



## Estimating Life Expectancy at Birth using Direct Method in Torbat Heydariyeh County in Iran during 2015-2016

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### ABSTRACT

Life expectancy at birth is an appropriate index representing abridged population mortality rate in the form of a number which can reflect socio economic status in each community. Thus, the purpose of the present study was to estimate life expectancy at birth in Torbat Heydariyeh County in northeastern Iran during 2015-2016. This study was a cross-sectional study using mortality data from 2015 to 2016 among the population covered by Torbat Heydariyeh University of Medical Sciences. The raw demographic data and the number of deaths in each age group was obtained from the Vice-Chancellor's Office for Health Affairs in the given County and then life expectancy for each age group and gender was separately calculated using the Excel software and based on the indices associated with Life Table. Life expectancy at birth in Torbat Heydariyeh County in 2015 was estimated equal to 75.70 years old (78 years old for women and 72.1 years old for men). Moreover, life expectancy rates in 2016 for women and men were 80.6 and 79.1 years old, respectively. Life expectancy rates in Torbat Heydariyeh County during 2015-2016 compared with the national values of this index in those years were higher. During one year, life expectancy at birth in the given population had an increasing trend and it was higher in men than women.

**Key words:** Life Expectancy, Life Table, Torbat Heydariyeh, Iran

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### INTRODUCTION

Mortality-related data are an integral part of health plans and prioritizations employed by policy-makers in order to compare health status of communities in different times and places [1]. Among the indices associated with mortality, life expectancy at birth is considered as a good indicator reflecting abridged mortality rate in a population in the form of a number [2, 4]. In addition to manifesting health status, this index is taken into account as an estimate of different

economic, social, environmental, and other factors so that the World Bank has been using it to calculate Human Development Index [3, 5, 6]. Furthermore, measurement of life expectancy in various communities can be helpful in terms of identifying the existing gaps and paying more attention to sensitive and vulnerable populations [7, 9].

Life expectancy at birth indicates the number of years that a newborn can survive provided that the current mortality conditions remain constant [10]. Besides, life expectancy can be calculated for any age. Furthermore, life expectancy is usually calculated and compared in terms of gender due

to biological differences between men and women [11].

There are two direct and indirect methods to estimate life expectancy. When the mortality and demographic data are available, life expectancy is estimated directly using Life Table; otherwise the indirect method is employed to estimate life expectancy using statistical models [3, 12].

According to the latest statistics published by the World Health Organization (WHO) in 2016, life expectancy was equal to 75.5 years old in Iran which was 76.6 years old for women and 74.5 years old for men. It should be noted that Iran is ranked the sixtieth among all the countries in the world in terms of life expectancy [13].

The given index is also different in various regions and provinces of Iran and depends on social, economic, and cultural levels of life in each region and city in a way that life expectancy is higher in provinces and cities such as Tehran where people are in better conditions in terms of recreational and welfare facilities, job opportunities, medical and therapeutic equipment, and health status compared with those in other cities [3, 14, 15].

According to the importance of life expectancy index and its change trends over time, the present study was conducted to calculate and determine this index in the population in Torbat Heydariyeh County during 2015-2016.

The resulting data from this study can be useful in order to identify the current status and help in making economic and social decisions by officials and politicians. Thus, estimating the above-mentioned index in Torbat Heydariyeh County and its comparison with those in other regions of Iran can determine the vision of this County and its affiliated regions compared with other regions in Iran.

**MATERIALS AND METHODS**

This study was a cross-sectional research using mortality data between 2015 and 2016 in the population covered by Torbat Heydariyeh University of Medical Sciences including the cities of Torbat Heydariyeh, Zaveh, and Mahvelat. One of the calculation methods for life expectancy is the use of the Abridged Life Table. It should be noted that the calculation of the Life Table for a community can be fulfilled using a population size

and the number of deaths in each age or age group during one year. In health and population surveys, the Abridged Life Table is employed in which the first group is associated with one-year-olds, the second group is for four-year-olds, and other groups have been placed with a five-year range (Appendix 1) [16]. In the present study, the demographic data and the number of deaths in each age group was obtained and used from the Vice-Chancellor’s Office for Health Affairs in Torbat Heydariyeh County. Then, the resulting data were entered into the Excel software and life expectancy for each age and gender during 2016-2016 was separately obtained through providing the Life Table in this software. The Life Table was also calculated via the following indicators and programming using the Excel software [16].

**Table 1: Indicators used to calculate life table and life expectancy**

Calculation method	Definition
	X: Age group
	$m_x$ : Age of death for one person
${}_nq_x = \frac{2n \times m_x}{2 + n \times m_x}$ In one year age, n is 1, in four year age n is 4 and in In other age groups it is 5	$q_x$ : The probability of death during the X year if the person survives until the beginning of this age
$P_x = 1 - q_x$	$p_x$ : The probability of survival during the X year if the person survives until the beginning of this age.
$l_{x+n} = l_{x,n} \times P_x$	$l_x$ : Number of survivors at the start of X age
${}_nL_x = \frac{n(l_x + l_{x+n})}{2}$ ${}_1L_0 = 0.3l_0 + 0.7 l_1$ ${}_4L_1 = 1.35l_1 + 2.65 l_5$	$L_x$ : The sum of the years that the $l_x$ survivor survives in the X year.
This value is calculated from the sum of $nL_x$ s from the x age group to the end of the table	$T_x$ : The sum of the years that $l_x$ survivor survives.
$E_{60} = 3.725 + 0.00000625 l_{60}$	$e_x$ : life expectancy

**RESULTS**

Life expectancy was reported for men and women in the population covered by Torbat Heydariyeh University of Medical Sciences in terms of age groups during 2015-2016 in Tables 2 and 3, respectively. According to these calculations, life expectancy at birth in 2015 for women and men was 80 years old and 79.1 years old. Moreover, life expectancy at birth in 2016 was estimated by 78 years old for women and 72.1 years old for women.

