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CHANGES IN CHILDREN'S AND ADOLESCENTS' MORTALITY IN ESTONIA DURING THE LAST CENTURY

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ABSTRACT

The problem of infant mortality arose in the discussion on risks connected with new-borns' vaccination. When we compare infant mortality about ninety years ago and nowadays, then it is easy to see that children's mortality has decreased enormously. But this process has not been uniform during the whole 90-year period: we can see the sub-periods of rapid progress and also sub-periods of stagnation. Obviously, some social and political factors have an impact here, but the mechanism of this influence is not clear.

Keywords: *infant mortality; children's mortality; exponential model*

INFANT MORTALITY

Estonia is a country where the population size is very small, and all problems connected with population are exciting for a great part of the population. One of the topical issues in social media is vaccination of new-borns: does it damage the child's health? There are people who are convinced that vaccination harms young children, and, as it is voluntary in Estonia, they refuse vaccinating their children.

Positive and negative aspects of vaccination become evident if we look at the changes of children's mortality in Estonia during the last hundred years. In fact, accurate statistical data exist since 1924. Then, the independent Republic of Estonia had just celebrated its 5th birthday, several years had passed from the end of the Estonian War of Independence, and the Statistical Office of Estonia was established.

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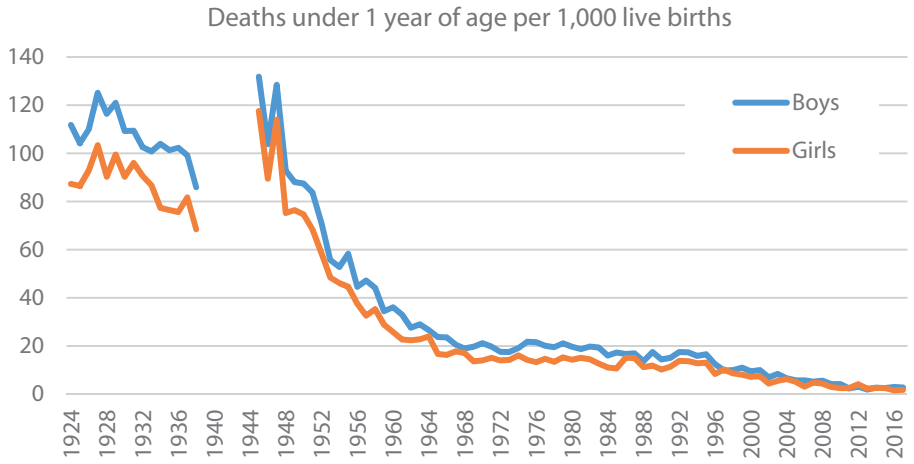

Figure 1. The dynamics of death rates under 1 year in the period 1924–2017

Figure 1 presents the curve describing the changes in infant mortality. There is a gap in the time-series for the period 1939–1944 – these were the years of the first Soviet occupation (started in 1940), the Second World War and the German occupation when the collection of statistical data was disturbed.

It is interesting to find the statistical model to exposit this curve and to explain the changes in the model – how they relate to changes in society and achievements in medicine and health care.

To gain a smoother curve, we calculated the average death rates characterising a year as a mean of three years' (k–1, k and k+1) death rates of both boys and girls. It became evident that the ratio of boys' and girl's rates was almost constant during the whole period. During the period, boys' infant death rate has been in average 1.28 times as high as that of girls, but the ratio has not been stable – it was about 1.2 at the beginning of the period, increased to 1.4 in the 1980s and dropped to 1.2 in the last years. The reason behind this feature is not clear.

To discover the peculiarities of the time series, it is reasonable to divide the whole 94-year period into four sub-periods with a length 20–25 years, as, in each of the periods, the dynamic of changes in infant mortality has quite a different character.

