The Rise and Fall of Excess Male Infant Mortality

Extended Abstract

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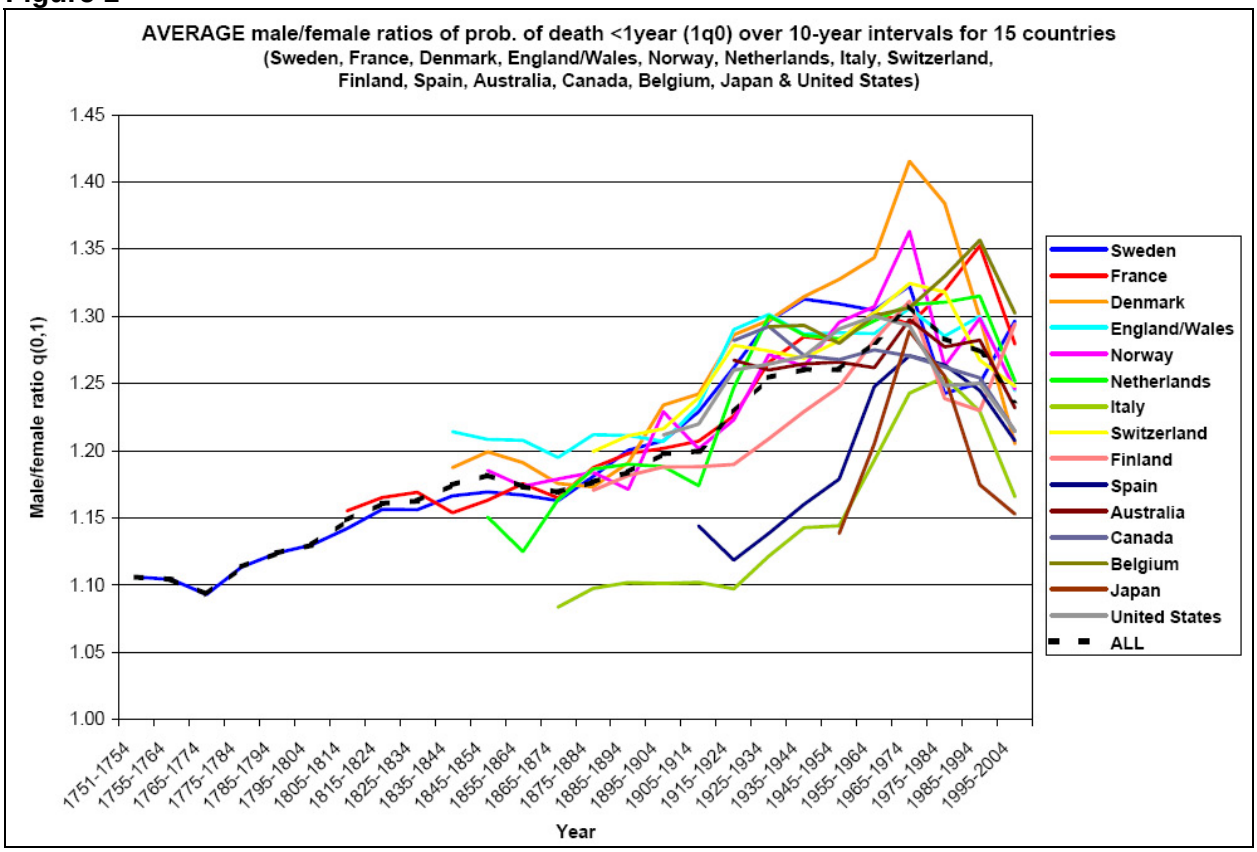
Introduction

Sex mortality differences have been well-documented, with a nearly universal female advantage. Mortality is higher for males over the lifespan and for nearly all causes of death, and this pattern has persisted over time and space. The female advantage begins in utero, with male fetuses less likely to survive until birth. Although evidence is limited, it is widely believed that the primary sex ratio (at conception) is much higher than the secondary sex ratio (at birth). The sex ratio at birth averages 105 males to 100 females. The higher primary sex ratio may be an evolutionary response to higher risks of mortality among males to maintain approximate equilibrium by sex in human populations.

