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Guest editorial

Long-term trends in relative health differences between men and women

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Abstract

Long-term health differences between men and women are studied by making use of a graphic display of mortality rates for the Netherlands. It turns out that till WW II women aged between eight and 16 and between 25 and 45 were worse off than men. After WW II, male excess mortality among young adults and among people aged 55 and over became a characteristic feature of the mortality pattern in many European countries. Factors explaining these historical patterns in mortality are explored.

Keywords: Editorial; Mortality; History; Gender differences

To study the long-term development of the health status of a population, mortality statistics have clear advantages. Data on morbidity are hardly available for historical populations and where they do exist they mostly relate to small segments of the population. Mortality registration on the other hand started already in the beginning of the 19th century, covered the whole population and was based on comparable definitions of the health outcome [1]. Mortality information is therefore perfectly suited to throw light on the development of health differences between men and women over a long period of time.

As mortality differences between the sexes might vary substantially over the life cycle, death rates for single years of age have to be available to localise the age pattern of health differences. Dutch data will be used here for this purpose as they are representative of the historical experience of other Western European countries as well [2]. The data set consists of probabilities of death for single years of age (ages 0 to 95) and time (years 1850–1998) [3]. Probabilities of death are equal to the proportion of persons of a given age alive at January 1st who die before January 1st of the next year.

For each age and time combination the ratio of female to male death probabilities is computed (see Fig. 1). Ratios above 1.0 indicate that males at the age concerned have a higher death risk than females, ratios below 1.0 point to higher mortality of females.

To visualise the evolution of these 14 000 ratios of death probabilities (149 years × 95 ages), a so-called shaded contour map is used [4]. In these maps, surfaces are shaded according to the degree in which male and female death risks deviate from each other. The shading varies from light to dark as the surface rises from female excess mortality to ever increasing levels of male excess mortality.

In the past 150 years men had at most ages higher death risks than women. In the 19th century, men in the age range between 45 and 70 years had death risks which were 10–30 percent higher than those of women. In the range between 70 and 90 years death risks varied in the same direction. The contour map shows some structural changes in this pattern of male excess mortality as well as some temporary disturbances of the normal pattern. Examples of period-effects are the epidemics of cholera in 1866 and

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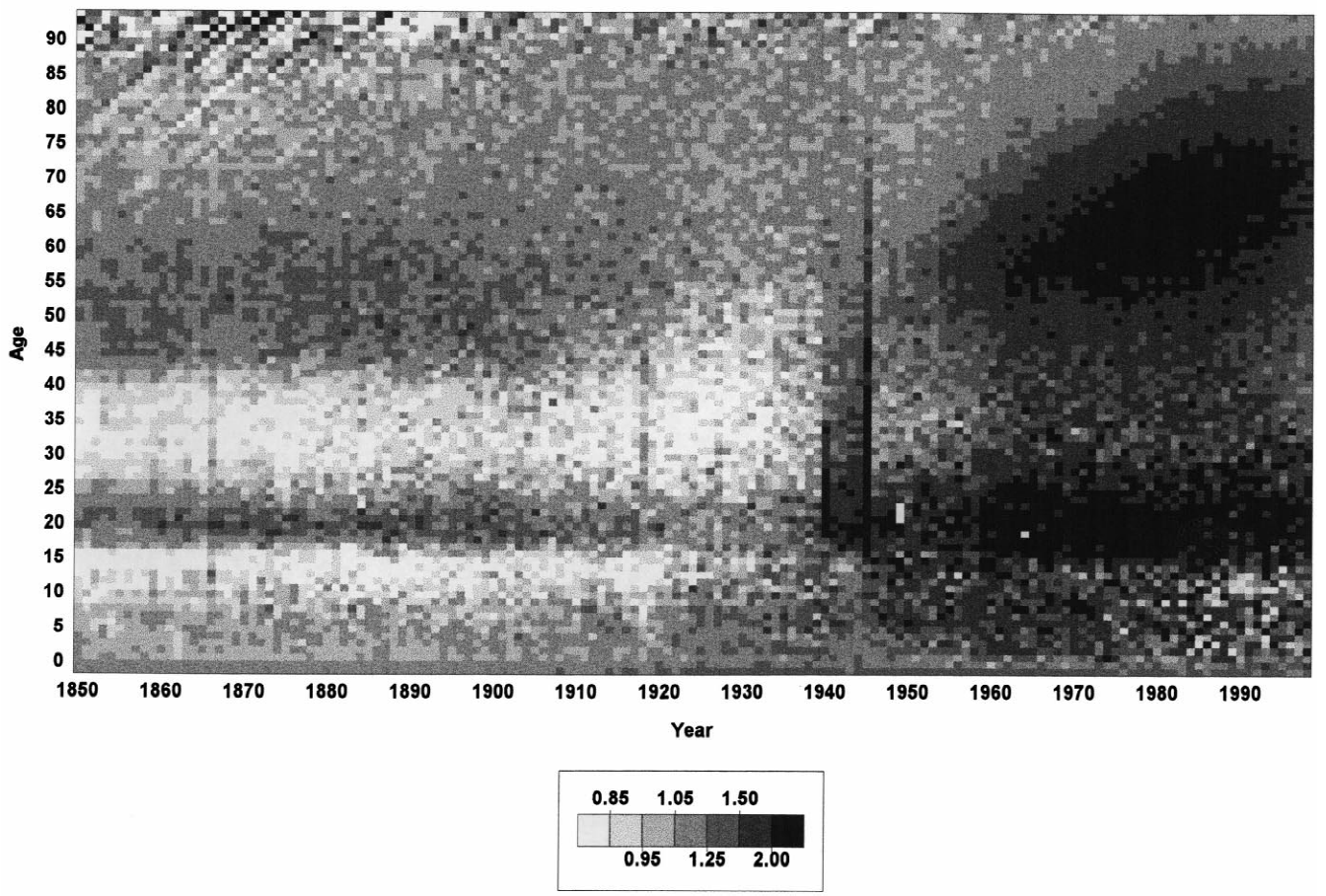

