Evolution of the Birth Rates and Infant Mortality Rates between 1990-2007 in Cluj District

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Abstract

Despite this generally positive trend, our country continues to have the highest rates of infant mortality between countries and EU candidate countries, with a better reporting system of infant mortality. The study aims to identify and assess infectious risk factors affecting the survival chances of the child. This study is a descriptive epidemiological study of Cluj district population of children under 1 year, born between 2001-2007. In Cluj district, birth rate is rising slightly from 8.8 ‰ in 2000 to 9.3 ‰ in 2007, with a peak in rural areas (10.3 ‰) in 2000 and a minimum urban areas (7.8 ‰) in 2001. Infant mortality rate gradually decreases (29.7 ‰ in 1990 to 14.1 ‰ in 2007) but remains much higher in rural compared to urban (24.1 ‰ in 1990 to 10.2 ‰ in 2007). In the evolution of infant mortality depending on the causes of death between 1991-2007 there was a decrease in deaths due to respiratory disease, due to perinatal pathology and due to infectious and parasitic diseases. Congenital malformations death rate remains high and at constant level. Infant mortality is obviously decreasing, but its value remains among the highest in Europe. There is a very high proportion of deaths from respiratory diseases. These deaths are considered avoidable.

Keywords: Birth rate; Infant mortality; Perinatal; Infectious.

Introduction

In the last 35 years in public health in the world some improvement was produced. In the world during the years 1960-1990 the mortality of children up to age 5 years was reduced by half: from 216 ‰ to 107 ‰. The average life span has increased in this period from 46 to 62 years. However, fertility rates declined from 4.9 to 2.9 and are still falling. Maternal mortality in the same period has decreased substantially.

Although in the health care of mother and child were obtained many successes, many women remain at risk during pregnancy and birth, for causes which remained virtually unchanged over recent decades. Maternal complications remain a serious problem in obstetrical care and in the world, many cases of fetal death rate and early neonatal death occurs from preventable causes.

Each year there are 4000000 stillborn children, other 4000000 dies in the first month of life, 98% of these deaths take place in developing countries. A significant decline in infant mortality and

children mortality up to 5 years has been noted in the recent years [2]. Neonatal deaths represent 40% of all deaths among children to up 5 years of age. The risk of death in the first month of life is 15 times higher than in any other month during the first year of life. Women's health care in the period before pregnancy, in pregnancy, birth, postnatal period and that given to the newborn reflects consideration and respect of society for women and children [3].

In recent years, Romania has made progress in reducing child mortality, given that in 1990 its rate was 26.9 ‰. In 1999 the infant mortality rate reached the threshold of 20 ‰ and continues to decrease to a value of 16.7 ‰ in 2003[4].

Despite this generally positive trend, our country continues to have the highest rates of infant mortality between countries and EU candidate countries, with a better reporting system of infant mortality. 1-4 years child mortality rate has decreased every year, but still remains death at home. Accidents which are considered avoidable deaths were 38.9% in 2002 and 47% in 2003, according to the Center of Medical Statistics of Ministry of Health [5].

To work towards reducing child mortality, it is necessary to assess accurately the factors that determine or influence, followed by identifying and implementing the most effective solutions to minimize the effect of the factors identified. In this regard, systematic studies are needed to be developed, to be the basis for intervention programs, which must be implemented through synergistic inter-sectoral cooperation.

Starting with the premises that maternal and newborn mortality is determined by many factors among which a special role plays infectious diseases, the study aims to identify and assess infectious risk factors affecting survival chances of the child.

Material and Method

This study is a descriptive epidemiological study of Cluj district population of children under 1 year, born between 2001-2007. The comparison was made with the national data.

Local information source was represented by the Regional Directorate of Statistics Cluj and District Department of Public Health. For country-level data, data source was represented by the Romanian Statistical Yearbook. International data comes from the website of the World Health Organization. Data collection was performed during 2001-2007.

