

## The gender gap in survival: a new perspective

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**Summary. Introduction.** In Italy in the early twentieth century, mortality was high for men and women of all ages, a fact that was reflected in the low survival rates for both genders. Life expectancy at birth in 1900 was 41.8 years for women and 41.6 for men, meaning that women lived an average of 0.2 years longer than men. The beginning of the twentieth century coincided with the beginning of the process by which average survival increased for both genders, but, on the eve of the Second World War, women had a life expectancy at birth 3 years greater than that of men. In the following years, the distance between the genders continued to favour women. The gap widened until it reached the maximum difference of about 7 years in 1979. Unexpectedly, from that moment on, the trend began to reverse, and, in just over 30 years, the survival gap has dropped to less than 5 years, with men having closed the gap by more than 2 years. **Objectives and results.** The aim of this paper is to demonstrate how this particular development is linked to the different mortality models of men and women in adulthood and old age due to the different life histories of the two genders. More specifically, with reference to the development of mortality by age and by cause, we can see how the maximum gap in 1979 was largely determined by the increase in mortality from cancers for men belonging to the generations involved in the two world wars. For many years, the increase in the gender gap was the result of mortality models that penalised men, following the adoption of lifestyles that were dangerous to health, such as cigarette smoking. The later reduction in the gap was largely due to new male behaviour in the generations born after the 1930s, for whom the risk of death from cancers and circulatory diseases in adult life dropped more rapidly than it did for women. **Conclusion.** To conclude, unlike other countries, the reduction in the survival gap between women and men in Italy was not determined by female survival worsening, due to the adoption of behaviour and lifestyles similar to men's, rather, to men of more recent generations realising that they must imitate female behaviour if they want to live longer.

**Key words:** life expectancy, gender gap in survival, mortality by age, causes of death, cohort analysis.

### *Differenze di genere nella sopravvivenza: una nuova prospettiva*

**Riassunto. Introduzione.** In Italia, nel primo novecento la mortalità era alta per uomini e donne in tutte le età della vita e, specularmente, i livelli di sopravvivenza erano bassi per entrambi i generi. La speranza di vita alla nascita nel 1900 era rispettivamente di 41.8 anni per le donne e di 41.6

anni per gli uomini. Le donne vivevano, dunque, mediamente solo 0.2 anni più degli uomini. L'inizio del novecento segnò anche l'avvio dell'aumento della sopravvivenza media per entrambi i generi, ma alla vigilia della seconda guerra mondiale le donne avevano un'attesa di vita di 3 anni più elevata di quella dei coetanei. Negli anni successivi le distanze tra i generi continuarono a favorire le donne. La forbice si allargò fino a raggiungere il massimo della distanza di circa 7 anni nel 1979. Inaspettatamente, da quel momento in poi il trend iniziò un cammino contrario, e in poco più di 30 anni le differenze di sopravvivenza scesero sotto i 5 anni, permettendo agli uomini di recuperare ben 2 anni sulle donne. **Obiettivo e risultati.** L'obiettivo di questo lavoro è di dimostrare come questa particolare evoluzione sia legata ai diversi modelli di mortalità degli uomini e delle donne in età adulta e anziana in ragione delle diverse storie di vita vissute dai due generi. In particolare, i risultati più interessanti consentono di vedere che, facendo riferimento all'evoluzione della mortalità per età e per causa, la distanza massima del 1979 è determinata in gran parte dall'aumento della mortalità per tumori per gli uomini delle generazioni coinvolte nei due conflitti mondiali. Per lunghi anni l'aumento delle differenze di genere è stato il risultato di modelli di mortalità che hanno penalizzato gli uomini a seguito dell'adozione di stili di vita nocivi alla salute, come il fumo di sigarette. La successiva riduzione delle differenze è dovuta in gran parte ai nuovi comportamenti maschili delle generazioni nate dopo gli anni '30, per le quali i rischi di morte per tumori e per malattie del sistema circolatorio nelle età adulte sono diminuiti più rapidamente di quelli femminili. **Conclusioni.** In conclusione, in Italia, contrariamente a quello che si nota in altri paesi, la riduzione delle differenze di sopravvivenza tra donne e uomini non è determinata da un peggioramento della sopravvivenza femminile a seguito dell'adozione di comportamenti e stili di vita sempre più simili a quelli maschili, ma è, piuttosto, determinata dal fatto che gli uomini delle generazioni più recenti hanno capito che devono imitare i comportamenti femminili se vogliono vivere più a lungo.

