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Original Article

Analysis and Forecast of Birth Related Indicators in Selected Balkan and Eastern European Countries

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Abstract

Background: Health indicators are often used for a variety of purposes, including program management, resource allocation, monitoring of country progress, performance-based payment, and global reporting. Real progress in health towards the United Nations Millennium Development Goals and other national health priorities is vitally dependent on stronger health systems. We aimed to analyse the progress of "birth related indicators" of selected countries of Balkan and Eastern Europe and to forecast their values in the future.

Methods: This research report article represents a descriptive data analysis of selected health indicators, extracted from European Health for All database (HFA-DB) and EuroStat. Indicators of interest were analysed for 17 countries in observational period from 1990 to 2019. The data were analysed using a linear trend estimate and median operation and interquartile range 25th–75th percentile were used for better comparison of each country. Forecasting analysis to year 2025 was performed by combining Excel analysis and SPSS program.

Results: Number of all live births to mothers aged under 20 is decreasing in almost all examined countries, while live births to mother over 35 is mostly increasing. Total fertility rate is also mainly decreasing in almost all countries of interest for our investigation, as well as the crude birth rate. Estimated infant mortality per 1000 live births is decreasing in all observed countries.

Conclusion: Population aging is becoming more pronounced, while current birth-related indicators have negative tendencies; this problem will obviously continue over time.

Keywords: Health indicators; Birth indicators; Balkan countries; South Eastern countries; Forecast

Introduction

Health indicators are measurements created with intention to gather information on a certain priority topic in the health of the population or concerning the work of the health system. Health indicators provide comparable information across different geographical, organizational or

administrative boundaries and can track progress over time. Indicators are often used for a variety of purposes, including program management, resource allocation, monitoring of country progress, performance-based payment, as well as global reporting (1).

The Global Reference List presents indicators according to multiple dimensions – domains, subdomains and the levels of the resulting chain framework (2). Each indicator belongs to one of the four domains: health status, risk factors, coverage of services and health systems. Real progress in health towards the United Nations Millennium Development Goals and other national health priorities is vitally dependent on stronger health systems based on primary health care (3). Improving health is obviously the main goal of each health system, but it is not the only one (4). Health systems have made a huge contribution to the better health of most of the world's population during the 20th century and beyond (5, 6).

Balkan countries share many historical specifics and a common heritage with the countries of the Eastern Europe. Health care system of the Balkan countries and the countries of Eastern Europe differs from country to country and the health coverage of the entire population is still very difficult to achieve in practice (7, 8). Health coverage is largely financed out of pocket, as the result of the numerous financial crises due to which governments of the countries have had to sacrifice a percentage of gross domestic products for all areas, including health, in order to restore economic stability (9).

Nowadays health systems, in all countries, whether richer or poorer, play a greater and more influential role in people's lives than ever before. All models of health systems are far from perfect and there is no one that is the best and widely accepted and recommended (10). There are still large differences between countries in terms of goals, structure, organization, finances, and other characteristics of health systems (11). These differences are influenced by history, tradition, socio-cultural, economic, political and other factors (12).

We aimed to analyse selected health indicators of interest and to assess the progress shown in selected Balkan and Eastern European countries during the examined period, as well as to estimate their values until year 2025.

Materials and Methods

This research report article represents a descriptive data analysis of selected health indicators, extracted from European Health for All database (HFA-DB) (13) and EuroStat (https://ec.europa.eu/eurostat/data/database).

HFA database provides indicators for 53 countries and 153 health indicators. Member States of the WHO European Region have been reporting essential health-related statistics to the Health for All (HFA-DB) family of databases since the mid-1980s, making it one of the oldest sources of data of the WHO.

Indicator of interest—Number of all live births to mothers aged under 20 year and over 35 year, total fertility rate, crude birth rate and estimated infant mortality per 1000 live births were analyzed. Research included the following Balkan and Southeastern European countries: Albania, Bulgaria, Bosnia and Herzegovina, Belarus, Greece, Croatia, North Macedonia, Montenegro, Romania, the Russian Federation, Serbia, Slovenia, Turkey, Estonia, Lithuania, Latvia, and Ukraine. Observation period was from 1990 to 2019.

