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HEALTH SYSTEM PERFORMANCE ASSESSMENT

2023

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HEALTH SYSTEM

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ASSESSMENT

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Health systmen performance assessment, Armenia 2023

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The report Health System Performance Assessment (HSPA), 2023, presents the following:

- Analysis of demographic, health-characterizing, as well as morbidity and mortality data of the RA population according to the most common nosologies, sex-age groups.
- Maternal and child health issues.
- Impact of climate on non-communicable diseases.
- Availability and distribution of personnel potential.
- Comparative analysis of data on morbidity and mortality, as well as human resources, according to WHO Health for all European database data by country and time period.

HSPA report is designed for health system organizers, health experts, clinicians, as well as other specialists interested and involved in health system issues.

CONTENTS

ABBREVIATIONS

NIH	National Institute of Health
PHC	Primary health care
HFA-DB	European Health for All Database, WHO
WHO	World Health Organization
MoH	Ministry of Health
BCSD	Blood circulatory system disease
NCHSR	National center for health statistics and research
a. v.	Absolute value
NMP	Nursing and midwifery point
MO	Medical organization
EBF	Exclusive breastfeeding
HEI	Higher education institution
AFHS	Adolescent-friendly health service
SCHBS	School-age children health behavior survey
EU	European Union
YSMU	Yerevan State Medical University
COPD	Chronic obstructive pulmonary disease
DHS	Survey of demographics and health issues
SDG	Sustainable development goal
BF	Breastfeeding
r. v.	Relative value
WB	World Bank

ICD-10	Tenth Revision of the International Classification of Diseases
ADHS	Armenia Demographic and Health Survey
RA	Republic of Armenia
ICD	International classification of diseases
NCDC	National Center for Disease Control and Prevention
WMO	World Meteorological Organization
AIDS	Acquired immunodeficiency syndrome
RTA	Road transport accident
UN	Organization of United Nations
BMI	Body mass index
HIV	Human immunodeficiency virus
IM	Infant mortality
DOD	Disease of digestive organs
NM	Neonate mortality
NISR	Natural infant sex ratio
NSR	Neonatal sex ratio
SD	Sugar diabetes
RDS	Respiratory distress syndrome
DRO	Disease of respiratory organs
NID	Non-infectious disease
CVD	Cerebrovascular diseases
MN	Malignant neoplasm
TFR	Total fertility
PMR	Perinatal mortality
FSDS	Fetal sex discriminatory selection
RF	Russian Federation
AMI	Acute myocardial infarction
IPEC	From injuries, poisoning, external causes
SC	Statistical Committee
EN	Early neonatal
TB	Tuberculosis
ARCRA	Agency for Registration of Civil Residence Acts

CHAPTER 1 DEMOGRAPHIC OVERVIEW

Size and composition of the population

The RA permanent population (January 1, 2023) was 2,977.100. Compared to the beginning of 2022, the population imcreased by 15.700.

In the beginning of 2023 the urban population was 63.8% and rural population was 36.2% of the whole structure. In 2022 the male permanent population in RA was 47.2%, and the female population was 52.8%. The average age of the population in 2022 was 37.2 years (males – 35, and females - 39.1). In 2022, the share of children aged 0-15 in the structure of the permanent population of RA was 21.4%, the working-age population was 63.5%, and the share of the population over the working age was 15.1% (https://www.armstat.am/am/?nid=82&id=2446).

One of the present problems of the demographic situation is the demographic aging of the population, the process of which has greatly acceled in the republic in the post-Soviet years. Population aging or demographic aging is a consequence of long-term demographic changes in population reproduction, birth rates, mortality and their ratios, and also, in part, migration. According to the demographic aging scale of the United Nations, if the population aged 65 and over is more than 7% in the structure of the country's population, then this indicates the aging of the given population. That RA indicator in the beginning of 2022 was 12.6%.

In the RA the number of births registered in 2022 was 36,802, of which 36,375 live births and 427 stillbirths. Compared to the previous year, the absolute number of live births decreased by 1%, and the total birth , which characterizes the number of live births per 1000 population in the reporting period, was 12.2%, which decreased by 0.2 per thousand points compared to the previous year's rate.

In 2022, the number of deaths registered in RA was 26,692. This number in 2021 decreased by 7,696, and the overall mortality per 1,000 population was 8.9%. Of the total number of deaths registered in 2022, 13,783 (51.6%) were men, and 12,909 (48.4%) were women.

Figure 1. The RA permanent population by marzes (1000 people) by the beginning of 2023
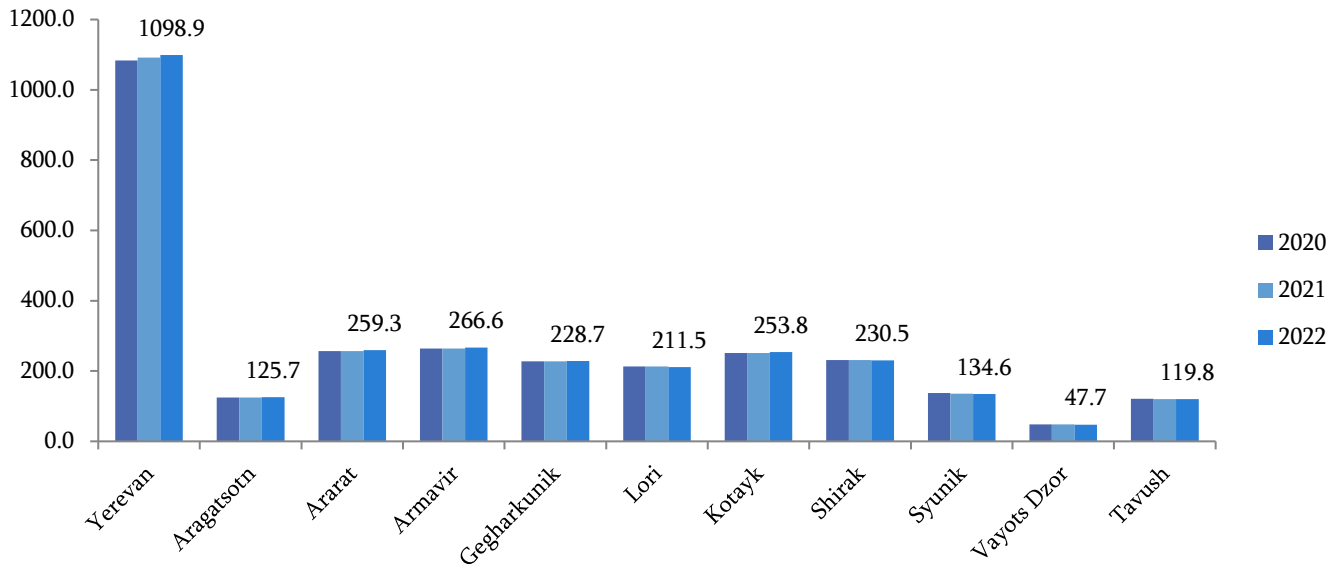
Source: RA SC, 2022

As for the beginning of 2023 the permanent population was concentd in the city of Yerevan (36.9%), in each of Kotayk, Ararat and Armavir marzes (8.5%-9%), in each of Lori, Gegharkunik and Shirak marzes (7.1%-7.7%), and in each of Tavush, Aragatsotn and Syunik marzes (4%-4.5%), and finally in Vayots Dzor marz (1.6%) of the population (Figure 1).

Figure 2. RA permanent population (1000 people), as for the beginning of 2023
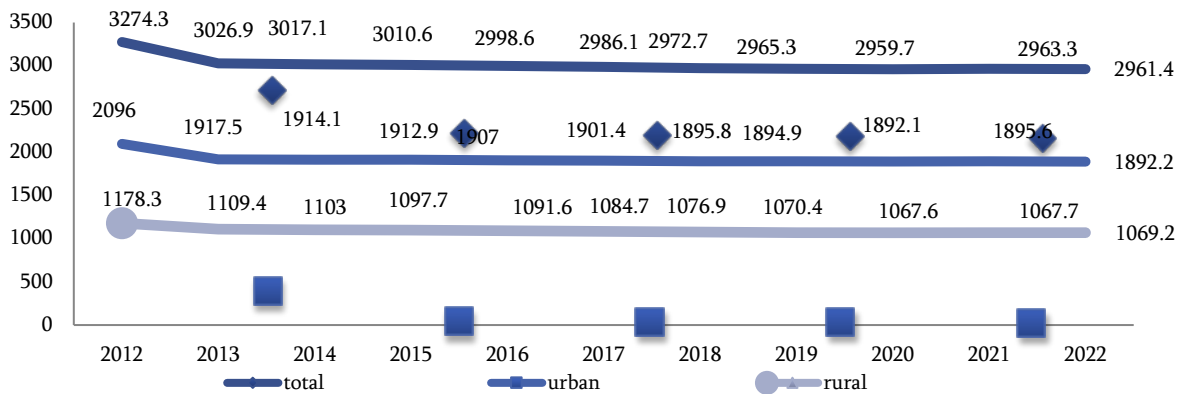
Source: RA SC, 2022

According to the data, registered in the beginning of 2023, the RA permament population decreased by 297.2 thousound, compared to 2012: the urban population decreased by 197.9 thousand, and the rural population decreased by 99.3 thousand people (Figure 2).

Life expectancy

Life expectancy since birth is considered as of the direct rates of Life expectancy at birth is considered one of the most direct rates of the population's standard of living. It is the number of years that the generation being born will live on averag, provided that during the whole lifetime of that generation, the death at each age will be equal to the death of the population for the given period. In 2022 the life expectancy at birth was 75.1, which is higher than it was in 2021 by 3 years. The average life expectancy at birth of the male population is 71.4, and the female population's is 78.3 years. It is necessary to note that compared to 2021, the life expectancy of the male population increased by 4 years, the women's by 0.9 year (Figure 3).

Figure 3. Life expectancy at birth, 1990, 1995, 2000-2022
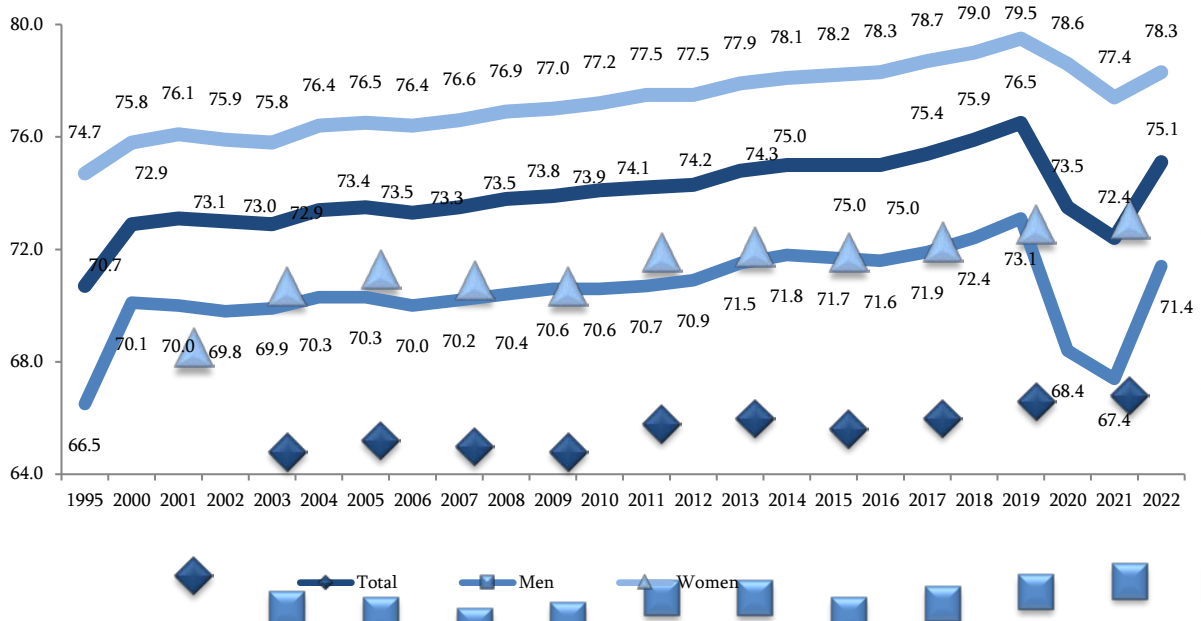
Source: RA SC, 2022

CHAPTER 2

POPULATION MORTALITY, HOSPITAL MORTALITY

Mortality problems

The study of the trend of the mortality documents that the general mortality in Armenia in 1949-1989. had a downward trend during the period, which was due to the annual improvement of the socio-economic condition and well-being, the development of the healthcare system (Figure 4). If in 1949 the total mortality per 1000 population was 10.9 person, then in 1989 the decreased: 6.0. In 1988 the significant increase of the mortality was caused by the natural disaster, Spitak earthquake.

In the post-Soviet years, the overall mortality increased from 6.5 in 1991 to 9.3 in 2015. The overall mortality of the population aged 55 and above is significantly exceeding the mortality of the younger population. Therefore, the aging of the population leads to an increase in the overall mortality rate. The economic collapse of Armenia led to a large-scale emigration of people in reproductive age and mass impoverishment of the population, as a result of which the total fertility began to decline, reaching a minimum in 2001, after which a very slow, although insufficient increase of natural reproduction was recorded.

Figure 4. General rates of the RA population mortality and birth, 1942-2022
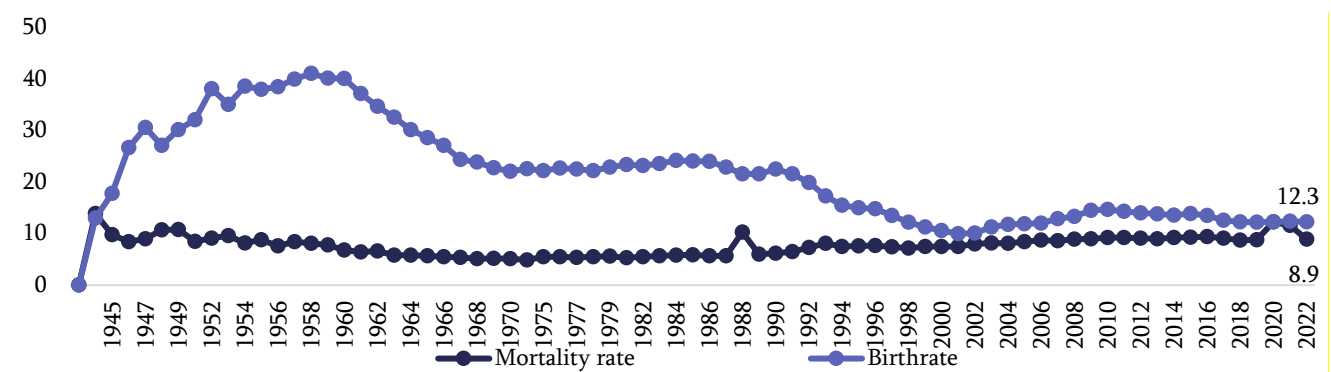
Source: RA SC, 2022

Figure 5. Mortality of the RA population from all causes (by 100,000 population)
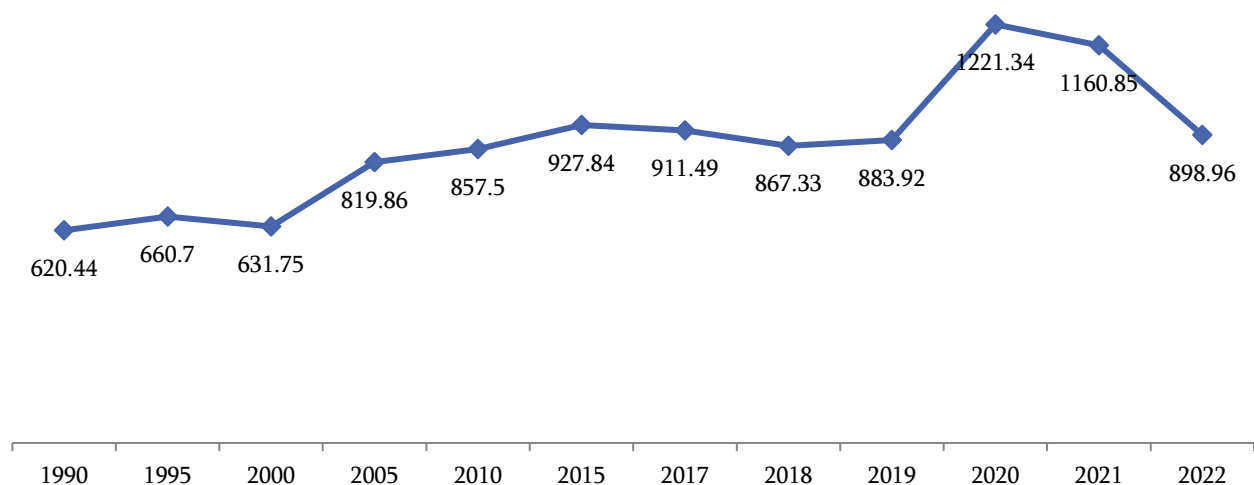
Source: RA SC, 2022

According to the data of 2022, the number of deaths from all causes was 26,692. It should be noted that in 2022, compared to 2021, mortality decreased by 7,696 cases, and compared to 2020, by 9,741 cases.