**Parole chiave:** speranza di vita, differenze di genere di sopravvivenza, mortalità per età, cause di morte, analisi per generazione.

### An introduction

In Italy, women account for more than half the population, making up 51.5% of the total. All western countries and, overall, 81 countries on the planet have

favourable figures for women. The proportions between the two genders are only inverted in 37 countries, whereas in the remaining 75 they are more or less equal. This would seem to suggest, in general, a prevalently female world; however, this impression is contradicted by the United Nations' 2013 world population estimates, which show that just 49.6% of the world population is female. This apparent paradox can be explained by the fact that the most populous countries in the world have such a large internal imbalance that it impacts on the total values: China has almost 50,000,000 more men than women, and India 4,000,000. This is due mainly to a relation between the sexes at birth that is higher (107-108 males for every 100 females) than that biologically expected (105-106) and, in India, also to a higher mortality for women of childbearing potential. The reasons for the imbalance between the sexes at birth in these countries are well known. The preference for a son induces a significant number of women to practice selective abortion (thanks to the availability of prenatal diagnosis techniques at accessible prices) or to give less care to a daughter, and even to practice infanticide on female infants (as occurred in China during the years of the one-child policy), when they stand in the way of the possibility of having another child – who, obviously, it is hoped, will be male.

The demographic evidence shows that amongst full-term infants, when Mother Nature is not conditioned by individual behaviour aimed at choosing the sex of the baby, the female gender is in the minority. However, females prove more resistant to elimination from their very first cry. This means that the gender imbalance in favour of males at birth gradually tends to be reduced, due to higher male mortality from the earliest days of life and in the years immediately following. In Italy, as in the whole of the industrialised world, this process continues into adolescence and adulthood, with the higher mortality of men leading to a gender balance that more or less coincides with the end of the reproductive age of women. This is the stage in life when the number of women becomes predominant, and continues to be so increasingly in the following ages, due to increasing supermortality in men that extends into extreme old age. In Italy on January 1st, 2015 there were 131 women over the age of 65 for every 100 men, whereas at the age of 80 this figure had risen to 181 women for every 100 men; this means that there are about 4,000,000 Italians over the age of 80, of whom just over 2,500,000 are women<sup>1</sup>.

On the one hand, we are witnessing a gradual increase in the aged population, thanks to the reduction in mortality at every age of life, which allows an ever-growing number of individuals to reach the threshold of 65 and even 80, whereas on the other, we are witnessing an increase in the number of women compared to

men as their ages increase. The life tables for the Italian population in 2014<sup>2</sup> tell us that, in the present mortality conditions, 600 male infants out of 1000 should reach the threshold of 80, against 800 female infants. As recently as the 1970s, these proportions were 300 and 500, respectively. This means the Italian population is aging and also becoming increasingly long-lived, but with women more numerous and longer-lived than men. It is clear that the population-aging process sees women in the front line and, indirectly, we can see that many health problems linked to age particularly concern women, often widows living alone.

This short introduction raises two fundamental questions: firstly, why do aging and longevity favour women? and secondly, what changes are taking place and what does the future hold for us?

### Lower mortality for women at every age of life: a century of changes

A history of differential mortality between the two genders, varying in time and due to age, is the basis of the gender differences indicated above. If we take the Italian population at the beginning of the twentieth century as our point of comparison, male mortality in the first year of life was higher than female mortality, whereas during adolescence and the reproductive ages between 20 and 40 female mortality was higher, albeit not significantly so (Figure 1)<sup>3,4</sup>. By contrast, in the remaining adult and senile ages, men were penalised to a greater extent. This behaviour indicated aspects of female frailty in the puberty period, when their physiological conditions require good living conditions, adequate diet, and special medical and health care. These elements were present in Italy in that period, due to poverty in the population and also to the preference given to the male child, often for economic reasons. From adolescence onwards, a son was a productive resource for the family, and therefore favoured in the distribution of the amount of food to give him, as well as the scanty resources available for medical and health treatment. Equally, the higher female mortality of the past in the age bracket from ages 20 to 40 – one that is still present in the poorer areas of the planet – was closely linked to demographic, socio-economic and health factors. In particular, it was due to the high number of children borne by women, along with a lack of proper diet and treatments to guarantee good health during pregnancy and childbirth. However, it should be said that, quite apart from gender differences, in the early twentieth century mortality was high for men and women of all ages. This high mortality meant low survival levels for both genders. Life expectancy at birth in Italy in 1900 was 41.80 years for women and 41.56 years for

