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Working papers

Did Men Benefit More from Medical Progress in Recent Decades? Cause-of-Death Contributions to the Decreasing Sex-Gap in Life Expectancy in the United States

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Abstract

The narrowing of the sex gap in life-expectancy since the mid-1970s in the United States has been explained by women's growing involvement in previously male-dominated risky behaviours, and in particular tobacco consumption. We argue that the narrowing sex-gap could additionally have resulted from greater benefits to men than women from new medical technologies due to differential access and the fact that many medical solutions result from studies based entirely on men. We decompose the sex gap in the mean duration of life between ages 0 and 75 into four large cause of death groups according to the index of amenable mortality.

In the studied years, with the exception of 1985-1995, the sex gap decreased due to causes amenable to public policy interventions. An important contributor to this change was increased smoking among women. The observed narrowing of the sex gap due to medically amenable causes is limited to age 0. When a new group of causes amenable to medical interventions was formed by including half of the contribution of IHD , it had a positive contribution to the narrowing sex gap, and in particular at ages 1-75 years. We demonstrate that when the group of medically amenable causes of death includes half of the contribution of IHD, the narrowing-sex gap in life-expectancy results from the two sexes benefiting to a different degree from medical developments due to differential access or from the fact that treatments are better fitted to male physiological needs than those of women.

Keywords: sex-gap in mortality, causes of death, medically amenable mortality, policy amenable mortality, sex differences in life expectancy, United States