Table 1. Deaths in the RA population by the main causes of death, 2021-2022

	2021 absolute value	By 100,000 population	2021 absolute value	By 100,000 population
Total	34388	1160.8	26692	898.9
Infectious and parasitic disease	158	5.33	148	4.98
Neoplasms	5332	180.0	5141	173.14
Including malignan	5266	177.77	5087	171.33
Disease of the circulatory system	16589	560.00	14244	479.73
Disease of respiratory organs	2895	97.73	2363	79.58
Disease of digestive organs	1250	42.20	1138	38.33
Injuries, poisoning and some other effects of external causes	1087	36.69	1258	42.37
Covid-19	5442	183.71	812	27.35

BCSD-caused deaths decreased by 2345, and neoplasm-caused decreased by 191 cases.

The analysis of mortality by gender and age groups clearly shows that among men, compared to women, the number of deaths is 874 more. The increase in mortality is recorded in age groups of 50 and older. It should be noted that in the age group up to 69, the death cases of men predominate compared to women. Thus, from the point of view of premature mortality, men are a risk group. The increase in mortality is recorded in the age group 50 and older (Figure 6).

Figure 6. The mortality of the RA population by gender/ age groups, 2022
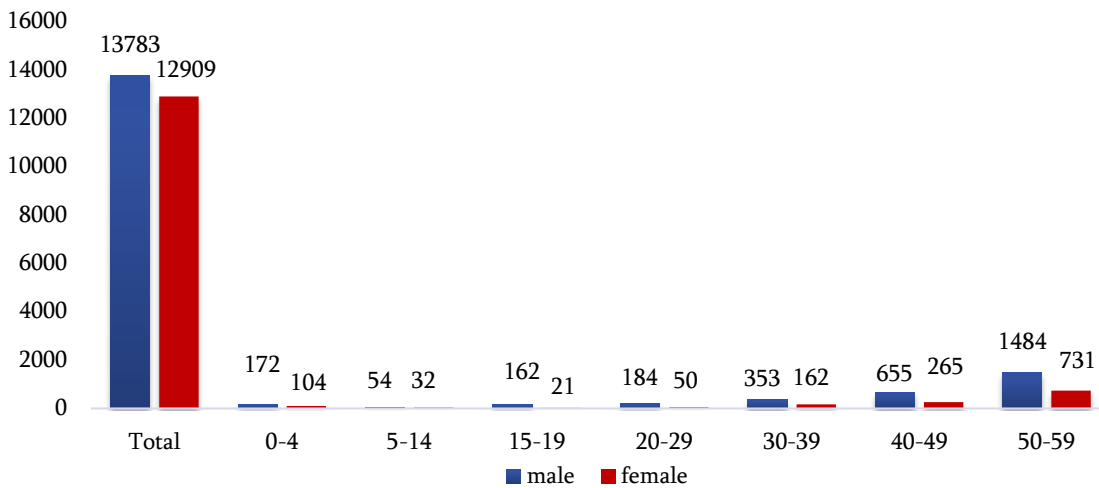
Source: RA SC, 2022

The burden of mortality from the 4 most spread non-communicable diseases is about 75%, the main part of which (53.4%) is mortality from BCSD. The subsequent shares are MN (19.1%), SD (1.4%), COPD (1.1%), (Figure 6).

Figure 7. Mortality of the RA population from the most common diseases in the structure of total mortality (%), 2022
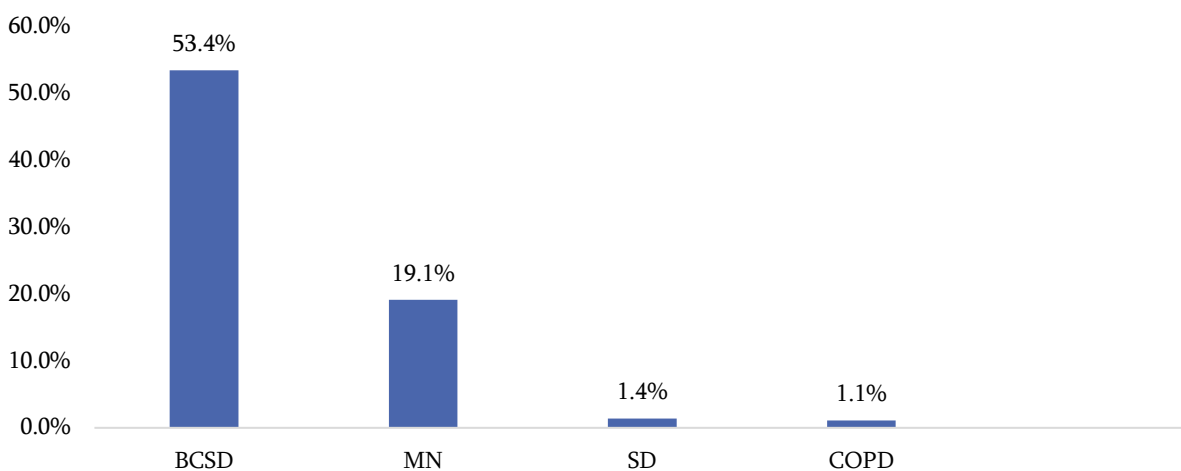
Figure 8. RA population mortality caused by BCSD and MN, (by100,000 population) 2009-2022
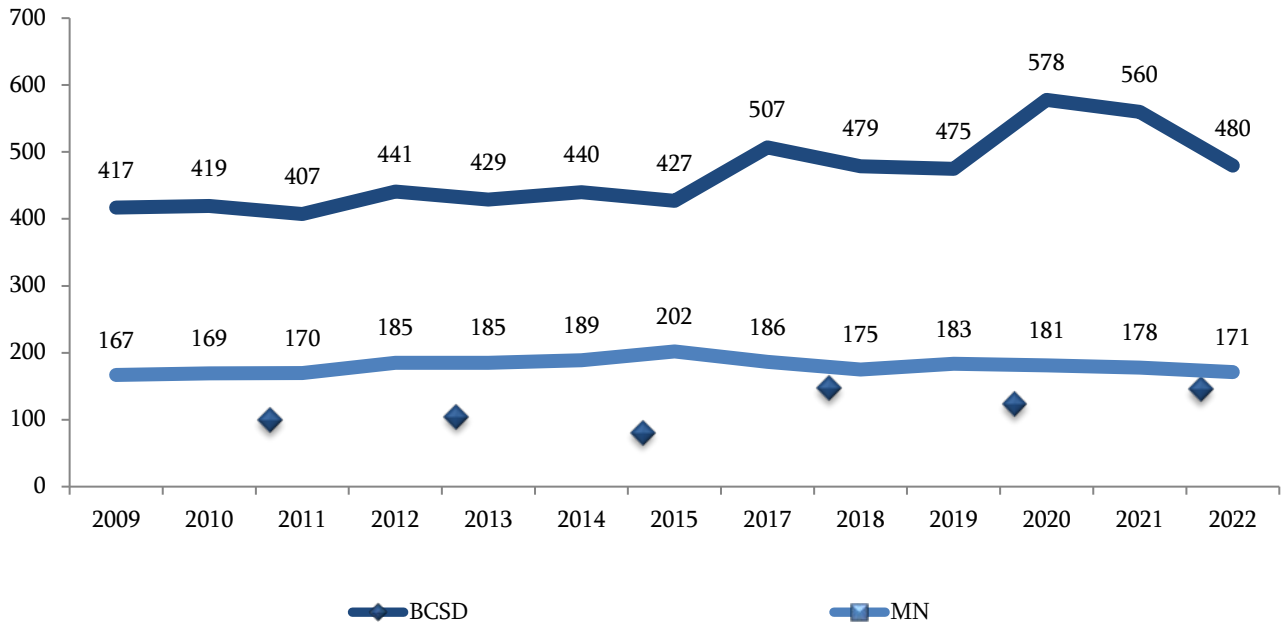
Source: NCHSR, 2022

Figure 9. RA population mortality caused by SD, ROD and DOD diseases (by 100,000 population), 1990-2022
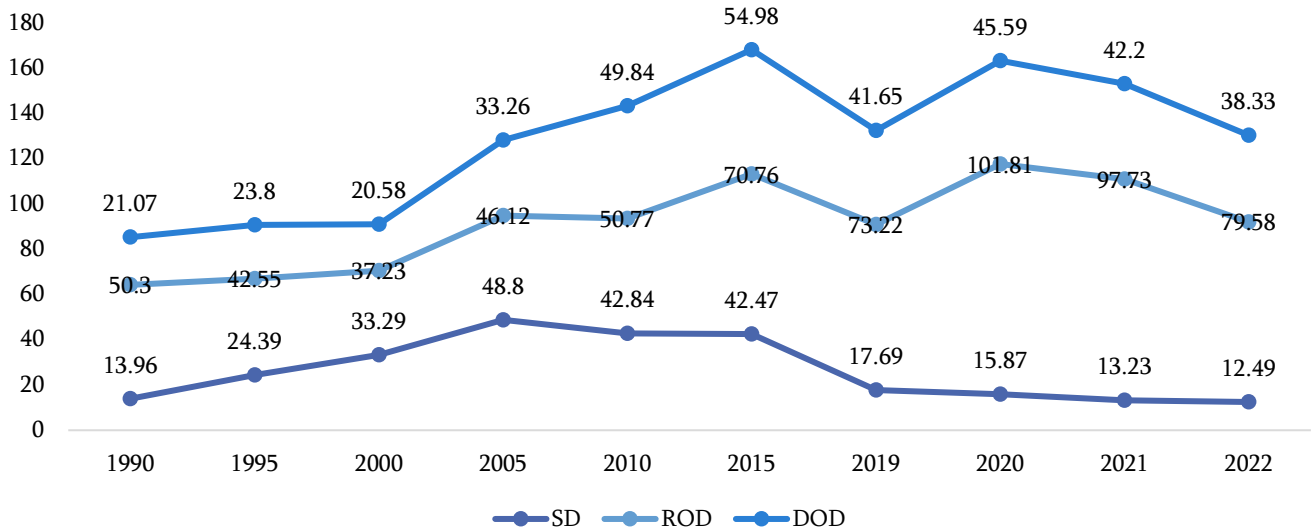
Source: NCHSR, 2022

According to data presented in Figures 7 and 8, the mortality caused by BCSD in 2020-2022 significantly reduced, and the same trend was registered the ratios of mortality caused by DOD and ROD (Figure 9).

Premature mortality

Reduction of the premature mortality is one of the challenges in the Republic of Armenia, and it is fixed in the SD goal, which defines: «Up to 2030, to reduce by one third the premature mortality caused by NID by means of prevention and treatment and to promote the mental health and well-being.»

Table 2. Mortality of the RA population by causes of death and gender-age groups, 2022

Diseases	Women						Men						Total					
	Total in all age groups		Premature mortality				Total in all age groups		Premature mortality				Total in all age groups		Premature mortality			
			0-70 y/o		35-65 y/o				0-70 y/o		35-65 y/o				0-70 y/o		35-65 y/o	
	a. v.	r. v.	a. v.	r. v.	a. v.	r. v.	a. v.	r. v..	a. v.	r. v.	a. v.	r. v.	a. v.	r. v.	a. v.	r. v.	a.v.	r. v.
MN	2374	151.4	1208	84.3	824	123.2	2713	193.6	1525	115.3	964	175.4	5087	171.3	2733	99.1	1788	146.7
NSD	245	15.6	94	6.6	56	8.4	153	10.9	87	6.6	57	10.4	398	13.4	181	6.6	113	9.3
BCSD	7345	468.4	1118	78	629	94	6899	492.4	2790	210.9	1865	339.3	14244	479.7	3908	141.8	2494	204.6
ROD	1162	74.1	222	15.5	113	16.9	1201	85.7	361	27.3	200	36.4	2363	79.6	583	21.1	313	25.7
DOD	517	33	125	8.7	64	9.6	621	44.3	342	25.9	238	43.3	1138	38.3	467	16.9	302	24.8
Injuries, Poisoning	278	17.7	175	12.2	97	14.5	980	69.9	870	65.8	411	74.8	1258	42.4	1045	37.9	508	41.7
Covid -19	321	20.5	117	8.2	64	9.6	491	35	154	11.6	81	14.7	812	27.3	271	9.8	145	11.9
Total	12242	780.7	3059	213.3	1847	276.1	13058	931.9	6129	463.3	3816	694.2	25300	852.1	9188	333.3	5663	464.7

Source: NCHSR, 2022

The data given in Table 2 are related to the total mortality and premature mortality ratios and registered deaths in the 35-65 years age group. The premature mortality caused by BCSD among men is two times higher than among women.

Figure 10. The standartized BCSD premature (0-64) mortality rate (by 100.000 population), by sex and selected countries, 2018, 2019
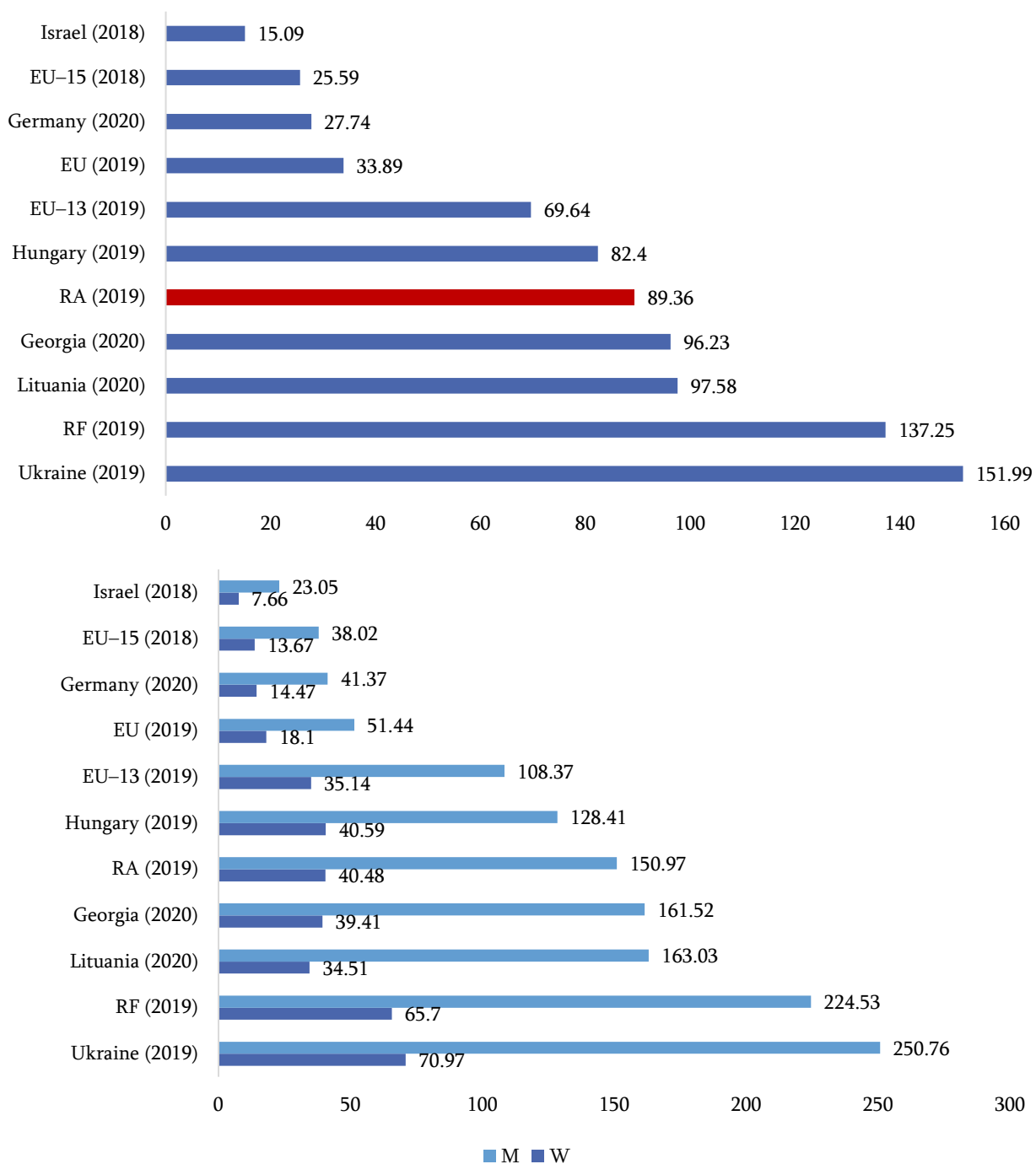
Analysis of the data on premature mortality in Figure 10 proves that the BCSD premature mortality registered in the RA (89.4) is almost 3-4 times higher than that in the developed countres of the European region, and 6 times higher than in Israel. However, it is less than in RF, Georgia and Ukraine.

