Original Article

Trends in Life Expectancy and Mortality Rates in Turkey as Compared to Organization for Economic Co-Operation and Development Countries: An Analysis of Vital Statistics Data

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Abstract

Aims: In recent decades, Turkey has seen sustained improvements in life expectancy, although it has remained well below the Organization for Economic Co-operation and Development (OECD) average level. The present study aimed to assess trends in life expectancy and mortality rates in the context of changes over a long time period (1997–2016) in Turkey relative to OECD countries. **Materials and Methods:** Annual demographic and mortality datasets from various official database sources were used. In this descriptive-analytic study, the general stepwise-replacement method was performed to determine the decomposition of changes between two life expectancies of the population between two time points into age-specific contributions. Sex-specific trends in life expectancy since 1997 and age-specific mortality in Turkey with median values for member states were compared. **Findings:** Female life expectancy in Turkey continued at the lowest level until 2005 and then caught the lower 20% bound in 2015. By contrast, male life expectancy was below this level by 2009. Since 1997, for the first time, infant mortality rates in Turkey have been remarkably low in the comparator group. All age groups contributed to the negative trend in both sexes compared to OECD countries, especially in the 15–64-year group. **Conclusions:** Compared to OECD countries, Turkey has shown significant improvements in life expectancy since 1997 despite large differences. Particular attention must be paid to understanding why these improvements for both sexes in Turkey have been consistently below the median value of the OECD countries. Health and social policies are needed to curb widening life expectancy inequalities.

Keywords: Life expectancy, mortality rate, Organization for Economic Co-operation and Development countries, Turkey

Introduction

Over the last century, life expectancy at birth, number of years a person can be expected to live, has increased steadily for many countries in the world, although this improvement differs between countries.[1] Furthermore, periodic fluctuations in the decline of mortality rates are not unusual and have been seen in many Organization for Economic Co-operation and Development (OECD) countries.[2] Many risk factors, such as cancers and respiratory and circulatory system diseases, contribute to lower life expectancy and the inequality gap between male and female life expectancy for younger than 65 years.[3] Although higher incomes are associated with longer life expectancy,[4] a few high-income countries, including Latvia and Lithuania, have fallen below the life expectancy line of Turkey since 2002.[1,5] Some studies showed income level was the main determinant of life expectancy,[6] while others did not find any associations between both variables.[7] These inconsistent findings may have different analyses or variables. Nevertheless, the slowdown in improvements in life expectancy, especially in the USA and the UK, has continued since about 2010.[2,5] Many studies have discussed the reason for these slowdown improvements.[1-3,6,7] Despite all these

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trends, life expectancy in Turkey has steadily increased in recent decades, converging slowly toward the OECD average.[5]

In recent years, this slight increase in life expectancy in Turkey has received attention among researchers and practitioners interested in public health from various scientific areas. Particularly, life expectancy at birth and old-age mortality rate and its relationship to health expenditures in recent years have been discussed.[1–3,6] However, recent adverse mortality trends and their substantial differences between infant and younger adults have been given less attention, even though several studies have focused on the cross-sectional analysis of life expectancy and mortality trends.[8] Most of these studies have largely ignored comparable trends in life expectancy and mortality rates in all OECD countries over the long term since 1997. In particular, the factors affecting life expectancy and its relationship with these factors are not fully known. Studies on life expectancy are essential to identify places in need of intervention and measure the effects of policies. Therefore, this study makes an important contribution to the literature on Turkey's situation in life expectancy and deaths in the last 20 years among the OECD countries by analyzing vital statistics data. In this context, the study seeks to address the following main research questions: among OECD countries, how have the rates of life expectancy improvement in Turkey changed over time? What was the ratio of the total mortality rates in each 1-year age group for males and females in Turkey from 1997 to 2016 relative to OECD member countries?

