

ANALYSIS OF INFANT MORTALITY IN THE REPUBLIC OF ARMENIA USING MULTIVARIATE STATISTICAL METHODS

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Abstract

Mortality and particularly infant mortality is one of the most important indicators of state's socio-economic development and welfare level, as well as the population's health condition and a quality of life evaluation. It allows to get the right understanding about the accessibility, quality and efficiency of medical care in the given country.

Considering the fact that in the last two decades a significant decline of birth rate is witnessed worldwide, the preservation of the life of each newborn became a major value and state-wide strategic objective. Consequently, in each country conducting research aiming at studying the tendencies and causes of infant mortality rate becomes strictly important, to which this report is dedicated.

Keywords: demographic situation, infant mortality, quality of life, regression analysis, coefficient of determination.

When studying population mortality of a particular country, special attention is paid to the analysis of the mortality of children under one year of age (infant mortality), because according to that indicator it is possible to judge about the socio-economic situation of the country, region. Actually, all the factors, be it economical, or social and environmental, affect the health and life of the newborn. That is why infant mortality rate in

any country is considered as comprehensive characteristic of quality of life [5, page 13].

Infant mortality rate in the Republic of Armenia during 2000-2022 with certain fluctuations demonstrated a tendency of stable decline. During the observed period the intensity level of infant mortality rate decreased by 57,1 % (the average annual rate of increase amounted to -3,8 %), and absolute value decreased around 2.2 times (by 54,8 %).

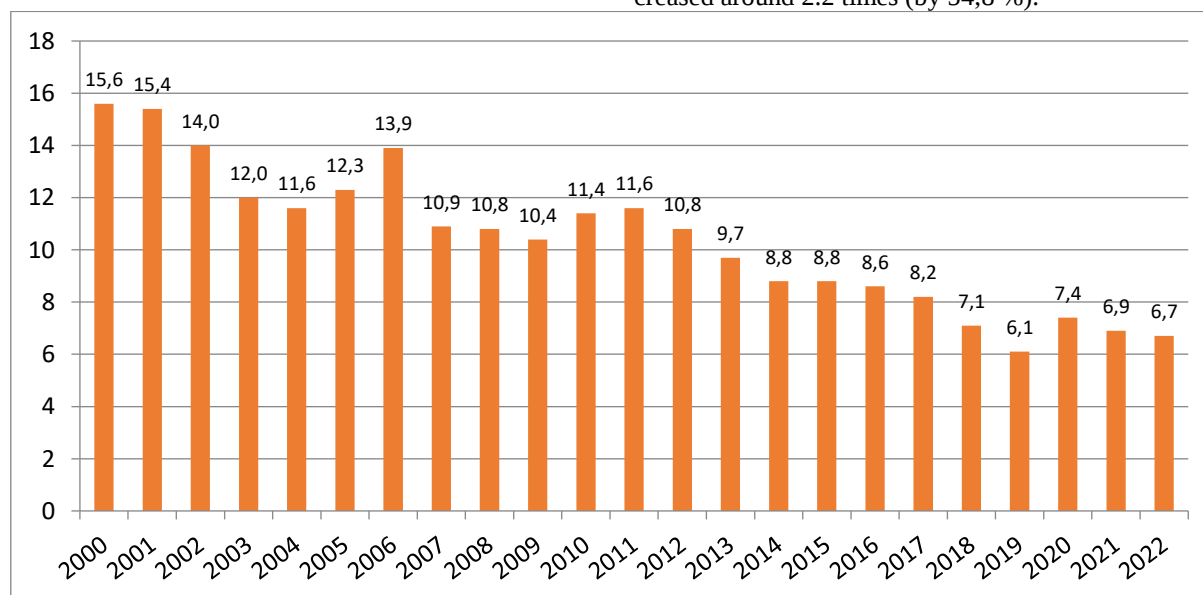


Chart 1. The dynamics of infant mortality in Republic of Armenia during 2000-2022 [2, page 79]

In the mentioned period the lowest infant mortality rate was registered in 2019 and amounted to 6.1 %. It is evident from the Chart 1 that during the observed period the variation of the levels of studied indicator had different tendencies. Thus, during 2000-2004 the indicator decreased by 25.6 %, amounted to 11.6 ‰, during 2005-2006 at a slow pace increased again by 19.8 %, amounted to 13.9 ‰. After 2006 with insignificant fluctuations the infant mortality rate demonstrated a tendency of stable decline. Remarkable is the fact that, if during the period of 2000-2011, the intensity

level of infant mortality rate decreased by 25,6 %, then during the period of 2012-2022 it already decreased by 38 %.