The first part is the period between the two wars, 1924–1939, see Figure 2. This was still a time when about ten percent of new-borns did not see their first birthday. In the beginning, the death rate increased somewhat and then started to decrease. When watching the declining graph of the time series, we can see the results of the health-care policy of the young Estonian state. The model

describing the change of the infant mortality curve is a quadratic parabola having the highest point in 1927. The description rate of the model is 86%. During 14 years, infant mortality decreased by almost 30%, see Figure 2. We can see that, in 1938, 12 new-borns out of 13 already lived to their first birthday.

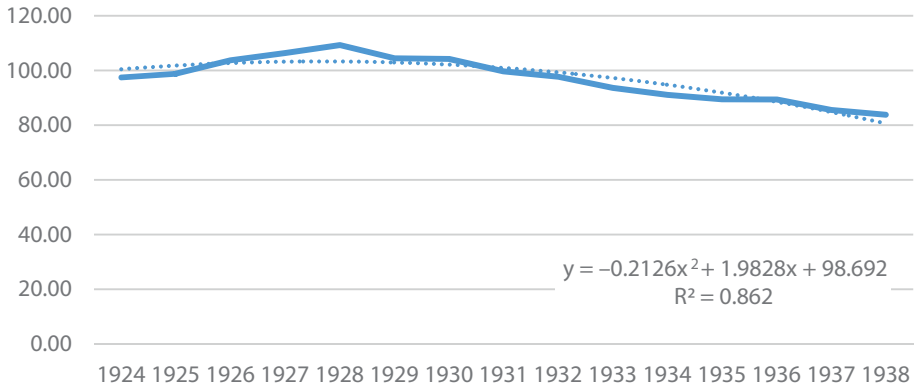

Figure 2. Infant mortality in the Republic of Estonia before the Second World War

After the Second World War, the second period starts that extends to the end of the 1960s, see Figure 3.

The beginning of the period was rather hard – in 1945 and 1946, less than nine out of ten new-borns survived their first year. But the situation improved rapidly. The change can be modelled using the exponential function, and the description rate is very good.

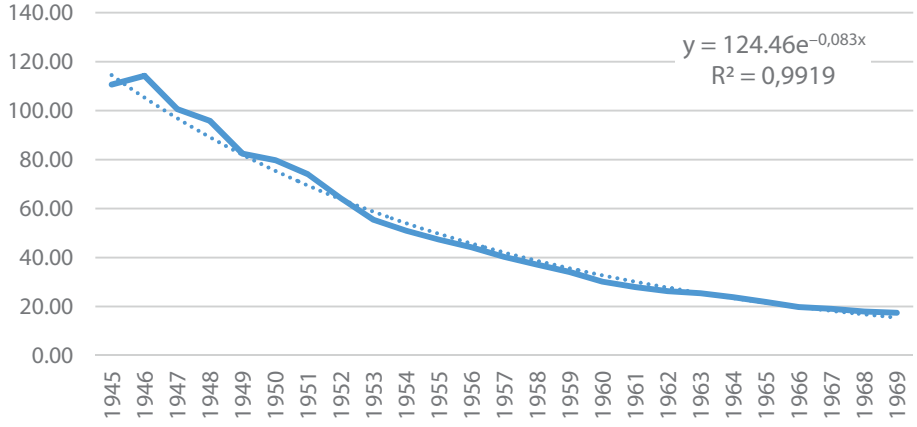

Figure 3. Infant mortality in Soviet Estonia after the Second World War

The reason for such a rapid change is not connected with politics – Estonia was occupied, and the political situation was rather hard. But the reason was the development of medicine – vaccination of children against infectious diseases (for instance, diphtheritis) had started. Also, new effective drugs, including antibiotics, had reached everyday practice of health care. During almost 25 years, infant mortality dropped more than six times, and in 1969 only one child out of about 60 new-borns died during the first year.

The third period of our analysis will cover the years 1970–1995, which also includes several years after gaining independence in 1991, see Figure 4. During this period, the time series has quite a curious form that seems to resemble stagnation. Exponential change has changed into poor linear decrease with some periods of increase. The very last four years can be explained by the "transition shock" that occurred in most East and Central European countries. In Estonia, the deepest hole in all social processes was 1994. But why mortality increased in the mid-seventies and also in the mid-eighties is not evident. In general, during the 25-year period, infant mortality decreased by 15%, and, in 1995, one out of 67 new-borns in average did not survive the first year.

