Cause-of-Death Contribution to the Female-Male Gap in Life-Expectancy in the United States

Extended Abstract

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Abstract

We study the effect of four large groups of causes of death on the mean duration of life between ages 0 and 75 for both sexes. Our main hypothesis is that the narrowing sex-gap in life-expectancy in the US since the mid-1970s resulted from differential benefits from medical developments for both sexes. In the years 1968–2004, we do observe excess female mortality from causes amenable to medical care. This effect, however, resulted from excess mortality from female breast cancer, and not any cause of death that both sexes would be equally exposed to. We conclude that disregarding morbidity, we could not show that the sex-differences in the effectiveness of medical interventions and access to those result in the narrowing gap in life-expectancy.

1 Introduction

In developed countries women live longer than men. In the last decades, however, one can observe an almost universal pattern when the increase in the sex-gap in life expectancy at birth

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(female minus male) stopped by the mid-1970s and 1980s and has been narrowing every since (Glei and Horiuchi, 2007). The United States represents no exception here: Life expectancy at birth has been improving faster for males than females, resulting in a shrinking gap between the two since 1975.

The widening gap in mortality between the two sexes until the last decades of the twentieth century resulted from women's growing advantage in survival and men's excess mortality (Vallin, 2006). This female advantage is usually attributed to biological factors, as well as, epidemiological developments that made it possible for women to benefit from their natural advantage. On the other hand, male excess mortality is often discussed in the context of differences in behavioral patterns between the sexes. The predisposition of men to undertake risky behaviours (i.e. smoking, extensive drinking of alcoholic bevarages, fast driving, and violence (Nathanson, 1984)) exposes men to a greater extent to mortality risks. It is women's growing involvement in this type of behaviors that is usually brought forward to explain the narrowing differences in life-expectancy between the sexes (Case and Paxson, 2005; Pampel, 2002; Preston and Wang, 2006; Vallin et al., 2006; Wingard, 1984, e.g.), and predominantly smoking: "smoking fully explains the recent narrowing of sex differential" (Pampel, 2002, p. 96). An explanation for the narrowing gap between the sexes that is not prominent in demographic studies, however, is that at adult ages both sexes might benefit differently from the advancement in medicine and new medical technologies. The benefits for men might be actually greater than those for women. Despite the fact that women more often consult a doctor in general, men are equally likely as women to seek medical help for life-threatening illnesses (Waldron, 1983), but also "short-stay and emergency hospital services are more accessible to men" (Ruiz and Verbrugge, 1997, p. 107). Due to the differences in socio-economic status and types of health insurance between the two sexes (Chulis et al., 1993), it is very probable that men in the United States have better acccess to expensive procedures and medicines. This is because the type of insurance is often claimed to determine type and quality of treatment and medications received (Blustein, 1995; Hurd and McGarry, 1997; Pezzin et al., 2007; Shi, 2000). Furthermore, the biological differences between men and women also require variation in the diagnosis and treatment (Henry, 2005; Oda et al., 2006). Those two might currently be insufficiently tailored to the women's physiological needs, as many medical solutions result from studies based entirely on men (Bennett, 1993; Cotton, 1990; Gregg et al., 2007; Merkatz et al., 1993).

2 Method and Data

Following the argument of differential benefits from health care, in this study we make an attempt to explain the narrowing gap in life-expectancy between the sexes by separating causes that are (a) amenable to medical treatment from (b) causes mainly related to behavioral factors and (c) other conditions. Deaths from ischaemic heart disease (IHD) form a distinct group (d). As James et al. (2007) argue, deaths from IHD could be prevented by medical intervention and behavioral/public health factors and can, thus, not be strictly classified into one of these categories. This classification of causes was originally proposed in 1976 by Rutstein et al. in order to measure the quality of medical care. This indicator of amenable mortality is often used to assess performance of health care systems, in particular in international comparisons (Douglas and Mao, 2002; Mackenbach et al., 1990; Nolte and McKee, 2003, 2008).

The causes considered to be amenable to public health are: HIV, lung cancer, skin cancer, chronic obstructive pulmonary disease, liver cirrhosis and motor vehicle accidents. The number of causes amenable to medical care is considerably larger. The most notable causes are the majority of infectious diseases, cerebrovascular diseases, respiratory diseases like pneumonia, influenza or asthma, and several cancers such as breast cancer, prostate cancer, or leukaemia.