Statistical processing included, in addition to the calculation of different rates, χ2 test and Bravais-Pearson correlation coefficient (r). χ2 test is a nonparametric test, used to test the degree of "proximity" between an empirical and a theoretical distribution, testing the differences between the two structures. The test applies to any type of frequencies, irrespective of the size of tables they appear. Thus, for contingency tables we can test the significance of association, comparing the empirical frequencies with those obtained under the assumption of independence of factors.

To detect the correlation between two quantitative variables continue using Bravais-Pearson correlation coefficient (r). Correlation coefficient analysis was performed using Colton's rule. Statistical limit of tests used was $\alpha = 0.05$.

Statistical processing was performed with Microsoft Excel (Microsoft Office 2003), online software - statistical analysis Medical OpenEpi v.2.3. [1]

Graphical representation of results was done with the Excel application (Microsoft Office 2003).

Results

1. Dynamics of infant mortality and birth rates in Cluj district, since 1990

The main indicator characterizing the health of children is child mortality. Analysis of infant mortality dynamics generally shows a decreasing trend of the indicator during 2001-2007 (Figure 1).
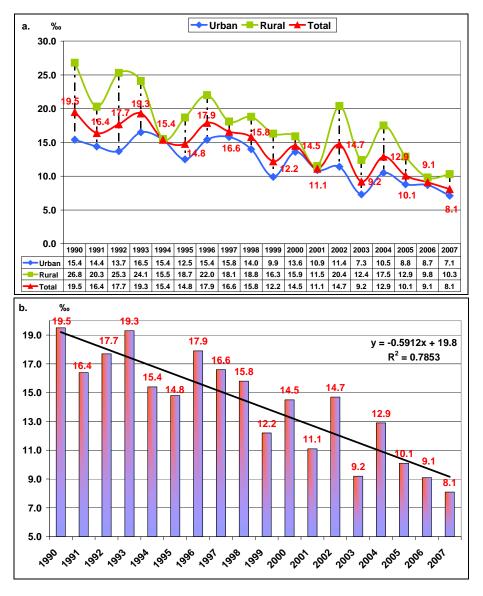
a. ‰	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Urban	15.4	14.4	13.7	16.5	15.4	12.5	15.4	15.8	14.0	9.9	13.6	10.9	11.4	7.3	10.5	8.8	8.7	7.1
Rural	26.8	20.3	25.3	24.1	15.5	18.7	22.0	18.1	18.8	16.3	15.9	11.5	20.4	12.4	17.5	12.9	9.8	10.3
Total	19.5	16.4	17.7	19.3	15.4	14.8	17.9	16.6	15.8	12.2	14.5	11.1	14.7	9.2	12.9	10.1	9.1	8.1

$y = -0.5912x + 19.8$
$R^2 = 0.7853$

Figure 1. (a) Infant mortality dynamics and **(b) I**nfant mortality tendency in Cluj district between 1990-2007

At the district level, the birth rate is continuously decreasing from 1990 till 2007 (from 19.5 to 8.1). The birth rate is higher in rural compared to urban areas. Over 10‰ live births were registered in urban area only in 2006 (Figure 2).
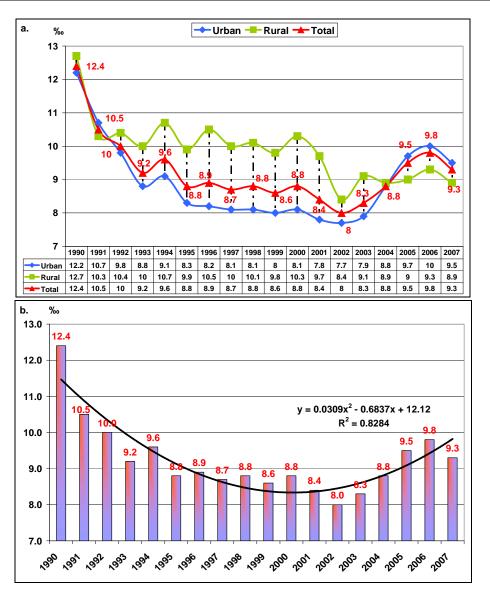
Figure 2. (a) Natality dynamics and **(b)** natality tendency in Cluj district between 1990-2007

Reducing infant mortality is caused by several factors, one of them being female fertility, which was significant decrease in the period studied (Figure 3).