Figure 11. The standartized premature (0-64 age group) mortality caused by MN (by 100.000 population), by sex and selected countries, 2018-2020

Source: HFA-DB, WHO, 2018-2020
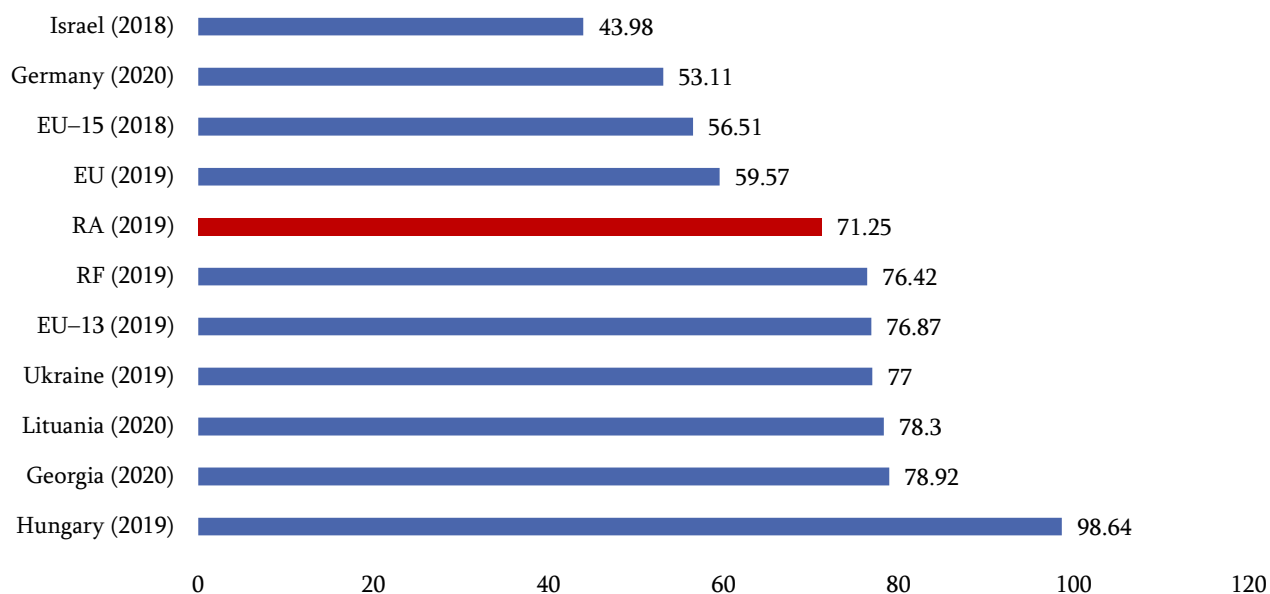
In the RA the premature mortality caused by MN is higher than in Israel, Germany and EU developed countries, but less than in Hungary and Lituania. In the given countries, the relevant s among men is higher than among women.

Figure 12. Standardized premature (0-64) mortality caused by SD (by 100.000 population), by sex and selected countries, 2018, 2019
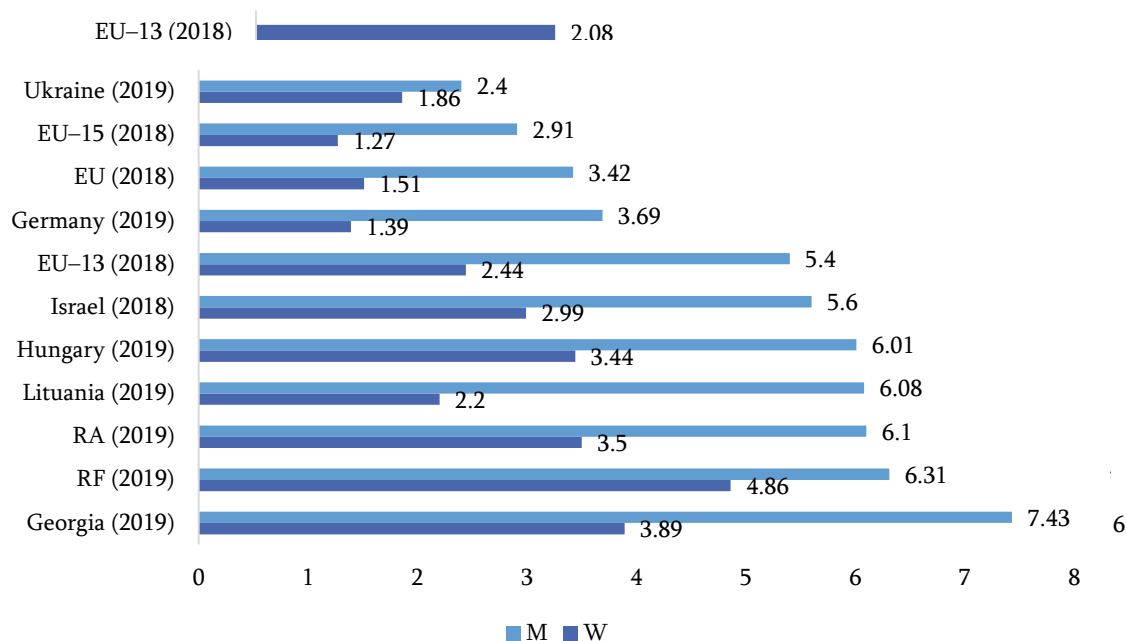
Sources: HFA-DB, WHO, 2018, 2019

Comparison with the international data makes it obvious that in the RA the mortality caused by SD is higher than relevant rates in the European countries, but lower than in Georgia and Russian Federation. It is necessary to point out that the mortality caused by SD is higher among men in all countyries (Figure 12).

Figure 13. Decline the average life expectancy in the age group before 65 caused by prmature mortality (by 100.000 population), by sex and selected countries, 2018, 2019
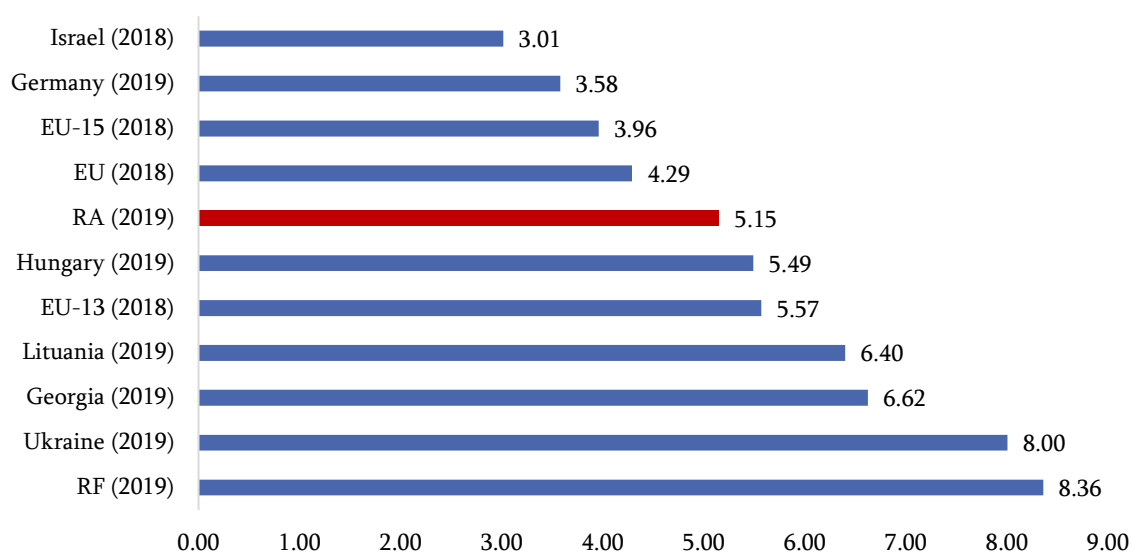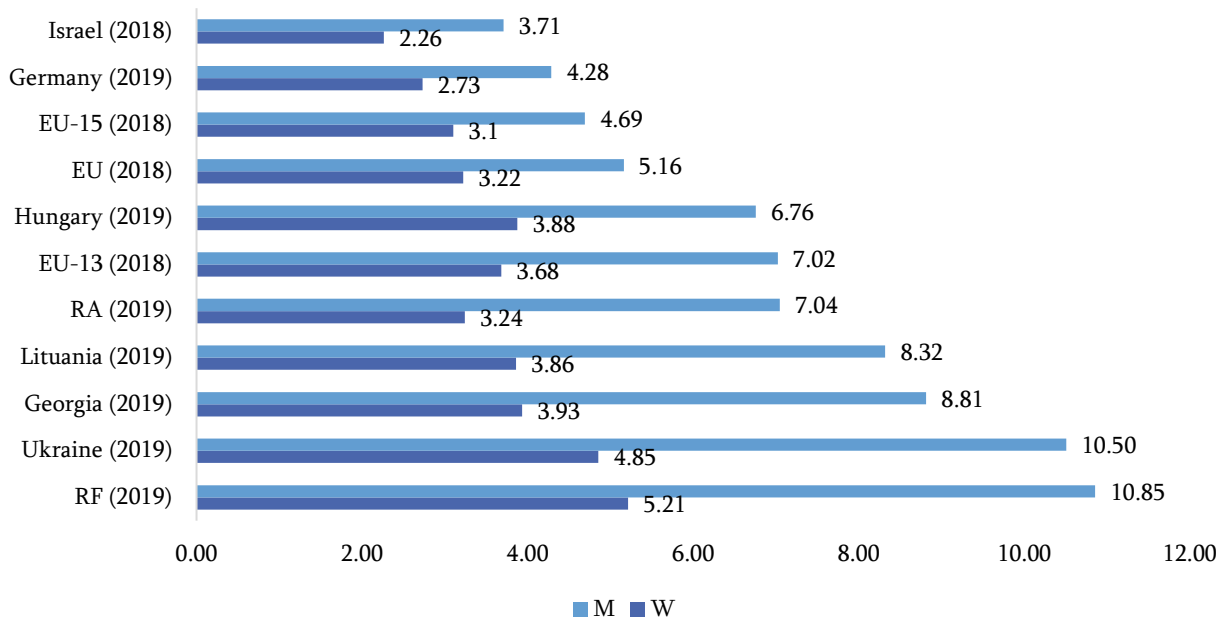
Source: HFA-DB, WHO 2018, 2019

As it can be seen from the given international data, the RA is relatively higher than the average ratios of EU-15, EU and Israel (all 2018) and Germany (2019), but it is lower in comparison with EU-13 (2018), Ukraine, RD and Georgia. Here the men's is also than women's (Figure 13.)

In-hospital mortality

The total in-hospital mortality and the mortality rates for each disease describe the quality of the organization and provision of hospital care.

The total mortality from all diseases and causes during 1990-2022 is given in Figure 14, showing that in 2001-2019 the in-hospital mortality displayed constant decline, which is the evidence of the improved organization and quality of the in-hospital medical aid. In 2020 and 2021 the rates grew up due to the Covid-19 epidemic and the war.

In 2022, the total mortality declined (1.4).

Figure 14. In-hospital mortality (by 100 received patients), 1990-2022
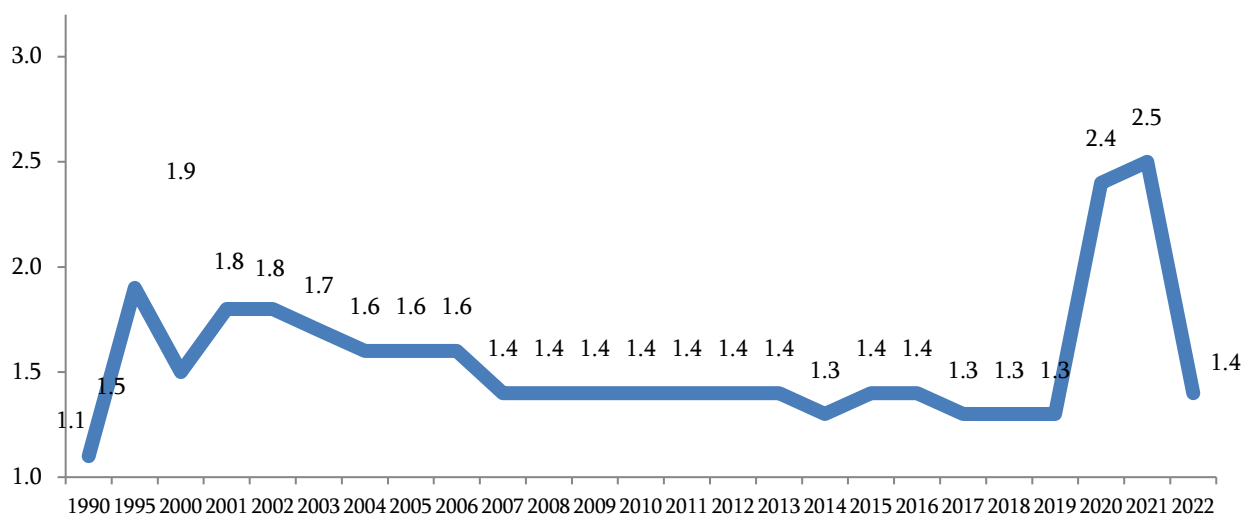
Sources: NCHSR, 2022

Figure 15. In-hospital mortality caused by CVD, AMI, SD, TB and burns (by 100 admissions), 1990, 1995 and 2000-2022
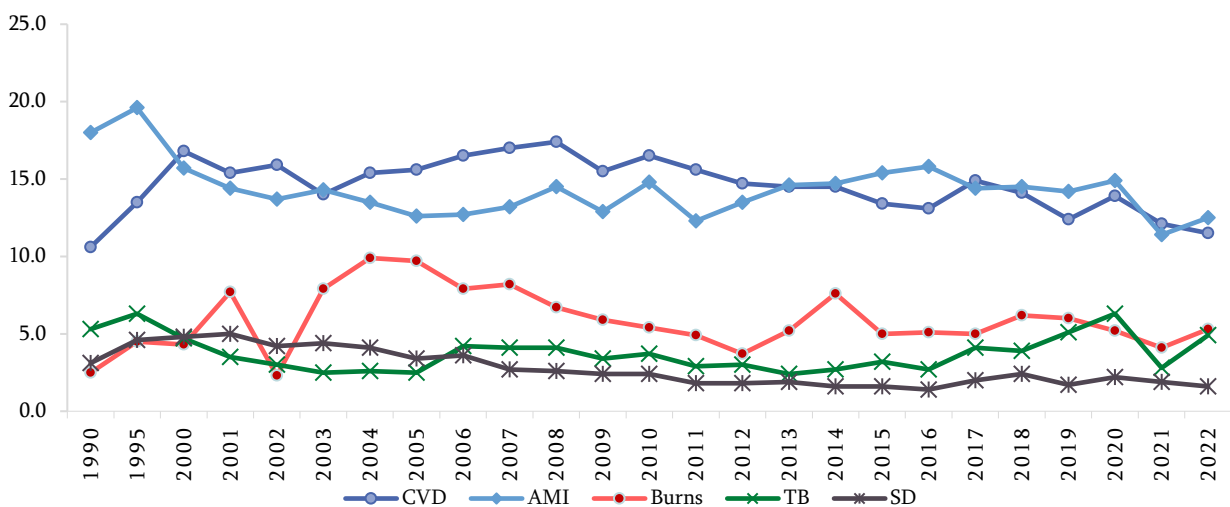
Source: NCHSR, 2022

If we consider the in-hospital mortality by concrete diseases (Figure 15.), it is possible to come to the conclusions given below:

As it can be seen, in 2008-2015 there was trend of decrease in mortality, caused by CVD; in 2017 there was a growth of this , which was followed by a new decrease;

In 2014, a sharp increase in in-hospital mortality from burns was fixed, which reduced up to 2021, but in 2022 another growth of this was registered;

In 2017 and 2020 a growth of mortality caused by tuberculosis was registered; in 2021 it decreased, but grew up in 2022;

During 2016 the in-hospital mortality caused by sugar diabetes decreased, but in 2018 a slight increased was registered, after which there was a decreasing trend.

CHAPTER 3

TRENDS IN MATERNAL AND CHILD HEALTHCARE RATES

The chapter, dedicated to the trends and main issues of mother and child healthcare rates, was prepared by analyzing and evaluating the trends of the last decades. The situation analysis was conducted by means of official publications of the RA MoH NIH NCHSR and RA Statistical Committe (SC) (statistical yearbooks, demographic surveys, thematic reports and information bulletins), as well as in the reports of sample surveys carried out in households and/or health facilities (Demographic and Health Surveys: 2000, 2005, 2010 and 2015-2016, and others) available data on the health and health rates of children and women, their trend assessment and international comparisons based on their comparisons with the relevant data.