The data was analyzed using a linear trend estimate to interpret the data with time series, a trend estimate used to make and justify statements of tendencies in the data, linking the measurements to the times in which they occurred. Linear trend estimation show the occurrence of possible patterns in the behavior of the variables over the observed time period and will provide information on whether the developed trend is positive, negative, or absent. Linear trend and regression analysis were used to access the timeline changes in observed indicators for each country and to calculate the progress of these countries over time. Median operation was used

for better comparison of each country. Forecasting analysis to year 2025 was performed by combining Excel analysis and IBM SPSS software, version 20 (IBM Corp., Armonk, NY, USA).

The data are anonymous and do not belong to individual citizens. Therefore, there is no question of protecting the privacy of the data. According to the International Ethical Guidelines for Biomedical Research involving Humans and Good Clinical Practice Guidelines, a study like this does not require consideration by the Ethics Committee; https://cioms.ch/wp-content/uploads/2017/01/WEBCIOMS-EthicalGuidelines.pdf; https://www.ema.europa.eu/en/documents/scientificguideline/guideline-good-clinical-practice-e6r2-4-step2b_en.pdf.

Results

When comparing all countries of interest in this research, we can clearly see that all birth related indicator have the highest median values in Turkey. On the second place, Albania has the highest median values in indicators marked as A, D, and E in the Fig. 1.

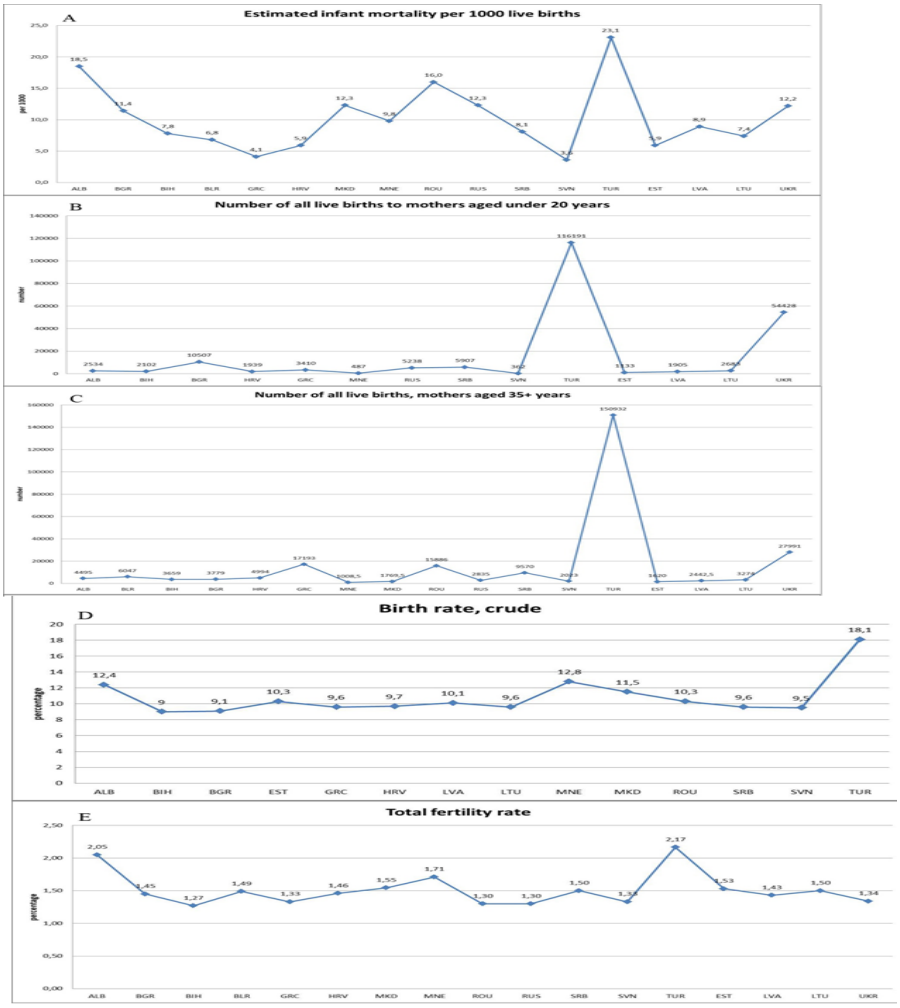

Fig. 1: A - Estimated infant mortality rate, B - Number of all live births to mothers aged under 20 years, C - Number of all live births mothers aged 35+ years, D- Birth rate, crude, E - Total fertility rate. Albania – ALB; Bulgaria – BGR; Bosnia and Herzegovina – BIH; Belarus – BLR; Greece – GRC; Croatia – HRV; North Macedonia – MCD; Montenegro – MNE; Romania – ROU; Russian Federation – RUS; Republic of Serbia – SRB; Slovenia – SVN; Turkey – TUR; Estonia – EST; Latvia – LVA; Lithuania – LTU; Ukraine – UKR