Reducing the birth rate and increased overall mortality determined reducing the natural growth rate in Cluj district, reaching the value of - 2.3 ‰ in 2007 (Figure 4).
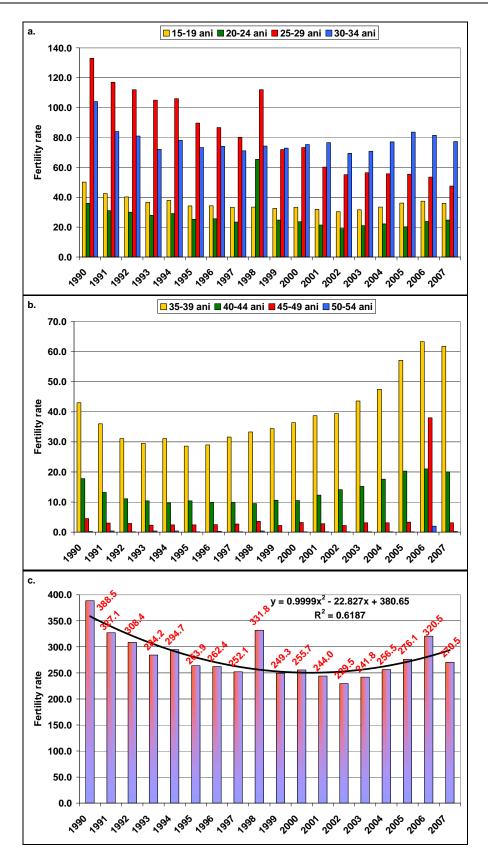
Figure 3. (a,b) Fertility dynamics by age group and **(c)** fertility tendency of Cluj district between 1990-2007
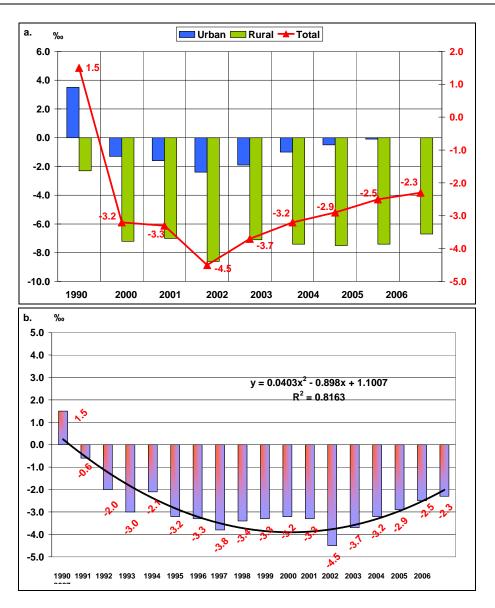
Figure 4. (a) Natural growth rate and **(b)** his tendency in Cluj district between 1990-2007

2. Structure and causes of infant mortality in Cluj district between 1991-2007

Infant mortality in Cluj district, depending on the time of death is shown in Figure 5.

The downward trend of infant mortality is more pronounced for post-neonatal mortality rate (28-365 days) comparing with early neonatal mortality and neonatal mortality (Figure 6).

Differences between neonatal mortality and post-neonatal mortality from Cluj district and the rest of Romania proved to be statistically significant (p = 0.01038). There was no statistically significant difference between the remaining types of infant mortality between the Cluj district and the rest of Romania (Table 1).