We disregard deaths that occured after age of 75 years, as deaths above this age are less likely to be preventable. Furthermore, certification of causes above this age is claimed to be less acurate than for deaths at younger ages (James et al., 2007; Nolte and McKee, 2008). Decomposition of life expectancy by age and groups of causes of death is based on the discrete method as proposed by Arriaga (1984). As we set the upper age limit for amenable causes of death to 75 completed years, we limit in our study the contribution of the four groups of causes to the ages between 0 and 75 years. In addition, due to the fact that the composition of the causes responsible for the excess male mortality is different at infant ages than at other ages (Drevenstedt et al., 2008), we repeat these analyses for the ages 1–75 years.

Multiple cause of death data on the individual level have been compiled by the National Center for Health Statistics (NCHS). In this study we cover the years 1968–2004. The corresponding population data have been downloaded from the Human Mortality Database (University of California, Berkeley (USA), and Max Planck Institute for Demographic Research, Rostock, (Germany), 2008).

3 Results

The trajectory of the sex gap in life expectancy at birth in the calendar period 1968–2004 (Figure 1) is largely driven by ages at or below our threshold of 75 years since the development over time of the blue and red curves (ages 0–75 and 1–75, respectively) closely resemble the pattern of the steady decline in the gap in the life expectancy at birth (black curve). The greater decrease in the gap for ages 0–75 (blue on Figure 1) as compared to 1–75 (red) in the years 1968–1995, results from faster improvements in infant mortality for boys than for girls in this period due to developments in neonatal medicine (Drevenstedt et al., 2008).

Between 1968 and 2004, deaths that could have been prevented by *public health interventions* were responsible in total for 13% of all deaths (Table 1). The importance of this group to the gap between the sexes in the number of years lived between ages 0 and 75 decreased over the studied years. Two peaks can be observed in the age-specific contribution: at young adult ages and around age 60 (Figure 3). The first peak of excess male mortality results from higher incidence among men of violent deaths, accidents, and other causes of death directly related to the propensity of men to undertake risks at those ages. The peak of excess male mortality at older ages coild be interpreted in the light of health consequences at later life of risky behaviors when young, like for example smoking (Nathanson, 1984).

The effect of these causes on improvements in the number of years lived betweed ages 0 and 75 was small or negative (in case of women in the years 1968–1985). This increase in mortality among women from causes related to behavioral factors probably resulted from the fact that women started to undertake risky behaviors similar to those of males (Wingard, 1984). In the second period (1985–2004) the increase in the number of years lived between birth and age 75 due to a reduction in mortality from this group of causes was higher among males than females at most of the age groups and hence contributed to the narrowing sex-gap in life-expectancy (Figure 5).

It was deaths from *Ischaemic Heart Disease* that had the largest contribution to the sex-gap in in the number of years lived between ages 0 and 75 in the year 1968; the weight of this cause of death has been constantly decreasing over the studied period. However, it was IHD which contributed more than any other of the four categories to the narrowing sex gap in the United States over time.

More than a third of all deaths during our observation period belonged to the residual category (*Rest, other*). The contribution of this group of causes of death became more important over time for women as well as for men.

Deaths from causes *amenable to medical intervention* were responsible for 24% of all deaths in the years 1968–2004 (Comapare, Table 1). The effect of those causes on the overal sex-gap in the number of years lived between age 0 and 75 years has been the least important among the four groups, though. Nevertheless, it was the only group that had a negative effect on the sex-gap in mortality for several years (Figure 2). In particular, in most years under study, at ages 25–59, it was women whose mortality was higher due to causes amenable to medical interventions (Figure 3). This result could be interpreted according to our hypothesis: at those ages, women benefit to a lesser extent from life-saving medical interventions than men. As we subsequently found out, however, this result was heavily influenced by one particular cause of death: breast cancer. After deducting this cause of death, the gap turned out to be positive and hence for the benefit of female survival.[1]

While medically amenable causes of death had a rather negligible impact on the narrowing of the sex gap, it was this group that contributed most between 1968 and 1985 to the increase in the average number of years lived between ages 0 and 75 for women as well as for men — in particular at infancy (Figure 4). On the contrary, in the last two decades of our observation period (1985–2004), developments in medically amenable causes of death only had a minor impact on survival chances between 0 and 75 years of age, both for females and males. Excluding infant mortality, it was actually women who benefited more from improvements in medical care during the last twenty years of our observation period (Figure 5).