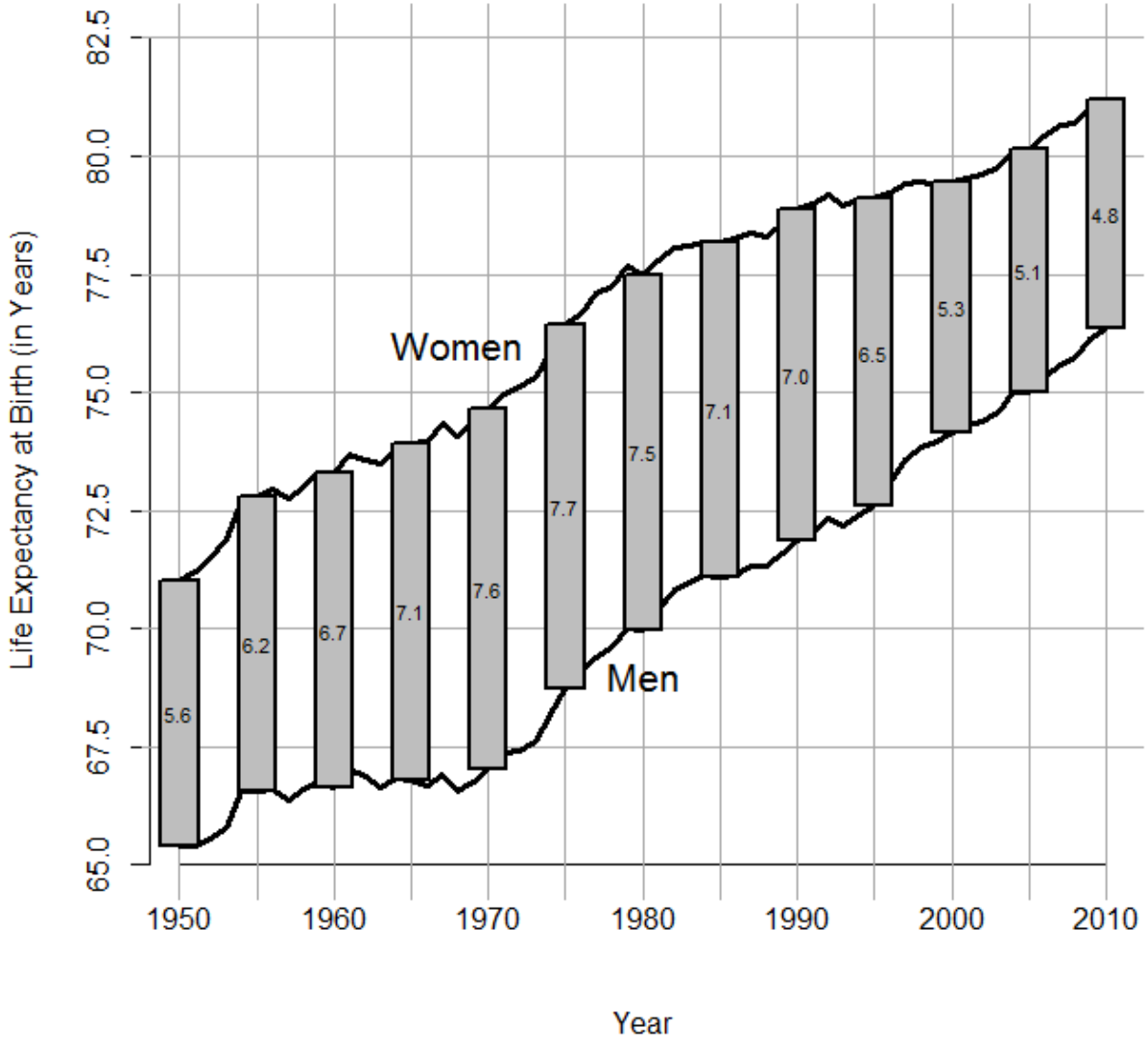
Spis tresci

1. Introduction and Background

Women live, on average, longer than men. Over the last decades, however, in many developed countries improvements in the mean duration of life were greater for men than for women. We observe an almost universal pattern where the steady increase in the sex gap in life expectancy at birth stopped by the mid-1970s or 1980s and has been narrowing ever since (Glei and Horiuchi, 2007). The United States represents no exception: since the mid-1970s, life expectancy at birth has been improving faster for men than for women, resulting in a shrinking gap between the two (Figure 1). As a result, in the US the sex gap in life expectancy decreased from the largest value ever observed of 7.7 years in 1975 to 4.8 years in 2010.

The faster increase in life expectancy for women than for men from about 1920 until 1975 — resulting in a widening gap between the sexes — was not triggered by a single factor. Male excess mortality is most often discussed in terms of differences in behavioural patterns between the sexes that expose men to greater mortality risks. Those behaviours include '…smoking, drinking, driving, and violence' (Nathanson, 1984:204). Unquestionably, the widespread adoption of smoking among men born in the first decades of the 20th century (see, for instance, Giovino et al., 1995; Giovino, 2002; Harris, 1983) contributed considerably to the sex differences in mortality among these generations. It is women's growing involvement in these previously male-dominated risky behaviours that is usually brought forward to explain the narrowing differences in life expectancy between the sexes since the

Figure 1: Life expectancy at birth in the United States for females and males and the respective difference in five year intervals (grey bars), 1950 – 2010



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

mid-1970s (e.g. Case and Paxson, 2005; Pampel, 2002; Preston and Wang, 2006; Vallin et al., 2006; Wingard, 1984). The major cause of the slower decrease in female mortality is commonly attributed to rising prevalence of smoking among women. For example, Pampel (2002:96) argues that 'smoking fully explains the recent narrowing of the sex differential'.

There is another argument, however, which is rarely discussed: the sexes might have benefited differently from advances in medicine and new medical technologies, with greater benefits for US men than for women. We argue that the benefits from medical developments in the United States were possibly greater for men than for women because of 1) financial reasons and 2) gender bias in diagnosis and treatment.

1. In comparison to women, men have on average a higher socio-economic status and income. As a result they may also have a more generous type of health insurance (Chulis et al., 1993). Since the type of insurance is often claimed to determine the type and quality of treatment and medication received (Blustein, 1995; Hurd and McGarry 1997; Pezzin et al., 2007; Shi, 2000), men in the United States may have easier access to expensive (and potentially more effective) procedures and medicines.

2. Furthermore, the biological differences between men and women also require varying approaches to diagnosis and treatment (Henry, 2005; Oda et al., 2006). These two areas may currently be insufficiently tailored to 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).

The opposite can also be claimed, however, taking into account well-known sex differences in behavioural patterns that determine utilization of medical services, i.e. the higher propensity of women to see a doctor. However, it has been shown that even though women consult doctors in general more often, the average number of curative visits is the same for both sexes (Verbrugge, 1989), men and women are equally likely to seek medical help for life-threatening illnesses (Waldron, 1983) and poor health is equally predictive of hospitalization for both sexes (Case and Paxson, 2005).

Summarizing, our research question is: to what extent can the recent narrowing of the sex gap in life expectancy in the United States be explained by behavioural factors and to what extent does it result from the differential benefits men and women receive from developments in medicine and medical technology. The effect of the two factors on the sex-gap in mortality is discussed based on the contribution of the following groups of causes of death to the sex gap in life expectancy: (a) causes amenable to medical treatment, (b) causes amenable to health policies that influence behavioural patterns, (c) ischemic heart disease and (d) other conditions. The above classification was introduced by Rutstein et al. (1976) more than 30 years ago and with several adjustments has been used ever since to assess the quality of healthcare, in particular in international comparisons. A previous attempt to apply this classification to discuss sex differences in mortality was made by Westerling's (2003). In this study, a significant decrease in the sex gap in mortality from causes amenable to medical treatments and health policies was found for Sweden between 1971 and 1996.