We can conclude that decline of the infant mortality rate at such pace is caused not only by improved state of health of pregnant women, women in labour and newborns, but by other demographic factors, as well as by profound revision of care and treatment for newborns in the first days of life. Based on the rating scale of the infant mortality rate we can state that it is at a low level, as it is less than 20‰ [8, page 114].

From the point of view of demographic situation estimation, the study of changes of infant mortality rate according to the gender also have a particular importance (Chart 2). As worldwide in the Republic of

Armenia the following regularity is observed: the mortality rate of boys under one year of age is much higher than that of girls.

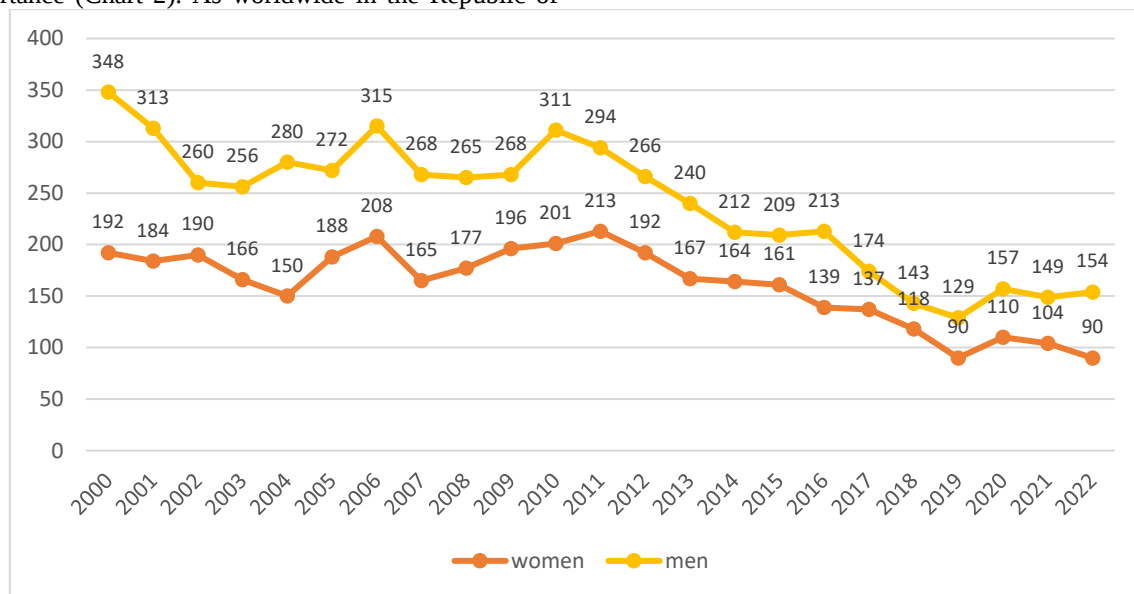


Chart 2. Infant mortality according to the gender during 2000-2022 [2, page 80].

From the data of Chart 2 it appears that during the period under consideration the number of both deceased girl and boys under one year of age has decreased significantly, respectively by 53.1 % and 55,7 %.

If in 2000 among deceased children under one year of age the specific weight of girls amounted to 35,6 %, and that of boys amounted to 64,6 %, then in 2022 respectively amounted to 36,9 % and 63,1 %. As we can see, the part of deceased girls under one year of age increased by 1,3 percentage points, and that of boys vice versa decreased to the same extent. If in 2000 the mortality of girls was lower than the mortality of boys by 44.8 %, in 2010 by 35.4%, then in 2022 was already by 41.6 %.

In the Republic of Armenia, the intensity level of the infant mortality rate of urban and rural population during 2000-2022 also changed in different patterns.

Analyzing these data, we notice that infant mortality rate both on the scale of the republic, and in urban and rural settlements, and according to the gender during the period under consideration manifested a tendency of stable decline. The infant mortality rate during 2000-2022 in urban and rural settlements decreased by 53.6 % and 59.7%, respectively.

As we can see, in rural settlements this indicator decreased at a faster rate than in urban settlements, by

around 11.3 %. In general, in the Republic of Armenia in 2022 the intensity level of infant mortality rate compared to 2000 decreased by 57.1 %, which is considered to be one of the positive tendencies of the demographic situation. Despite the fact that the infant mortality rate in the Republic of Armenia is steadily declining, however, it should be noted that it is still much higher than the infant mortality rate in the world, and especially in developed European countries [4, page 321].

