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VARIABILITY OF THE BIRTH, DEATH AND POPULATION GROWTH RATES IN GEORGIA IN 1994-2023

,**Japaridze N., **,Khazaradze K., ****Chkhitunidze M., ***Revishvili A.**

**Tbilisi State Medical University, Tbilisi, Georgia*
***Ministry of Internally Displaced Persons from Occupied Territories, Labour, Health and Social Affair of Georgia, Tbilisi, Georgia*
****Georgian State Teaching University of Physical Education and Sport, Tbilisi, Georgia*
*****Mikheil Nodia Institute of Geophysics of Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia*
njaparidze@moh.gov.ge

Abstract: *The paper presents the results of statistical analysis of variability of birth, death and population growth in Georgia in 1994-2023. The role of the COVID-19 pandemic in the deterioration of the demographic situation during its existence (2020-2021) and in the post-COVID period (2022-2023) is shown.*

Key words: *Human health, birth, mortality, population growth, environment.*

Introduction

For many years, the M. Nodia Institute of Geophysics of TSU, together with various medical organizations, has been conducting research on the impact of various natural (astro-meteo-geophysical factors) and anthropogenic (air pollution, photochemical smog, ozone) factors on the health of the population of Georgia [1-3]. Over the past decade, these studies have been successfully continued, the results of which, in particular, are published in [4-9]. During the Covid-19 pandemic, a number of works were carried out on the statistical analysis of various components of the pandemic, including ten-day, two-week and monthly interval forecasting of these components (infection cases, infection rate, deaths) [10,11]. In the post-COVID period, studies of the impact of various bioclimatic indicators on the spread of this infection have begun and will be continued [12-14]. Studies have also begun on the impact of the COVID-19 pandemic on the demographic indicators of Georgia during the pandemic and after it.

For example, the paper [15] presents results of a statistical analysis of the variability of annual mortality per 1000 population (M) in Georgia and its regions from 1994 to 2022. The average value of M for Georgia in 1994-2022 is 12.6, the lowest mortality on average is observed in the Kvemo Kartli region (M = 9.4), the highest – in Racha-Lechkhumi and Kvemo Svaneti (M = 21.5). The range of variability in annual mortality is from 5.4 (Kvemo Kartli) to 31.1 (Racha-Lechkhumi and Kvemo Svaneti). It is shown, that the Covid-19 pandemic (2020-2021) has had a significant impact on the population mortality. In particular, during the period with the Covid-19 pandemic compared to the period without the pandemic (1994-2019, 2022), the average M value in Georgia increased from 12.4 to 14.9 (by 2.5 units). The smallest increase in M values was observed in Tbilisi (from 11.4 to 13.3, by 1.8 units), the largest – in Racha-Lechkhumi and Kvemo Svaneti (from 21.0 to 28.8, by 7.8 units). Data on the differences in average annual mortality in Georgia and its regions for different time intervals (including taking into account the impact of Covid-19 pandemic) are also presented.

This work is part of these studies. The results of statistical analysis of variability of birth, death and population growth in Georgia in 1994-2023 are presented below. The role of the COVID-19 pandemic in the deterioration of the demographic situation during its existence (2020-2021) and in the post-COVID period (2022-2023) is shown.

Study area, material and methods

Study area – Georgia.

Data of National Statistics Office of Georgia [https://www.geostat.ge/en] on annual birth (B), death (D)and population growth (PG) per 1 000 population, from 1994 to 2023 is used.

In the proposed work the analysis of data is carried out with the use of the standard statistical analysis methods [16]. The following designations will be used below: Mean – average values; Min – minimal values; Max – maximal values; St Dev – standard deviation; R – coefficient of linear correlation; α – level of significance.

Results and discussion

Results in Fig. 1,2 and Table are presented.

In Fig. 1 the time series of population birth, death and growth rates in Georgia from 1994 to 2023, and in Table the statistical characteristics of these parameters are presented.

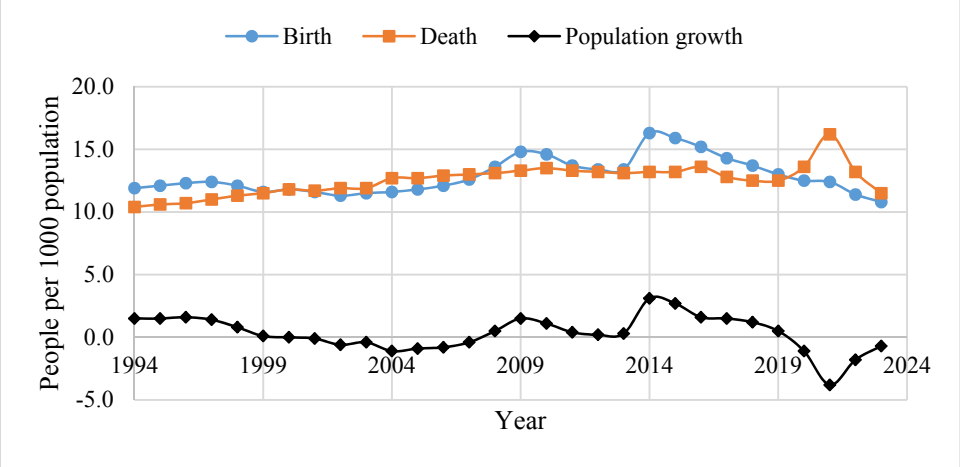


Fig. 1. Changeability of population birth, death and growth rates in Georgia in 1994-2023.