This study aims to examine how life expectancy at birth and mortality rates in Turkey have evolved gradually for the last 20 years relative to OECD member states, including high-income and upper-middle-income countries. The current study also pays particular attention to differences between males and females and distinctive age patterns.

Materials and Methods

Annual demographic and mortality datasets from the Human Mortality Database (HMD), which provides detailed and well-organized population and mortality data for both sexes,[9] were used. However, because of limited data in HMD, other data sources were used, respectively, from the Human Life Table Database, the World Bank Open Data, and the Eurostat Dataset. These data sources have assembled a wide range of life tables for countries and have ensured detailed official mortality data for both sexes. The period of 1997–2016 was selected due to the availability of data for the chosen countries and allows us to analyze the fluctuations of life expectancy and mortality rates.

With this descriptive and analytical study, Turkey was compared with the reference group of countries comprising of 36 OECD countries to identify trends in life expectancy and age-specific mortality and determine possible causes of changes over time.

Median life expectancy and mortality rates for all 36 comparator states were used to identify the central tendency for this reference group. The median, which is less sensitive than mean values, was preferred because some countries such as Iceland, Chile, and Lithuania have random fluctuations of life expectancy and mortality. For each year, the median death rate at every age was calculated as the median of death rates across all OECD countries at the same age period, and then, the lower and the upper quintile death rates were computed. These death rates and median values were used to calculate life expectancy for the median, the upper, and the lower 20% levels.

To display the evolution of differences in life expectancy at birth in Turkey relative to the other member countries between 1997 and 2016, the annual data of life expectancy for Turkey and each of the other member states were plotted separately for both sexes. The top and bottom quintiles and the annual median for the member countries were placed on these life expectancies. The ratio of the total mortality rates in each 1-year age group in Turkey to the median of the other member countries was calculated.

Finally, to identify trends in life expectancy, two different methods were used. The first was a comparison of the life expectancy differences between Turkey and the 36 countries' median by each 2-year period for genders. The second was a general stepwise-replacement method, presented the decomposition of changes between two life expectancies of the population between two time points into age-specific contributions. This executes a chain of replacements of elementary age-cause-specific death rates in one population by corresponding rates from another population and calculates life expectancy effects after each replacement. This method is a universal tool for the decomposition of differences between aggregate measures (life expectancy) computed from demographic tables.[10]

Comparisons of the median values of life expectancy at birth in Turkey and 36 countries' medians were performed to assess associations between groups by using the Mann–Whitney *U*-Test. To test the robustness of the results for the study, all analyses using both mean and median values for the comparator countries were repeated. These analyses were done in an equivalent way by taking the mean instead of the median and the lower and the upper quintile of age-specific mortality rates in each year for the 36 comparator countries. All findings provided consistent results.

Focusing on the changes in life expectancy over time improves this analytical study by avoiding misleading inferences from confounding factors due to unobserved or unmeasured variables.[11] Hence, the study might have various confounding factors affecting life expectancy and mortality rate. Possible confounders might include age, smoking, cancer, body mass index, diabetes mellitus, and various other risk factors that might be unevenly distributed between the groups being compared.

Results

In 2003, male life expectancy in Turkey was the first time to catch the lower 20% level and ranked from the 33rd position to

the 30th position until the end of the 2000s [Figure 1]. Despite occupying that position, male life expectancy in Turkey has steadily followed the bottom quintile. In Turkey, female life expectancy continued at the lowest level of the 36 comparator countries until 2005 and then caught the bottom quintile of the distribution in 2015.

Under the age of 15 years, the mortality rate in Turkey relative to the 36 countries' median has simultaneously increased for males and females since the beginning of 1997 [Figure 2]. The excess of infant mortality rates continued to grow markedly in Turkey until 2007 compared to the median of the comparator group. The mortality rate of men, nearly aged 25–50 years, from the beginning of 2010 has been at the lowest level since 1997, relative to the median of 36 comparator countries, as shown in the white dashed rectangle with dark red color [Figure 2].