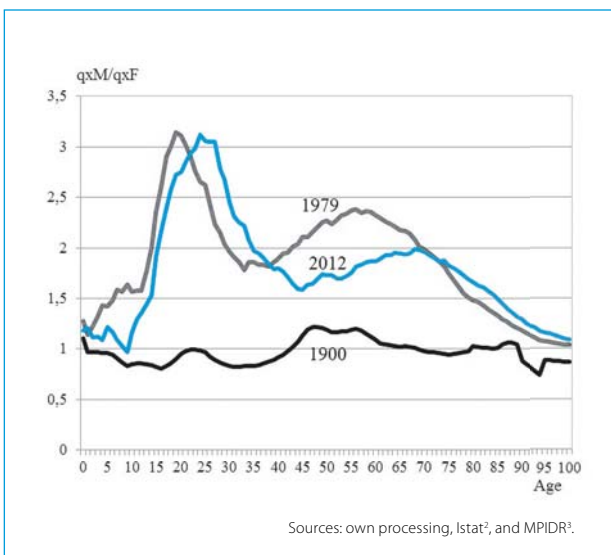
men. This meant that women lived an average of just 0.24 years more than men (Figure 2)<sup>3,4</sup>.

It was in the early twentieth century that the decline in mortality at all ages began – a decline interrupted only during the two world wars and by the Spanish ‘Flu epidemic of 1918-19. With the passing of time, better living conditions, economic, social and health development, important discoveries in medicine and pharmacology gradually led to generally low mortality levels for both genders. As early as the immediate post-war period from 1946 onwards, and still more so from the 1960s onwards, the two periods of life in which wo-

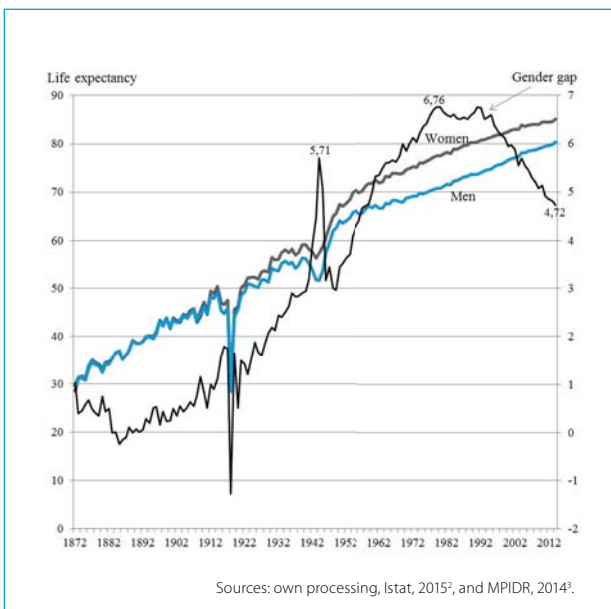
men were particularly frail no longer constituted a problem of survival, whereas the negative role of working and environmental and behavioural factors increased the frailty of men in youth, adulthood and old age. Indeed, if we study figure 1, we note that at the start of the 1980s, there was no longer any age of life in which men were not penalised by mortality levels significantly higher than those of women. What happens at the moment of birth and in the first year of life, when male mortality exceeds female mortality by 28 percentage points, is nothing, compared with the difference in later life, when the risk of death for men is as much as three times higher than for young women, and more than twice as high in the central period of life. These differences remain higher than ever in extreme old age, to the point that it can be said that not even the greater selection brought about by mortality in the preceding ages allows men to reach this age with greater resistance to death than their female peers.

