in the Netherlands before 1870.
During the cyclical recession between 1870 and 1890 there was evidence of considerable proletarianization in towns (Wintle 2000: 303–11). It might also be relevant that our study did not include any of the large towns. However, several other recent studies have also shown on the basis of macro data on height and mortality that a deterioration in health was not an inevitable concomitant of nineteenth-century industrialization and urbanization processes (Sandberg and Steckel 1997; Weir 1997). The secular economic development in the Netherlands showed continuous improvement from 1864 (Van Zanden and Van Riel 2004), and policies intended to improve public health and reduce health differences were launched after 1875, partly in response to these same economic factors (Mackenbach 1992). It seems as if during the nineteenth and early twentieth centuries the lower social classes in particular took advantage of the new possibilities created by medical knowledge, improved sanitary standards, and economic growth (Rogers Hollingsworth 1981; Ferrie 2003).

Third, where one lived in the nineteenth-century Netherlands had more effect on life chances than the social class to which one belonged. The sanitary situation was generally worse in Zeeland than in the other provinces, and this had a tremendous effect on mortality levels. Expectations of life in the same social class diverged from 5 to 10 years between Zeeland and Limburg. Historians of mortality increasingly question the value of national-level mortality data for explanatory purposes. Sheila Ryan Johansson and Alice B. Kasakoff (2000) stress that until the first decades of the twentieth century the “disease environment” and economic circumstances varied enormously from place to place. That could lead to large differences in the expectation of life at birth among regions, on the order of 15–30 years (Woods and Shelton 2000). In studies of trends in SES mortality differences, these regional differences have to be taken into account.

Notes

This is a revised version of a paper presented at the Social Science History Association Conference, Minneapolis, Minnesota, November 2–5, 2006. We wish to express our gratitude to the anonymous reviewers for their suggestions in improving this article and to the Zeeuws Archief (province of Zeeland) and the Rijksarchief Limburg (province of Limburg) for placing their data at our disposal.

1 The Historical Sample of the Netherlands 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 between 1812 (when the vital registration system was introduced) and 1922. In all Dutch provinces a random sample of births was drawn that was stratified by period of birth (11 periods) and level of urbanization of the municipality. Information is used on the age of the father at the time of the child’s birth, which is mentioned on the birth certificate for the two selected provinces.

2 The time references for the mortality estimates for the four age categories that can be deduced from the Brass and Bamgboye (1981) and Brass (1985) methods all fall within the period covered by our time classification. As our data relate to a period much longer than that reference period, the best way to treat these estimates is to average them to produce a single estimate of mortality.

References


——— (2005) “HISCLASS: A historical international social class scheme for occupa-