Fig. 1. Dutch female probabilities of death divided by Dutch male probabilities of death.

1867, the Spanish influenza epidemic of 1918, and the devastation of the Hunger Winter in 1944–1945, all leading to increased male excess mortality.

Four structural changes might be observed. Of a relatively recent date is the strong rise in excess mortality among men aged between 16 and 26 years. This development started in the early 1950s, and showed itself as a peninsula of high excess mortality during a period of some thirty years. Male death risks in this age range in the 1960s and 1970s were two to three times higher than those of women. This was caused by a strong increase in mortality due to motor vehicle accidents, to other accidents and to suicide among men [5].

From the early 1950s also dates the increase in male excess mortality at ages above 55 years. This upsurge started among men aged between 55 and 65 years and in the 1960s it had already resulted in male death risks which were at least two times higher than those of women. After 1960, this high level of male excess mortality shifted upwards until finally only at ages between 65 and 75 years these large discrepancies between male and female mortality probabilities were observed.

The very large diagonal blotch of dark surfaces strongly suggests that male excess mortality followed a cohort pattern. Excess mortality started to rise in the middle of the 1950s in cohorts born between 1892 and 1905 when these cohorts reached ages between 50 and 60 years [5–7]. Later cohorts that reached age fifty also showed this excess mortality at around the same age during the 1960s and early 1970s. At the same time excess death risks diffused in the earlier cohorts over ages 60 and higher. It is the long-term effect of the spread in the consumption of cigarettes among males which is visible here [8]. Cigarette smoking augmented substantially from the second decade of the twentieth century on when the 1890s-cohorts reached adult life. After two to three decades this resulted in an increase in male mortality due to lung cancer and cardiovascular diseases. It was only in cohorts born after 1930, reaching adulthood after 1950, that tobacco consumption started to decrease [7]. Cigarette smoking for a long time remained quite definitely a male affair [9]. As a consequence of the late adoption of smoking among women, the highest-prevalence cohorts of women started only in the 1980s to enter the age groups of highest smoking-related mortality. Death rates for lung cancer among women therefore lagged decades behind those of men.

Two other structural changes, both involving a less

favourable health situation of women, had their origin before the middle of the 19th century. During a long period women aged between 25 and 45 years had higher death risks than men. This excess mortality still was at a level of between 5 and 30 per cent at the beginning of WW II and disappeared only after the war. Cause-of-death statistics for the Netherlands show that these differences were for a large part caused by maternal mortality. Between 1875 and 1939, puerperal fever and other diseases of pregnancy were responsible for between 5.4 and 10.1 per cent of all deaths among women aged 20–49. However, for several other causes of death middle-aged women showed excess mortality till the beginning of WW II as well. This applied for example to cancer (in particular since the first decades of the 20th century), to diseases of the circulatory system, acute diseases of the digestive system, diseases of the genito-urinary system and in particular to respiratory tuberculosis [10]. Maternal mortality was directly related to the number of pregnancies experienced, and additional risks were associated with pregnancies occurring at the late stages of a woman's reproductive period, as well as with very high parities. Repeated pregnancies and confinements might also have had an indirect influence on female mortality risks. Mechanisms that might explain the relation between number of children and non-maternal mortality include restrictions on mobility, maternal depletion, competition for food, care and money, and increased potential household sources of transmission for a variety of infectious agents [11,12]. This indirect effect of the number of children was confirmed in a recent study for 18th and 19th-century rural Germany based on individual-level mortality data [13]. The addition of a child increased the mother's mortality by more than twice the amount it increased the father's mortality. This was not due to maternal mortality since women who died as a direct result of childbirth were specifically excluded. Rural practices in the division of labour (in addition to the usual duties of cooking, housework and childcare, women were expected to help do the men's work) and in the allocation of vital resources (cash incomes were kept by the husband) considerably reduced the advantages in longevity which females normally would have had [14].