This chapter provides the evaluation of the current situation in the child/adolescent and maternal health care, developments of last years and the recorded progress, as well as the highlight of existing problems and challenges and outline of the strategic directions to overcome them.

The assessment is based on the analysis of the current situation of the main rates characterizing the mother and child health, as well as systemic problems in the context of the functions of the healthcare system.

Maintaining the health of mothers and children is important for every family and the whole society, because their health status significantly determines the future well-being of the society, guaranteeing sustainable economic and social development, and investments made in the field of child and maternal health are considered to be aimed at a prosperous future.

In recent decades, the issues related to the well-being of mothers and children have always been in the focus of attention of the world's progressive community. And this is no accident. The well-being of society depends largely on the health and well-being of mothers and children. In the real world, unfortunately, many mothers and children suffer and die from preventable diseases and hunger. Each year 7 million children die before reaching the age of 18, and 1 million of them in adolescence. 5 million children die before becoming 5 years old, and 3.8 millions of them during the first year of their life, 2.4 millions die during the first month. 295.000 women die because of the problems, related to their pregnancy and birthgiving, and 2 million neonate infants are born dead. And it is despite the fact that nearly 70% of those deaths are considered preventable (Source: UNICEF, Every Child Alive, 2017, Levels and trends in child mortality, United Nations Inter-Agency Group for Child Mortality Estimation (UN IGME), Report 2022, December).

Taking into account the above, a number of strategies and programs aimed at reducing child and maternal mortality, improving the health and well-being of women and children have been reviewed and developed by UN member countries and agencies, international and donor organizations.

In September 2015, during the UN summit, the leaders of 150 countries of the world adopted the "Sustainable Development Agenda 2030" declaration, which involves overcoming 17 global goals

aimed at eradicating poverty and increasing the well-being of the population in the world. The 3rd goal of sustainable development refers to improving the health and well-being of the population.

Today, the whole world is called upon fulfilling Sustainable Development Goals (SDGs), including achieving the decrease of maternal and child mortality, which implies that by 2030 the mortality of childrenof the age below 5 years should not exceed 25‰, including infant mortality no more than 12‰, and maternal mortality should be less than 75/100,000 . It is also pointed out that each country, out of its own starting data, should define its SDG national targets.

Armenia, as a member country of the Orgnization of United Nations, joined this call of the world community and set up the priority of ensuring children's well being and health at the national level. The issues related to maternal and children health are reflected in the RA legislation, strategic and other program documents. In particular, in the activity programs of the RA government for the last decade, special emphasis was placed on improving reproductive health, mother and child health care and early childhood issues.

The mother and child health preservation is considered a priority sphere in the healthcare development strategy for 2023-2026, adopted by Decision N174-L of the RA Government of February 9, 2023. As for the action plan aimed at implementing thestrategy, it envisages targeted actions at maintaining moternal and reproduction health, improving the quality and availability of healthcare services provided to children and adoscents, and defines expected results and targeted indexes. In the 2023-2026 development strategy of the healthcare system of the Republic of Armenia, approved by the decision of the Government of the Republic of Armenia N174-L of February 9, 2023, the protection of maternal and child health is considered as a priority area, and the action plan for the implementation of the strategy provides for the protection of maternal and reproductive health, children and targeted measures to improve the quality and accessibility of health services for adolescents, expected results and target rates are defined.

The data of the Statistical Committee of the Republic of Armenia prove that Armenia is in a situation of demographic crisis. In particular, there is an unprecedentedly low birth , an index that does not even provide simple reproduction of the total fertility rate, a continuous reduction in the number of children, an increasing trend of population aging.

Sex-age composition of the population

According to the RA Statistical Committe,[1] the permanent population of Armenia by January 1, 2023, was 2,977.1 thousand. (in 1990 it was 3 514.9 thousand), 47% of which were men and 53% were women.

In 2022, within the stucture of RA permanent population, nearly 596. 600 were children of the age below 15, which made 20% (30.5% in 1990), including 182.500 of 0-5 y/o children (6.1%) and 126.900 children of 15-17 years age group (4.3%). The number of children of the age below 15 reduced by 1/3, compared to the year of 2000 (824.500 children). 27% of children live in the capital city and 22% of children are residents of rural areas.

In the recent years, the number of women of reproductive age (15-49) has been continuously decreasing (770.500 in 2016; 760.900 in 2017; 756.600 in 2018; 745.100 in 2020 and 744.100 in 2023), but as for the 0-18 y/o children, there is still a trend of growth in their number: with exceeding 40-60 thousand of boys each year.

Table 3. Number of children below 18, 2018-2023

By the beginning of the year	The number of children below 18 (people)		
	Boys	Girls	Total
01.01.2018	371883	327022	698905
01.01.2020	378030	329787	707817
01.01.2021	379781	342290	722071
01.01.2022	386912	335880	722792
01.01.2023	377200	346800	723500

In the recent decades, the age composition of the RA population has displayed a continuous trand of aging.[2] In 2022, the share of the 65+ age group in Armenia was 13% of the whole population, and the aging index[3] was 98.2. The latter increased 2.4 times, compared with 41.4 of 1996.

 The aging ratio represents the number of people aged 60 and over per 100 people aged under 15. https://www.armstat.am/file/article/demog_2022_2.pdf

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[1] Women and men of Armenia.2023, RA SC https://www.armstat.am/file/article/gender-2023.pdf

[2] According to the demographic aging scale defined by the United Nations, if the share of the population aged 65 and above in the structure of the country's population exceeds 7%, then the given population is considered aging.

[3] The aging ratio represents the number of people aged 60 and over per 100 people aged under 15. https://www.armstat.am/file/article/demog_2022_2.pdf

Figure 16. Demographic pyramid of Armenia*, 1990 and 2023
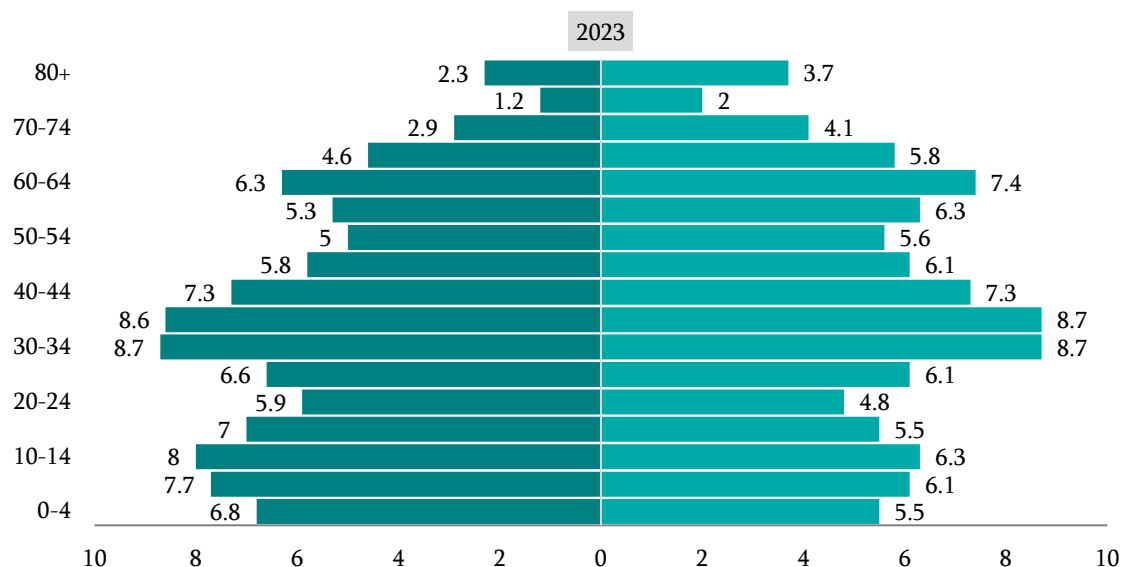
* In 1950, the share of children of the age below 15 was 33% of the whole population, and the sahe of the age group of 60 and above was 16.1%. According to the demographic predictions, this picture will sharply change in 2025: there will be 30% of age people and only 12% of infant population. In other words, the base of this pyramid will get narrower, it will turn upside down.

2. Life expectancy from the moment of birth[4]

Compared to 1990 (70.7 years), the average life expectancy has increased by nearly 4 years: in 2022 it was 75.1 years, including in case of women it was 78.3 (compared to 73.4 years in 1990: increase by 4.9 years), and in case of men it was 71.4 years (compared to 67.9 years in 1990: increase by 3.5 years.)

Table 4. Average life expectancy calculated from the moment of birth

Years	Total population			Urban			Rural		
	Men and women	Men	Women	Men and women	Men	Women	Men and women	Men	Women
2018	75.9	72.4	79	76.1	72.5	79.2	75.4	72	78.6
2019	76.5	73.1	79.5	76.7	73.2	79.7	76	72.7	79.1
2020	73.5	68.4	78.6	72.9	67.2	78.7	74.3	70.0	78.5
2021	72.4	67.4	77.4	71.6	66.1	73.1	73.7	69.5	78.0
2022	75.1	71.4	78.3	74.9	71.2	78.1	75.3	71.7	78.7

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[4] Demographic Survey of Armenia, 2023թ. https://www.armstat.am/file/doc/99541178.pdf

Basically, on average, women live about 7 years older than men. live longer. The average life expectancy from birth in rural areas is 0.5 years longer for both men and women compared to the urban population.

3. Trends in birth rate and natural growth rate

Crude birth ratio (CBR) is the ratio of live births and the average annual of permanent population per 1,000 people. According the WHO classification, the crude birth is evaluated by the following range:

 < 15‰ low level, 15- 25‰ medium level, > 25 ‰ – high level.

By this classification, in the period of 1990-2020 Armenia left the list of countries with medium level of birth for the list with low level (22.5‰ in 1990, 10.6‰ in 2000, 13.8‰ in 2010, 13.9‰ in 2015, 12.3‰ in 2020, 12.4‰ in 2022.) In the range the lowest birth level was registered in 2001 (10‰). During the years after, the highest birth was in 2015(13.9‰), after which the level decreased, reaching 12.2 ‰ in 2019. The started to slightly grow after 2020, reaching 12.4‰ in 2022.

Figure 17. Trends in the demographic rates,*
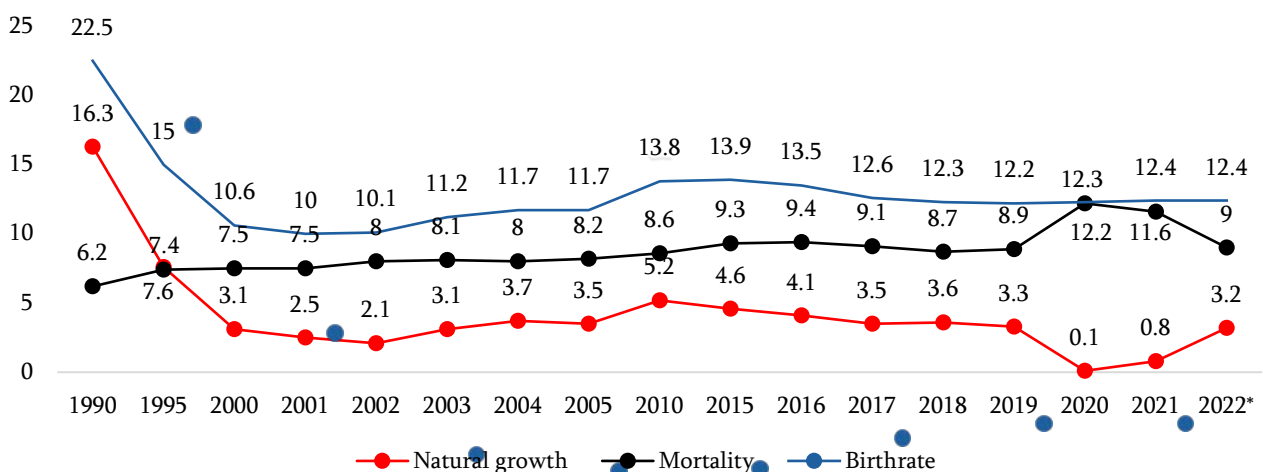
 * *Per 1000 population*

According to the data given by the RA SC,[5] the number of live births decreased more than 2 times in 2022 compared to 1990 (36 375 against 79 882). The minimum number of live births was recorded in 2001-2002: about 32,000 babies per year, which will enter active reproductive age starting from 2025-26. Unfortunately, the main share of war-related losses fell on boys born in these years.

According to the source, during 2016-2017 the downfall of the number of neonate children -2277, in 2017-2018 it was -1126, and in 2018-2019 it was only -533.

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[5] Population statistics, Yearbooks, ՀՀ ՎՎ, https://www.armstat.am/file/doc/99541178.pdf

The trends of recent years are encouraging. According to the SC,[6] for the first time the growth of births was registered in 2020: 36448 children were born, which is more than in the same period of the previous year by 407. In 2021 the number of births increased again by 270. The most pleasing fact is that in 2015-2021 the specific share of the third and more children by the order of birth grew up twice as much in the whole number of births (16.6% in 2015, 33% in 2021.)[7]

1) *Trends in the natural growth*

According to the data pulished by RA Statistical Committee,[8] in the years following 1990, there was a constant decrease of the birth, reaching almost half of that in 2022. During the same period of time the natural growth (difference between the births and deaths per 1000 population) decreased almost 5 times: in 2022 it was 3.2‰ compared to 16.3‰ in 1990). In 2020 and 2021 the natural growth significantly reduced (0.1‰ and 0.8‰, respectively) due to the unpecedented increase in the losses and mortality rates caused by the Covid and the war. In 2022 the grew up to some extent: 3.2‰.

According to the pre-war forecasts of UN Population Fund experts, if the current trends of birth and natural growth decline are preserved, in 2050 only 31,000 births will be recorded. Even this prediction seems unrealistic from the view of the current demographic situation.

Age-specific fertility rates define the average fertility of women in each age group. The age-specific birth is the number of live births among women of a given age group, calculated per 1000 women of the same age.

Figure 18. Age-specific fertility rates, **2000-2021**
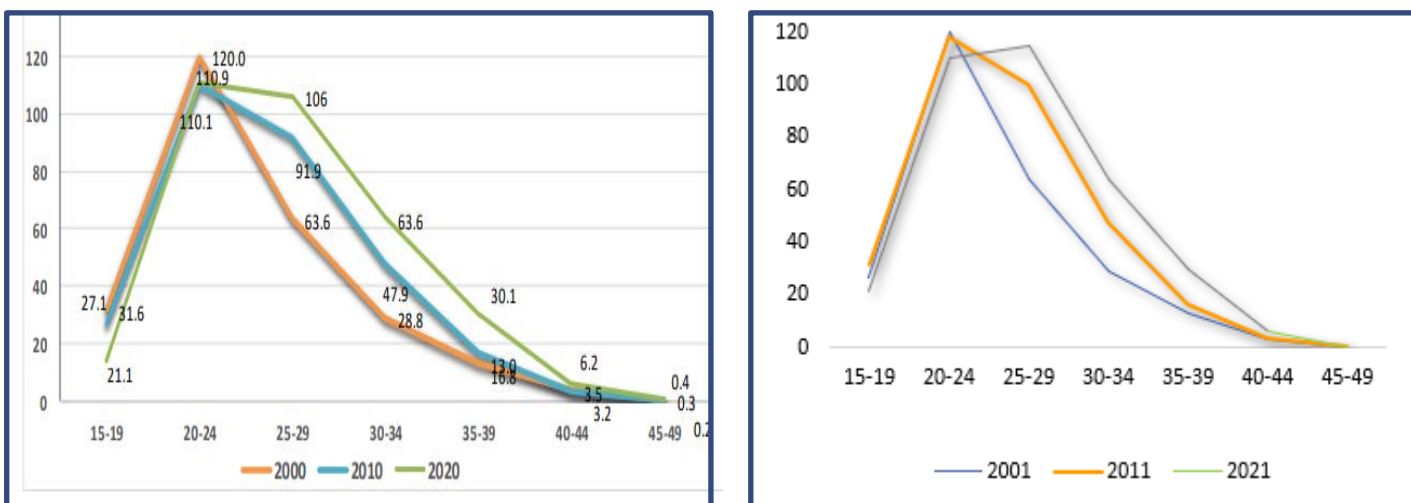
[6] «SOCIO-ECONOMIC SITUATION OF THE REPUBLIC OF ARMENIA in 2022. JANUARY-DECEMBER», https://www.armstat.am/file/article/sv_12_22a_510.pdf

[7] Demographic handbook of Armenia, 2022, RA SC, December, 2022, https://www.armstat.am/am/?nid=82&id=2535

[8] RA Statistical Committee, Publications by years: https://www.armstat.am/am/?nid=82

According to the last available data by the RA SC,[9] in the period of 2000-2021 the highest birth from the 20-24 years age group moved to the 25-29 year age group, which proves the fact that young people young people are postponing marriage, and therefore delaying the time to have their first child. (Figure 18.)