Table 1 provides a comparison of sex-specific life expectancy at birth with the median of the 36 comparator countries in each 2-year period between 1997 and 2016. In the 2015–2016 year period, both genders had –3.70 years and –3.30 years (respectively) disadvantage in the general life expectancy over the median for the 36 OECD countries. In general, the adverse trends of life expectancy differences became gradually smaller from year to year for both sexes in Turkey when comparing the median of the 36 OECD member states.

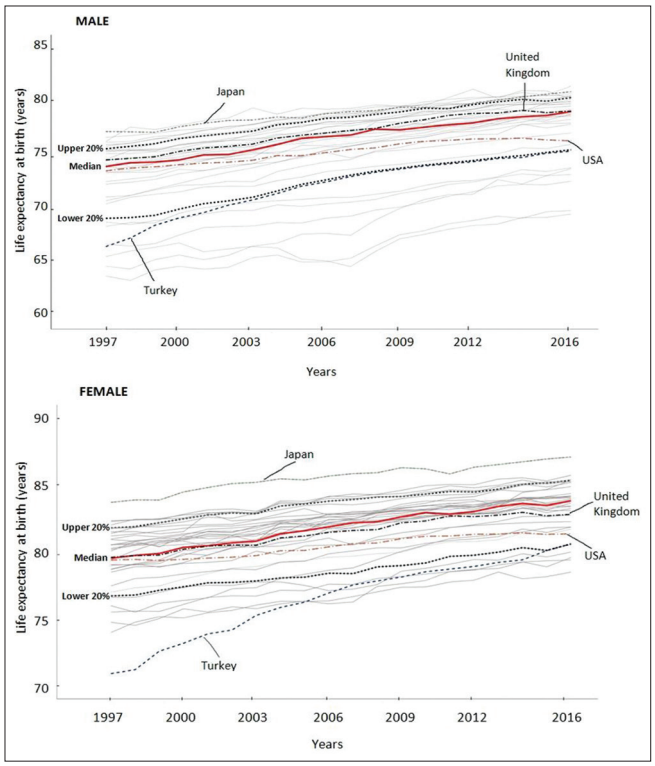

Figure 1: Life expectancy in all 37 Organization for Economic Co-operation and Development countries, plus the median life expectancy and the lower and the upper median life expectancy quintiles for the comparator group of 36 countries These countries are Australia, Austria, Belgium, Canada, Chile, Czechia, Colombia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea Republic, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. Median and lower and upper quintile values are shown as straight dashed lines between 1997 and 2016 years

The results of the stepwise-replacement method [Table 2] show the age-specific contribution of trends to the changes in life expectancy in each 5-year (1997–2016). All age groups contributed to the negative trend in both sexes. Adverse contributions to the 15–64-year group (working ages) were slightly larger for women (–4.6 years) than for men (–4.4 years) in the period 2012–2016.

Discussion

This was the first study to compare sex-specific trends in life expectancy and age-specific mortality rate in Turkey with all 36 OECD countries and examine whether and how trends changed for mortality and life expectancy in Turkey, 1997–2016. Study findings have unveiled a few important trends in life expectancy in Turkey compared with the rest of the OECD countries. First, male life expectancy in Turkey has been higher than in several OECD states since 1997. In contrast, the female life expectancy rate followed at the lowest level of the comparator countries from 1997 to 2005. Second, Turkey has been one of the largest improvements in life expectancy at birth since 1997, although it has been consistently below the median value of the OECD countries. Third, focusing on the past decade before 2006, the newborn mortality ratio for both sexes in Turkey was quite high, varying from 8.0 to 4.0 compared with the median for comparator 36 OECD countries. Finally, and most surprisingly, although Turkey is one of the two upper-middle-income countries among the OECD countries, the gap in life expectancy for both sexes between Turkey and the rest of the 34 high-income member countries has progressively decreased since 1997.