Death, by cause of death in Cluj district, between 1991-2007 is shown in Figure 7.
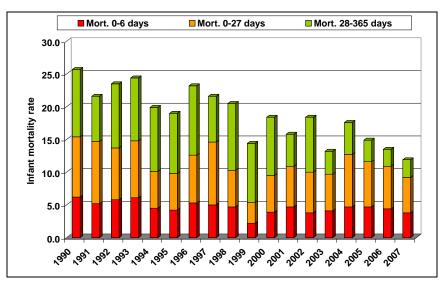
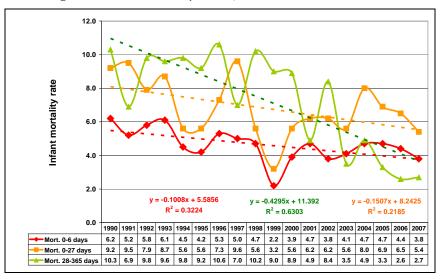**Figure 5.** Infant mortality in Cluj district between 1990-2007

Trend equations shown on the chart:

$$y = -0.1008x + 5.5856 \quad R^2 = 0.3224$$
$$y = -0.4295x + 11.392 \quad R^2 = 0.6303$$
$$y = -0.1507x + 8.2425 \quad R^2 = 0.2185$$

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Mort. 0-6 days	6.2	5.2	5.8	6.1	4.5	4.2	5.3	5.0	4.7	2.2	3.9	4.7	3.8	4.1	4.7	4.7	4.4	3.8
Mort. 0-27 days	9.2	9.5	7.9	8.7	5.6	5.6	7.3	9.6	5.6	3.2	5.6	6.2	6.2	5.6	8.0	6.9	6.5	5.4
Mort. 28-365 days	10.3	6.9	9.8	9.6	9.8	9.2	10.6	7.0	10.2	9.0	8.9	4.9	8.4	3.5	4.9	3.3	2.6	2.7

Figure 6. Infant mortality tendency in Cluj district during 1990-2007

Figure 7. Deaths, by cause of death, in Cluj district, between 1991-2007

Table 1. Relationship between different types of infant mortality in Cluj district in comparison with the rest of Romania

Region	Deaths 0-1 an		
	Mortality 0-6 days	**Rest of deaths 0-1 year**	**Total**
Cluj district	183	268	451
Rest RO	8652	14725	23377
RO	8835	14993	23828
Alpha	0.05		
df	1		
Hi squared critical	3.84		
p value	0.12046		
Hi squared observed	2.41136		

Region	Deaths 0-1 an		
	Mortality 7-27 days	**Rest of deaths 0-1 year**	**Total**
Cluj district	89	362	451
Rest RO	4028	19349	23377
RO	4117	19711	23828
Alpha	0.05		
df	1		
Hi squared critical	3.84		
p value	0.16367		
Hi squared observed	1.93996		

Region	Deaths 0-1 an		
	Mortality 28-365 days	**Mortality 0-27 days**	**Total**
Cluj district	179	272	451
Rest RO	10697	12680	23377
RO	10876	12952	23828
Alpha	0.05		
df	1		
Hi squared critical	3.84		
p value	0.01038	*p < 0,05*	
Hi squared observed	6.56888		

3. The main causes of death in infant mortality in Cluj district between 1991-2007

Among the leading causes of death of children up to 1 year of life during the years 1991-2007, the first place is occupied of states due to the perinatal period, followed by congenital anomalies, respiratory diseases, infectious and parasitic diseases, accidents and poisoning. In 2002 congenital anomalies exceeded the perinatal causes. Other major causes of death of children up to one year of life are respiratory diseases, especially pneumonia and acute respiratory viral infection (Table 2 and Figure 8).

Deaths at home occupied a prominent place in infant mortality depending on the causes of death. The causes of home place mortality were: respiratory diseases, congenital malformations and other causes (Figure 9).

Fetal death rate depending on environment residence, has generally been declining since 2000, except for a peak in rural area in 2003 (Figure 10).