Figure 19. The average age of maternity, 2011-2021
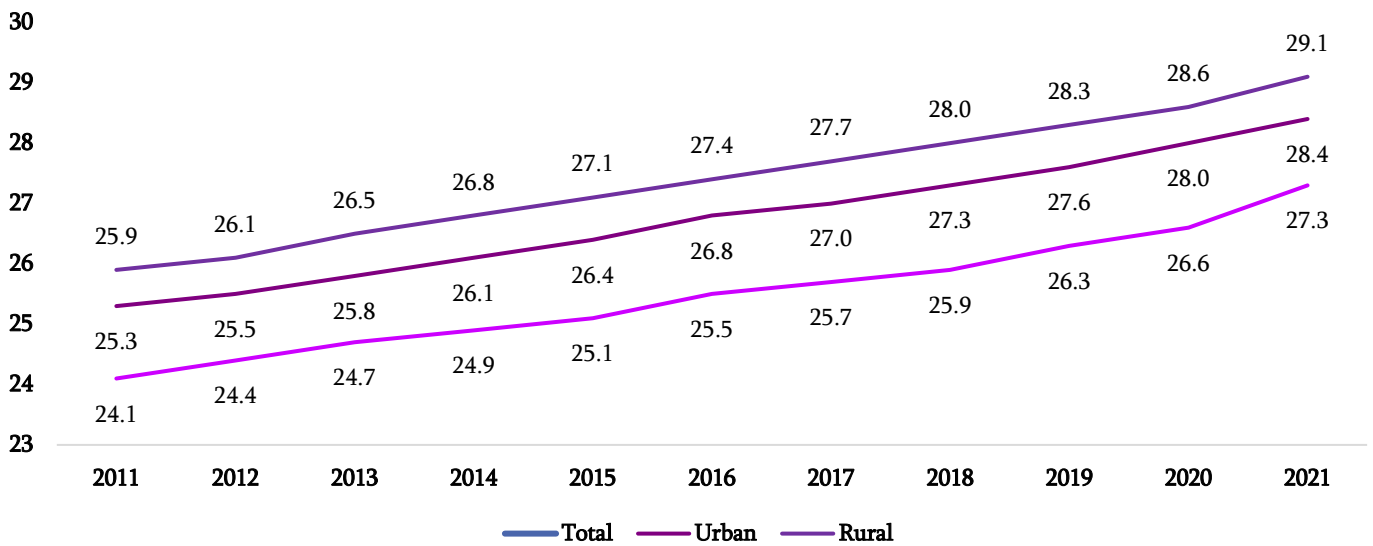
This trend is reflected in the given ages of both the marriages (boys: 28 years in 2000, 32.4 years in 2021; girls: 23.6 years in 2000, 28.5 years in 2020) and motherhood (24.4 years in 2000, 28.4 years in 2020). Basically, during 2000-2021, these s increased on average by 4-5 years on average. There is also a difference between villages and cities: young people from villages get married and become mothers 1-2 years earlier than urban residents.

Total fertility (TFR). TFR defines the average number of children that one woman will have during her reproductive age, if the birth level of the given year remains. It shows the average number of children per one woman.

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[9] Demographic handbook of Armenia – 2022, Part 6, https://www.armstat.am/file/article/demog_2022_6.pdf

Figure 20. Total fertility rate, 2011-2021
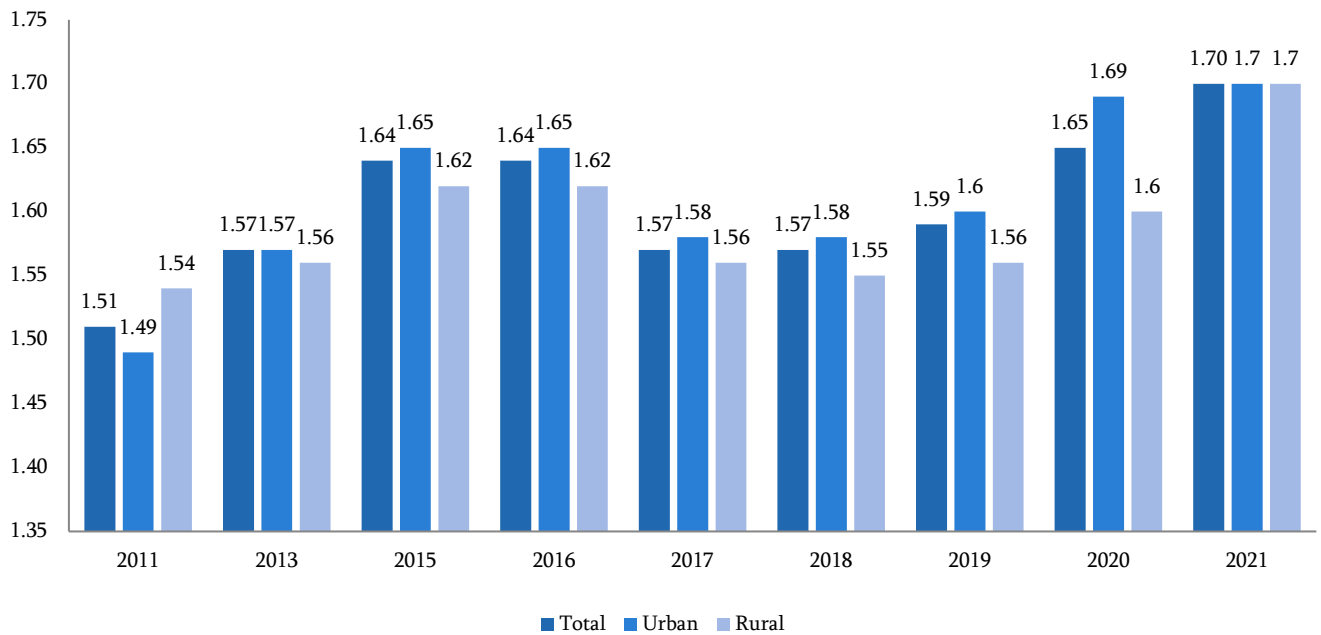
According to publications of the RA SC,[10] in the years after 1990, the TFR had a swift downfall, which is more obvious in village/town structure: in the rural places of residence that downfall was higher than in towns. In the last 10 years the TFR remains within the same range (1.6-1.7), which does not guarantee even a level, necessary for a simple reproduction (2.1): in 1990 it was 2.6. In 2022 a slight improvement of the was registered (1.74). It is necessary to note that TFR for urban population was 1.71, less than 2.12 for rural population. The presented information shows that the reproduction process in Armenia is getting narrower, which indicates a deepening demographic crisis.

In the conditions of the presented developments of the demographic trends, the issues of promoting birth, improving reproductive health, overcoming infertility, protecting mother and child health are becoming more important at the national level.

4. Healthcare factors affecting fertility

The influence of the healthcare system on the demographic situation and birth rates is indirect, mediated. By implementation of programs aimed at improving reproductive health, including adolescent health, reducing losses due to perinatal causes, decreasing selective abortions, and overcome infertility, it is possible to partially restore the reserve of "unborn" children, which will an ultimately positive effect on the birth .

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[10] Demographic Handbook of Armenia – 2022, Part 3, https://www.armstat.am/file/article/demog_2022_3.pdf

In terms of improving the demographic situation, the impact of the health system and future developments in this direction should be based on the principle of enhancing the health of a person throughout the "lifelong cycle."It starts with improving adolescent reproductive health, includes preservation of the healthy reproductive potential of young people (family planning, preventing unwanted pregnancies and abortions, reducing sexually transmitted infections, etc.), including prevention and overcoming of infertility, and then ensuring healthy and safe motherhood (proper prenatal care), surveillance and early detection and effective management of pathologies and safe delivery with reduction of perinatal losses), followed by the birth of a healthy baby, effective management of sick and premature babies with reduced infant mortality and continues with healthy growth and development of the child until adolescence.

Thus, in terms of improving the demographic situation, the following health program measures can positively affect the birth :

1. Improving adolescent health, including reproductive health;

2. Providing the adolescent health, including premarital screening and preconception care for reproductive couples;

3. Preventing artificial interruptions of pregnancy, including selective abortions;

4. Increasing the availability and quality of prenatal care and management services, including expanding prenatal diagnostic screenings, early detection of pregnancy and fetal pathologies, and reducing prenatal losses (miscarriages, stillbirths, etc.);

5. Ensuring safe birth care, including strengthening emergency and outpatient obstetric services;

6. Strengthening the neonatal servies, improving the treatment and care of premature, low birth weight and sick infants, and as a result, reducing the mortality/morbidity rates among neonate infants;

7. Research of the etiology and treatment of infertile couples, including the medical aid with the use of assisted reproductive technologies, increasing accessibility and enlarging the amounts of relevant services.

5. Disproportion of children's sexes at birth

The problem of disproportion of sexes at birth and selective abortion is a global challenge for all countries of the world. In Armenia the SBR of such disproportion in favor of boys is one of the highest in the world. There all three preconditions for interruption of pregnancy caused by sex in the country:

- Precondition 1. The Armenian society prefers more boys and girls,
- Precondition 2. Invasive and non-invasive technologies are available in the country, which allow expectant parents to know the sex of the child in advance and avoid the birth of unwanted girl children,
- Precondition 3. A continuous decline in the birth is recorded; couples prefer to have fewer children.

The natural ratio of sexes at birth (NRSB) equals 100:104-106 girls/boys at birth. By the data of RA Statistical Committee (RA SC), the natural ratio of sexes at birth started declining after 1990, and in 2000's it was 120 neonate boys against 100 neonate girls. The ratio stabilized on early 2010's at the level of 100:114 girls/ boys. The ratio of sexes at birth in 2012, the year before the national program preventing the gender-boased sex selection (GBSS), was 100:115.

According to the last SC publication,[11] a significant decreasing trend of SRB was registered after 2012 (100:113 in 2013, 100:113.4 in 2014, 100:112.7 in 2015, 100:111.9 in 2016, 100/109.8 in 2017).

Table 5. Sex ratio at birth, SRB, 2012-2022

Year	Girls	Boys	Ratio of sexes since the moment of birth
2012	19737	22743	1.15
2013	19638	22152	1.13
2014	20162	22869	1.13
2015	19630	22133	1.13
2016	19147	21445	1.12
2017	17969	19731	1.10
2018	17322	19252	1.11
2019	17128	18913	1.10
2020	17299	19054	1.10
2021	17566	19057	1.08
2022	17139	19236	1.12

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[11] Men and women of Armenia - 2023, Armstat (TA statistical committee) https://www.armstat.am/file/article/gender-2023.pdf

In 2018, against the background of reducing program actions against GBSS, a growth of the ratio (100:111.9). During the following three years, the SBR continued decreasing: 100:110.4 in 2019, 100:110.0 in 2020 and 100:108.8 in 2021, getting closer to the natural ratio. Unfortunately, in 2022 the SBR returned to the level of 2018 (100:111.9).

According to the same source, the gender disproportion of neonates in Armenia varies according to the birth order of the child. For instance, as for the neonates in 2010, the ratio of sexes at birth in case of the first child was 100:106, in case of the second child it was 100:110, and the ratios 100:169 and 100:165 in the cases of the third child and the fourth child, respectively. It was the highest ratio, registered in the world ever.

Table 6. Infant sex ratio by birth order, 2010-2022

Year	First	Second	Third	Fourth
2010	1.06	1.10	1.69	1.65
2011	1.07	1.10	1.58	1.68
2012	1.07	1.11	1.60	1.53
2013	1.06	1.09	1.50	1.57
2014	1.07	1.08	1.46	1.57
2015	1.06	1.08	1.43	1.41
2016	1.09	1.07	1.31	1.36
2017	1.07	1.03	1.30	1.27
2018	1.04	1.05	1.40	1.32
2019	1.04	1.07	1.27	1.26
2020	1.07	1.03	1.25	1.33
2021	1.03	1.03	1.21	1.29
2022	1.06	1.08	1.23	1.27

According to the data of 2022, the infant sex ratios by birth order in the case of the first baby was 100:106, second baby: 100:108. And third and fourth babies 100:123 and 100:127, respectively.

The presented data prove that in the recent decade the ISR index by the birth order has improved in almost all groups. Moreoever, in the case of the first and second baby, the ratio is almost relevant to the average statistical naturally defined proportion, providing the evidence of the lack of gender predetermination and selective abortions in the case of the first and second babies in Armenia, which poses a serious problem for many other countries. In our country the fetal sex-related discrimination begins from the third child. Nevertheless, in this case there is a positive dynamics in the infant sex ratio index (100:169 in 2010, compared to 100:123 in 2022,). And despite reducing the gender disparity of neonates by 46 points, it still remains an agenda issue for Armenia.

Disparity in the genders of neonates in Armenia varies in marzes. According to the average data of RA SC,[12] in 2019-2021 the ISR index varied in the range from 100:107 to 100:117. It is the lowest and nearest to the natural ratio in Syunik and Lori. The highest ratio of neonate male children is in Gegharkunik (100:117), Aragatsotn and Armavir (100:113).

Table 7. Gender ratio of neonates in Yerevan and RA marzes, 2019-2021

	2019	2020	2021	2019-2021
RA	1.10	1.10	1.08	1.10
Yerevan	1.09	1.09	1.07	1.08
Aragatsotn	1.24	1.09	1.08	1.13
Ararat	1.13	1.18	1.08	1.13
Armavir	1.07	1.12	1.13	1.10
Gegharkunik	1.29	1.15	1.06	1.17
Lori	1.03	1.04	1.13	1.07
Kotayk	1.07	1.09	1.08	1.08
Shirak	1.06	1.11	1.12	1.09
Syunik	1.02	1.08	1.10	1.07
Vayots Dzor	1.16	1.04	1.06	1.09
Tavush	1.15	1.09	1.09	1.11

Thus, although compared to 2010 the ISR index decreased by more than 1/3, (100:115 in 2010, 100:108.8 in 2021), it still exceeds significantly the natural ratio, which poses a potential danger in terms of breaking the demographic balance in the future. Moreover, a serious decrease of the ISR index (100:111.8) was recorded in 2022.

MATERNAL HEALTH

1. Antenatal control of pregnancy, trends in rates

1) The data of the RA NIH National Center of Healthcare Statistics and Research related to the antenatal control of pregnancy[13] prove that there have been positive developments in the recent years. In particular, if in 2000-2005 in the interval, the of early registration of pregnant women (up to 12 weeks) did not exceed 45% (2000: 43.1%, 2005: 43.7%), then in 2008 after the introduction of the State Certificate of Maternity Assistance (hereinafter referred to as the Certificate), this indicator has continuously increased due to the

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[12] Demographic handbook of Armenia - 2022, RA Statistical Committee, 2023. https://www.armstat.am/file/article/demog_2022_3.pdf

[13] RA MoH NIH. Health and Health Care. Statistical Yearbook, Armenia 2023, https://nih.am/assets/pdf/atvk/2d5537b6227666a32f97571d7dd15420.pdf

significant improvement in the availability of this service and the introduction of mechanisms that facilitate the registration of pregnant women (in order to receive the Certificate at the 22nd week of pregnancy, a pregnant woman had to pass all examinations for prenatal control before that period and screenings, for which the earliest possible registration with a doctor was a necessary prerequisite).

2) In 2010 this exceeded 60%, and in the years to follow grew up: 66.5 in 2015, 75,8 in 2020 and 76.8 in 2022.

3) The improvement of rates of the antenatal control of pregnant women is proved by the results of the Survey of demographic and health issues of Armenia, conducted in 2015. According to the results of the given survey, nearly 100% of women in Armenia in the antenatal period receive professional aid and care. Such services are a little more accessible in towns (97.8%), than in villages (93.6%). 96% of women made at least four prenatal visits. 60% of women the first antenatal visits made in the first three months of their pregnancy (48.2 % in 2005), and 80% during the first four months of pregnancy.