Table 1. Statistical characteristics of population birth, death and growth rates in Georgia in 1994-2019 (R_{min} = 0.40, α = 0.05) and 1994-2023 (R_{min} = 0.36, α = 0.05).

Years	1994-2019, Pre-Covid-19 period			1994-2023, Full period		
Variable	Birth	Death	Population growth	Birth	Death	Population growth
Max	16.3	13.6	3.1	16.3	16.2	3.1
Min	11.3	10.4	-1.1	10.8	10.4	-3.8
Range	5.0	3.2	4.2	5.5	5.8	6.9
Average	13.0	12.4	0.7	12.9	12.5	0.3
St Dev	1.4	1.0	1.1	1.4	1.2	1.4
	Correlation Matrix					
Birth	1	0.66	0.74	1	0.44	0.65
Death	0.66	1	-0.01	0.44	1	-0.40
Population growth	0.74	-0.01	1	0.65	-0.40	1
Years	2020-2021, Covid-19 period			2022-2023, Post-Covid-19 period		
Average	12.5	14.9	-2.5	11.1	12.4	-1.3

In particular, as follows from Fig. 1 and Table 1, average value of B and D for Georgia in 1994-2019 and 1994-2023 differ little from each other (13.0 and 12.9; 12.4 and 12.5 accordingly). But PG value in 1994-2019 in 2.3 times higher than in 1994-2023 (0.7 and 0.3 accordingly).

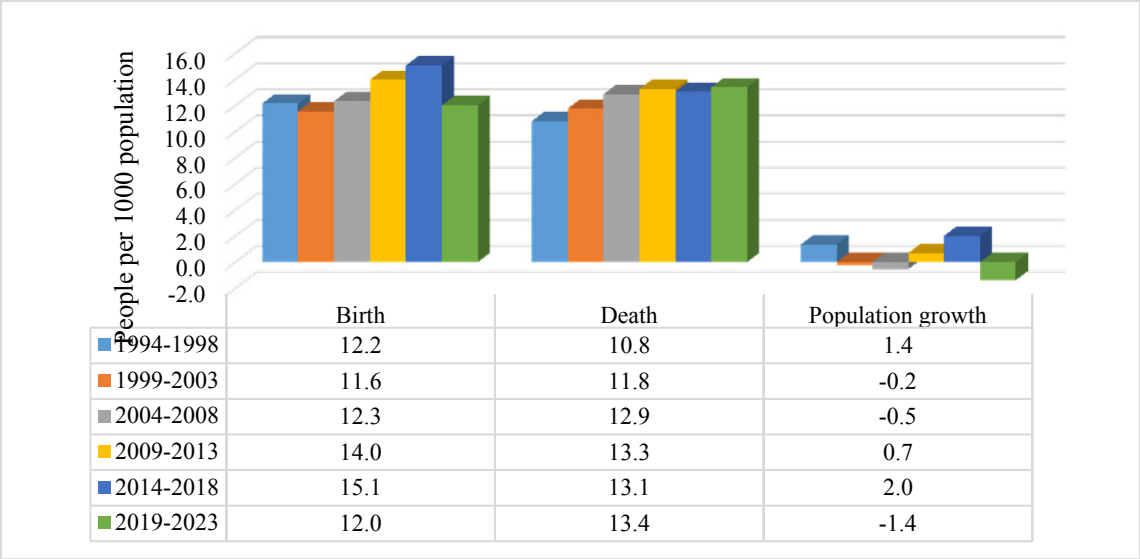
Two years of the pandemic and the post-pandemic period had a significant impact on the correlation connections between the studied parameters. In 1994-2019 value of linear correlation coefficient between population birth and population death was 0.66 (moderate correlation), but in 1994-2023 – 0.44 (low correlation). In 1994-2019 value of linear correlation coefficient between population birth and population growth was 0.74 (high correlation), but in 1994-2023 – 0.65 (moderate correlation). In 1994-2019 value of R between population death and population growth was negligible, but in 1994-2023 was -0.40 (low correlation).

n 2020-2021, the average B value was 12.5, which is lower than in 1994-2019 (13.0) and in 1994-2023 (12.9), but higher than in 2022-2023 (11.1).

In 2020-2021, the average D value was 14.9, which is significantly higher than for all other specified time periods (12.4-12.5).

The pandemic has had a significant impact on population growth. In 2020-2021, the average PG value was -2.5, which is significantly lower than in 1994-2019 (0.7), in 1994-2023 (0.3), and in 2022-2023 (-1.3).

Finally, in Fig. 2 for clarity data on average five-year population birth, death and growth rates in Georgia in 1994-2023 are presented.



	Birth	Death	Population growth
1994-1998	12.2	10.8	1.4
1999-2003	11.6	11.8	-0.2
2004-2008	12.3	12.9	-0.5
2009-2013	14.0	13.3	0.7
2014-2018	15.1	13.1	2.0
2019-2023	12.0	13.4	-1.4

Fig. 2. Average five-year population birth, death and growth rates in Georgia in 1994-2023.

In particular, as follows from this Fig., in the last five years Georgia had the worst demographic indicators: B = 12.0, D = 13.4, PG = -1.4.

Conclusion

In the near future, we plan to conduct a similar study for the regions of Georgia.

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