Table 2. Structure of 0-1 year deaths in Cluj district, according to leading causes of death

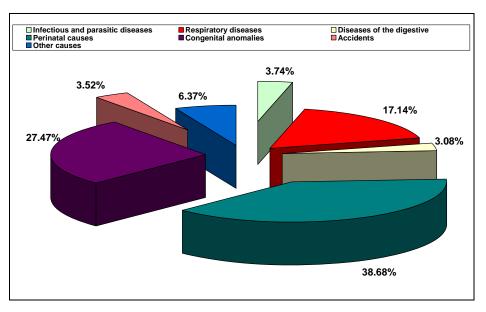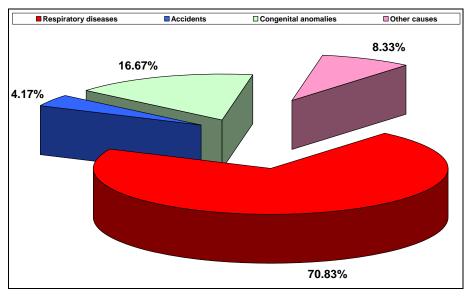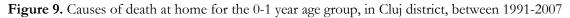| Causes of death	1991	1993	1995	1997	1999	2002	2003	2004	2005	2006	2007
Infectious and parasitic diseases	5	9	1	2	4	4	2	1	1	2	3
Respiratory diseases	18	21	16	20	16	18	13	15	5	6	8
Diseases of the digestive	10	6	2	6	0	2	0	0	1	1	0
Perinatal causes	53	49	33	36	30	20	22	31	31	26	21
Congenital anomalies	25	29	31	24	20	24	12	24	23	21	17
Accidents	6	4	5	4	2	4	2	2	1	1	1
Other causes	10	10	5	11	2	8	1	4	3	3	1
Total	**127**	**128**	**93**	**103**	**74**	**80**	**52**	**77**	**65**	**60**	**51**

Figure 8. Structure of 0-1 year deaths in Cluj district (%), according to leading causes of death, between 1991-2007

Figure 9. Causes of death at home for the 0-1 year age group, in Cluj district, between 1991-2007
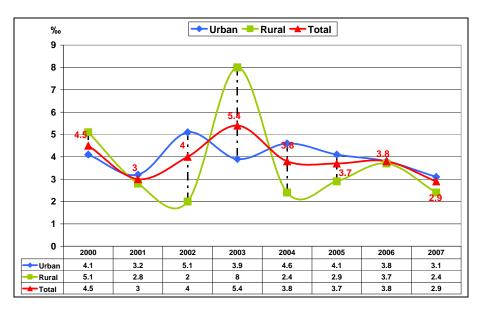
Figure 10. Fetal death rate depending on environment residence, in Cluj district, between 1990-2007

Between 1990-2007 the fetal death rate trend was in a continuously decreasing in Cluj district(Figure 11).In the urban areas the fetal death rates were higher than in rural areas.
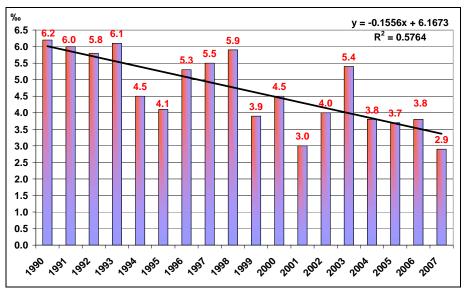

Figure 11. Fetal death rate tendency depending on environment residence, in Cluj district, between 1990-2007

Discussion

Demographics highlights important issues and events taking place in a population and influences economic and social development and health of the human community. [17]

In Cluj district, over the years, the number of births decreased from 9114 in 1990 to 6277 in 2007. Reducing the birth rate from 12.4 ‰ in 2001 to 9.3 ‰ in 2007 and increasing overall mortality from 10.9 ‰ to 11.6 ‰ in the same period determined the reduction of natural growth rate in Cluj from 10.7 ‰ in 1985 to -2.3 ‰ in 2007. The district birth rate is below the average

birth rate of Romania and natural growth is also low. At the district level, the lowest value of 8 ‰ live births was registered in 2002. After that, the birth rate began to increase slightly to 9.8 ‰ in 2006. We can say that since 2002 the evolution of this indicator is positive.

The birth rate remained higher in rural areas, but with values declining from those of 2000.