To date, previous studies have highlighted various factors associated with life expectancy for both genders in Turkey. Health-care spending, adequate and equitably distributed health infrastructure, and health-related variables, including improved hygienic conditions, stroke and coronary heart disease, significantly influence life expectancy in Turkey.[12] Structural changes in major health system functions of service delivery, resource management, financing, organization, and governance with the Health Transformation Program (HTP) in Turkey between 2003 and 2013 are likely to be one of the most important factors of improvement in life expectancy.[13] With this program, health expenditures on health service access increased across the country, the maternal mortality ratio greatly reduced, and distribution of health substantially improved. In fact, the important decline in the maternal mortality rate[14] and under-age-5 mortality because of effective immunization coverage[15] has also supported the findings of the study for explaining Turkey's situation in life expectancy and mortality rates.

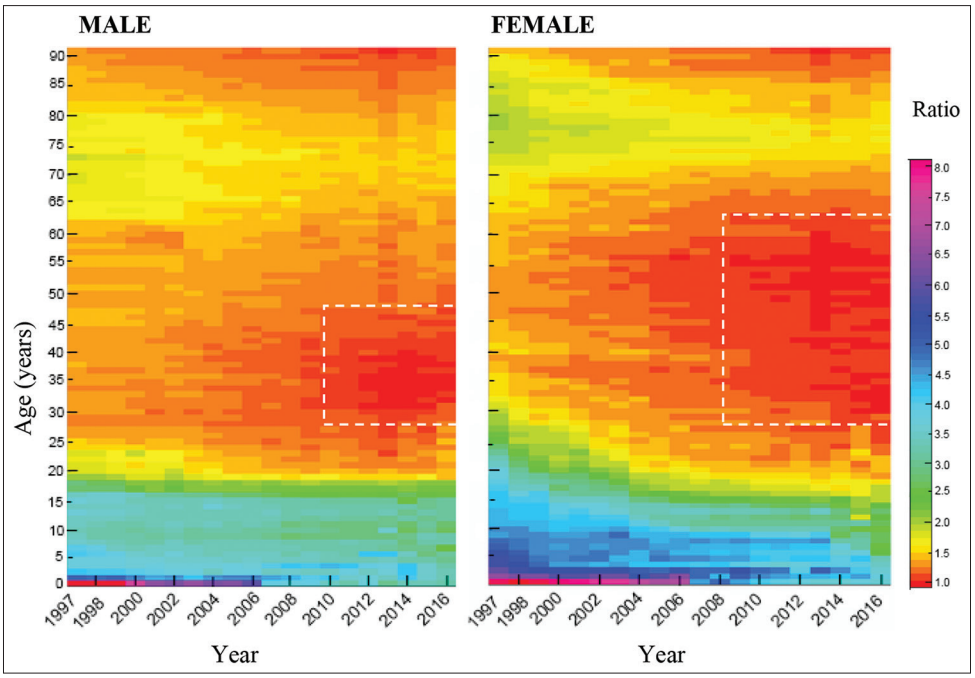

Figure 2: Mortality rate ratios in Turkey relative to the median for the comparator 36 Organization for Economic Co-operation and Development countries by year, age, and sex

Table 1: Comparison of life expectancy in Turkey and the median of 36 countries by sex, plus differences in life expectancy between Turkey and 36 countries' median by 2-year periods between 1997 and 2016 years

Years	Male				Female			
	Turkey	36 countries' median	Differences in life expectancy (years)	*P**	Turkey	36 countries' median	Differences in life expectancy (years)	*P**
1997-1998	66.80	74.09	−7.29	<0.001	70.95	80.23	−9.27	<0.001
1999-2000	68.75	74.58	−5.82		72.80	80.65	−7.85	
2001-2002	69.95	75.18	−5.23		73.95	81.04	−7.08	
2003-2004	71.10	75.95	−4.85		75.50	81.37	−5.87	
2005-2006	72.30	76.74	−4.44		76.55	82.06	−5.51	
2007-2008	73.20	77.18	−3.97		77.65	82.40	−4.75	
2009-2010	73.85	77.58	−3.72		78.30	82.81	−4.51	
2011-2012	74.30	78.07	−3.77		78.80	83.12	−4.32	
2013-2014	74.75	78.61	−3.86		79.30	83.54	−4.24	
2015-2016	75.30	79.00	−3.70		80.35	83.65	−3.30	