Summing up, comparing mortality developments in the years 1968–2004, after excluding excess female mortality due to breast cancer, we could not find support for our hypothesis that the narrowing sex-gap in life-expectancy is a result of differential level of effectiveness of medical interventions for the two sexes and access to those procedures. One should keep in mind, however, that the emergence of the residual cathegory might indicate that the original classification from 1976 needs to be adjusted. Moreover, ischaemic heart disease contributed considerably to the changing sex-gap in life expectancy – a cause of death for which progress is at least partly dependent on medical technology.

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[1]This result holds true even after excluding prostate cancer.

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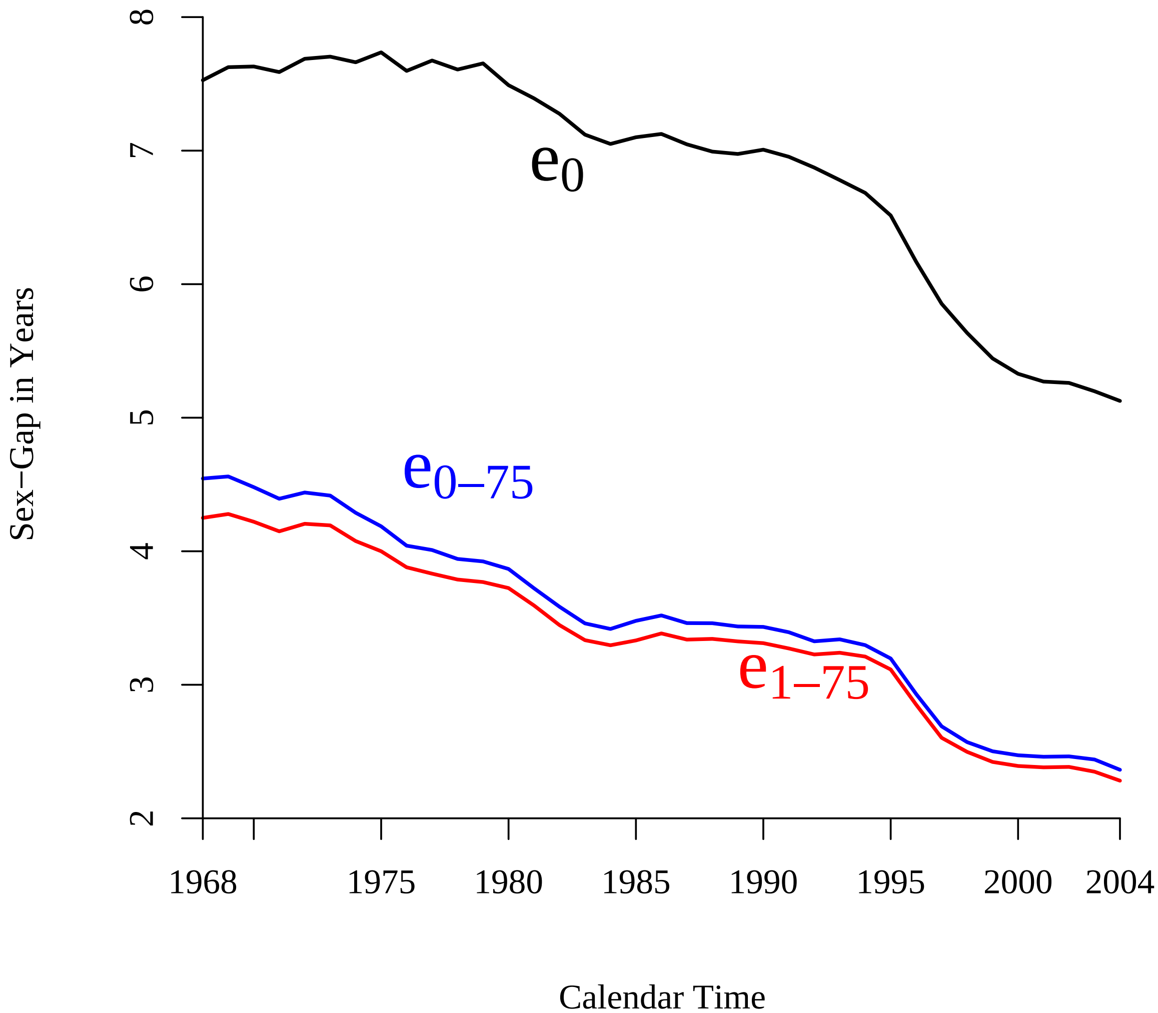
TABLE AND FIGURES