2. Data and Methods

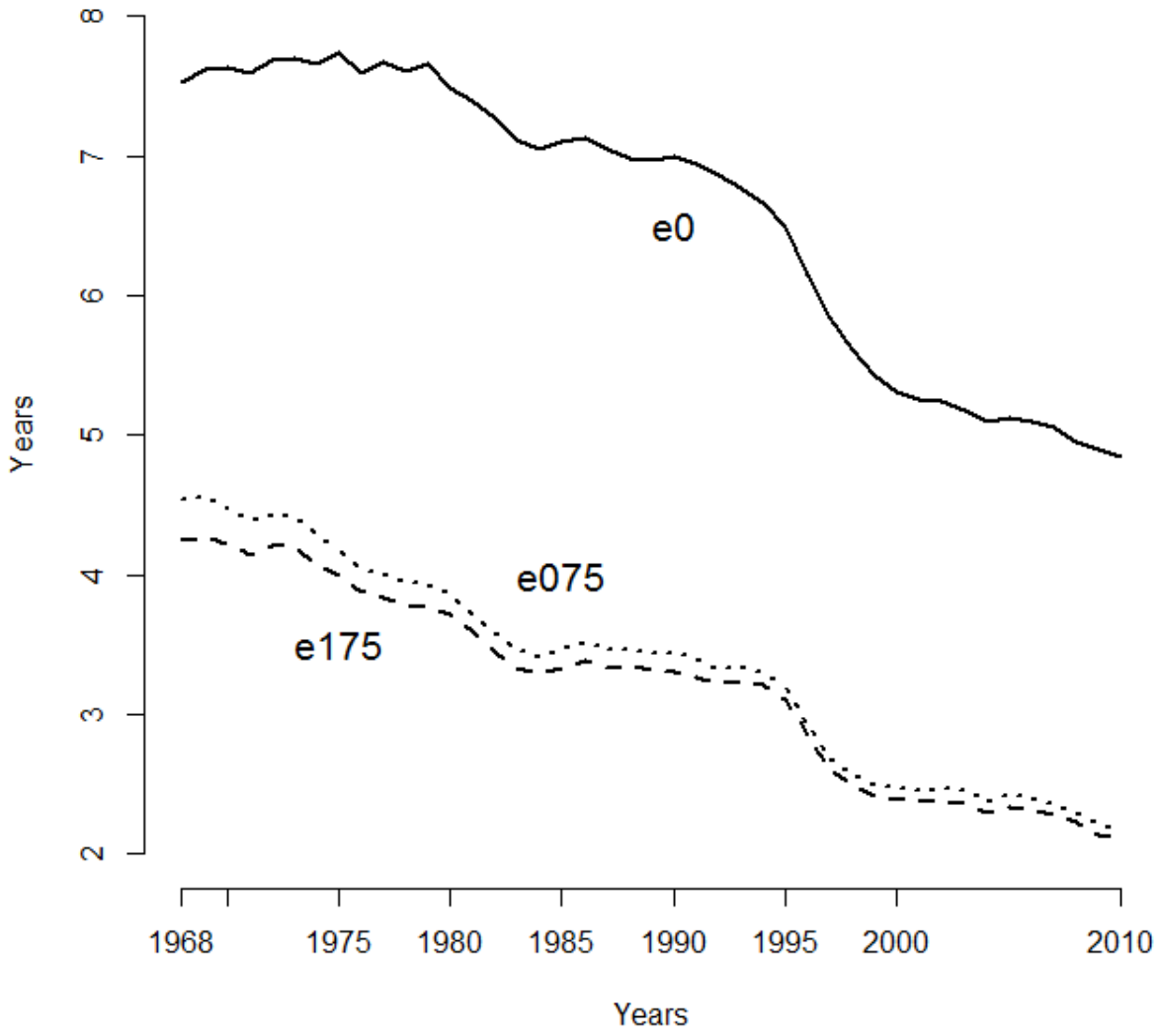
To analyze whether the observed narrowing sex gap in mortality resulted from greater benefits for men from medical progress, or rather from converging behavioural patterns between the two sexes, we distinguish four large cause of death groups following a classification scheme of amenable causes of death adapted from those originally proposed by Rutstein et al. (1976). The primary aim of this method is to assess the quality of medical care by compiling a list of conditions resulting in disease, disability or death that could have been otherwise treated or prevented by the health care system. The index has often been employed to assess the performance of health care systems in a comparative international perspective or in terms of improvements over time (for example, Nolte and McKee (2004) provides an overview of 70 studies based on the classification published in the years 1983-2002). Although the division of causes of death between the groups is disputable, it has become a standard heuristic in epidemiological studies for classifying causes of death and with the developments in medicine, the original version has been subject to modifications (for the history of adjustments compare Nolte and McKee (2004)). The causes considered to be amenable to public health policy intervention are: HIV, malignant neoplasm of lung, chronic obstructive pulmonary disease, liver cirrhosis and motor vehicle accidents (after Nolte et al. (2002) and James et al. (2007)).