In the second half of the twentieth century there was a marked and constant decline in mortality in all ages of life and, consequently, survival levels increased for both sexes, but so did the gender gap in terms of life expectancy. 1979 was the year in which the survival gap between women and men reached its peak in Italy, with life expectancy at birth standing at 77.3 years for women and 70.5 years for men, a gap of almost 7 years of life (6.8 years) on average at birth (in Figure 2, following the right-hand axis of the ordinates). Over the following fifteen years, the gender gap did not show significant variations until, once again, in 1991 there was a new peak (6.6 years). From the early 1990s until the present time, as we can see in Figure 2, there was a marked inversion in the progress of the survival gap between women and men, dropping to 4.8 years in 2012 and 4.7 in 2014 (last year available). The trend seems to be one of a convergence of men and women at some of the highest survival levels in the world. According to the life tables for 2014, Italian women now have a life expectancy at birth of 85 years, and men of 80.3 years. Since the maximum gap in survival in 1979 and 1991 is little more than twenty years, men have recouped 2 whole years over women – the result of important changes in the models of male mortality in adult and pre-senile ages. If we look at Figure 1, we can already see that the values of male supermortality (mortality sex ratio) have dropped in the ages between 40 and 70, whereas the relation of male supermortality in youth (age 20 to 40) and in old age has changed, again in women’s favour.

Obviously, the risk of death is low for both men and women up to the age of 40, and so has little effect on survival differences between the two genders, whereas, after the age of 70, the risk is high for both, and has an important role on the survival and longevity gap between the two genders. For the moment, we know that



**Figure 1.** Mortality ratio by age between men and women, Italy. Years 1900, 1979 and 2012 ( $q_x$  is the probability of death at age  $x$ ).



**Figure 2.** Life expectancy at birth for women and men, and gender gap from 1872 to 2014.

women certainly live longer than men and that their mortality is lower at every age of life, but that the gap in terms of survival is narrowing fast.

### Are women losing some of their advantage or are men recovering their disadvantage?

As said above, although women and men are living longer and longer, the difference between genders seems to have closed. For almost a century, we observed a gradual, rapid increase in the gap between female and male life expectancy, and until the threshold of the 1980s this process seemed inexorable (Figure 2). Since then, against all expectations, everything has changed. If we need to simultaneously observe the two specular faces of mortality and survival to discover what process led to this result, then we also need to link the two aspects and estimate the role played by the decline in mortality at all ages of life on the years of survival recovered by men over women, if we are to describe this process better. The path leading from description toward explanation of the process observed also obliges us to understand the reasons for the ongoing modifications. We should not forget that the development of life expectancy is the result of the joint action of many social, economic, health and environmental factors whose action makes the likelihood of illness and being cured of it higher or lower. It is therefore useful to evaluate the role played by the main diseases on survival if we want an explanation. This means linking mortality by age and by cause of death to the development observed in the gender gap in survival.

First of all, we must remember a well-known fact: that the decline in mortality in adulthood and old age allowed both women and men to survive 5 and 7 years longer respectively between 1991 and 2014. This was possible thanks to the central role played by the decline in mortality in adulthood and old age caused by circulatory diseases; however, this development does not explain the reduction in the gap between the survival values for the two genders. A recent study<sup>4</sup> shows that the contribution to the increase in survival due to the decline in mortality from these causes has produced 40% of the years gained for men and 51% for women. It was, rather, the decline in mortality from cancers that favoured men over women in adult ages, with 33% of years of life gained for men and 19% for women.

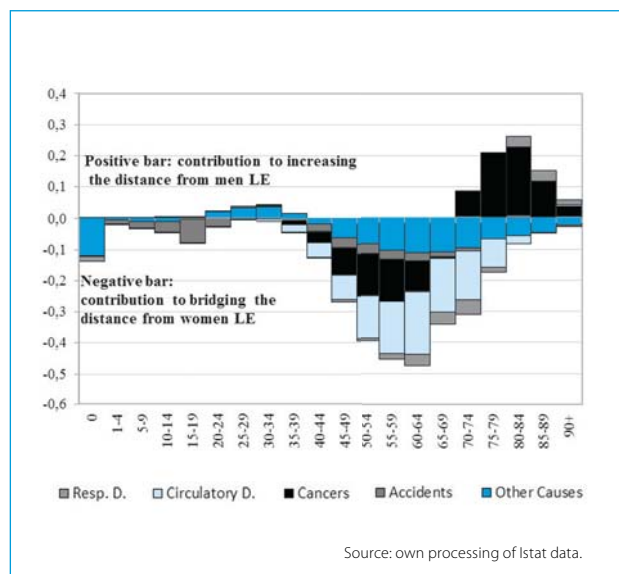
Let us now try to set down the evidence of these developments, examining the role of the combined action of the age dynamic and the main causes of death in the reduction of the gender gap in life expectancy. We shall limit our field of enquiry to the period in which there was a maximum gender gap, which means since 1979, when it was, as we have mentioned, 6.8 years. The most recent year considered is 2012, for which we have detailed and