The analysis of infant mortality from 1990 to present indicates a decreasing trend. Despite the downward trend from 1990, the infant mortality rate in Romania is three times higher than the average EU countries and two times higher than in Eastern European countries [15]. The reducing of infant mortality rate is caused by several factors [13]. One of them is significant decrease in fertility.

Fertility rate in Cluj district shows the same downward trend as the country level, which has fallen below replacement level, reaching in 2007 to -27.8 ‰ in women of childbearing age (15-49 years). To properly express women fertility we have to mention the abortion evolution which had an upward trend. Although women can avoid an unwanted pregnancy many women still use abortion and their number exceeded that of live births

Pregnancy in the multipara women ends more often with child death by 1 year of life. In addition, decreased number of pregnancies and births contribute to a better quality of nutrition of mothers and children in those families, to increase resources allocated to each new-born increases the chances of survival [7].

Since 1990 to present the infant mortality rate had a downward trend, except for peaks in 1993 (19.3 ‰), 1996 (17.9 ‰), 2002 (14.7 ‰) (probably by improving the methodology reporting) and 2004 (12.9 ‰), so that in 2007 the infant mortality rate reached 8.1 ‰.

Analysis of infant mortality by causes of death between 1991-2007 showed a decrease in deaths due to respiratory disease, perinatal pathology and infectious and parasitic diseases. It remains constant at the high rate death due to congenital anomalies.

Most children under 1 year died at the age of one month (25.9%) and almost half of children died before reaching 3 months. Experts explain this by the fact that in the current system of registration of such events there is a greater degree of under-reporting of neonatal deaths [8]. Thus, the official rates of recent years shows that neonatal mortality represented 60% of the infant mortality, referring to the death of children until the age of one year.

In early ages untreated infectious pathology, respiratory pathology or digestive pathology can lead to death (bronchiolitis, acute diarrheal diseases - acute diarrhea syndrome). We emphasize that these diseases belong to the category where the current therapeutic arsenal is fully effective(the rate of healing tends to 100%).

By age group (0-6 days, 0-27 days and 28 days and over) is observed the decrease of early neonatal mortality, neonatal mortality and of the post neonatal mortality.

We can therefore say that the downward trend of infant mortality in all age subgroups in Cluj district does not correspond with the tendency in the country where oscillations occur from one year to another.

Early infant mortality is the most yielding component of infant mortality through the quality of health care. In the EU this type of infant mortality decreased by 70% during 1980-2004. In Romania, this indicator was still showing an oscillating trend showing once again the inefficiency of health services, especially those relating to maternal and child care. Evolution can be explained in part by the fact that many child deaths under 1 year occur outside health care.

We distinguish the early neonatal mortality rate (0-6 days) from 4.7‰ to 3.8‰ and the neonatal mortality rate (0-27 days) from 6.2 ‰ to 5.4 ‰ with a peak of 8, 0 ‰ in 2004.

Early neonatal mortality rate (recorded from 1000 g) had a fluctuating dynamic since 2001, with variations from 4.7 ‰ to 3.8 ‰. Peaks of this indicator were recorded in 2001, 2004 and 2005 (4.7 ‰). This indicator decreased since 2006 and reached 3.8 ‰ in 2007. Neonatal mortality rate has a similar dynamic with early neonatal mortality, showing a decreasing trend (from 6.2 ‰ in 2001 to 5.4 ‰ in 2007).

The improvement of pregnant women and infant care in the first period after birth led to the decreasing of early neonatal mortality rate, and to a less spectacular decrease in late infant mortality rate.

Among the main causes of early neonatal mortality during the years 2001-2007, infections and congenital anomalies had the first two places. The causes of death can be arranged in the following decreasing order: maternal-fetal infection, obstetric trauma, fetal distress and asphyxia of the newborn, birth and respiratory distress syndrome. In the evolution of infant mortality depending on the causes of death between 1991-2007 was estimated a decrease in deaths from respiratory disease from 4.7 ‰ to 2.8 ‰, the pathology of perinatal mortality from 5.9 ‰ to 4.28 ‰, infectious and parasitic diseases from 1.6 ‰ to 1.0 ‰. It remains high at constant level congenital malformations death rate: 4.6 ‰.