The highest median rates of indicator named Infant mortality per 1.000 live births in the observed period, had Turkey and Albania, followed by Romania. Slovenia and Greece had the lowest rates. Looking at the regression analysis, a decrease in the number of infant mortality rates was noticed in all observed countries, with the largest decrease in Montenegro ($y = -3.7338x + 17.123$; $R^2 = 0.9966$) and Romania ($y = -5.1086x + 26.489$; $R^2 = 0.9906$). The projection of infant mortality shows that it will decrease in each observed country by 2025 (Table 1).

Table 1: Estimated infant mortality per 1.000 live births, Total fertility rate and Crude birth rate - First year of follow-up, Last year of follow-up, Prediction to 2025 and Median value for the observed countries

Countries	*F (1990)*	*L (2019)*	*P*	*M*	*F (1990)*	*L (2019)*	*P*	*M*	*F (1990-2000)*	*L (2017)*	*P*	*M*
	Estimated infant mortality per 1.000 live births				Total fertility rate				Crude birth rate			
Albania	35.5	8.6	0	18.5	3.0	1.5	0.99	2.1	22.8	10.7	7.3	12.4
Bulgaria	14.7	5.6	2.5	11.4	1.7	1.5	1.69	1.5	8.6	9	10.2	9.1
Bosnia and Herzegovina	16.1	5.1	2.5	7.8	1.6	1.3	1.05	1.3	12	8.3	6.6	9.0
Belarus	12.2	2.4	0	6.8	1.9	1.7	1.73	1.5	N/A	N/A	N/A	N/A
Greece	9.1	3.3	1.6	4.1	1.4	1.4	1.43	1.3	9.6	8.2	8.5	9.6
Croatia	11.1	4.1	2	5.9	1.7	1.4	1.38	1.5	10.9	8.9	8.9	9.7
North Macedonia	32.3	5.3	2.4	12.3	2.1	1.5	1.11	1.5	16.4	10.5	8.7	11.5
Montenegro	14.8	2.0	0	9.8	1.9	1.7	1.65	1.7	15.4	11.9	10.2	12.8
Romania	24.2	5.7	0.6	16.0	1.5	1.2	1.18	1.3	10.4	10.3	9.8	10.3
Russian Federation	18.4	4.9	0.8	12.3	2.4	1.3	1.01	1.3	N/A	N/A	N/A	N/A
Republic of Serbia	24.0	4.6	0	8.1	2.1	1.5	1.26	1.5	11.3	9.2	8.6	9.6
Slovenia	8.8	1.7	0	3.6	1.5	1.6	1.76	1.3	9.5	9.8	12.4	9.5
Turkey	55.4	8.6	0	23.1	3.1	2.1	1.70	2.2	23.8	16.1	13.5	18.1
Estonia	14.0	1.9	0	5.9	2.1	1.6	1.75	1.5	9.4	10.5	11.4	10.3
Latvia	13.2	3.1	0	8.9	2.0	1.7	1.79	1.4	8.7	10.7	12.0	9.6
Lithuania	11.9	3.0	0.1	7.4	2.0	1.7	1.59	1.5	11.4	10.1	10.9	10.1
Ukraine	16.5	7.1	3.3	12.2	1.7	1.5	1.46	1.3	N/A	N/A	N/A	N/A

*F - First year of follow-up, L - Last year of follow-up, P - Prediction to 2025, M – Median value

The indicator of live births of mothers under the age of 20 has the highest median value, in the observed period, Turkey and Serbia, while the lowest median value has Slovenia and Montenegro. Regression analysis shows that 13 of the 14 observed countries, except of Turkey ($y = 5020.4x + 661.31$; $R^2 = 0.4411$), have a decrease in the number of live births of mothers under 20 years of age. The highest decrease is in Croatia ($y = -100.87x + 3524.5$; $R^2 = 0.9447$) and Ukraine. Belarus, Macedonia and Romania do not have data on this indicator. The number of live births of mothers under the age of 20 is expected to decline in all observed countries by 2025 (Table 2). The indicator of live births of mothers older than 35 has the highest median value in the observed period in Turkey and Ukraine, while the lowest median value is detected in Estonia (1620) and Slovenia (2023). Regression analysis shows that in 14 of the 17 examined countries, there is an increase in the number of live births from mothers over the age of 35, mostly in Croatia ($y = 858.7x + 5868.3$; $R^2 = 0.9569$) and Slovenia. The decline exists in Serbia, Russia, and is scientifically expressed in Albania ($y = -251.72x + 7072.8$; $R^2 = 0.7658$). The number of live births

of mothers over the age of 35 is expected to increase in 14 observed countries by 2025, mostly in Croatia and Slovenia. The decline in numbers is expected in 3 countries and the largest one is expected in Albania (Table 2).

