

3. Methods of decomposition of differences between life expectancies at birth by causes of death

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The secular decline in mortality levels experienced in Hungary, which continued during the two decades immediately following the end of the Second World War, stopped in the middle of the 1960's and mortality began to rise in the case of the Hungarian male population. For the Hungarian female population, however, the change was hardly noticeable. The tempo of the rise in mortality levels somewhat slowed down between 1980 and 1990 but, according to more recent mortality data, increased after 1990. This rising mortality level was accompanied by a change in the structure by cause of death. Moreover, the increase went hand in hand with a change in mean ages at death of the victims of the different causes of death. This chapter describes the decomposition of differences between the life expectancies at birth (e_0^0) as the weighted arithmetic means of mean ages at death of victims of different causes of death, according to the Hungarian life tables by causes of death, and compares the results to the methods of decomposition of these differences elaborated by Pollard (1982, 1988), Andreev (1983), Pressat (1985, 1995), and Arriaga (1984).

1 | Decomposition of differences between life expectancies at birth as weighted arithmetic means of mean ages at death of victims of different causes of death

Ten groups of causes of death are taken into account for the purpose of the comparison of mortality levels, an eleventh group containing all the other causes of death. The groups of causes of death and their codes according to the 9th Revision of ICD are presented in the appendix tables 1 and 2. The distribution of deceased males and females by causes of death is derived by using the age- and cause specific death rates by sex. The idea which underpins the method of decomposition of differences between life expectancies at birth currently used in the Demographic Research Institute of the Hungarian Central Statistical Office is very simple. The life expectancy at birth is the mean age at death of the deceased in the life table:

$$e_0^0 = \frac{\sum_{x=0}^{\omega} x d_x}{\sum_{x=0}^{\omega} d_x} = \frac{\sum_{x=0}^{\omega} x d_{1,x} + \sum_{x=0}^{\omega} x d_{2,x} + \sum_{x=0}^{\omega} x d_{3,x} + \dots}{\sum_{x=0}^{\omega} d_x}$$

$$= \frac{\sum_{x=0}^{\omega} d_{1,x} \frac{\sum_{x=0}^{\omega} x d_{1,x}}{\sum_{x=0}^{\omega} d_{1,x}} + \sum_{x=0}^{\omega} d_{2,x} \frac{\sum_{x=0}^{\omega} x d_{2,x}}{\sum_{x=0}^{\omega} d_{2,x}} + \sum_{x=0}^{\omega} d_{3,x} \frac{\sum_{x=0}^{\omega} x d_{3,x}}{\sum_{x=0}^{\omega} d_{3,x}} + \dots}{\sum_{x=0}^{\omega} d_x}$$

where $\frac{\sum_{x=0}^{\omega} x d_{1,x}}{\sum_{x=0}^{\omega} d_{1,x}}$ is the mean age at death of the victims of the cause of death or

group of causes of death (1), $\frac{\sum_{x=0}^{\omega} x d_{2,x}}{\sum_{x=0}^{\omega} d_{2,x}}$ is the mean age at death of the victims of

the cause of death or group of causes of death (2), etc. The proportion dying

from cause of death (1) equals $\frac{\sum_{x=0}^{\omega} d_{1,x}}{\sum_{x=0}^{\omega} d_x}$ the proportion dying from cause of death

(2) equals $\frac{\sum_{x=0}^{\omega} d_{2,x}}{\sum_{x=0}^{\omega} d_x}$ etc. The mean age at death of all the deceased in the life table

is a weighted arithmetic mean of mean ages at death of victims of different causes of death. The decomposition of differences between life expectancies at birth is achieved with the help of the method of double standardization elaborated by E.M. Kitagawa (1955, 1964). If we denote the weights when studying e.g. the difference between the life expectancies of females and males by

$$f_{i,0}^{(F)} \text{ and } f_{i,0}^{(M)} \text{ with } \left(\sum_i f_{i,0} = 1 \right)$$

and the life expectancies of victims of different causes by

$$e_{i,0}^{0(F)} \text{ and } e_{i,0}^{0(M)}$$

the life expectancy at birth (exact age 0) will be equal to

$$e_{i,0}^{0(F)} = \sum_i e_{i,0}^{0(F)} f_{i,0}^{(F)} \text{ and } e_{i,0}^{0(M)} = \sum_i e_{i,0}^{0(M)} f_{i,0}^{(M)}$$

and the difference between life expectancies at birth of females and males will be equal to

$$e_0^{0(F)} - e_0^{0(M)} = \sum_i \left(e_{i,0}^{0(F)} f_{i,0}^{(F)} - e_{i,0}^{0(M)} f_{i,0}^{(M)} \right)$$

In order to show the effect of the differences of the structures of deceased by causes of death and the effect of the differences of the mean ages at death of victims of different causes of death in the corresponding life tables, we may use one of the following formulae:

The Life Table

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