Respiratory illness at age 0-1 year is consistently one of the leading causes of deaths of children [9, 10]. Child deaths due to respiratory diseases had a downward trend from 18.0 ‰ in 2002 to 8.0 ‰ in 2007. Such a situation can have many reasons, one of which may be the low level of care during post neonatal period. Deaths from respiratory and infectious diseases are caused by poverty, poor living conditions and low levels of education and information to parents [16] .

Analysis of perinatal mortality rate dynamics (stillbirths and deaths in the first 6 days of life) indicates an almost constant dynamic indicator (recorded from more than 1000 g weight) with annual limits ranging 1-1.5 / 1000 [12] .

Regarding infant mortality dynamics in Cluj district, rural values remain higher than those in urban areas because of deficiencies in the health network, as well as poor health education [14] .

It is noted that there are large differences between the percentages of male children which are deceased, and the percentages of feminine children which are deceased. In official statistics, from the total infant deaths, the proportion of male children which are deceased does not exceed by more than 5% female children which are deceased (Yearbook of Health Statistics)

The structure of infant mortality by place of death in the years 2003-2007 is 7.9% deaths at home (24 children). The home place mortality scale by causes is: first place - respiratory diseases (17 cases), second place - congenital malformations (4 cases) and third place - accidents and other causes (3 cases).

Infant mortality presents some features that lead to the conclusion that there is a large and under-exploited potential, to reduce this phenomenon:

- Remains a very high proportion of deaths from respiratory diseases (18.0% for 2002). Deaths from this category are considered avoidable in developed countries.
- Half of the deaths recorded in the first year of life are after the first month of life (in post neonatal period), which represents a value 2-3 times greater than that in other European countries.
- In socially disadvantaged children and in rural areas children there are high infant deaths rates.

Considering the whole Cluj district and a longer period of time, fetal death rate trend was decreasing, from 6.2 ‰ in 1990 to 2.9 ‰ in 2007. Highest fetal death rates were recorded in the 1990s (6.2 ‰), 1993 (6.1 ‰), 1998 (5.9 ‰) and 2003 (5.4 ‰).

To work towards reducing child mortality, it is necessary to assess accurately the factors that determine or influence it, followed by identifying and implementing the most effective solutions to minimize the effect of the factors identified [18]. In this regard, systematic studies are needed to be developed with intervention programs and to be implemented through synergistic interdisciplinary cooperation.

Use of family planning is important to prevent unwanted pregnancies and reducing infant mortality [11]. The results of is methods are: families will have only the number of children they want (to which are given more attention) and will have the wished spacing of births, allowing the mother to recover biologically between two pregnancies, thus reducing the risk of children with low weight or premature [19] .

Conclusions

1. Birth rate fell slightly, while overall mortality decline but this trend did not result in a positive natural growth.

2. Infant mortality is obviously decreasing, but its value remains among the highest in Europe.
3. In recent years, Romania has made a significant progress in reducing child mortality, but still has the highest infant mortality rates between countries and EU candidate countries.
4. There is a very high proportion of deaths from respiratory diseases. These deaths are considered avoidable, in developed countries.
5. Half of deaths under one year are recorded in the first month of life, representing a value of 2-3 times higher than that in other European countries.
6. In Romania early neonatal mortality rate (official data) recorded the lowest percentage, compared with European countries. The data collected through epidemiological studies or case studies shows that this situation is because in many maternity rules are not respected definitions for "live newborn" and " stillborn ", which can lead to under-assess the real level of neonatal mortality and infant mortality in Romania.
7. Still, there is a high proportion of deaths at home.
8. There are higher rates of infant deaths (particularly at home) in socially disadvantaged children and in children from rural areas compared with the national average.
9. There is significant potential, still unexploited, to reduce infant mortality rates in Romania.

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