Figure 1: Sex-gap in life expectancy at birth and sex-gap in the mean number of years lived at ages 0–75 and ages 1–75, 1968–2004



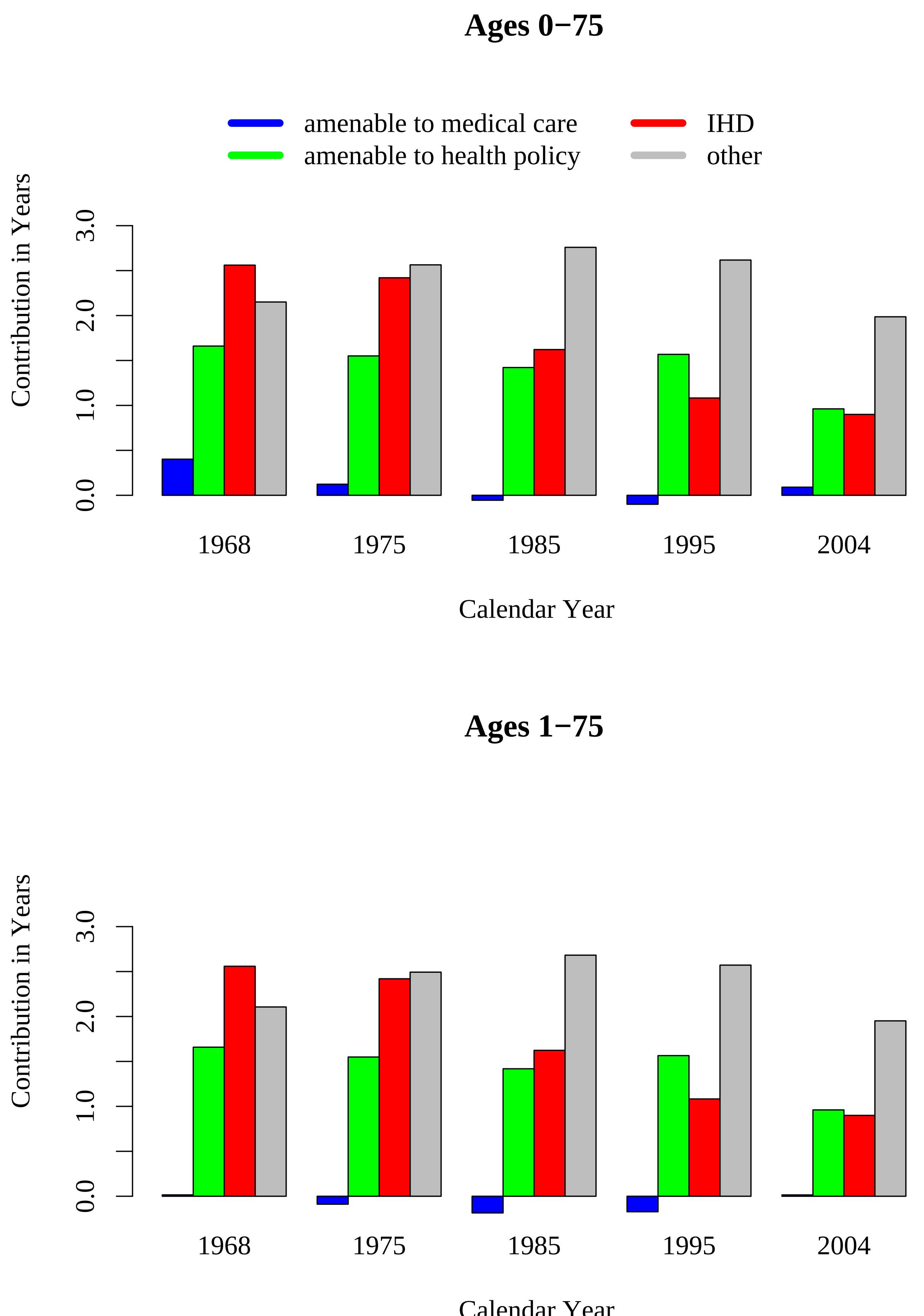
Data-Source: Human Mortality Database

Table 1: Numbers of Death by Cause Category; Females, Males, and Total, United States 1968–2004