Table 2: Number of all live births to mothers aged under 20 years and aged 35+ years - First year of follow-up, Last year of follow-up, Prediction to 2025 and Median value for the observed countries

Countries	*F (1991)*	*L (2016)*	*P*	*M*	*F (1990-2000)*	*L (2017)*	*P*	*M*
	Number of all live births to mothers aged under 20 years				Number of all live births to mothers aged 35+ years			
Albania	2264	1952	1375	2534	6816	2846	1789	4495
Bulgaria	22549	6031	1410	10507	6047	15284	16812	6047
Bosnia and Herzegovina	6784	1175	0	2102	3702	3846	3545	3659
Belarus	N/A	N/A	N/A	N/A	3657	9766	13193	3779
Greece	6759	2493	1148	3410	3400	7587	8303	4994
Croatia	4033	1086	195	1939	8092	28627	37359	17193
North Macedonia	N/A	N/A	N/A	N/A	816	1186	1194	1009
Montenegro	713	219	73	487	1798	3374	3764	1770
Romania	N/A	N/A	N/A	N/A	20670	27235	35122	15886
Russian Federation	10843	2686	0	5238	5311	3670	3202	2835
Republic of Serbia	14573	2674	0	5907	10736	11141	10308	9570
Slovenia	1536	182	0	362	1222	3989	5299	2023
Turkey	157060	76397	35773	116190 1	15867 4	19812 0	21410 5	15093 2
Estonia	2858	310	0	11323	1634	2948	3858	1620
Latvia	4406	648	0	1905	2621	4140	4681	2443
Lithuania	6276	1022	0	2683	3289	4697	5334	3274
Ukraine	109174	2419	0	54428	32183	47286	66812	27991

*F - F - First year of follow-up, L - Last year of follow-up, P - Prediction to 2025, M – Median value

The highest median value of the crude birth rate indicator in the observed period can be observed in Turkey, as well as in Montenegro and Albania, while the lowest median value is observed in Bosnia and Herzegovina and Bulgaria. Regression analysis shows that there is a declining trend in the crude birth rate in 9 of the 14 observed countries, with the most pronounced decline in Turkey ($y = -0.338x + 22.965$; $R^2 = 0.8601$) and North Macedonia. The growth trend is expected in 5 countries, with the most pronounced in Latvia($y = 0.1383x + 7.8504$; $R^2 = 0.6578$). The crude birth rate will fall in more than half of the observed countries by 2025, and the highest in Turkey and North Macedonia. In less than a half of the countries it is expected that this rate will increase by 2025 (Table 1).

The indicator of total fertility rate has the highest median value in the observed period concerning Turkey and Albania, while Bosnia and Herzegovina has the lowest median value. Regression analysis shows that in 9 of the 17 observed countries exist the decline in fertility rates, and most in North Macedonia ($y = -0.0334x + 2.215$; $R^2 = 0.8249$) and Turkey. There is a slight increase in the total fertility rate in eight countries. The total fertility rate until 2025 will not have drastic changes but there are fluctuations in decline and growth in all countries, with the most noticeable decline in North Macedonia, and the most noticeable increase can be expected in Slovenia (Table 1).

Discussion

The aim of this study was to analyze the progress of "birth related indicators" of selected countries of Balkan and Eastern Europe as well as to forecast their values in the future. Main findings of our research were that the number of all live births from mothers under the age of 20 decreased in almost all examined countries, while live births from mothers over the age of 35 was mostly increasing. Total fertility rate was mostly decreasing in almost all countries as well as crude birth rate. Estimated infant mortality per 1000 live births was decreasing in all examined countries. Taking into account all countries of interest in our research, it can be clearly seen that all birth indicators calculated for Turkey had the highest value. This can be explained with a fact that Turkey is one of the most populated countries among observed ones and with their more traditional attitudes towards the roles of women.

