Socioeconomic development and sex differences in cardiovascular disease mortality between East Asian and Western populations

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Abstract

The excessive mortality from cardiovascular disease (CVD) among males is an important component of high sex ratio of overall mortality. It has been observed that the sex ratio of CVD mortality in some Western countries increased from the 1950s but that has declined in recent years. However, little research has assessed secular trends in the sex differentials of CVD mortality, particularly by age-period-cohort decomposition, in areas under rapid economic development with swift epidemiologic transition and nutrition transition. We examine the trends in the sex ratio of CVD mortality in East Asia (Japan, Republic of Korea, Hong Kong, and Taiwan) which went through a rapid economic development during the past 5 decades. These trends are compared with those in selected Western populations (Australia, France, England & Wales, and Sweden). Our analyses suggest that the higher sex ratio of CVD mortality occurred among cohorts that had spent a large part of their childhood and early to middle adulthood in a more developed environment. This could be due to the influence of risk factors on males, who appear to be more susceptible to CVD than females. These risk factors are associated with the Nutrition Transition under economic development.

Key Words

Sex Ratio; Cardiovascular Disease; Economic Development; East Asia
Introduction

The excessive mortality from cardiovascular disease (CVD) among males is an important component of high sex ratio of overall mortality. Some studies showed that changes in the sex ratio for smoking were correlated with trends in the sex ratio of CVD mortality (Zhang et al. 1995; Pampel 2002). Others demonstrated that geographical variation in the sex ratio of ischemic heart disease were associated with fat consumption but were not associated with the sex ratio for smoking (Lawlor et al. 2001). Moreover, living conditions throughout the life course, particularly early life, affect mortality from CVD more significant for males than females (Chung et al. 2010). There is some evidence that environmentally mediated differences in pubertal maturation associated with changes in nutrition (when the male disadvantage in lipids and fat patterning emerges) may contribute to excess male premature ischemic heart disease mortality in recently developed environments (Schooling et al. 2008; Chung et al. 2010). The increasing sex ratio of mortality from CVD may be observed during the socioeconomic development related to changes in diet, particularly in birth cohorts that had spent a large part of their childhood and early to middle adulthood in a more developed environment.

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nutrition transition. Here, we take the examples of four East Asian populations (Japan, Republic of Korea, Hong Kong, and Taiwan) which currently enjoy the almost highest life expectancy in the world and underwent a rapid socioeconomic development during the past 5 decades. In order to understand whether the trends in the sex ratio of CVD mortality in East Asian populations are similar to those in Western populations and whether the patterns in East Asia have regional characteristics, we compare these trends with those in selected Western populations (Australia, France, England & Wales, and Sweden). These populations are selected because of their high quality of data, relatively large populations, and the availability of long-term mortality data (WHO 2012).

We use age-period-cohort models to estimate the effects of age, calendar period, and birth cohort on sex differentials in mortality from CVD. Using mortality from lung cancer as a proxy for the prevalence of smoking, we explore the correlation between smoking and changes in the sex ratio of CVD mortality. Although the proxy of lung cancer is criticized by the delayed effect of smoking, lung cancer is a reliable indicator of the damage from smoking, particularly to index cohort smoking-related mortality (Murphy & Di Cesare 2012; Preston et al. 2010). Our analyses indicate that changes in sex differentials in smoking prevalence are probably not responsible for the increases in the sex ratio of mortality from CVD. Rather, we provide evidence for the influence of the Nutrition Transition on the sex ratios of CVD mortality, and argue that a developed environment could have led to higher sex ratios of CVD mortality through changes in dietary and activity patterns.
Data and Methods

We extracted mortality data in Australia (1950-2007), England & Wales (1950-2007), France (1950-2007), Hong Kong (1960-2007), Japan (1950-2007), Republic of Korea (1985-2006), Sweden (1951-2007) from the World Health Organisation (WHO) Mortality Database. The early period data (1907-1950) in Australia were obtained from General Record of Incidence of Mortality in Australia. In addition, mortality data for Taiwan (1971-2007) were obtained from their official registration systems, and the corresponding population data as denominators were taken from censuses and the household registration system from Taiwan-Fukien demographic fact book in Taiwan respectively.

Sex ratio was calculated by standardized death mortality by males and females using the direct method weighted to the WHO standard population (Ahmad et al. 2001). We applied log-transformed linear regression to estimate the relative risks for sex ratio by age-period-cohort effect, with 95% confidence intervals, using sequential method (Carstensen & Keilding 2005; Wang & Yue 2007). Considering limited cases dying from CVD before age 30 years, we only include the population aged 35-84 in the age-period-cohort analysis. The birth cohort in 1948 is defined as the reference cohort.

We also adopted the estimates of cohort risk for the sex ratio of lung cancer mortality as a proxy for sex differentials in cohort’s history of cigarette smoking. It has been proved that lung cancer provides a simultaneous indicator of smoking burden by cohort (Murphy & Di Cesare 2012; Preston et al. 2010)
Results and Discussions:

- The trends in the sex ratio for age standardised mortality from CVD in Western populations were different from those in East Asian populations from 1950 to 2007. Japan, the earliest developed countries in East Asia, experienced an increase in the sex ratio in the 1950s, and then the sex ratio levelled off, with a marked increase from the mid 1980s. In Hong Kong and Taiwan, there were no increasing trends in sex ratio of CVD mortality before the 1980s, while the sex ratio increased after the 1990s. In South Korea, the sex ratio decreased from 1985 to 1993, and the levelled off. By contrast, in four Western populations, a substantial increase of the sex ratio was observed from the 1950s to the 1970s, and the sex ratio has declined slightly or levelled off since the 1980s.

- In all populations, the sex ratio of CVD mortality increases with age, reaching a peak around age 60, and then declines (Figure 1, left panel). This age pattern is related to the protective effect of endogenous estrogen in females (Barrett-Connor 1997).

- The onset of an increasing sex ratio appeared in earlier birth cohorts in countries that developed earlier (Figure 1 middle panel). An increasing trend in the sex ratio by birth cohort occurred earliest in the West, followed by Japan and other East Asian populations.

- The birth cohort curves for sex ratio of lung cancer mortality, which is a proxy of smoking, did not mirror the curves of CVD. Smoking cannot explain such an increasing pattern across birth cohorts in a more developed environment.
Reference