comparable information on mortality by cause of death, and when the gender gap was 4.8 years. By applying Pollard's decomposition model<sup>5</sup> we can see which ages and which causes are responsible for the decrease in gender gap of 2 years that can be seen in life expectancy between 1979 and 2012. In Figure 3, the positive bar represents the contribution of the mortality dynamic to increasing the distance from male life expectancy at birth, conversely, the negative bar represents the contribution to bridging the distance from female life expectancy at birth. In fact, this figure shows, if we observe the part of the negative contributions, that the relative shortening of the survival gap between women and men is due to the differential decline in mortality (which is greater for men than for women) in the ages between 40 and 70 (corresponding to the area between 1979 and 2012 indicated in Figure 1 for these ages). In the ages 40 to 70, gender differentials tend to be reduced mainly thanks to the more favourable male mortality dynamic for cardiovascular diseases, cancers and "other causes". The impact of this dynamic would have led to a much more significant recovery than the 2 years recorded had it not been mitigated by a more favourable mortality dynamic for women in the other ages of life (positive bar in Figure 3). Indeed, in young ages – those in which, in figure 1, we note a delayed supermortality in 2012 compared with 1979 –, the role of an unfavourable development in mortality for men between 25-40 years under the heading "other causes" produces a limited increase in the survival gap between genders. Under the heading "other causes", the dominant causes of death for men in these ages are due to accidents and AIDS<sup>6</sup>. Likewise, there is a reduction in the survival gap (positive bar) between women and men in old ages, when mortality for cancers favours the former. Indeed, thanks to a more significant increase in male mortality due to cancer in these ages, old women recover years of life over their male peers.

From a demographic point of view, it is now clear that, overall, men's recovery compared to women essentially depends on the more recent development in male mortality in the central ages of life. This can be seen in many industrialised countries. The national and international debate on the subject has seen the closing of the gender gap as natural, given the increase in harmful life styles also amongst women. This is a reasonable hypothesis, but it clashes with the fact that, in Italy, mortality also continues to drop for women of all ages of life. It is not inevitable that a convergence of behaviours need necessarily translate into a worsening of the survival conditions for women. On the one hand, the process of convergence happened and is happening within a situation of improved control of mortality for both genders, and, on the other, there is a general attempt to interpret the most recent convergence without explaining the previous divergence, which lasted nearly a century.

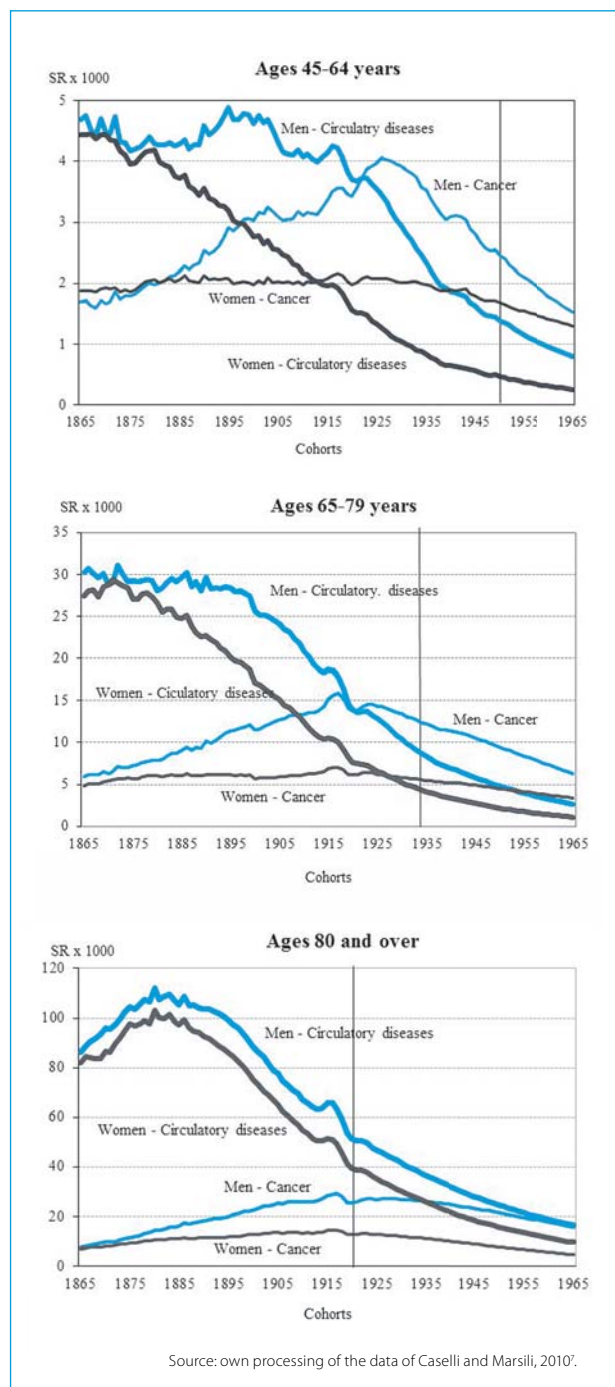
To understand the mechanisms of these changes, we believe that their study must necessarily involve the changes in the mortality of different cohorts. We must consider the whole process of life and death if we want to progress from a mere description of the phenomenon to solid theories explaining it.