*Correlation is significant at<0.001 level (two-tailed); the *P* value refers to all pairs of differences in life expectancy

Table 2: Contribution of trends by selected age groups to differences between life expectancy in Turkey and the median for the 36 Organization for Economic Co-operation and Development countries for 5-years periods, 1997 and 2016 years

Age group (years)	Male				Female			
	1997-2001	2002-2006	2007-2011	2012-2016	1997-2001	2002-2006	2007-2011	2012-2016
0-14	−1.93	−1.86	−1.74	−1.64	−2.18	−2.01	−1.81	−1.63
15-34	−1.77	−1.62	−1.50	−1.36	−1.89	−1.76	−1.62	−1.50
35-49	−2.10	−1.98	−1.81	−1.51	−1.66	−1.62	−1.59	−1.49
50-64	−3.15	−2.95	−2.65	−1.53	−1.97	−1.89	−1.71	−1.64
65-79	−1.68	−1.55	−1.33	−1.17	−1.80	−1.66	−1.57	−1.48
≥80	−0.72	−0.64	−0.55	−0.48	−0.79	−0.71	−0.65	−0.54
All ages*	−2.25	−2.21	−2.19	−2.16	−1.61	−1.59	−1.56	−1.51

*The overall contribution of trends in life expectancy

One of the most surprising findings is that until 2003, men aged between 20 and 65 (working-age group) had regularly higher mortality than the 36 countries' median. For women, the mortality rate, particularly the age between 20 and 30 years, was also distinctly higher until 2004. The reason for this may include regional differences in health and socioeconomic characteristics of adults. According to the results of the 2002 World Health Survey for Turkey, health outcomes varied markedly between the rural and urban place of residence and individual socioeconomic inequalities closely linked to adult health.[16] Furthermore, the lack of or poor maternal health services throughout Turkey until 2004, when substantial improvements were performed in the provision of health services delivery, may have led to a rise in the mortality rates of women.[17] This view is supported by high infant mortality rates that began to fall considerably in Turkey after 2006 relative to the 36 countries' median [Figure 2].

The present study includes some countries where the gender gap in life expectancy decreased slightly for various reasons, such as the impact of certain causes of death on changes in mortality for both sexes.[18] Although in these countries, such as Sweden, Switzerland, the United Kingdom, Iceland, Ireland, and Norway, male–female differences in life expectancy relatively narrow at <4 years,[19] Turkey has slightly large gender differences (more than 4 years). This could partly be explained by men's greater exposure to risk factors, such as excessive alcohol consumption, smoking, high blood pressure, which result in more deaths from cancer, circulatory system diseases, and other chronic diseases than women.[13]

The life expectancy gap between Turkey and the 36 countries' median was smaller in 2016 than in previous years, because in these years, the mortality rate diverged in every age group in Turkey. Mortality divergence contributed to the increase of the life expectancy gaps before 2010. The result of study on estimating cause-specific mortality rates showed the mortality levels of adults aged 15-59 in Turkey were 50-75% higher than those in developed countries in 2000.[20] Another study found a similar result for adults in Scotland that age-specific mortality was higher than the rest of the United Kingdom and Western Europe until 2010.[21]

Although the mortality rate in Turkey tended to decline from the middle of the 2000s, an upward trend in cause-specific mortality among adults was observed until 2016.[22] Several factors could explain this observation. First, health system reforms in Turkey have introduced important improvements in health organization, resource management, and service delivery to provide equitable access to quality health services for all since the middle of the 2000s.[13] Second, the lack of adequate quality data on the cause of death before 2009 may be an impediment to accurate interpretations.[23] For example, a study in 2004 showed only 15.3% of reports of the cause of death were submitted correctly to the National Statistic Office in Turkey.[24] Third, International Classification of Diseases (ICD) coding changes in cause-specific mortality reporting systems may have led to difficulty in establishing reliable mortality statistics because of the transition from ICD-8 to ICD-10. Therefore, this transition may contain uncertain and inaccurate information on ICD-based mortality coding.