**Table 2: Life expectancy at birth according to age and sex groups in Torbat Heydarieh in 2015**

Age (years)	Females Mid-year population	Number of deaths	Life Expectancy (years)	males Mid-year population	Number of deaths	Life Expectancy (years)
0	3987	78	80.6	4439.5	83	79.1
1-4	14090	5	81.2	14473	8	78.5
5-9	16635	2	77.3	17533	4	74.7
10-14	19772	3	72.3	17710	4	69.8
15-19	28497	4	67.4	18796	13	64.9
20-24	18479	3	62.4	18982	5	60.1
25-29	30506	4	57.4	18342	9	55.1
30-34	27632	5	52.5	15699	16	50.3
45-39	26126	3	47.5	13833	9	45.5
40-44	18894	3	42.5	9940	13	40.7
45-49	14175	8	37.6	7200	21	35.9
50-54	6442	10	32.7	5985	25	31.4
55-59	5351	13	27.9	4665	24	27.0
60-64	4505	25	23.2	3678	32	22.6
65-69	3648	24	18.8	2896	25	18.5
70-74	3408	34	14.3	2909	48	14.2
75-79	2347	47	9.9	2405	54	10.3
80+	2794	165	8.5	3244	207	7.9

**Table 3: Life expectancy at birth according to age and sex groups in Torbat Heydarieh in 2016**

Age (years)	Females Mid-year population	Number of deaths	Life Expectancy (years)	males Mid-year population	Number of deaths	Life Expectancy (years)
0	3885	127	78	3909	113	72.1
1-4	13669	9	79.5	14000	5	73.2
5-9	16302	9	75.8	17067	2	69.3
10-14	18665	4	71	17515	6	64.4
15-19	27790	5	66	18985	15	59.5
20-24	31162	6	61.1	19850	13	54.7
25-29	30789	5	56.2	18438	24	49.9
30-34	27027	3	51.2	15300	31	45.2
45-39	25332	2	46.2	13042	22	40.6
40-44	18195	7	41.2	9198	19	35.9
45-49	14243	8	36.3	7022	23	31.3
50-54	6372	14	31.4	5721	44	26.7
55-59	5052	21	26.7	4477	55	22.7
60-64	4509	39	22.2	3600	31	19
65-69	3912	40	18.1	3167	42	14.7
70-74	3192	53	13.9	2741	74	10.5
75-79	2528	88	9.9	2621	89	6.7
80+	2770.5	261	7.8	3256	331	7.1

## DISCUSSION

Based on the results of this study, life expectancy at birth in 2015 in Torbat Heydariyeh County was 75.05. The report released by the WHO in 2015 also estimated life expectancy in Iran's total population equal to 74 years old which was 76 years old for women and 72 years old for men [13, 17]. The difference observed in life expectancy between women and men all over Iran was equal to 4 years. As well, the difference between women and men in the same year in Torbat Heydariyeh County was nearly 6 years. Additionally, life

expectancy among women in Torbat Heydariyeh County in the given year was two years higher than the national average, while life expectancy for men in Torbat Heydariyeh County was similar to the national average for men.

Furthermore, the estimate made by the WHO for life expectancy in Iran in 2016 showed that life expectancy for Iran's entire population was 75.5 years old with a 1.5 years rise compared with that in the earlier year [17]. Life expectancy for both genders in Torbat Heydariyeh County in 2016 was calculated equal to 79.8 years old that was higher

than life expectancy in Iran's total population and also it had increased nearly 4 years compared with that in 2016 indicating improvement in socioeconomic conditions and other factors influencing life expectancy in Torbat Heydariyeh County. The highest amount of this increase had occurred in men so that life expectancy for men had significantly enhanced by 7 years from 2015 to 2016. Besides, the difference in life expectancy between women and men in 2016 in Torbat Heydariyeh County was 1.5 years (80.6 years old for women and 79.1 years old for men) which had significantly declined compared with that in 2015.

It seems that the reduction of mortality at birth from 240 cases in 2015 to 161 cases in 2016 was considered as the most important factor increasing life expectancy in Torbat Heydariyeh County within one year because the number of deaths in this age group can have a significant effect on life expectancy rate [18, 19].

A study conducted in the city of Tehran in 2010 demonstrated that social factors such as gender, per capita expenditure, household non-food expenses, level of education, socio economic subgroups, and household dimension were associated with life expectancy. In the given study, life expectancy at birth among individuals in Tehran as the capital city was equal to 77.98 years old in 2010 (74.53 years old for men and 79.96 years old for women) which was higher compared with life expectancy rates at birth in 2016 among people in Torbat Heydariyeh County [14]. The most important reason behind this difference was greater public access to recreational and welfare facilities, job opportunities, medical and therapeutic equipment, etc. by individuals living in the city of Tehran compared with those among people residing in Torbat Heydariyeh County.

The results of the study by Taheri in 2015 evaluating socio economic factors affecting life expectancy in Iran also suggested that factors such as urban population growth rate, literacy rate, and per capita tobacco consumption had significant and negative effects on life expectancy while per capita income and per capita social welfare spending had significant and positive impacts on this index [20].

### CONCLUSION

Life expectancy rates in Torbat Heydariyeh County during 2015-2016 were reported higher

compared with the national values of this index in those years. It was concluded that life expectancy at birth during one year had an ascending trend in Torbat Heydariyeh County which was higher in men than women. Thus, differentiation of life expectancy based on place of residence, level of income, level of education, and other determinants can provide a better estimate of the impacts of these factors on life expectancy. Accordingly, it is suggested to consider these cases in future studies.

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