The picture provided by Figure 4 for ages 45-64, 65-79 and 80+ is enough to explain the two most important points regarding our aims. In the first place, the reasons for the changes in the mortality models of adults and the elderly today compared with the immediate past appear absolutely clearly. We should remember that, according to Figure 2, the adults of 1979 (age class 45-64) are those of the cohorts 1915-1934, whereas the adults of 1991 are those of the cohorts 1927-1946 and that the cohorts of 1947-1952 are central in the group of cohorts of adult age today. Since circulatory diseases and cancer for adults and the elderly have long been the two main causes of death, it is worth examining their mortality trend carefully, comparing one cohort to another, and focusing on these ages, which are the periods that most favour the extension of life for the most recent cohorts (Figure 4)<sup>7</sup>. The mortality histories in adult age (45-64 years) are complete for the cohorts between 1865 and 1948. The estimates for the later cohorts start from our knowledge of a very small part of the story. For example, for the 1952 cohort, mortality is that actually observed up to 60 years old, whereas that between 61 and 64 years is projected. Mortality projections by sex, age and causes of death were performed by Graziella Caselli and Marco Marsili<sup>7</sup> on cohorts born between 1865 and 1965 and up to the year 2050.



**Figure 3.** Contributions by age of the leading causes of death to increasing or decreasing the gender gap in life expectancy at birth (LE) from 1979 to 2012. (The decrease in gender gap is 2 years).

For men, mortality due to circulatory diseases fluctuates frequently, but has a slightly decreasing trend until the cohorts born during World War I. The highest values are those for the cohorts involved in or born during the war. Mortality due to cancer, by contrast, shows a clearly growing trend up to those born in the 1920s.



**Figure 4.** Cohort trends of standard mortality rates (SMR) for the 45-64, 65-79, 80 and over age brackets, for two causes of death, observed (on the left) and projected (on the right). Men and Women. Standard Population: Italian men and women as of January 1<sup>st</sup> 1952.

As is generally accepted, the increase in male cancer is largely the result of the increase in mortality from cancer of the respiratory system<sup>6</sup>, which is closely linked to cigarette smoking, a practice that was widespread amongst soldiers during WWI, but also a lifestyle that was particularly cultivated among the cohorts of adult men in the 1890s. In fact, the increase in mortality due to cancer in the 45-64 age bracket does not only involve men in the cohorts that took part in the war, but also those born during the conflict (albeit to a lesser extent) and, later, those involved in World War II. These three groups of cohorts, whose average survival values, we have seen, were also penalised, actually lost years of life compared with the others because they were also struck down at these ages by higher mortality due to circulatory diseases. As a result, fewer of the individuals in these cohorts reached the 65-years threshold, and, despite the lower mortality levels that they enjoyed in later ages, above all due to circulatory diseases, the number of them that might have hoped to reach extreme ages remained very limited.

It is interesting to note that it was around the cohorts born in the early 1920s that the crossover in adult age took place between the circulatory disease curve and that for cancer. From then on, mortality due to cancer occupied first place in these ages and for all the following cohorts. The cardiovascular revolution and the start of the decline in mortality from cancer fully involved the men in the cohorts born toward the end of the 1920s down to that born in 1948. In adulthood, and at later ages, the men in these cohorts (1920-1935 in old ages) experienced a decline in mortality from these two causes, not only in terms of male mortality but also compared with the decline experienced by women in the same cohorts.