Several studies of life expectancy for Turkey have focused on the possible contribution of the health-care financing policies. According to the result of the study in 2019, the relationship between health expenditures and life expectancy was strong in Turkey, based on data from the period 2000–2015.[25] Similarly, the study on health expenditures and life expectancy at birth of 34 OECD countries, including Turkey, for the years 1970–2012, concluded that health expenditures have positive effects on life expectancy depending primarily on the share of the public health spending in (Gross Domestic Product [GDP]).[26] In terms of health spending as a share of GDP in Turkey, it has gradually risen from 4.7% in 1999 to 5.8% in 2009 and then has dropped back to the same level of 1999 until 2016.[27] A 2019 report clearly showed that Turkey spends the least with this level at around a quarter of the OECD average.[19]

Socioeconomic inequalities in mortality among different regions and geographic differences in life expectancy are possible contributions to a slowdown in life expectancy improvements in Turkey.[2] According to a report in 2019, inequalities in longevity and adult health among the regions were generally larger.[28] A study revealed regional life expectancy inequalities among the European countries, with data between 1991 and 2008 for 129 regions did not narrow.[29] Another study in 2016 concluded that there were regional inequalities in mortality, especially infant and neonatal mortality rate, between 2007 and 2012 in Turkey.[30] In the same way, a recent report showed that regional disparities in under-5 year mortality in Turkey were higher than the OECD average, although a substantial decline was observed from 7.4% in 1990 to 1.2% in 2017.[31]

Finally, from a broader perspective, as people worldwide are living longer, life expectancy becomes a paramount concern, especially for elderly individuals because of efforts on mortality reduction and successfully dealing with multiple physical, mental and chronic diseases to gain healthy life years. Although on average across OECD countries, life expectancy at birth was 73 years for both sexes in 2016, the average expected lifespan of newborns to live in a healthy condition and free from disability was 69 years.[5] According to the recent report, this trend seems to be a critical issue for Turkey, with 58 years for men and women in the period of 2016–2018, despite slightly increasing life expectancy at birth.[28]

The main strength of this study is that the data of all OECD countries are included to compare trends in life expectancy and mortality rates. Second, this is the first study to analyze the age-specific contribution of trends to the changes in life expectancy in each period in Turkey, 1997–2016. While international databases in this study include many more countries, they have some limitations largely pertaining to data

quality.[1,14] Particularly, official vital statistics on mortality from developing countries, including Turkey, may have potential concerns about considerable measurement error because of challenges in obtaining reliable data.[26] However, a study found that empirical findings using these databases were consistent with other reputed data sources like the HMD.[1] Furthermore, to overcome the limitation, the robustness of the results was tested.

Conclusions

Life expectancy for both sexes in Turkey has still remained well below the median value of the OECD countries, although this trend is converging gradually toward the median level. A closer look at trends in life expectancy indicated that Turkey experienced reasonable gains in the period 1997–2016 relative to the other OECD countries. Furthermore, longevity gains were slightly higher for women than men, by contrast with almost all OECD countries. However, these gains in longevity should not be considered as a better life and absence of disease for older people. It is essential to improve the quality of life of people with policies that can support social and economic investment in health care, decrease health inequalities, promote healthy lifestyles, and improve the working conditions of the public health labor force.

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Conflicts of interest

There are no conflicts of interest.

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