Cause	Women		Men		Total	
	Count	%	Count	%	Count	%
IHD	9,472,193	25.31	11,019,841	26.72	20,492,034	26.05
Medical Care	11,088,807	29.63	7,752,822	18.80	18,841,629	23.95
Public Health	3,547,832	9.48	6,741,774	16.34	10,289,606	13.08
Rest	13,313,778	35.58	15,733,959	38.14	29,047,737	36.92
$\sum$	37,422,610	100.00	41,248,396	100.00	78,671,006	100.00

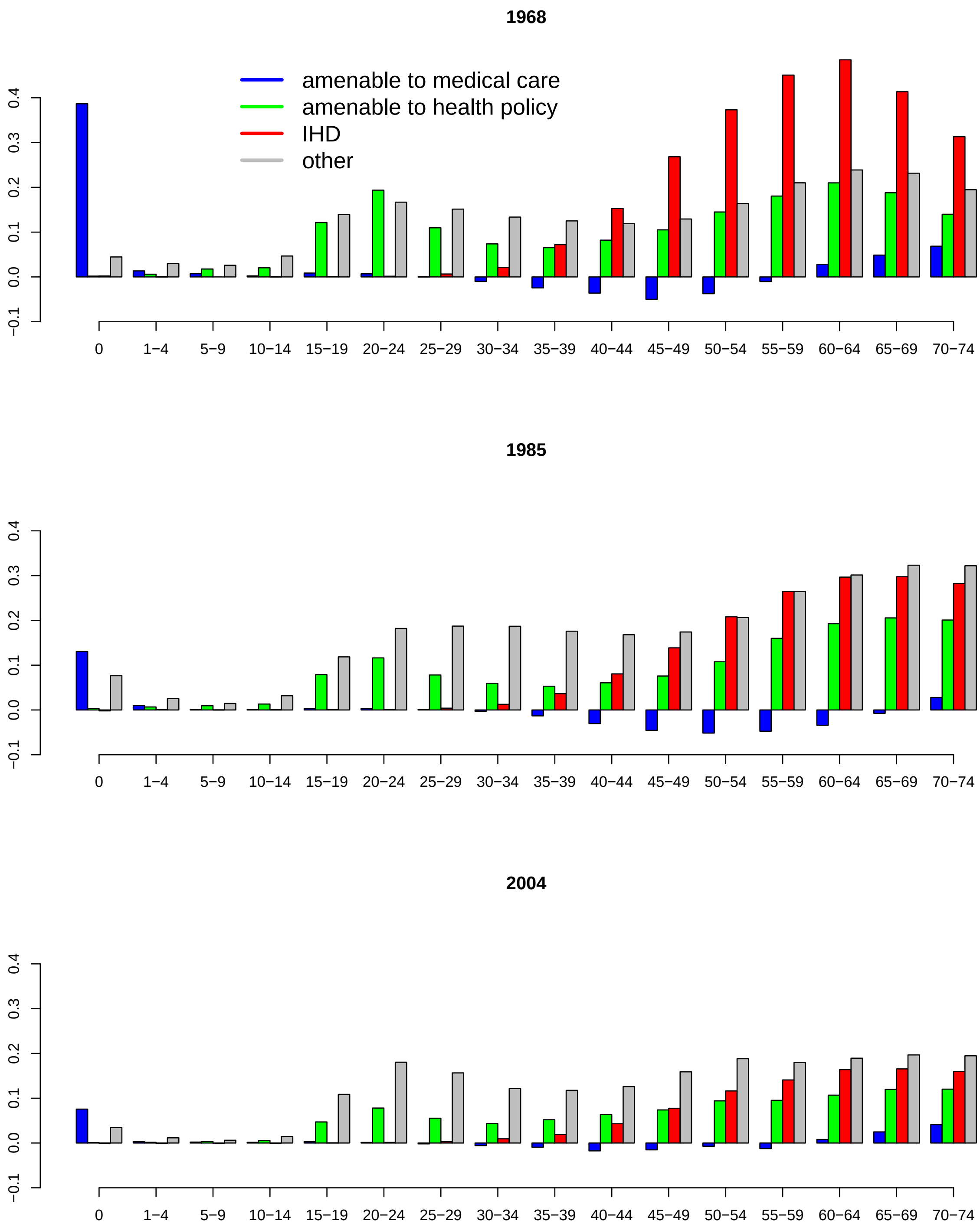
Cause	Women		Men		Total	
	Count	%	Count	%	Count	%
Breast Cancer	1,411,940	12.73	5,439	0.07	1,417,379	7.52
Prostate Cancer	0	0.00	977,266	12.61	977,266	5.19
Medical Care	11,088,807	100.00	7,752,822	100.00	18,841,629	100.00