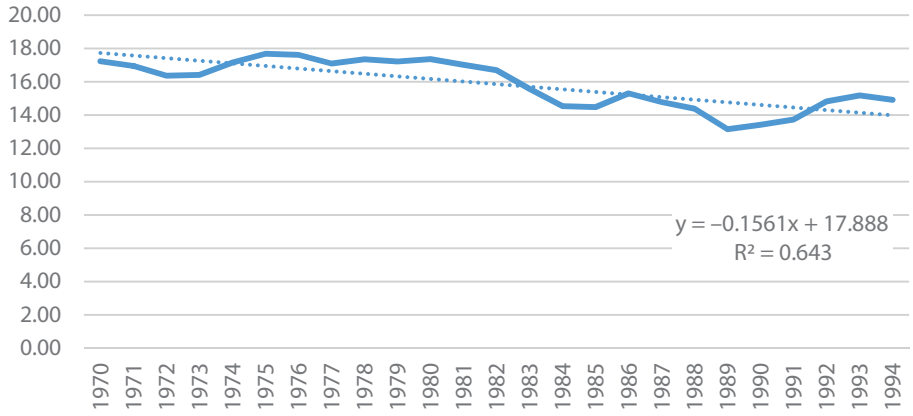

Figure 4. Infant mortality in Soviet Estonia and the Republic of Estonia in 1970–1995

The fourth period starts in 1996 and is continuing now, see Figure 5. The curve describing the time series of almost 22 years is quite similar to the model curve of the second period – it is exponential again, and the fitting of the model is also very good. During more than 20 years, infant mortality dropped almost six times, although the statistical definition of birth was changed in 2006. In 2017 only one child out of about 435 new-borns died during the first year.

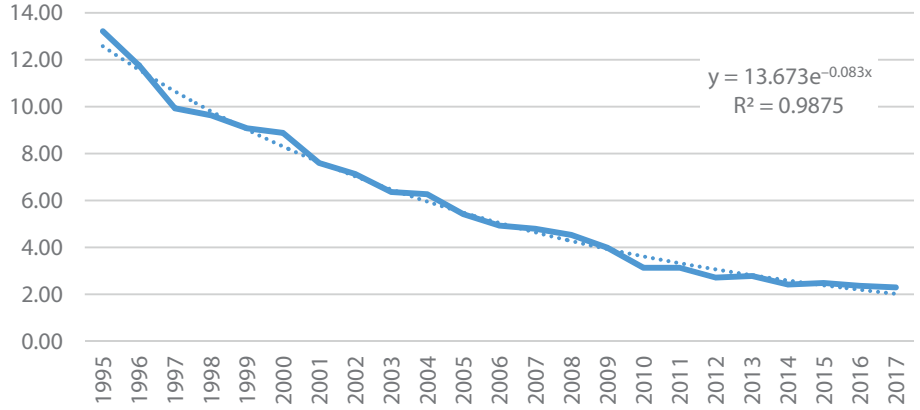

Figure 5. Infant mortality in Estonia in 1996–2017

In sum, when we compare the years 1927 and 2017, infant mortality has dropped about 50 times within 90 years. But what is special for Estonia, there are four periods having quite a different character of dynamics and also different models describing the dynamics of infant mortality, see Figure 6. Surprisingly, the decrease in mortality has been most rapid during the last period in independent Estonia; this fact is quite difficult to establish when looking at Figure 1. But, in fact, the infant mortality level in Estonia is already lower than in many European countries.