Although the female mortality advantage is robust, the magnitude of the advantage varies depending on environmental, social, and economic conditions. Throughout much of the 20th century, as overall mortality declined and causes of death shifted from infectious diseases to chronic, degenerative diseases, the female advantage in life expectancy increased in many industrialized countries (Trovato and Heyen 2006). However, since the 1970s, the gender gap in life expectancy has narrowed in many countries (Trovato and Lalu 1996). Preston and Wang (2006) attribute the narrowing of sex mortality differences to sex-specific patterns in smoking, and they argue that the gap will continue to shrink. Although lifestyle factors may play a primary role in explaining sex differences in adult mortality, such factors are more questionable at the youngest ages.

We document a remarkably consistent pattern of sex differences in infant mortality over time. As shown in Figure 1, infant mortality data for Sweden reveal that males had approximately 10% higher mortality (male/female ratio of ${}_1q_0 \approx 1.1$) as far back as 1751. Excess male mortality in the first year of life increased over time, reaching approximately 20% (male/female ratio of ${}_1q_0 \approx 1.2$) around 1900. Other European countries for which data are available to varying degrees from the 19th century onward – including France, Denmark, England/Wales, Norway, Netherlands, Switzerland, and Finland – also show a gradual increase in excess male mortality during the first year of life. Italy is a noticeable exception, with a much lower male disadvantage.

Figure 1



During the 20th century, as mortality decline accelerated, so did the male disadvantage in infant mortality. Nearly all countries shown in Figure 1 exhibit a steep increase in the male/female ratio of ${}_1q_0$. Nine of the fifteen countries reach a peak of excess male mortality during 1965-1974, after which the male/female ratios decline. Exceptions to this pattern are Canada (peak in 1925-1934 at beginning of series, with declines thereafter); the United States (1955-1964 peak); Italy (1975-1984 peak); and France, Netherlands, and Belgium (1985-1994 peak). The maximum male/female ratios of ${}_1q_0$ range from a low of 1.255 in Italy to a high of 1.415 in Denmark.

These ratios are striking: across a more than a dozen countries, male infants were 25% to 40% more likely to die than female infants in the first year of life in the latter half of the 20th century. This worsening male disadvantage in infant mortality emerged during a period when infant mortality rates were declining sharply. What accounts for this widening sex differential in infant morality? Why does it exhibit such a consistent pattern over time and across countries? And why, in the most recent decades, has the male disadvantage begun to diminish?

Hypotheses

We hypothesize that a number of factors play a role. First, exposure to infection decreased sharply during the first half of the 20th century. As infectious causes of death declined, mortality from congenital anomalies, conditions of the perinatal period, and other causes became increasingly important. We will test the hypothesis that males are more susceptible to mortality from congenital anomalies and other causes by decomposing sex differences in infant mortality by cause of death.

Second, maternal nutrition improved over time, which increased maternal stature and may have contributed to higher birth weights. It is well-known that, on average, males are heavier than females at birth. Larger male fetuses would be at higher risk of injury during birth. We will test this hypothesis by examining data on adult height and birth weights.

Third, birth practices have changed over time. Over the course of the 20th century, babies were much more likely to be delivered in hospitals. In a hospital setting, medical instruments such as forceps are more likely to be used in the event of a difficult delivery. Furthermore, cesarean (C-section) deliveries became more common over time, increasing from only 5% of U.S. births in 1970 to nearly 25% in 1988 (Eskew 1994). Since cesarean deliveries are recommended when labor is difficult, the increased use of this birth practice may have favored males and contributed to the decline in excess mortality in recent decades.

Data

We use mortality data from the Human Mortality Database (HMD) to document the historical pattern of sex differences in infant mortality by country. We use HMD data for fourteen countries: Sweden, Denmark, England/Wales, Norway, Netherlands, Italy, Switzerland, Finland, Spain, Australia, Canada, Belgium, Japan, and the United States. We use mortality data for France supplied by Jacques Vallin. We supplement U.S. data with historical vital statistics on infant mortality by cause of death and births by birth weight. Other secondary sources are used to examine trends in adult height and birth practices.

Conclusions

Unlike adult mortality, infant mortality is not strongly affected by lifestyle factors such as smoking. Other factors such as exposure to infection, maternal nutrition, and birth practices exert more influence on infant mortality. This paper makes an important contribution to an often overlooked aspect of sex mortality differences.