The infant mortality rate is considered as one of the most important indicators for describing the demographic conditions and socio-economic well-being of the country (14). The United Nations Millennium Development Goal 4 (MDG 4) has set a goal of reducing the high infant mortality rate by two-thirds, to be achieved by 2015, using 1990, as a reference (15). Institut national d'etudes demographicus (INED) calculated the infant mortality rate (per 1000 live births) in Europe and other developed OECD countries (16). The 2018 results showed that Mexico, Colombia, Kosovo and Albania had the highest infant mortality rates (8.9 per 1.000); Romania (6 per 1.000) and Bulgaria (5.8 per 1.000) showed moderate values of this indicator, while Estonia (1.6 per 1.000), Slovenia (1.7 per 1.000) and Liechtenstein, without child mortality, were at the bottom of the list (149). Our findings are consistent with these data. All surveyed countries are expected to reduce infant mortality by 2025. The most prominent decline is expected in Montenegro, followed by Romania and Bulgaria. More often, higher mortality rate occurs in younger mothers (17, 18). There is a strong significance when comparing infant mortality with number of newborns by mothers less than 19 years of age. The literacy rate of people over the age of 15 is also increasing in the world. Literacy is an essential characteristic of social progress, it speaks of preserving tradition and developing and preserving culture, and education generally increases the level of public awareness of the medical and social responsibilities of individuals (19-22).

In 2015, 302.700 women worldwide died as a result of pregnancy or childbirth. The risk of a woman dying in childbirth has dropped significantly worldwide, but healthcare inequalities remain high among countries, and in some regions childbirth remains a high risk for both mother and newborn (23). In most high-income countries, maternal mortality is very low at present (24). The average rate in the European Union is 8 dead mothers per 100.000 live births. In some countries, such as Poland, Greece, Finland and Sweden, the rate is even lower, accounting for 3 to 4 per 100.000 (25). The number of young mothers in European countries is declining, while more and more mothers are over 35 (26). In the large number of studies, women's literacy levels, socioeconomic status, career advancement, termination of teenage pregnancies, and gender equality that has been promoted have shifted the age limits for giving birth to a first child, and more and more mothers give birth after 35 (27, 28). In our study, the number of mothers who gave birth to a child under 20 is expecting to decline in all countries but Turkey, while the number of live births to mothers over the age of 35 is increasing, especially in Croatia and Slovenia, according to regression analysis and prediction analysis by 2025.

The relationship between the economy and population dynamics has been talked about for a long time. There are a lot of assumptions about the connection between economic change during the recession and reduced fertility (29). In the 19th century during the Great economic depression, total numbers of live birth have significantly changed negatively (30). Comparing to last decade, this trend still isn't showing the positive trend, relating this to the slow ability of most of the countries to recover from previous crises

(31). Fertility rate, according to regression analysis and prediction analysis decreases in more than half of observed countries, in our study.

More than 4 million children were born in 2019 in the Europe Union which is, expressed in the crude rates roughly 9 per thousand (32). Comparing to the crude birth rates of the previous years it can be clearly noticed that the numbers are dropping down significantly, where the crude rate was 16.4 in 1970, 12.8 in 1985 and just above the 10 in 2000s (33, 34). The decline in the crude birth rate was observed in our research; with further predicted decrement in the majority of countries, especially in Turkey, while in Slovenia and few other countries, this rate is projected to increase. After World War II, the U.S. experienced rapid change in gender roles with the expansion of women's education and entry into the labor force. One of the most prominent reasons of declining birth rates are due to changing the woman's role in different aspects such as employment and career opportunities and very importantly the reproductive health knowledge which is now accessible more (35). On the other hand, some less developed countries have lower household budget and less available child healthcare that is publicly funded so that directly affects the fertility rates negatively (36).

Conclusion

Value of indicators of the raw birth rate, fertility rate and the rate of mothers under the age of 18 were declining in almost all examined countries, while the rate from mothers over the age of 35 was rising, which was in many studies linked to socioeconomic indicators and literacy rates. Turkey has the highest crude birth rate (1.8 / 1000), fertility rate (2.2%) and the number of live births from mothers under the age of 20 (116.191), as well as the largest increase in the number of live births from mothers over the age of 35 (150.932) and number of estimate infant mortality per 1000 live births (23.1). It is necessary for governments to provide adequate publicly funded reproductive health and social care in order to achieve required birth rates and have a younger population to contribute to nations and global progress. In parallel, it is also necessary to have a national and an international initiative for the prevention of infertility and protection of fertility.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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