The list of causes amenable to medical care is based on the most recent classification in Nolte and McKee (2004) and includes causes that could be considered amenable to medical care at the beginning of the 21st century; it is the largest set for the studied period. 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 and leukaemia. A table containing the list of causes amenable to medical care and their corresponding ICD-8, ICD-9 and ICD-10 codes is provided in the Appendix. Ischemic heart disease (IHD) is considered separately from the causes of death amenable to medical intervention and also separately from causes amenable to inter-sectoral health policies (for example, in studies by Andreev et al., 2003; James et al., 2007; Nolte et al., 2002). The reason is that, according to the literature, deaths from IHD can be prevented by medical intervention as well as through behavioural/public health factors, thus they cannot be strictly classified into just one category. However, similar to the study of Nolte and McKee (2003), we also run separate analysis for group of causes amenable to medical care which includes half of deaths amenable to IHD.

As in epidemiological studies on amenable mortality, in our analysis we disregard deaths that occurred after the age of 74 years, as deaths above this age are less likely to be avoidable and their certification is claimed to be less accurate than for deaths at younger ages (e.g. James et al., 2007; Nolte and McKee, 2008). As the upper age limit is set for 74 years, we refer not to the traditional measure of life expectancy at birth (e_0) but to the average number of years lived until the 75^{th} birthday. We denoted this indicator, sometimes labelled as "partial life-expectancy", by e_{075}. Although a large proportion of deaths in the United States in our study period occurred after those ages, this restriction on age allows us to address the research question concerning causes of the observed changes in the sex gap in life expectancy and the

Figure 2: Sex gap in life expectancy at birth (e0, solid line) and sex gap in the mean number of years lived at ages 0–74 ($e_{0\text{-}74}$, dashed line) and ages 1–74 ($e_{1\text{-}74}$, dotted line), 1968–2010



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

contribution of mortality above age 74 into life-expectancy remained relatively constant (see Figure 2). As the reasons for excess male mortality are very different among infants than in the remaining age groups (Drevenstedt et al., 2008), we conducted additional separate analyses for ages (a) 0 and 74 years and (b) 1 and 74 years.

The effect of the four groups of causes of death on the sex gap (female minus male) in the number of years lived between age 0 and 75 years is quantified using Arriaga's (1984) discrete decomposition method.. Although there are two alternative discrete decomposition methods for studying the difference between two life expectancies (that of Andreev (1982) and of Pressat (1985)), it was demonstrated by Shkolnikov et al. (2001) that the three are essentially equivalent. Our work follows Arriaga's decomposition method as presented in Preston et al. (2001).

Information on deaths was taken from the Multiple Cause-of-Death Mortality Data compiled by the National Vital Statistics System of the National Center for Health Statistics. They are available as public-use files on the website of the National Bureau of Economic Research. The longest part of the 1968–2010 period of analysis, namely 1979–1998, was covered by ICD-9. ICD-10 has been employed to classify causes of death since 1999.

To obtain mortality rate estimates, we applied death counts by age, sex, and cause to the corresponding population data by age and sex, which were obtained from the Human Mortality Database

3. Results

In Table 1, we provide descriptive statistics for the deaths at ages 0 to 74 that were recorded in the United States in 1968 and 2010. Deaths are presented by sex and the four categories of causes. The table demonstrates the dramatic change that occurred in the distribution of deaths between the four categories over the last five decades. In 1968, the leading groups were medically amenable causes among women and IHD for men. Between 1968 and 2010, the largest shift among women was a 2.3-fold increase in the share of deaths amenable to health policy interventions and a decrease by 22 percentage points in the proportion of deaths due to IHD. At the same time, men experienced a decrease in the proportion of deaths due to the three defined categories of causes. For men, the largest drop of 27 percentage points was in the share of deaths due to IHD. In 2010, as a result of the changes in the composition of causes of death over the study period, the majority of deaths for both sexes occurred in the 'other' category.

In Table 2, we provide results that refer to change in the mean number of years lived between age 0 and 75 in each decade under study by sex and cause-specific contribution to that change.