The reversal trend of mortality from cancer at age 65-79 is mainly explained by the significant decline of 'respiratory system' cancer, particularly involving the cohorts born after World War I (Figure 4).

For women, mortality in the adult age from cardiovascular disease had already begun to decrease for the cohorts born in the second half of the nineteenth century, and this drop continued rapidly and more or less consistently for later ones. Mortality from cancer remained more or less at the same levels for all cohorts, at both adult and later ages (65-79 age bracket), showing a moderate increase only after the age of 80. There was a different gender behaviour in the development of mortality for these causes, which became particularly important for the cohorts born between the second half of the 1920s and the second half of the 1930s. Figure 4 shows that the pace of decline for adult men, but also for old people at later ages, accelerates more than that for the women in the same cohorts and, of course, of the same age. This different behaviour probably plays a

significant role in the bridging of the survival gap observed in Figure 2, and in the modifications of the male/female ratios at adult age observed in Figure 1. What we noticed in the period mortality diagrams (Figure 3) might, then, be explained by the various modifications in the mortality models of the cohorts of women and men. We can at once conjecture that the reduction in gender differences in Italy is due more to men recovering among the more recent cohorts than to a potential reduction in the rhythm of the increase in survival by women in the same cohorts, such as is visible in other countries. In Italy, we can say that, for the most recent cohorts, the role of mortality from cancer was decisive in the gradual erosion of the female advantage between 40 and 70 years of age. Beyond the age of 75, however, women increased their advantage thanks, above all, to the increase in male mortality from cancers. This particular change in mortality for the oldest men has played a part in blocking the process of convergence between female and male survival.

### Discussion and conclusion

The cohort analysis allowed us not only to observe the important modifications in the mortality between cohorts but also between genders. This analysis confirms and adds to the results of the period analyses, providing answers to some of the questions advanced in observing both the continual increase in the survival gaps between genders before 1979 and the reversal in the following years.

In particular, the cohort analysis has shown how the increase in the survival gap by gender is often the result of a life history – and, so, of mortality histories – that penalized the cohorts of men involved in World War I and World War II, probably due to their adoption of habits such as cigarette smoking that increased their risk of death, especially from cancer<sup>8-10</sup>. At the same time that men suffered the effects of a life history that had involved risks that endangered their health, Italian women in the same cohorts, who had been marginalised by the world of work and protected by a traditional culture, were, as a result, also protected from more harmful life styles, and were therefore able to recover more years of life, gradually increasing the gender gap until 1979.

The most interesting result is that concerning the different reduction in mortality for the more recent cohorts for men than for women and, consequently, the reduction in the gender gap over the last 30 years. In other countries, this reduction was determined by a worsening in female survival due to the new life styles of women, which became increasingly similar, negatively, to those of men<sup>11-12</sup>. This is not true in Italy for the cohort involved in our study. Here women of the past and present cohort

in adult and old ages did not increase the risk of death by imitating male behaviour. Italian women of adult age today (class of age 45-64) seem to remain quite close to a traditional culture, and even if they experience some of the typically male risks (smoking, for example) more frequently, we may suppose that they quickly try to reduce the intensity and length of their exposure to these risks, and therefore their impact on overall survival. If we examine the prevalence of smoking among women from some selected countries in the mid-1970s according to age<sup>13,14</sup>, in Italy the figure was 14% at age 50-59, vs 48% in England and Wales and 18% in Japan (where the prevalence of female smoking is one of the lowest), whereas at age 40-49 the figure was 16%, equal to Japanese women and lower than Danish women (49%). In 1976, Italian women aged 30-39 years (65-75 years in 2012) who were smokers accounted for 29%, vs 46% of Danish women.

Men in the recent cohorts, by contrast, seem to be imitating the female mortality models and even showing a reduction in some of the typically male risks of illness and death (also included in "other causes"). This may be the result of a new health and fitness culture, which would appear increasingly interesting to young males, who study and imitate some of the behaviour of women. Greater care for their bodies, for example, leads them directly or indirectly to follow the path of prevention and to detect in advance some illnesses that might otherwise become fatal. We would like to be able to interpret the gradual closing of the gap in female and male survival values (due to the reduction in male adult mortality) as the result of a feminising of male behaviour. We could conclude that Italian men in the younger generations of today understand that they need to follow the example of women if they want to live longer, hoping that Italian women do not imitate the men of the previous generations!