Higher female death risks were also observed at younger ages. Till around 1920 girls aged between eight and 16 years had higher death risks than boys. This excess mortality of girls has been documented in several other Western European countries as well [15].

As infectious diseases were the major cause of death during the 19th and early 20th centuries, trends in these causes of death were particularly important in explaining female children's excess mortality. Lung tuberculosis, a cause of death exceptionally sensitive to differences in welfare, in nutrition, feeding and care, was by far the most important cause of girls' excess mortality. It reached a peak between 1880 and 1890 and declined thereafter. Almost everywhere in the Western world, girls and young women aged 5–19 years had a higher probability of dying from tuberculosis than their male counterparts. For other infectious diseases as well (typhus, scarlet fever, whooping cough, cholera and acute respiratory diseases) boys were better off [11].

Some historians have argued that differences in *exposure* to infections and other risks were the main cause of this excess mortality. Boys and girls had different roles and tasks within the family: girls and women were more likely to take care of the sick; they more than boys therefore were in touch with the patients themselves, their clothes and bedding. Due to their specific sex role, girls were also more exposed to particular types of accidents within the home. As girls were more devoted to activities within the home, the high density and poor housing conditions of the period, with its associated greater risks of infection to e.g. measles, whooping cough and tuberculosis, may have subjected female children to greater dangers than male children [15,16].

Other authors have suggested that the degree in which boys and girls were able to *resist* viral and bacterial infections played a more important role [15]. The argument is that before WW I girls and women were not as well nourished as boys or men. Girls were often trained from an early age to 'sacrifice themselves' for the benefit of boys, in particular in rural societies. Yet it seems that discriminatory practices affecting the nutritional status of girls and women were not generally present [16]. Resistance to infections also depended on immunisation. Before the beginning of the 20th century, it was only smallpox and diphtheria against which vaccination was possible. There are indirect indications that historically there were differences in smallpox vaccination levels between boys and girls. For the Netherlands, Rutten showed that the vaccination level was a direct function of school attendance [17]. Children which had not been inoculated or vaccinated were not allowed at school. Given the strong differences in the degree of school attendance between boys and girls till 1900, a difference in the level of vaccination can reasonably be assumed. Nineteenth-century medical doctors confirmed that 'for various reasons, more boys than girls are vaccinated and revaccinated' [18].

Finally, the domestic *response to symptoms of distress* in children and resort to health services might have played a role. Tabutin and Willems suggest that sick girls were taken to hospital or to a physician less often than boys, especially in cases where health services were costly and distant. As schools played an important role in fostering personal hygiene and rising consciousness about health problems and girls were less likely to attend school than boys or to stay in school as long as boys, differences in school attendance played a role here as well [16]. A crude indicator of gender differences in the resort to health services – the relative number of persons who had died without having been attended prior to their death by a medical doctor – showed however that in the first decade

of the 20th century in the Netherlands deceased girls had been attended by a doctor at least as frequently as deceased boys [18].

Tabutin and Willems attribute the reduction of excess female mortality under age 20 to three developments [15]. First, a rapid and irreversible reduction of the incidence of infectious and parasitic diseases occurred, accompanied by an increasing incidence of causes of death that disadvantaged males, such as accidents and violence. Second, social progress favoured females: schooling became universal; the health system expanded; there was increasing regulation of work in terms of minimum age and maximum hours of work; and legal protection of women and children was established. Third, a different vision of women and childhood emerged, which was accompanied by changing aspirations, and resulted in a more egalitarian position of men and women.

Although the same factors apply to middle-aged women as well, for this group additional factors played a role. The fall in the number of children per woman (in the Netherlands from 5.4 in the 1870s to 1.5 in the 1990s), and the decrease in grand multiparities (fourth births and higher gravities) considerably reduced the risks of maternal mortality and the negative long-term influences of repeated pregnancies and childbearing. Maternal mortality itself has declined due to the introduction and diffusion of a number of innovations in the medical care system, coming into operation in particular during the period 1935–1950: the introduction of sulphonamides and penicillin, of blood transfusion on a large scale, the improvement of obstetrical care and education and the advance of maternal care [19].

Differences in health and mortality between the sexes can be interpreted as a result of sex-specific cultural norms regarding rights and behaviours, leading to differential patterns of exposure and resistance within specific disease environments. The fact that norms, behavioural patterns and disease environments change separately or simultaneously makes the study of differential mortality between men and women intrinsically historical and provides an unique opportunity for close co-operation between historians and epidemiologists.

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