Over the study period, the mean number of years lived between age 0 and 75 increased every decade for both sexes, with the largest gains in the first two decades under study. In the first decade, changes in the group of causes amenable to medical care were the most important for the increase. For example, for males the mean number of years lived between

Table 1: Number of deaths for ages 0-74 years by cause category; females and males, United States 1968 vs. 2010

Cause	**Women**		**Men**	
	Count	**%**	**Count**	**%**
		1968		
Amenable to health policy	35,547	7.9	113,781	21.7
Amenable to medical care	163,626	36.4	161,295	15.3
Ischemic heart disease	113,841	25.3	245,550	33.0
Other causes	136,117	30.3	224,174	30.1
All	**449,131**	**100.00**	**744,800**	**100.00**
		2010		
Amenable to health policy	78,286	18.1	111,758	17.3
Amenable to medical care	97,066	22.4	91,631	14.2
Ischemic heart disease	16,492	3.8	36,758	5.7
Other causes	241,543	55.7	406,591	62.9
All	**433,387**	**100.00**	**646,738**	**100.00**

Source: Authors' estimations, based on data from the NCHS

age 0 and 75 increased by 1.43 years between 1968 and 1975 while gain in life-years due to causes amenable to medical care over this period equaled 0.922 years. Over the same years, the expected number of years lived by women increased by a year, the decrease in mortality from causes amenable to medical care being 0.814 years. For both sexes, the contribution of causes amenable to medical care to the changes in the expected number of years lived decreased over the study years. For males, the last two periods under study (1995-2005, 2005-2010) were characterized by an increase in mortality from causes amenable to medical care that resulted in a drop in the number of years lived. However, over the entire study period the changes in the mean number of years lived by males that were due to medically amenable causes were positive for age 0 and larger than the corresponding shifts for ages 1-75 years. For females, shifts in mortality from causes amenable to medical care caused a steady

increase in the number of years lived and, with the exception of the first period under study, were larger for age 0 than ages 1-75 years.

The net effect of change in the expected number of years lived by the two sexes, that is shifts in the sex gap in expected number of years lived between age 0 and 75, together with a contribution of selected cause of death groups to change in the sex gap, is presented in Table 3. Over the study period, the sex gap in expected number of years lived between age 0 and 75 decreased steadily, with the largest drop of 0.732 years between 1995 and 2005. Shifts in mortality due to causes of death amenable to medical care decreased the sex gap in each decade between 1968 and 1995 and increased the gap in the last two decades. In the years 1968-1995, the sex gap decreased by 1.283 years (sum of -0.356, -0.678 and -0.249 years in Table 3), 0.175 years of which (sum of -0.108, -0.053 and -0.014 years in Table 3) was a result of medical advances. Hence, since men's benefits from medical developments were greater, the gap in the expected number of years lived between age 0 and 75 changed to their advantage, as we postulated in our research hypothesis.

The change in the contribution of causes amenable to medical care to the narrowing sex gap in e_{075} in 1968-1995 described above occurred only at age 0. Since at ages 1-74 years both sexes derived similar benefits from medical developments, the sex gap increased, but only by less than a month (Table 2: 0.029, 0,006 and 0.031 years). However, when a new group of medically amenable causes was formed to include half of the IHD mortality, changes

Table 2: Cause-specific contribution (in years) to the change in the mean number of years lived between ages 0-75 years and separately at age 0 and ages 1-75 years in the United States by sex

Group of causes	**1968-1975**	**1975-1985**	**1985-1995**	**1995-2005**	**2005-2010**
Males, Ages 0-75					
Amenable to health policy	0.225	0.127	-0.219	0.478	0.269
Amenable to medical care	0.922	0.582	0.221	-0.047	-0.078
Ischemic heart disease	0.388	0.666	0.388	0.144	0.084
Other causes	-0.105	0.235	0.254	0.579	0.263
Total	1.430	1.610	0.644	1.154	0.538
Males, Age 0					
Amenable to health policy	0.002	0.003	0.000	0.003	0.005
Amenable to medical care	0.493	0.353	0.163	0.014	0.019
Ischemic heart disease	0.002	0.000	0.001	0.001	0.001
Other causes	-0.035	0.019	0.080	0.033	0.046
Total	0.462	0.375	0.244	0.051	0.071
Males, Ages 1-75					
Amenable to health policy	0.223	0.135	-0.219	0.475	0.264
Amenable to medical care	0.429	0.229	0.059	-0.061	-0.097
Ischemic heart disease	0.386	0.666	0.387	0.144	0.083
Other causes	-0.070	0.216	0.175	0.546	0.217
Total	0.968	1.246	0.402	1.104	0.467
Females, Ages 0-75					
Amenable to health policy	0.043	-0.054	-0.086	0.093	0.026
Amenable to medical care	0.814	0.530	0.207	0.022	0.030
Ischemic heart disease	0.189	0.225	0.124	0.062	0.041
Other causes	0.029	0.233	0.152	0.246	0.182
Total	1.075	0.934	0.397	0.423	0.279
Females, Age 0					
Amenable to health policy	0.002	0.004	0.000	0.002	0.002
Amenable to medical care	0.356	0.295	0.118	0.018	0.019
Ischemic heart disease	0.001	-0.002	0.003	0.001	0.001
Other causes	-0.015	0.024	0.055	0.027	0.029
Total	0.344	0.321	0.176	0.048	0.051
Ages 1-75					
Amenable to health policy	0.041	-0.058	-0.086	0.091	0.025
Amenable to medical care	0.459	0.235	0.089	0.004	0.011
Ischemic heart disease	0.188	0.227	0.120	0.061	0.040
Other causes	0.044	0.209	0.097	0.219	0.153
Total	0.732	0.613	0.220	0.375	0.229