This concern is not unfounded, if we consider that the young women of today are those who most frequently adopt habits and behaviours that are damaging to their health. Smoking is increasing rapidly among them<sup>15</sup>, reaching levels that approach those of women in countries where the smoking habit has been widespread for a long time. In the 2004 survey, 22.5% of Italian women described themselves as current cigarette smokers, compared with 30% for men, while the difference in smoking prevalence between genders was greater in the elderly<sup>16</sup>.

Obviously, the results of Caselli and Marsili's mortality projections<sup>7</sup>, conducted with an eye to mortality by age, cohort, and cause of death until 2050, can provide an interesting glimpse of the future. In 2050, men are expected to reach a life expectancy at birth of 88.7 years, against 92.4 years for women. This means that, instead of the 6.8 years of difference in 1979 and the 4.8 years in 2012, there would be a difference of 3.7 years in 2050 and the trend towards a gradual closing of the gap female and male survival will continue. Indeed, for the young

women of today we can see a long-term process of coming closer to men of the same age, as, although they will maintain mortality levels for cancers that are much lower than men's, the projection of a slight increase in their mortality from these causes will combine with an increased reduction in men's (see Figure 4).

Obviously, between now and 2050 there will also be a gradual increase in the survival of the elderly, with a life expectancy for sixty-year-old men of 25 years, and of almost 29 years for women of the same age (18.9 and 22.3 years in 2014 respectively), and for eighty-year-olds of 12.5 and 15 years, respectively (8.4 and 10.3 in 2014). The constant increase in survival will be accompanied by an inevitable increase in the population of old and very old people. In the coming decades, the large cohorts of the second post-war period will pass the threshold of seventy and then eighty years, to be followed by those born in the years of the economic boom, to which we must now add increasing numbers of immigrants, who arrive in Italy at a young or adult age and who might remain there until old age. In 2030, we can expect there to be 3,364,000 women and 2,089,000 men aged eighty years and over, which is a female sex ratio equal to 161/100. There will continue to be more old women than old men and, despite the process of convergence, their survival is – and will remain – higher. By contrast, their health is – and, according to the forecasts, will continue to be – worse than that of their male peers<sup>6</sup>. It is well known that women live longer than men, but that their state of health is on average worse. The health differential between genders reaches its peak amongst the over-eighties, partly because of the greater aging of the female population. For women over this age, only 15% of the years of life ahead are lived in a state of complete autonomy, against 24% of the years ahead for men. According to many studies, including the most recent, this female disadvantage tends to increase over time<sup>17</sup>. This means that, referring to the hypothetical 1000 Italian new-born babies of the 2014 life table, mentioned at the beginning of this paper, according to the results of Istat's research on the health of the Italian population (in 2004-2005), only 240 men out of the 600 or so total survivors at age 80 (40%) would reach this age in a state of complete autonomy compared to just 200 women out of the 800 or so survivors at the same age (25%).

We can conclude that women and men live longer and longer, but the current gap between them has closed somewhat. Women's health is, of course, an average worse, particularly after age 80 and older, when they account for 65% of the approximately 4 million Italians of this age.

**Conflict of interest statement:** the Author declares no potential conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias conduct and findings of this study.

### Key messages

- A history of differential mortality between the two genders, varying in time and due to age, is the basis of the gender gap in survival.
- 1979 was the year in which the survival gap between women and men reached its peak in Italy, with a gap of almost 7 years of life on average at birth.
- From the early 1980s until the present time, there was a marked inversion in the progress of the survival gap between women and men, which dropped to 4.8 years in 2012 and 4.7 in 2014. This inversion is the result of important changes in the models of male mortality in adult and pre-senile ages.
- The cohort analysis showed how the increase in the gender gap until 1979 is often the result of a life history – and, therefore, of mortality histories – that penalised the cohorts of men involved in World War I and World War II, probably because of their adoption of habits such as cigarette smoking that increased their risk of death, especially from cancer,
- From a demographic point of view, it is now clear that, overall, the fact that the gap between men and women has narrowed, essentially depends on the more recent development in male mortality in the central ages of life.

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