Figure 2: Cause specific contributions to the sex-gap in the mean number of years lived between ages 0-75 years and 1-75 years



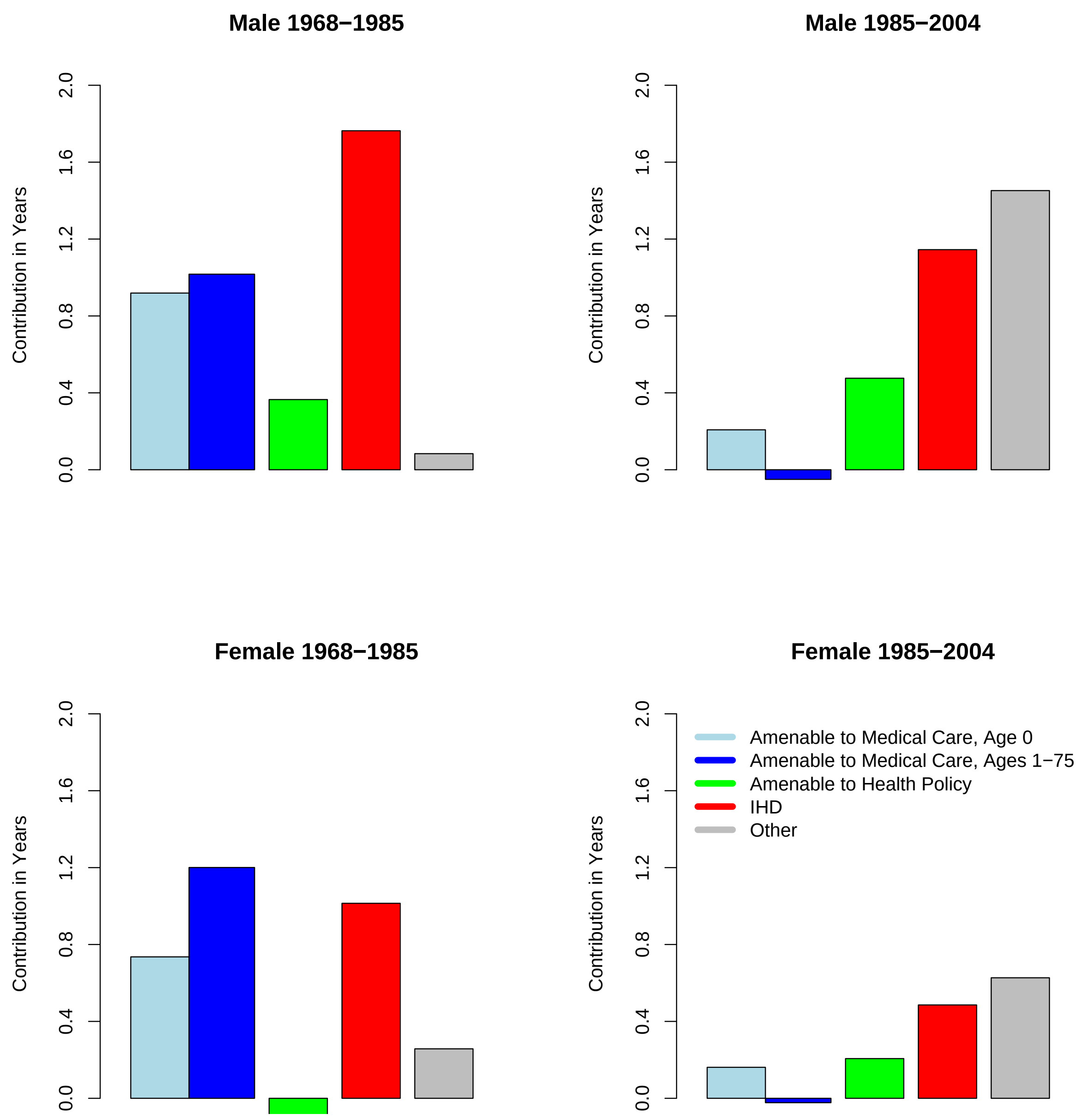
Source: Authors' Estimations, based on data from the Human Mortality Database

Figure 3: Age- and cause specific contributions to the sex-gap in the mean number of years lived between age 0 and 75 years, calendar years: 1968, 1985, 2004