If until 2008, the infant mortality rate of the urban population exceeded that of the rural population (in 2000 by 19.4 %, in 2008 by 37.9 %), then, since 2009, the opposite process has already taken place, which is the infant mortality rate of the rural population has begun to exceed that of the urban population (in 2009 by 21.9 %). The biggest difference was observed in 2020, about 65.6 %. During 2010-2015, there was very little difference in the infant mortality rate, only about 4-5 %, which was maintained until 2021. In 2022 an increase by 37.5 % of infant mortality rate of the urban population was recorded again. In urban settlements the high rate of the infant mortality of children under one year of age is caused by endogenous causes (congenital defects), and in rural settlements by exogenous causes (respiratory organ diseases, infections, internal causes).

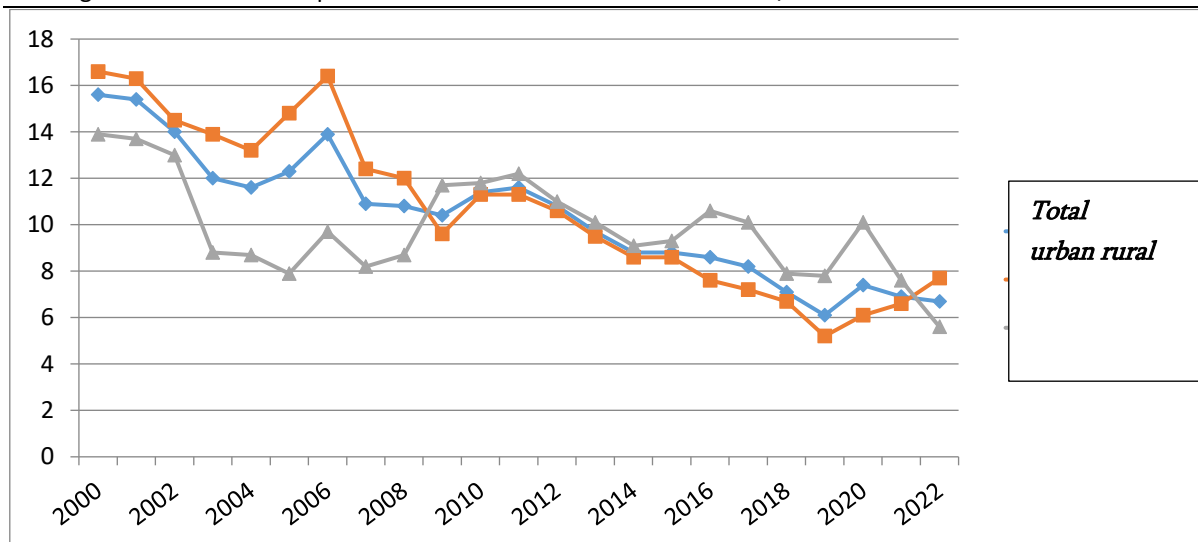


Chart 3. The dynamics of urban and rural infant mortality in 2000-2022. [2, page 79]

When observing the changes in the structure of infant mortality according to the main causes of death, it becomes clear that more than half of it, 63.3 %, is

accounted for infectious and parasitic diseases mortality, and 18.8% for congenital disorders mortality.

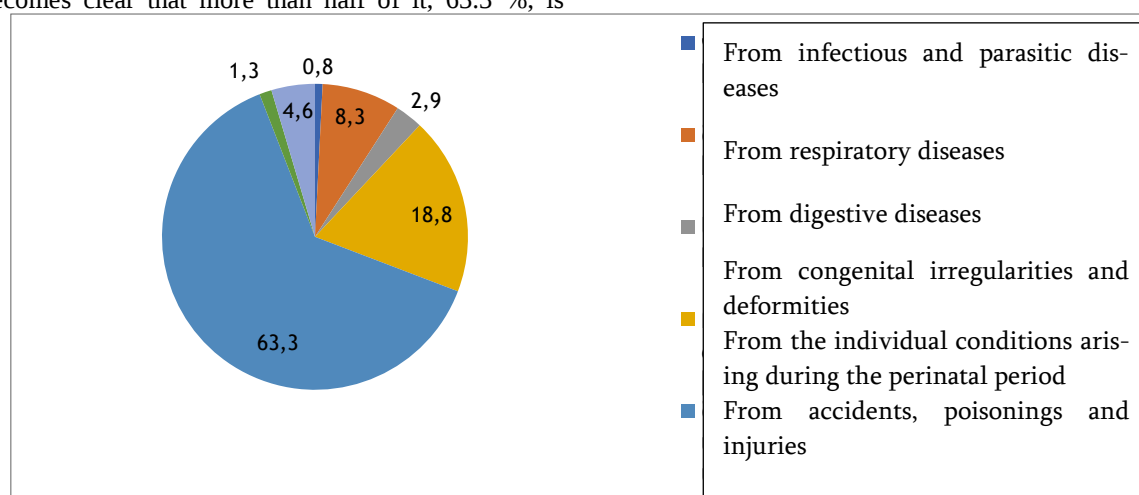


Chart 4. The structure of infant mortality in 2022 according to the main causes of death [1, page 43]

Hence, summarizing the statistical analysis of infant mortality, which is one of the most important demographic and healthcare indicators characterizing the population's quality of life, we shall perform a multistep regression analysis in order to evaluate the interdependence of the factors affecting it.