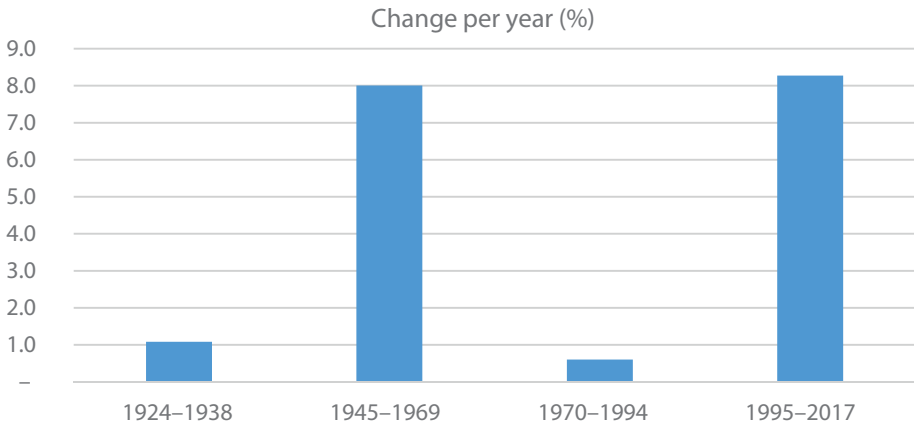

Figure 6. Decrease in infant mortality per year in different periods

CHILDREN'S AND ADOLESCENTS' MORTALITY

When babies survive their first year of life, a long series of risky years are awaiting them when different children's infections threaten them; see Figure 7 where age-dependent mortality rates (number of deaths per 1000 persons) are given for children and youngsters of different generations.

From Figure 7 it is clear that the difference in children's mortality between the era before and after the II World War is huge. The danger of coming down with some children's infections was the highest in pre-school age but also increased in teenagers. As a result, the number of youngsters surviving to their 20th birthday was less than 80% from the number of births of the given year, see Figure 8.

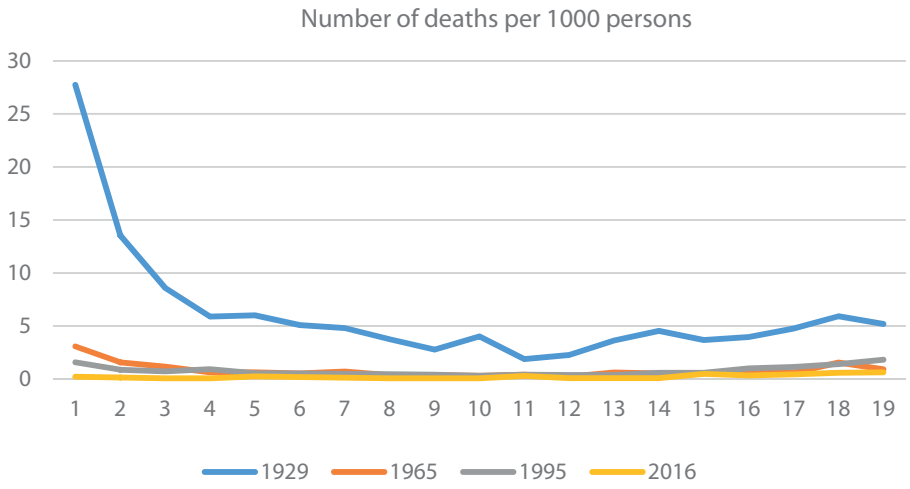

Figure 7. Children's (aged 1—19) death rate for different generations

From Figure 8, it follows that in the first half of the 20th century the most dangerous life-period for children was pre-school age. The question that follows is if the same is also true nowadays. The answer is expressly depicted in Figure 9.

In all generations, the mortality rate has the form of a U-shaped curve that starts to increase in teenage years, but there are several differences between generations. In the case of the 1965 generation, the mortality of pre-school children is higher than the mortality of teenagers, and the minimum point is at 12-year-old children. In the case of the 1995 generation, both legs of the curve are balanced, and the minimum point is at 10 years. The latest generation, of 2016, is characterised by the fact that mortality is increasing with age, while the minimum point is at 8 years.

From here it follows that, besides health care services (that, in general, have improved with time), some other factors also influence children's mortality, and these factors seem to have a greater impact on teenagers.