Source: Authors' estimations, based on data from the NCHS and the Human Mortality Database

in the medically amenable causes of death resulted in a narrowing sex gap in life expectancy between 1968 and 1995 at both age 0 and ages 1-75 years. Such an allocation of deaths has been done previously, for example by Nolte and McKee (2003), who argued that Ischemic Heart Disease mortality is partly avoidable by medical interventions. The decrease in the sex gap in life expectancy due to changes in the new group of causes amenable to medical care between 1968 and 1995 (denoted as amenable to medical care II in Table 2) equals almost 3 months for age 0 (Table 2: -0.138, -0.06 and -0.044 years) and almost 5 months for ages 1-75 years (Table 2: 0.069, 0.214, 0.103 years). This result supports our hypothesis that women benefited from life-saving medical interventions to a lesser extent than men. The socio-economic interpretation of the above conclusion formulated in the research hypothesis appears plausible, in particular for ages 1-75 years.

In the last two periods under study, 1995-2005 and 2005-2010, the number of years lost due to causes of death amenable to medical care increased among men and decreased among women. As a result, in the last two decades the sex gap in the number of years lived increased due to changes in medically amenable causes of death. Although it only amounted to a month (Table 2: 0.027 and 0.086 years), an increase in the sex gap in e_{075} due to medical developments was the opposite of what we initially expected. In addition, we observed an increase in the sex gap due to a change in the contribution of the new group of medically amenable causes that included half of the deaths due to IHD.

Table 3: Cause-specific contributions to change in the existing sex gap in the mean number of years lived between ages 0-75 years and separately at age 0 and ages 1-75 years in the United States

Group of causes	**1968-1975**	**1975-1985**	**1985-1995**	**1995-2005**	**2005-2010**
Ages 0-75					
Amenable to health policy	-0.182	-0.181	0.133	-0.385	-0.243
Amenable to medical care	-0.108	-0.053	-0.014	0.068	0.108
Ischemic heart disease	-0.199	-0.441	-0.265	-0.082	-0.043
Other causes	0.134	-0.002	-0.103	-0.333	-0.080
Total change, Ages 0-75	-0.356	-0.678	-0.249	-0.732	-0.258
Amenable to medical care II *	-0.207	-0.273	-0.147	0.027	0.086
Age 0					
Amenable to health policy	0.000	0.002	0.000	-0.002	-0.003
Amenable to medical care	-0.137	-0.058	-0.045	0.004	0.000
Ischemic heart disease	-0.001	-0.002	0.002	0.000	0.000
Other causes	0.020	0.005	-0.024	-0.006	-0.017
Total change, Age 0	-0.119	-0.054	-0.067	-0.004	-0.020
Amenable to medical care II *	-0.138	-0.060	-0.044	0.004	0.000
Ages 1-75					
Amenable to health policy	-0.182	-0.183	0.133	-0.384	-0.240
Amenable to medical care	0.029	0.006	0.031	0.065	0.108
Ischemic heart disease	-0.198	-0.439	-0.266	-0.083	-0.043
Other causes	0.114	-0.007	-0.078	-0.327	-0.064
Total change, Ages 1-75	-0.237	-0.623	-0.181	-0.728	-0.238
Amenable to medical care II *	-0.069	-0.214	-0.103	0.023	0.087

* *includes deaths amenable to medical care and half of deaths due to ischemic heart disease*
Source: Authors' estimations, based on data from the NCHS and the Human Mortality Database

In the study period, apart from the years 1985-1995, improvements in life expectancy due to causes of death amenable to public health interventions were greater among men than among women and hence resulted in narrowing of the sex gap in life expectancy that totalled to almost a year (Table 2: 0.182,-0.181,-0.385,-0.243 years). Virtually the entire share of deaths from causes amenable to public health interventions is attributable to ages 1-74; the contribution of infant ages in negligible.