We shall distinguish the following factors for analysis:

Y – infant mortality per 1,000 liveborn births, %
 X_1 – average age of motherhood, years
 X_2 – average age of marriage for women, years
 X_3 – the number of doctors of all specializations per 10,000 inhabitants

X_4 – the number of beds previewed for pregnant women and women in labour per 10,000 women of childbearing age

X_5 – the number of diseases arising from pregnancy, childbirth and the postpartum period complications

X_6 – the number of diseases arising from individual conditions arising in the perinatal period, per 100,000 inhabitants aged 0-14 years

X_7 – maternal mortality per 100,000 liveborn births

- From infectious and parasitic diseases
- From respiratory diseases
- From digestive diseases
- From congenital irregularities and deformities
- From the individual conditions arising during the perinatal period
- From accidents, poisonings and injuries

X_8 – GDP per capita, thousand drams

X_9 – poverty rate, %

X_10 – extreme poverty rate, %

X_11 – total harmful substances released into the atmosphere, 1,000 tons

X_12 – the share of those with higher and post-graduate education in the composition of women labour resources, %.

To perform a multistep regression analysis, it is first necessary to calculate the matrix of cross-correlation coefficients [3, page 70]. From the analysis it becomes clear that there is multicollinearity between X_1 and X_2 , X_1 and X_3 , X_1 and X_6 , X_1 and X_8 , X_2 and X_{10} , X_2 and X_3 , X_2 and X_8 , X_3 and X_8 , X_3 and X_{10} , X_3 and X_{11} , X_5 and X_8 , X_6 and X_8 , X_8 and X_{10} coefficients (cross-correlation coefficients in absolute value exceed ± 0.80). In order for the corresponding regression coefficients of collinear variables not to be unstable in case mentioned factors are included in the model, factor X_3 was removed from the factor X_1 and X_3 , factor X_8 was removed from the factors X_1 and X_8 , because those factors had a weaker connection with resultant value. From the model were also removed

factors X_2 , X_5 and X_7 due to non-significance. Taking into account the abovementioned principles, as a result of the regression analysis performed with the help of the SPSS program, the characteristic model for the factors affecting infant mortality was obtained. Among

the factors included in the model, x_4 , x_6 and x_9 were excluded because they are not significant (Sig.= 0.220; 0.059 and 0.336).

Table 1

Stepwise regression results						
Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	24.230	12.411		1.952	.075
	x1	-.645	.414	-.442	-1.560	.042
	x4	-.177	.137	-.137	-1.295	.220
	x6	.010	.005	.401	2.083	.059
	x9	-.041	.041	-.138	-1.002	.336
	x10	.460	.301	.377	1.531	.049
	x11	.013	.005	.412	2.932	.013
	x12	-.049	.017	-.418	-2.882	.014
a. Dependent Variable: y						

In the Table 1 are shown the regression coefficient estimates, their standard errors, t-statistic values, and their significance levels.

Table 2

Model summary table					
Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.972 ^a	.945	.913	.6445	2.240

a. Predictors: (Constant), x12, x6, x9, x4, x11, x10, x1

b. Dependent Variable: y

In the Table 2 are shown the coefficients of multiple correlation and determination. Their values are high, which proves that the independent variables included in the model have a significant effect on the resultant variable.

The regression equation takes the following form:

$$\hat{Y} = 24,230 - 0,645x_1 + 0,460x_{10} + 0,013x_{11} - 0,049x_{12}$$

The results of the regression equation can be interpreted as follows.

- in case the average age of motherhood increases by 1 year, the infant mortality rate will decrease by 0.645 %,
- in case the extreme poverty rate increases by 1%, the infant mortality rate will increase by 0.460 %,
- in case the harmful substances emitted into the atmosphere increase by 1 ton, child mortality will increase by 0.013 %,
- in case the share of those with higher and post-graduate education in the composition of women labour resources increases by 1 %, infant mortality will decrease by 0.049 %.

The coefficient of determination indicates that the infant mortality rate variation by 94.5 % is due to the influence of the factors included in the model and by 5.5 % is due to the influence of other factors.

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