Figure 21. Antenatal care of pregnant women according to well-being
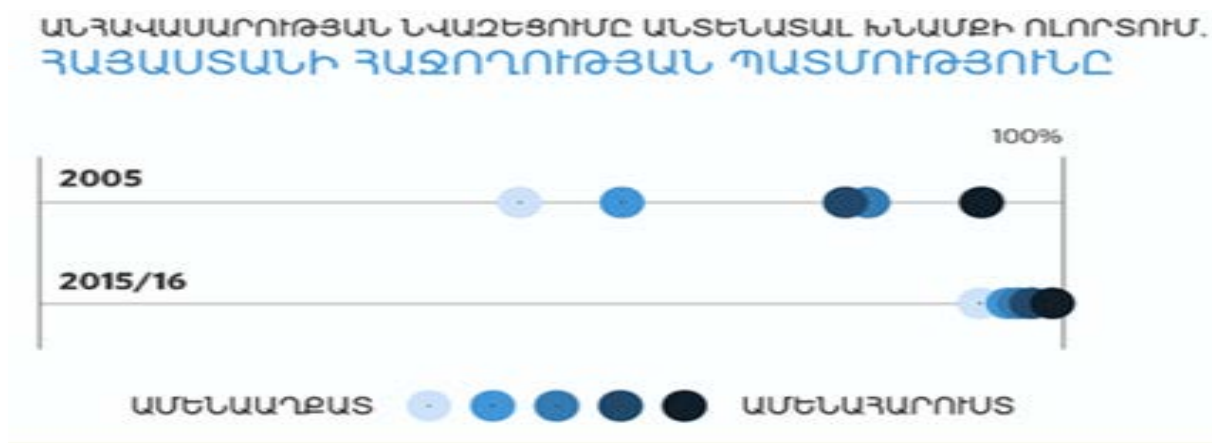
4) Availability and accessibility of the prenatal care for pregnant women is also documented by the UN Population Fund in its annual report "The State of World Population 2017,"[14] where the successful experience of Armenia is presented. In particular, as it is given in that report, if in 2005 the rates of the prenatal monitoring of pregnant women by the level of family well-being were significantly different (in the poorest and the richest households its was almost twice as much), then in 2015-2016 the difference almost disappeared.

5) Particularly impressive have been the positive development of the recent years. As a result of HIV/AIDS and antenatal care services, as well as the integd system for the prevention of mother-to-child transmission of HIV, more than 95% of pregnant women are tested for HIV. In 2016 the World Health Organization recognized Armenia as one of four countries

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[14] The State of World Population 2017, Report, UNFPA
https://www.un.org/ru/development/surveys/docs/population2017_en.pdf

of the world and one of the first countries in Europe, where the fact of elimination of mother-to-child transmission of HIV was registered and the countries was awarded by a special certificate. WHO in 2018 officially confirmed that Armenia preserved the rates confirming elimination of mother-to-child HIV transmission in 2016-17.

6) Despite the recorded positive trends, a number of issues remain on the agenda. Limited volumes of prenatal screenings, particularly non-invasive screenings and limited opportunities for research using expensive and complex technologies, often lead to late diagnosis of maternal diseases and pregnancy complications or fetal intrauterine pathologies, and sometimes to omissions with irreversible consequences. During pregnancy, tests on sexually transmitted diseases are carried out in limited volumes (HIV, syphilis, gonorrhea and trichomoniasis), other sexually transmitted diseases are tested only in case of medically indicated. According the RA MoH NIH data,[15] the of miscarriages, spontaneous and medically indicated pregnancy terminations shows a continuous upward trend (2.8% in 2005, 4.7% in 2010, 5.6% in 2015, 6.2% in 2018, 7% in 2022), which may indicate a woman's chronic infections, congenital or acquired thrombophilias, and/or diseases incompatible with pregnancy. 59.2% of women, who finished pregnancy in 2022, had diseases before pregnancy or in the period of pregnancy: among the top three ones anemia (17.1%), diseases of the genitourinary system (12.2%), and venous complications (9.4%).

7) Thus, from the point of view of ensuring the best pregnancy outcomes and reducing prenatal losses, the upcoming actions should be aimed at strengthening the capacity and performance of prenatal care services for pregnant women, as a result, early detection of maternal and fetal pathologies and prevention of complications.

8) Furthermore, preventive measures should be started before conception, and reproductive health status checks before marriage. All this will require targeted program measures and, of course, adequate financial resources.

Childbirth and caesarean sections

1) According to the DHS-2015, almost all women in Armenia (99.7%) give birth in medical institutions, and 96% of them under the doctor control. Only 0.2% of women give birth at home, which in comparison with 9% in 2000, is 45 times less. The proportion of births attended by a doctor or midwife/nurse has also improved. In 2000 it was 83% and 14%, and in 2015 it was 96.4 and 3.4%, respectively.

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[15] «Health and Health Care» Statistical bulletin, 2023. RA MoH NIH.

2) According to the RA MoH National center for healthcare statistics and reseacrh (NCHSR), the number of women who finished the pregnancy in 2022 was 37436, 87% of whom gave birth in time, and 6% were premature births. During the recent three years these s have been preserved at the same level, varying only within 0.9-1.2 percentage points. According to the same source, nearly 52% of women had birth and/or postpartum complications, among which bleeding (1.7%), birth giving practices (10.2%), anemia (15%), venous complications (4.5%), diseases of the genitourinary system (4.4%). It is necessary to point out that compared with the previous year all mentioned rates worsened. A slight improvement of the situation was registered in terms of pre-eclampsia and eclampsia rates, which was 1.38% in 2022 against 1.51% in 2021.

3) One of the problematic issues on the agenda in maternity care is the progressively increasing of caesarean sections, which compared to 1990 grew up more than tenfold (7.2% in 2000, 11.2% in 2005, 15% in 2008, 18.9% in 2010, 27.2% in 2015, 35.9% in 2020, 38,5% in 2022.) The difference in percentages of caesarean sections between Yerevan and marzes and by maternity hospitals is quite great (34,4% against 21.7%, respectively). In maternity hospitals of 3rd level, the percentage is more than 40%, and in some maternity hospitals it is more than 50%.

Figure 22. The trends in the caesarean sections, %, 1990-2022
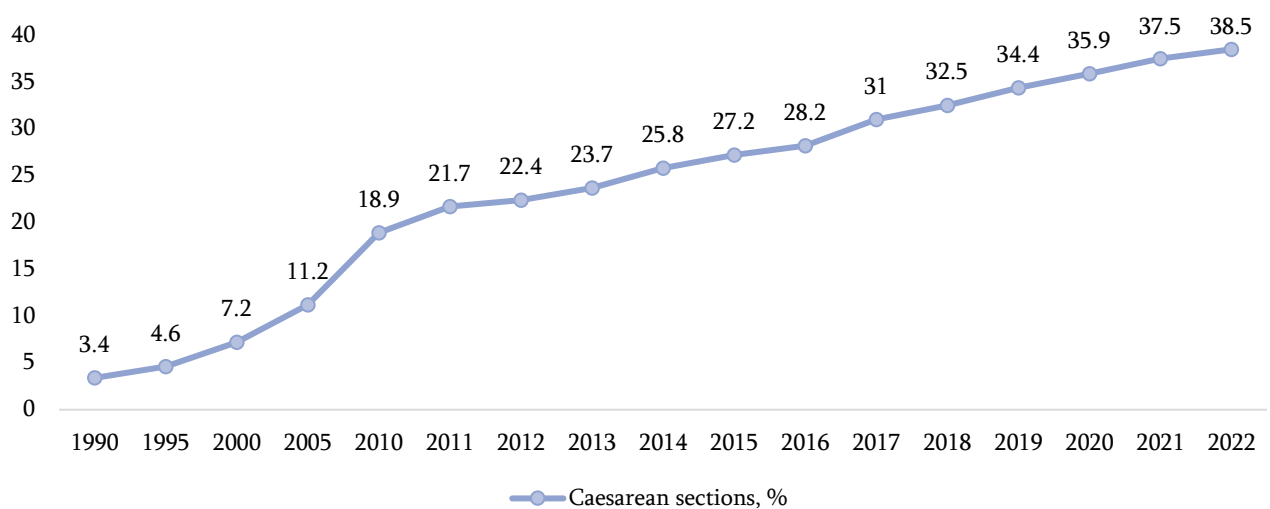
4) According to the data given in annual reports of the RA MoH NIH,[16] the growth of caeserean sections is accelerating as the number of births decreases. The analysis of trends in caesarean sections by maternity hospitals, shows that the increase in such ratios in those maternity hospitals is greater where the total number of births decreases more than in others.

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[16] RA MoH NIH. Health and healthcare. Statistical Yearbook, Armenia 2023
https://nih.am/assets/pdf/atvk/2d5537b6227666a32f97571d7dd15420.pdf

5) The increasing of caesarean sections is a global problem in many countries of the world. It is also one of the WHO agenda issues. In Armenia, as in many other countries, this problem has both objective and subjective reasons. The main objective reasons are listed below:
   - developing and applying medical technologies in obstetrics practice, thanks to which the possibilities of diagnosing pathologies in the fetus and pregnant woman have increased, critical conditions detected in time are often direct indications for caeserean section for the life of the mother or fetus (internal and external bleeding during pregnancy and childbirth, *placenta previa*, fetal distress syndrome, other), and therefore require caeserean delivery:
   - increasing in the prevalence of certain pathological conditions, including some severe extragenital and obstetric pathologies, which often require caeserean delivery;
   - increasing rates of infection among pregnant women with HIV/AIDS, hepatitis B and C and other perinatal infections, in which caesarean sections are also performed;
   - overcoming infertility with the use of assisted reproductive technologies, in which there are usually primiparous women at risk, also with indications for caesarean section;
   - introducing a new definition of the perinatal period from 2006, when birth was considered to be the end of pregnancy from 22 weeks, with these preterm births often require caeserean delivery;
   - constantly increasing of the number of those women with the history of one or more caesarean sections, followed by incompleteness of the uterine scar, which is also an indication for caeserean delivery.
6) Individual subjective factors also contribute to the increase in caeserean births: relative indication, performing caeserean sections with insufficient justification to avoid additional risks, performing caeserean sections, sometimes in the absence of an indication, by the woman's desire and/or insistence, etc;
7) The existence of a financial compensation mechanism with differentiated and higher prices also significantly contributes to the increase of caeserean sections, as a result of which both the medical institution and the doctor are motivated to give birth to the woman by caeserean section;
8) Solving this problem requires a more in-depth study of the situation and the development of measures aimed at overcoming the main causes. An example could be development of a new mechanism for compensation for caesarean sections and remuneration of health workers, or the introduction of a system of monitoring and analysis of individual cases, with assessment of validity and subsequent consequences.

3. Maternal mortality

Maternal mortality is defined as the death of a woman, regardless of gestational age, that occurred during pregnancy or within 42 days after its termination, from any cause related to pregnancy, complicated by the presence or management of the latter, except for accidental or sudden causes.

3.1 Trends of the maternity mortality

Maternal mortality is the number of women who died during pregnancy, childbirth or 42 days after birth in a given year, calculated per 100,000 live births.

According to the RA NIH HsandRN center, it was highest in 2000 (52.5/100,000), and in 2010-202 the flutuated within the range of 6.8-33.3/100,000. According to RA SC, the highest unprecedented of maternal mortality was registered in 2021 (16 cases), nine of which were related to Covid-19, and in 2022 eight cases of maternal mortality were registered (22/100,000). The fluctuations of the annual maternal mortality rate (MMR) in Armenia are significant due to the country's small population. According to the data of the National Academy of Sciences of RA, it was the highest in 2000, making 52.5/100,000, and in 2010-2020. during the period, the indicator varied between 6.8-33.3/100,000. According to the data of RA VC, in 2021 an unprecedentedly high number of maternal deaths was recorded: 16 cases, of which 9 were associated with Covid-19, and in 2022. 8 cases of maternal mortality were recorded with an index of 22/100,000.

Figure 23. Trends of the annual maternal mortality rate, %, in 2000-2022 by100,000 live births)
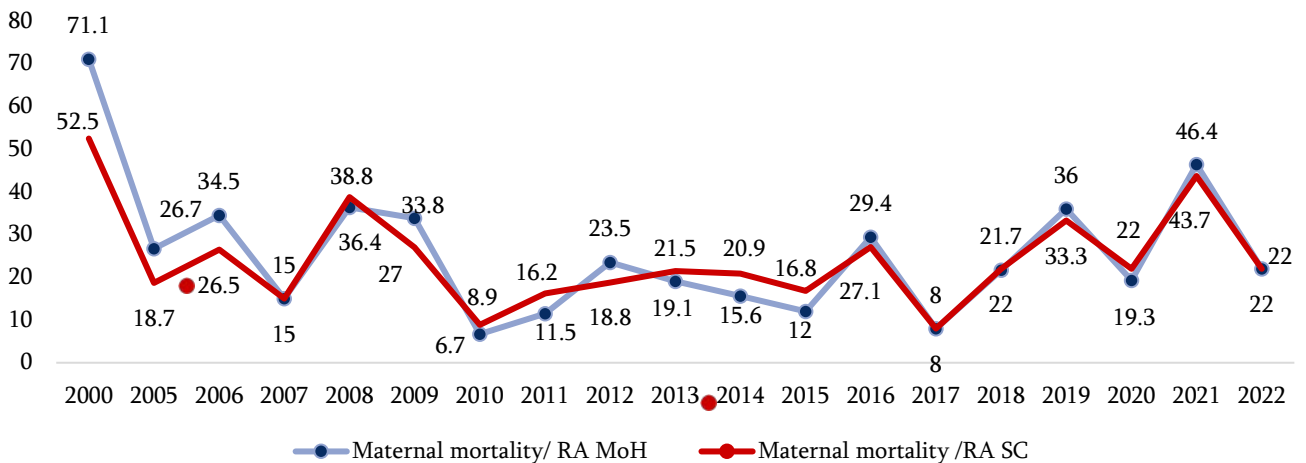
Assessing the trends of the RA maternal mortality rate, we are guided by the WHO instruction, according to which in case of the population less than 5 million, the analysis and assessment shall be given by average three year data.

According to the RA MoH operatively collected data, the maternal mortality average three-year rate for 2000 was 40.3. Up to 2014, the rate significantly decreased (2011-2013: 16.5/100,000), however it grew up by 5.3 in the following six years (2017-2019: 21.8/100,000). In 2020-2022 the average three year rate was unprecedentally high (29.3/100,000). 15 of 32 cases of those years were caused by Covid.

Figure 24. Trends of the maternal average three year mortality rate, 2000-22 (by 100,000 live births)
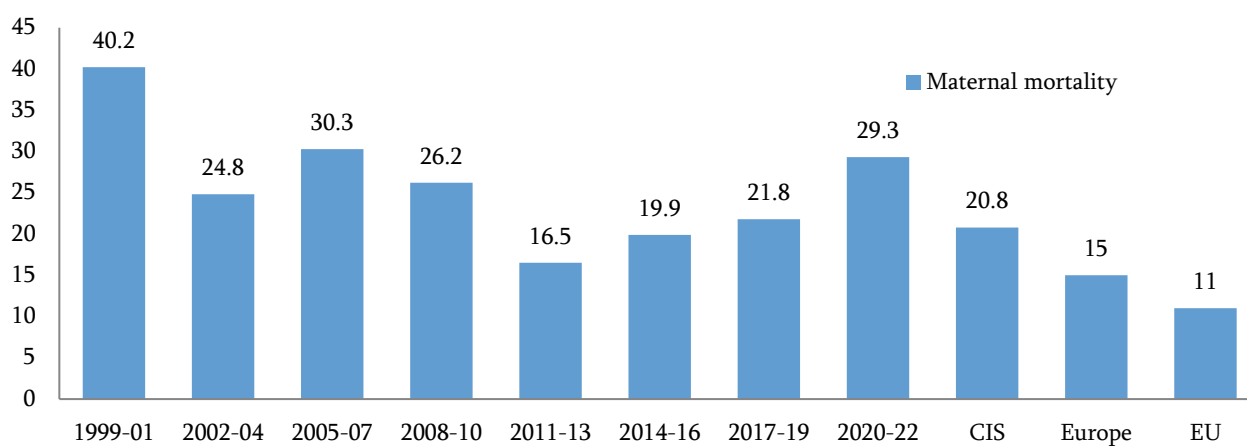
Thus, the presented data prove that during 15 years after 2000 in Armenia, the maternal mortality average three year rate decreased by nearly 50%, but in the following 2014-2022 the average three year rate registered 43% growth. Such a negative trend of the maternal motrality and its unprecedent high rate in 2020-2022 is disturbing and necessitates urgent measures.

According to the WHO data[17], in 2020 the estimated maternal mortality rate in Armenia was 27.2/100,000, which is almost equal to Georgia (27.6) and is significantly higher than the rates in some Baltic and CIS states (18): Latvia (18.3) Ukraine (16.5), Russia (13.7), Kazakhstan (13.6), Moldova (12.3) Lithuania (8.7). However, the is more favorable than in some Central Asian states: Uzbekistan (30.2) and Kyrgyzstan (50.4). In terms of international comparison, Armenia's maternal mortality rate is almost twice the average of European countries (Europe: 15, EU: 11). It is necessary to note that international comparisons should be made with reservations, as far as it was mentioned above, in small populations annual maternal mortality rates fluctuate.

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[17] Countdown to 2030. Women's, Children's & Adolescens' Health, Country Profile and Dashboards https://data.unicef.org/countdown-2030/country/Armenia/1

3.2. The causal structure of the maternal mortality

The causes of maternal mortality are divided into 2 main groups: direct/obstetrical (hemorrhage, ectopic pregnancy, toxic abortion, sepsis) and indirect/extragenital pathologies (embolisms, viral infections, pathologies of various organ systems, etc.). 2000 In the following years, against the background of the reduction of the maternal mortality rate, the proportion of deaths from obstetrical causes has gradually decreased in the structure of the latter, and vice versa, the majority of cases are currently caused by extragenital pathologies. Thus, if in 2000-2008 the proportion of direct and indirect causes of maternal deaths was 48% and 52%, then in 2009-2018 it became 26% and 74%.