Between 1985 and 1995, the contribution of deaths from causes amenable to health policy interventions resulted in a decrease in the expected numbers of years lived between ages 0 and 75 for both sexes (for women this was also true in the previous decade). As the decrease was larger among men than among women, in the years 1985-1995 deaths from causes amenable to policy interventions caused an increase in the sex gap in the expected number of years lived at ages 0-74. The gap increased by a 1.5 months in this decade (0.133 in Table 2).

The contribution of 'other' causes to the shift in the sex gap caused an increase in the years 1968–1975 by 0.1345 year, and a decrease in the gap afterwards of over half a year in total (see Table 2: sum of -0.103, -0.333, -0.80 years). The increase in the gap in the first period resulted from a rise in male mortality from 'other' causes. At the same time, female mortality from 'other' causes of death decreased constantly over the years. Since 1975, also male mortality from 'other' causes was lower every next decade.

5. Summary and Discussion

The research hypothesis of the study was that men's larger benefits from medical progress as compared to women's made an important contribution to the narrowing sex gap in mortality. The potential reasons behind this phenomenon are not only socio-economic differences in access to care, but also the possibility that medical innovations better meet the needs of men, since until recently clinical trials in the US involved mostly white male subjects.

We studied the phenomenon of the narrowing sex gap in life expectancy in the United States by decomposing the sex gap in the expected number of years lived into contributions of four large cause of death groups: deaths amenable to medical care, which served as an indicator of medical progress (e.g. new drugs, new medical procedures) in treating life-threatening conditions; deaths amenable to public health policies, which referred to behavioural patterns and potential policy interventions to prevent them (e.g. smoking, drinking, reckless driving); deaths from ischemic heart disease (IHD), preventable by both by medical procedures and by changes in behavioural patterns. The fourth and final group was a residual category.

In the study years 1968-2010, the share of deaths from causes amenable to medical intervention decreased for both sexes. Between 1968 and 1995, medically amenable causes of death contributed to the narrowing sex gap in the expected number of years lived between age 0 and 75 years. Falling mortality at age 0, where male infants disproportionately benefited from the increasing use of C-sections and improvements in neonatal medicine that started in the 1970s (Drevenstedt et al. 2008), was responsible for almost the entire contribution of the group of medically amenable causes to the narrowing of the sex gap in life expectancy. For ages 1-74 years, the contribution of causes amenable to medical intervention to the observed changes in the sex gap over the study period was small and, actually, in the opposite direction than expected, i.e. it turned out to be for the benefit of women. While a decrease in the sex gap in the expected number of years lived at age 0 supports our hypothesis that women

benefited from life-saving medical interventions to a lesser extent than men, our socio-economic explanations are not relevant at this young age.

Between 1968 and 2010, the share of deaths that could have been prevented by public health policy interventions grew for women and decreased for males. In the years 1975-1995, female life expectancy decreased due to greater mortality from these causes and in particular at ages above 55 years (not shown in the tables). This result supports findings of previous studies that related the narrowing differences in life expectancy between the sexes to an increase in smoking among women (e.g. Pampel, 2002; Preston and Wang, 2006). On the other hand, we observe a large increase in mortality due to this group of causes among males between 1985 and 1995, in particular at ages 25-45 years (not shown in the tables). This age-profile suggests that mortality from HIV/AIDS and the rise in homicide deaths among men (Ezzati 2008) were the major factors behind the observed change.

In 2010 56% of deaths among women and 63% of deaths among men belonged to the residual category, this share having grown significantly over the study period. The importance of the residual category suggests that despite later adjustments made by various authors the index of medically amenable causes of death as originally proposed by Rutstein et al. might not be a good measure of the efficiency of medical developments at the beginning of the 21st century. It is possible that these adjustments (for their history see Nolte and McKee, 2004) did not take into account all the medical developments achieved since 1976 when the original

Table 4: Causes of death in the 'Other' category with the highest frequencies at Ages 0–74, both sexes together, United States 2010

Cause of death Title	**ICD-10**	**No. of deaths**	**Percent of group**
Malignant neoplasm of pancreas	C25	20,481	3.2
Malignant neoplasm without specification of site	C80	13,369	2.1
Malignant neoplasm of liver and intrahepatic bile ducts	C22	13,639	2.1
Accidental poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified	X42	12,251	1.9
Cardiomyopathy	I42	11,442	1.8
Malignant neoplasm of brain	C71	10,281	1.6
Heart failure	I50	10,392	1.6
Intentional self-harm by other and unspecified firearm discharge	X74	10,511	1.6
Assault by other and unspecified firearm discharge	X95	9,525	1.5
Other ill-defined and unspecified causes of mortality	R99	7,223	1.1
Unspecified dementia	F03	6,160	1.0
Alzheimer's disease	G30	5,169	0.8
Parkinson's disease	G20	3,084	0.5
All	**--**	**648,134**	**100.0**

The titles for the ICD-10 codes in the data were obtained from the World Health Organization (WHO) website at http://apps.who.int/classifications/apps/icd/icd10online/

Source: Authors' estimations, based on data from the NCHS

classification was proposed and hence some of the causes of death that were categorised as 'other' even in the most updated version could be shifted to one of the other two groups of causes of death.