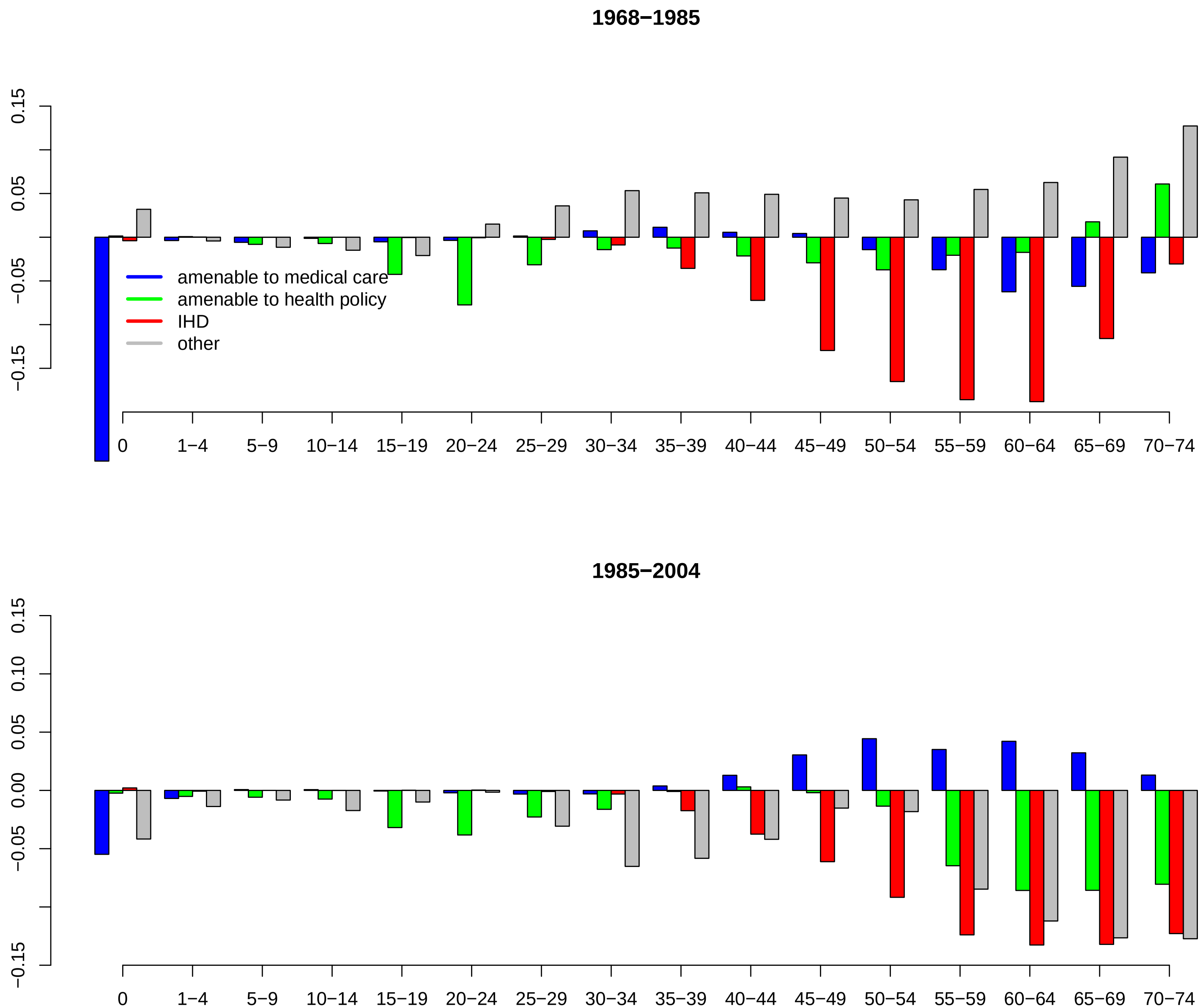
Source: Authors' Estimations, based on data from the Human Mortality Database

Figure 4: Cause specific contributions to the change in the expected number of years lived between ages 0–75 years, both sexes separately



Source: Authors' Estimations, based on data from the Human Mortality Database

Figure 5: Contribution of shift in age-specific mortality in the four groups of causes to the change in the sex-gap in the expected number of years lived between age 0 and 75 years



Source: Authors' Estimations, based on data from the Human Mortality Database