Figure 25. The causal structure of maternal mortality, 2008-2018
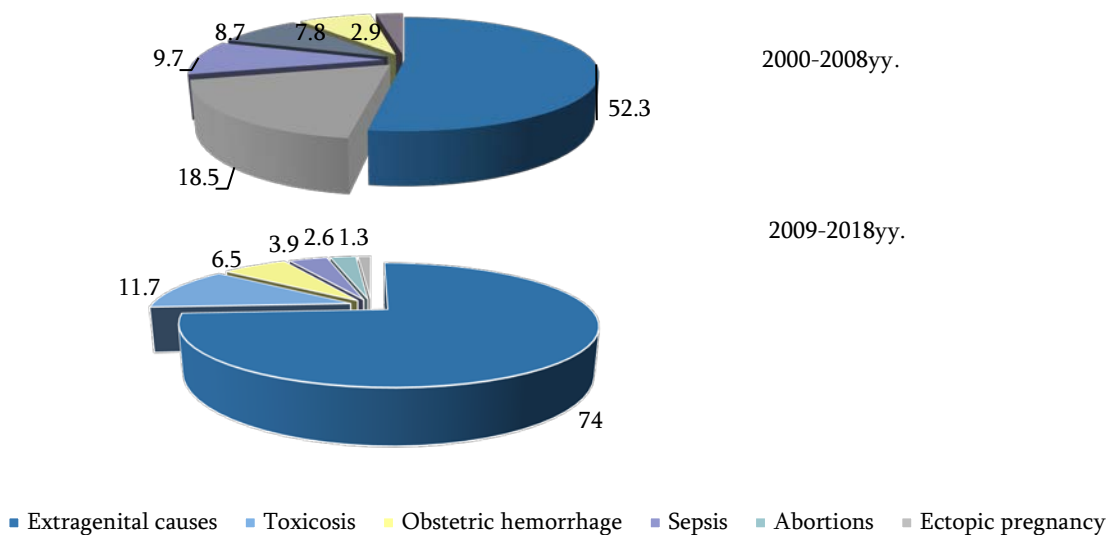
According to RA MoH, 45 cases of maternal mortality were registered in 2019-2022, of which only in 6 cases the death was caused by obstetric reasons, the other 39 cases were caused by extragenital pthologies, including 15 cases related to Covid-19. According to the RA MoH data, in the period of 2019-2022, forty-five cases of MMR were registered, of which only 6 cases were deaths due to obstetric reasons, the remaining 39 cases were caused by extragenital pathologies, including 15 cases associated with Covid.

In the causal structure of maternal mortality in recent years, the direct reduction of obstetric cases is related to the improvement of the quality and availability of maternity services, while the trend of the increase in the proportion of extragenital pathologies indicates the continuous deterioration of the general state of reproductive and somatic health of the population.

The strategy of overcoming this problem should be aimed at improving the situation related to almost all components of reproductive health, including early detection of somatic diseases

incompatible with pregnancy and prevention of high-risk pregnancies. 2020-2021 Unprecedented increase in maternal deaths due to Covid-19 points to a new global challenge: the need to redouble efforts to prevent infectious diseases.

PERINATAL PERIOD, TRENDS OF THE PERINATAL MORTALITY, STRUCTURE

In Armenia until 1995 definitions of the perinatal period, perinatal mortality and stillbirth/live birth of the WHO HMD 9 classification, according to which the perinatal period began at 28 weeks of pregnancy, and the neonate was considered a live birth if breathing. Prior to that time, termination of pregnancy with stillbirth was considered a miscarriage. Since 1996, live births and stillbirths with 22 weeks of gestation, weighing more than 500 grams were counted in the public health sector statistics, but the live births were recorded by the Civil Register bodies, if they lived six full days and more. Due to the aforementioned, double statistics were conducted: public health sector, including births, weighing 500-1000g, and official, without registering the birth and death of the latter.

Thus, by the comparative data of public health sector (RA MoH NIH) and official (RA SC) statistics, the stillbirth rate in 2005 (before the registration of births weighing 500-1000g in the official statistics) the stillbirth rate respectively 17.4 ‰ (by the public health sector data nearly 660 stillbirth neonates) and 9.5‰ (by official data: 360 stillbirths), so 300 stillbirth cases were not recorded in the civil acts registration (CAR) bodies.

Thus, according to the comparative data of the public health sector (the Ministry of Health of the Republic of Armenia) and official (the Ministry of Health of the Republic of Armenia) statistics, in 2005 (before registration of births weighing 500-1000g in the official statistics), the stillbirth was 17.4 ‰ (about 660 stillbirths according to the public health sector data) and 9.5 ‰ respectively (according to official data, about 360 stillbirths), therefore, 300 cases of stillbirth were not registered in the CAR bodies.

In the same year, 105 extremely low birth weight infants of 500-1000 were born, of which about 80 children died (in those years the survival of those born with this weight was only 20-25%) and these births were also not subject to registration. In the final result of 2005 about 380 cases of perinatal death were left out of the official statistics, which was a double number of these cases on average in previous years. Basically, the official statistics did not reflect the real picture of perinatal mortality in the country in accordance with the definitions of WHO ICD-10, which was also problematic from the point of view of international comparability of rates.

Based on the above, in 2005 (by the way, the first among the CIS countries) the Armenian government approved the definitions of main medico-demographic concepts in the maternal and child services in accordance with the 10th revised version of the WHO CDM-10, by which:

Perinatal period begins at 22 completed weeks (154 days) of intrauterine life of the fetus, when the birth weight is normally 500 grams, and ends at 7 full days (168 hours) after birth.

Perinatal mortality is the death of a viable fetus in the perinatal period, starting from 22 weeks of pregnancy until mother's delivery, as well as during the childbirth and up to 168 hours of the infant's life (full 0-6 days).

Fetal death is considered the death of the fruit of conception before its complete expulsion or withdrawal from the mother's body, regardless of the period of pregnancy. Death is proved by the absence of breathing or any other signs of life (such as a heartbeat, pulsation of the umbilical cord, or obvious voluntary muscle movements) after the fetus is separated from the mother's body.

Perinatal period begins at 22 completed weeks (154 days) of fetal intrauterine life, when the birth weight is normally 500 grams, and ends 7 full days (168 hours) after birth.

Perinatal mortality is the death of a viable fetus in the perinatal period, starting from 22 weeks of pregnancy until the mother's delivery, as well as during childbirth and up to 168 hours of the child's life (0-6 full term).

Fetal death is considered the death of the fruit of conception before its complete expulsion or withdrawal from the mother's body, regardless of the period of pregnancy. Death is indicated by the absence of breathing or any other signs of life (such as a heartbeat, pulsation of the umbilical cord, or obvious voluntary muscle movements) after the fetus is separated from the mother's body.

Stillbirth is considered the complete expulsion or withdrawal of the fetus of fertilization from the mother's body, after which the fetus does not breathe or dows not display any sign of life, such as palpitations, umbilical cord pulses, or apparent voluntary muscle movements.

1) According to the same decision of the RA Government, since 2006, cases of stillbirths and early neonatal deaths weighing 500g or more (with a gestation period of 22 weeks or more) have been registered and included in the perinatal mortality index of the Ministry of Justice of the Republic of Armenia. However, in the public health sector statistics, conduting double statistics (including extremely low birth weight 500-1000 g and without them) continues, which makes it possible to conduct a comparative assessment of the rates with a larger time interval.

Table 8. Perinatal mortality and stillbirth s, 1990-2022

Year	Perinatal mortality (0-6 d. stillbirths)		Stillbirth	
	Without 500-1000g born children	Including 500-1000g born children	Without 500-1000g born children	Including 500-1000g children
1990	17.6		10.1	
1995	15.6	22.9	8.5	15
2000	16.3	23..7	8.3	13.5
2005	11.9	24.0	7.3	17.4
2006	14.4	25.6	8.6	18.4
2007	13.4	20.5	9.2	15.3
2008	12.8	20.0	9.0	15.3
2009	10.9	19.1	7.5	15
2010	11.3	23.1	7.9	18.9
2011	10.3	24.4	7.0	20
2012	9.5	22.5	7.1	18.8
2013	9.3	20.2	6.5	16.5
2014	8.9	20.5	6.7	17.2
2015	8.9	21.8	7.0	19.2
2016	7.8	20.2	5.8	17.4
2017	7.6	19.0	6.2	16.5
2018	7.2	20.1	6.1	18.3
2019	6.8	18.0	5.7	16
2020	6.7	15.2	5.5	12.8
2021	7.4	16.3	6.4	14.3
2022	6.1	14.9	5.1	12.7

2) According to the data of NCHSR Statistical Yearbook 2023, the perinatal mortality rate (PMR) hin the republic in 2022 was 14.9‰, of which 12.7‰ were stillbirths, 2.2‰ were early neonatal deaths. Compared to the regional average, PMC is about 3 times higher in Yerevan. The picture can be partially explained by the logic that high-risk births take place in Yerevan maternity hospitals and neonatal intensive care units are mainly located in the capital (the only regional neonatal unit is in Gyumri).

3) The dynamics show that the perinatal deaths registered in maternity hospitals (excluding those born with extremely low weight) have significantly decreased, reducing by almost 3 times (17.6‰ in 1990, 6.1‰ in 2022), including the of stillbirth, almost 2 times. It is interesting to note that if in the 1990s the stillbirth/early infant mortality ratio was 2.1:1.0 (in 1995 the stillbirth rate was 15.6‰, early infant mortality was 7.3‰), then in 2022 this indicator increased almost 3 times to 5.9:1.0, while according to WHO data, in the

case of the average perinatal mortality (such as Armenia's), this difference does not exceed 2.0:1.0. This is evidence of "wrong" registrations that do not correspond to the definitions of stillbirths and live births.

4) According to the annual reports of maternity institutions, the dynamics of perinatal mortality rate (by WHO CDM-10), that in the period of 1995-2006 it flactuated within the range of 21.1‰ - 26.8‰: in 2006 it was 25.6‰. Introduction of the new WHO definitions brought to almost doubling of the rate of 2005: 25.6‰ against 11.9‰. This growth was mostly registered at the expense of stillbirths (18.4‰ against 7.3‰, almost 2.5 times), although the stillbirth rate, according to the WHO predictions, after taking the definions of the WHO CDM-10 classification, it could increase up to 40%. The introduction of the new definitions also led to an increase in the number of early perinatal deaths registered in maternity hospitals, but in contrast to stillbirths, only 1.6 times.

Figure 26. Structure, trends of the neonatal mortality, 1990-2022
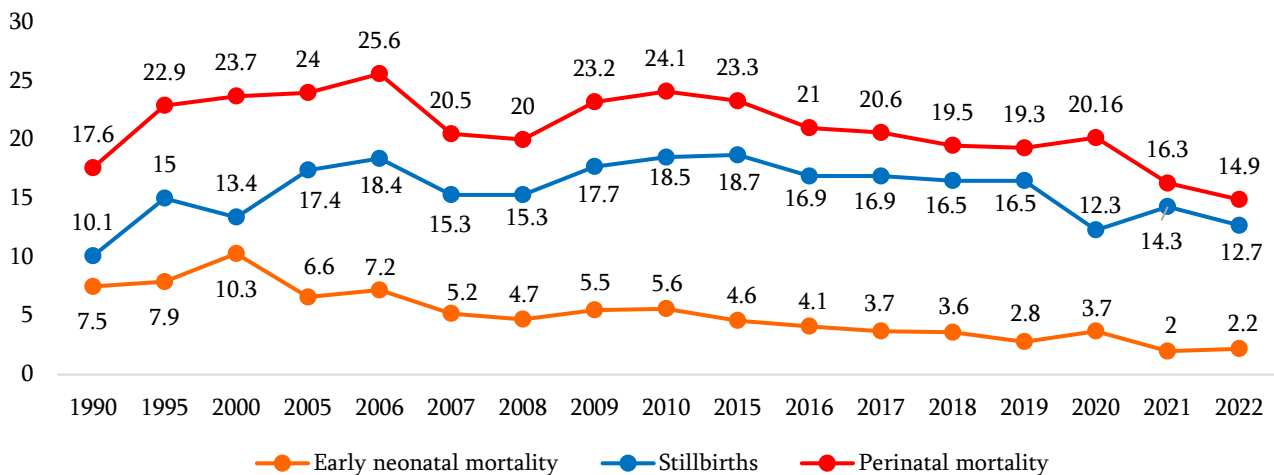
5) After the introduction of new WHO definitions, the perinatal mortality rate gradually reduced, reaching in 2022 the level of 14.9‰, of which 12.7‰ is the stillbirth share, and early neonatal mortality is 2.2‰. The average ENM rate in the republic (including the deaths of 0-7 day-old newborn infants in the neonatal or intensive care units of other medical institutions) also displayed the decreasing trend (8.7‰ in 2006, 5.6‰ in 2010, 4.6‰ in 2015, 4.1‰ in 2016, 4.0‰ in 2017, 2.6‰ in 2022). Comparing stillbirth and ENM in 2022 indicators, it becomes clear that the ratio of the latter is 5.9:1 (12.7‰ against 2.2‰), which is almost 5 times higher than the regional average figure (according to the WHO database, the ratio of stillbirth and early infant mortality for the European B region, which includes Armenia, is 1.2:1.0)

6) The figure presented above proves that this disparity in the structure of perinatal mortality is especially increasing in the 10 years following 2008, during which an increase in the stillbirth rate is recorded against the background of a slow decrease in early infant

mortality. Moreover, the increase in stillbirth cases in recent years is combined with the decline in the birth rate.

7) Such a disproportion of the international average data on the structure of pernatal mortality rate is illogical and can be a consequence of a number of factors: incorrect registration of stillbirths and live births or the lack in knowledge of their definitions/ signs, or the conflict of interest of specialists and /or incorrect registration of real timeframes of the perinatal period due to the financial motivation of the medical institution. These are speculative estimates, needing additional investigation by a qualitative and quantitative research of the real causes of the problem, which will make it possible to work out actions to overcome it.

8) Since 2018, with the joint efforts of the Ministries of Health and Justice, a unified electronic system for registration of births and deaths, including perinatal deaths, has been implemented in the republic, which can contribute to the solution of the above problem to a certain extent, and the transition to a fully electronic unified healthcare system and medical documents and individual cases a digitized procedure can improve the situation much more.

CHILDREN'S HEALTH

Children's health and mortality indicators are the most important indicators of the economic development of the country and the social condition of the society. The health of children and adolescents significantly determines the future well-being of society, and therefore investments in child health care are considered cost-effective investments for the future.

The child mortality rate is the main indicator of the situation related to their life and survival, and based on the characteristics of the life cycle, child mortality rates are analyzed according to separate age groups: newborn infants (0-28 days old), infants (0-1 year old), under 5 years children (including the 0-4 y/o ones) and adolescent mortality.

1. Infant health, infant mortality[18]

Improving the health of newborns is the key to reducing child mortality. It requires a special approach and greater investment. This challenge is currently in the center of attention of the international community and, as a target indicator of Sustainable Development, is included in the agenda of specialized UN structures.

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[18] By Decision N 949-N of the RA Government (2005), the WHO ICD-10 definitions of «The live birth, stillbirth and perinatal periods» became applicable since 2006, and all cases of live births and stillbirths weighing 500g or more are recorded in the ARCRA bodies.

1) According to the officially published data of the RA Statistical Committee,[19] the neonatal mortality rate (NMR) reduced almost two times in the period of 2000-2022: from 9.4‰ to 5‰.