Following the above argument, in Table 4 we list ten causes of death with the highest numbers of deaths in the residual category in our study for the year 2010 and also include old-

age degenerative diseases such as Alzheimer's, dementia, and Parkinson's. The ten most important causes of death in the 'other' category, for both sexes together, include four types of malignant neoplasms: of the pancreas, liver, brain, and unspecified. The first on this list, pancreatic cancer, is the fourth most common cause of cancer deaths in the United States. Men are more often diagnosed with pancreatic cancer than women. The diagnosis of this aggressive cancer usually happens at an advanced stage of the disease and mortality is very high (Riall et al., 2006). Hence, unfortunately, even in the last years of our study deaths from pancreatic cancer cannot be placed in the category of medically amenable deaths. Likewise, other causes listed in our top 10, such as liver or brain cancer, cannot be effectively treated at the beginning of the 21st century either. Survival rates for liver cancer (Jemal et al., 2006) and brain cancer (Bondy et al., 2008) are still very poor. The above suggests that the classification scheme applied in this study is not outdated since few successful therapies or interventions have been discovered or developed so far for the leading causes in the residual category.

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Appendix

Causes of death considered amenable to medical care, preventable by public policy, and ischemic heart disease

Name of group	**Age**	**ICD8**	**ICD9**	**ICD10**
Amenable to medical care				
Intestinal infections	0-14	000-009	001-009	A00-A09
Tuberculosis	0-74	010-019	010-018, 137	A15-A19, B90
Other infectious (Diphtheria, Tetanus, Poliomyelitis)	0-74	032, 037, 040-043	032,037,045	A36, A35,A80
Whooping cough	0-14	033	033	A37
Septicaemia	0-74	038	038	A40-A41
Measles	1-14	055	055	B05
Malignant neoplasm of colon and rectum	0-74	153-154	153-154	C18-C21
Malignant neoplasm of skin	0-74	173	173	C44
Malignant neoplasm of breast	0-74	174	174	C50
Malignant neoplasm of cervix uteri	0-74	180	180	C53
Malignant neoplasm of cervix uteri and body of the uterus	0-44	182	179,182	C54, C55
Malignant neoplasm of testis	0-74	186	186	C62
Hodgkin's disease	0-74	201	201	C81
Leukaemia	0-44	204-207	204-208	C91-C95
Diseases of the thyroid	0-74	240-246	240-246	E00-E07
Diabetes mellitus	0-49	250	250	E10-E14
Epilepsy	0-74	345	345	G40-G41
Chronic rheumatic heart disease	0-74	393-396	393-398	I05-I09
Hypertensive disease	0-74	400-404	401-405	I10-I13, I15
Cerebrovascular disease	0-74	430-438	430-438	I60-I69
All respiratory diseases (excl. pneumonia/influenza)	1-14	460-466, 490-519	460-479, 488-519	J00-J09, J20-J99
Influenza	0-74	470-474	487	J10-J11
Pneumonia	0-74	480-486	480-486	J12-J18
Peptic ulcer	0-74	531-533	531-533	K25-K27
Appendicitis	0-74	540-543	540-543	K35-K38
Abdominal hernia	0-74	550-553	550-553	K40-K46
Cholelithiasis & cholecystitis	0-74	574-575	574-575.1	K80-K81
Nephritis and nephrosis	0-74	580-584	580-589	N00-N07, N17-N19, N25-N27
Benign prostatic hyperplasia	0-74	600	600	N40
Maternal deaths	All	630-678	630-676	O00-O99
Congenital cardiovascular anomalies	0-74	746-747	745-747	Q20-Q28

Perinatal deaths, all causes, excluding stillbirths	All	760-779	760-779	P00-P96, A33, A34	
Misadventures to patients during surgical and medical care	All		E870-E876, E878-E879	Y60-Y69, Y83-Y84	
Preventable by public policy					
HIV	0-74	-	042		
Malignant neoplasm of lung	0-74	162	162	C34	
Chronic obstructive pulmonary disease	0-74	490-492	490–492, 496	J40-J44	
Cirrhosis of the liver	0-74	571	571	K70-K74	
Motor vehicle accidents	0-74	E810–823	E810–825	V02-Vo4, V12-V14, V19-V89	V09,
Ischemic heart disease	0-74	410-414	410-414	I20-I25	

Source: Nolte and McKee, 2004, p.66; James et al., 2007, p.289;