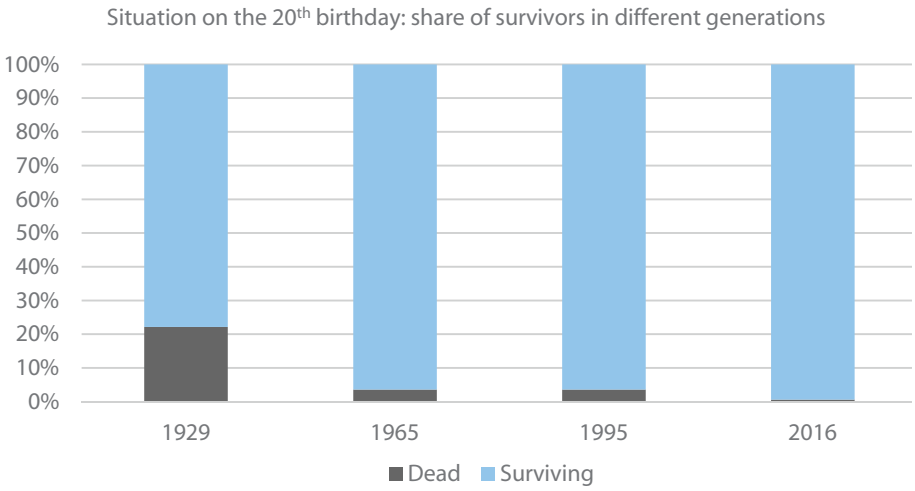

Figure 8. Share of youngsters surviving to their 20th birthday in different generations

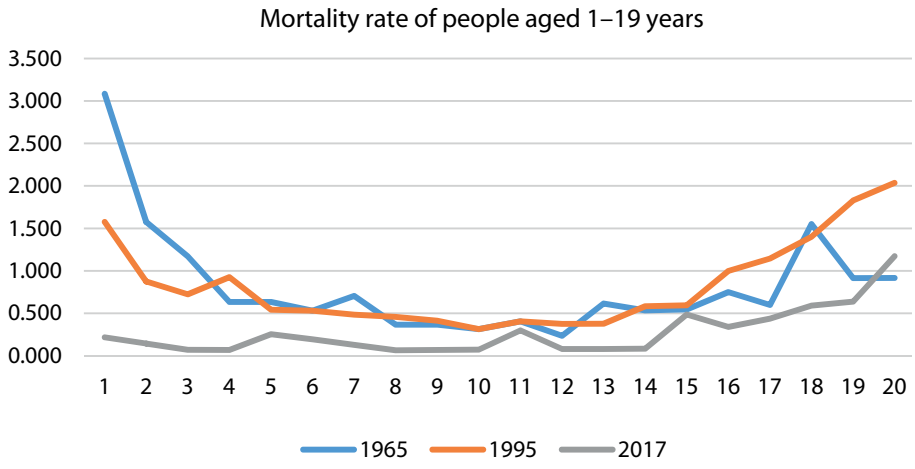

Figure 9. Mortality rate (number of deaths per 1000 persons) of children from different generations

CONCLUSION

The enormous decrease in infant mortality during the more than 90-year period since the Republic of Estonia was established is a well-known fact – today the probability to die before the first birthday is about 50 times less than 90 years ago. But the development has not been uniform. After the II World War, the rapid development of medical care – vaccination against children's infections and use of antibiotics – caused a rapid decrease in infant mortality. But it is interesting that, from the late sixties, a stagnation period started when the development was quite slow. This period ended in 1995 when a new rapid development period started.

Similarly, the dynamics of children's mortality has passed different stages. If, in the 20th century, younger children had a higher risk to die, then, in the 21st century, teenagers have a higher risk to die than pre-school children. The reasons for this feature might have a social character.

REFERENCES

Ene-Margit Tiit: Väikesed kirstud ja suured arvud, Postimees, 16 March 2019.
All statistical data are taken from the open data-base of Statistics Estonia https://www.stat.ee/.

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