Figure 27. The structure of neonatal mortality, 1990-2022
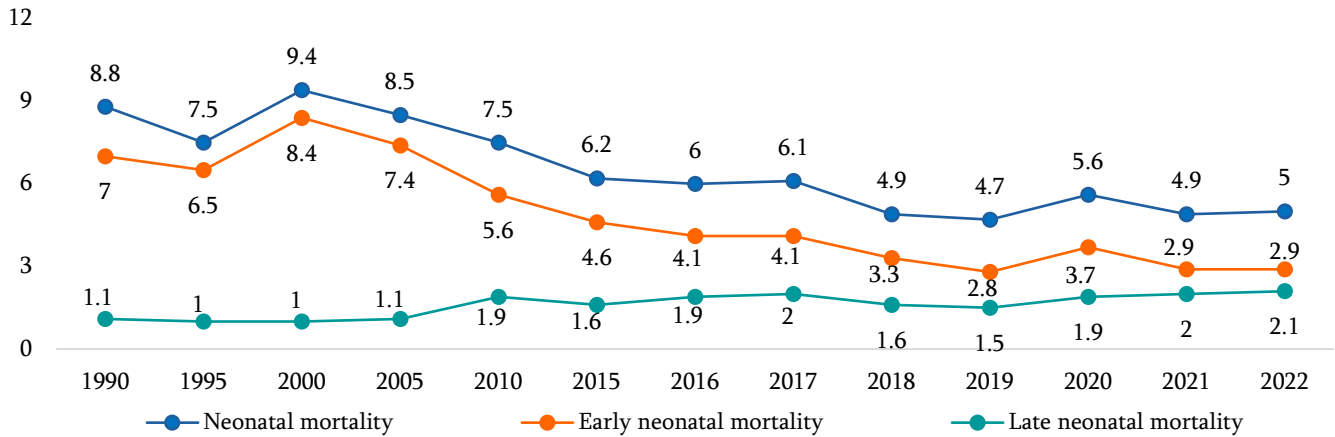
The trends in this structure indicate that after 2000, the ratio of early and late neonatal deaths has been reduced by about 6 times, by 2022 reaching its minimum: 1:4:1:0 (8.4:1.0 in 2000). Despite significant reductions in the intensive rate of early infant mortality, the majority of deaths in both child and neonatal mortality structures continue to occur in the first 6 days of life: in 2022 it was 43% and 58%, respectively, compared to 54% and 89% in 2000.

1) **The causal structure of the infant mortality**

In the causal structure of neonatal mortality (NM), 80% of deaths are attributable to three preventable pathological conditions: immaturity, asphyxia, and infections. According to the lastWHO/UNICEF publications,[20] three main causes of neonatal mortality in Armenia are the conditions caused by complications of immaturity (39%), congenital malformations (26%), asphyxia (15%).[21]

The NM structure has changed significantly over the recent 20 years. If in 2000, asphyxias had the highest rate in the mortality causes, birth defects had the second highest rate and only the third rate was respiratory distress syndrome (RDS) caused by immaturity, in 2020s in the NM structure the situations and pathologies caused by immaturity had the hishest rate, birth defects had the second highest rate, and asphyxia had the third one. Such a structure contains characteristics of the neonatal mortality structure of both developed and developing countries:

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[19] The socio-economica situation of the Republic of Armenia, January-December 2022, RA Statistical Committee, https://www.armstat.am/file/article/sv_12_22a_510.pdf

[20] World Health Organization, Maternal and Child Epidemiology Estimation 2021,

[21] Countdown to 2030. Women's, Children's & Adolescens' Health, Country Profile and Dashboards https://data.unicef.org/countdown-2030/country/Armenia/1

2) Neonatal morbidity and mortality

According to the NCHSR, in 2022[22] the neonatal morbidity rate of the immature neonates (at birth and acquired) was nearly 6.7 higher compared to the relevant rates of the mature neonates (674.7‰ and 101.7‰, respectively). In the etiology of neonatal morbidity, the first three highest rates of diseases of mature infants are congenital abnormalities of development (18.2‰), birth injuries (12.6‰) and intrauterine hypoxia and asphyxia (10.8‰).

In this list, congenital pneumonia ranks almost the same as the 3rd highest rate: 10‰. The situation with ratios of immature neonates is different: intrauterine pneumonia (100‰), hypoxias and asphyxias (73.6‰) and congenital abnormalities (40.3‰). Nearly six times higher is the difference between the mortality ratios of the mature and immature neonates: 0.,3% and 1.9%, respectively.

3) Immature neonates and neonates with low weight, trends in the rates

According to the RA MoH NIH "Health and healthcare" 2023 Statistical Yearbook, during 2022 35667 live births were registered, 8.8% of whom were immature/ prematurely born children (8.4% in 2021), and 9.2% were infants with low weight (less than 2500 gram), 0.4% of whom with extremely low weught (less than 1000 gram). The latter ratio is more by 0.1 points compared with the previous year.

Figure 28. The data related to neonates with low weights at birth and immature neonates, 1990-2022
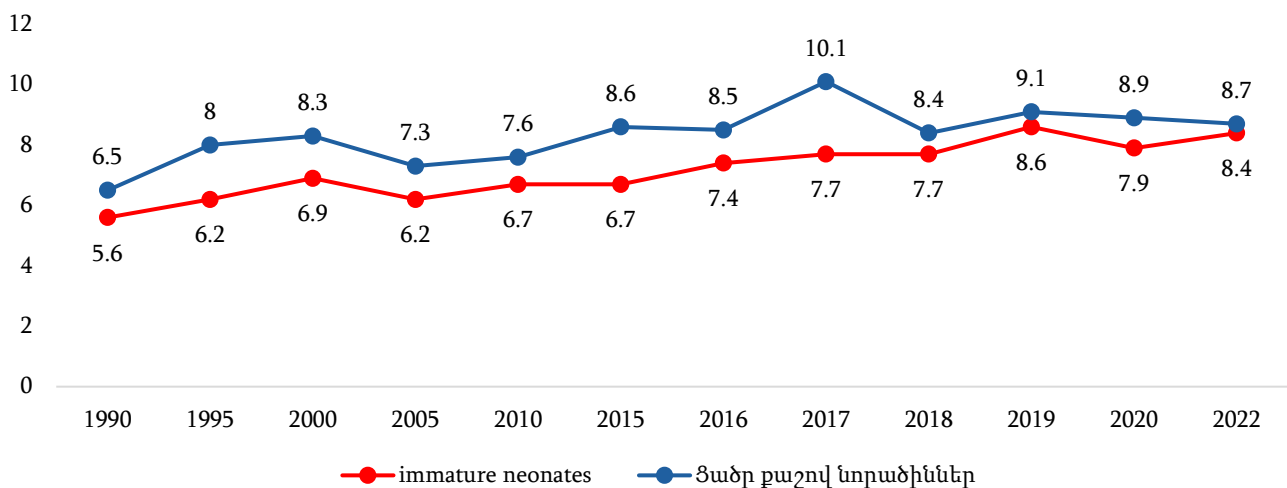
In the period of 2000-2022 the increase of rates of both the immature infants (6.9% in 2000) and infants with low weight (8.3% in 2000) by 27 and 13 percents, respectively. The highest rate of immaturity was registered in 2017 (10.2%), which can be partly explained by the fact of

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[22] «Health abd Health Care» Statistical Yearbook, 2023, RA MoH NIH.
https://nih.am/am/statistical_yearbooks/165/am

development of medical services with application of reproductive technologies and enlargement of their volumes in the recent years.[23]

Birth defects of development

High prevalence of birth defects is a serious problem in neonatal pathologies. According to the RA MoH NIH annual reporting data,[24] the indicator of infants with birth defects of development (per 1000 neonates) constantly increased in the period of 1990-2020 (9.7‰ in 1990, 19.5‰ in 2020).

Figure 29. Birth defects of development of the neonates, 1990-2022
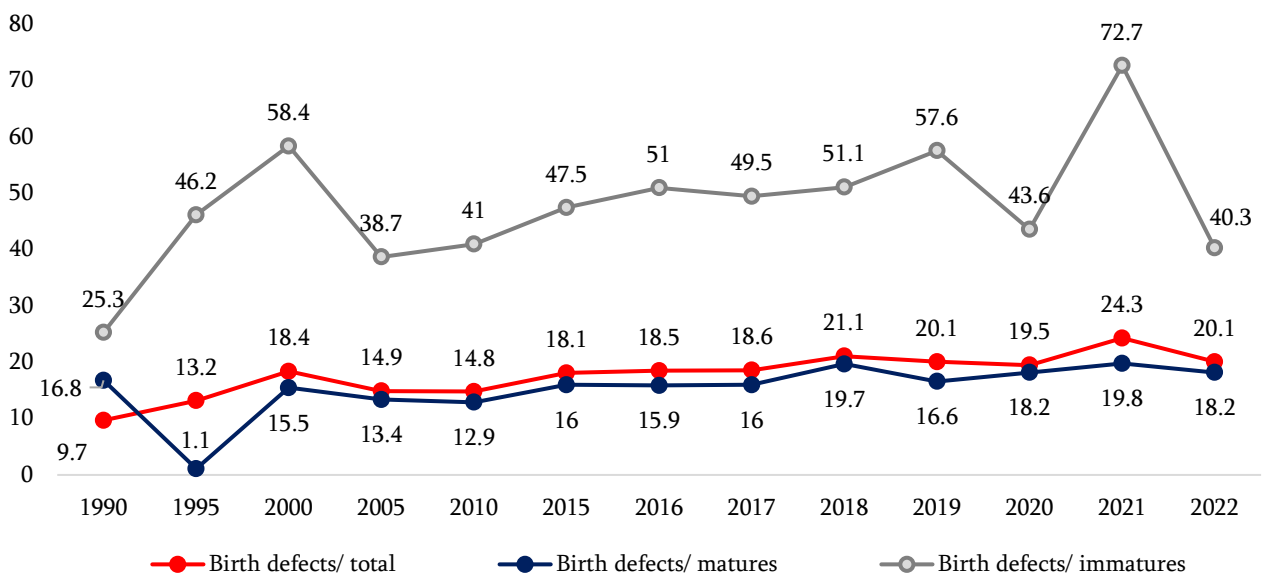
In the period of 2000-2010 the indicator displayed a step by step decrease ((14.8‰), but it grew up again afterwards, reaching 20.1‰ in 2022, which is twice as much higher than the level of 1990s. As for the rates of the immature infants, they are much greater.

In all years the indicator of birth defects was 3-5 times higher among the immature infants compared to the same indicator of the mature neonates.[25]

These trends in the rates of birth defects can be explained both by the improvement of the diagnostic process and the development of medical technology, as well as by the prevalence of pathological conditions during pregnancy. It is clear that programs in this area need to be strengthened, particularly in terms of increased investment in antenatal screenings and prenatal care.

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[23] «Maternal and child health» statistical yearbook, Armenia 2022.- Yerevan. RA MoH NIH, 2022. http://nih.am/am/statistical_yearbooks/159/am

[24] «Health and health care" statistical yearbooks, 2014-2022, RA Ministry of Health, https://nih.am/am/publications/report_yearbook_guide/1

[25] «Trends, issues and future strategic directions of the field of maternal and child health indicators», Report, The RA MoH NIH, 2020. http://nih.am/am/reports/115/am

2. Child mortality, structure, trends of rates

Infant mortality (CI) is the death of a child before the age of 1; The index is calculated per 1,000 live births. CI rates are analyzed by age (neonatal and post-neonatal mortality) and causal structure.

1) **Trends in the rates of the infant mortality**. According to the official data of the RA MoH NIH, during the period of 1990-2020 the child mortality (CM) decreased by an aboslute number nearly 5.5 times (1.465 cases in 1990, 267 cases in 2020), meanwhile the ratio decreased nearly times (18.6‰ in 1990, 7.4‰ in 2020). Compared to the previous year, in 2020 the CM ratio increased by 1.3 percent points. In 2021-2022 it slightly decreased, remaining at alsmot the same level: 6.9‰ and 6.7‰, respectively.

Figure 30. Trends in the child mortality rates, ‰, 1990-2022
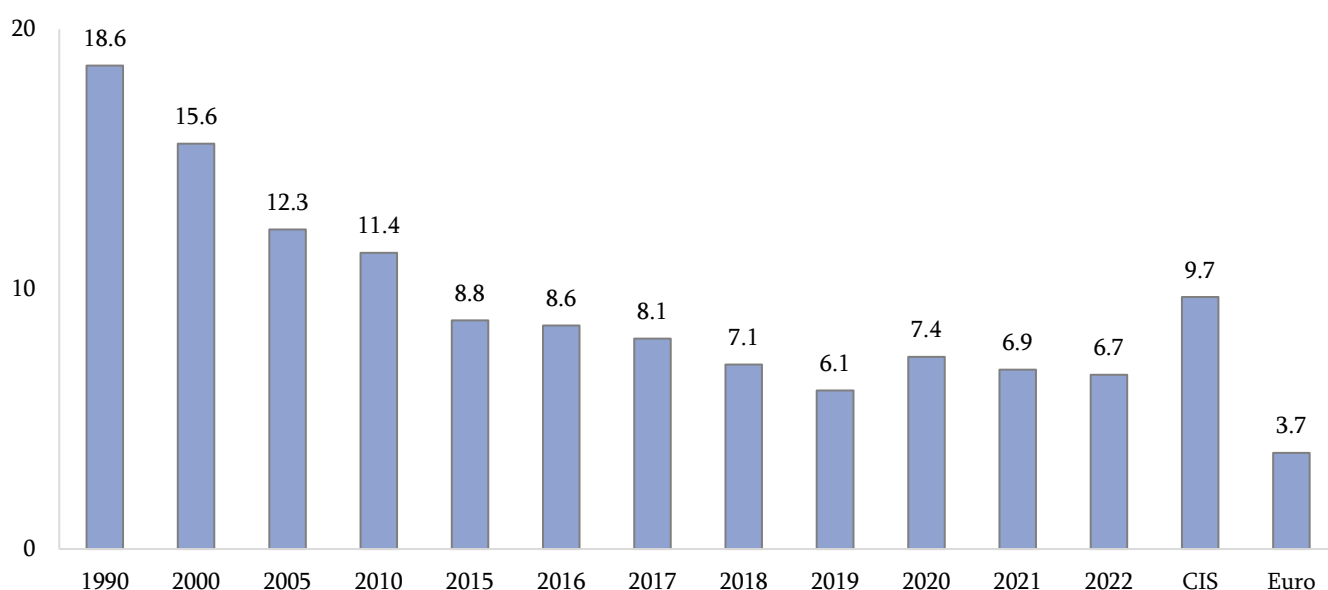
According the WHO/UNICEF data,[26] in 2021 the child mortality rate in Armenia was 9 5‰, which compared with level of 1990 (41.9‰) is less than 4.4 times. The CM rate is significantly less than the average level of the CIS states, but exceeds 2.5 times the average European level.[27]

2) **The age and causal structure of child mortality**

From the view of In terms of highlighting the health problems of children of early age, it is very important to analyze the causal and age structure of child mortality and their trends, both intensive (per 1,000 live births: ‰) and extensive (share in the total number of cases: %) trends. According to the RA SC data, 74% of the total cases of child mortality were neonatal deaths, and half of such cases were registered in the early infancy (2.9‰).

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[26] Levels & Trends in Child Mortality. Report-2022; Estimates Developed by the UN Inter-agency Group for Child Mortality Estimation / WHO, Unicef The WB, UN DESA, 2022 data sources are the latest UN IGME estimates , https://childmortality.org/profile

[27] Under-five mortality data.Unicef. Last update: January 2023, https://data.unicef.org/topic/child-survival/under-five-mortality

Figure 31. The ratio of child and infant mortality in dynamics,‰, 1990-2022

Legend: Infant mortality ▪ Neonatal mortality ▪ Post-neonatal mortality
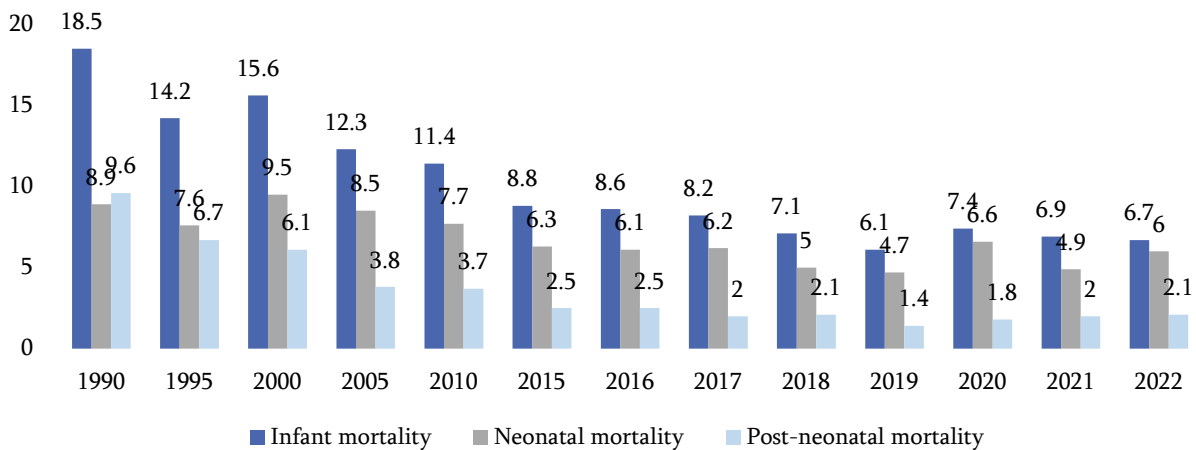
Analysis of trends in child and infant mortality ratios provides the evidence that during 1990-2000 that the neonatal deaths were almost half of the deaths in 0-1 year age group (8.9‰ of 18.6‰), Since 2015 70% of the infant deaths have been registered in the neonatal period. In the following years this indicator has not displayed any tangible trend of decrease (77% in 2016, 71% in 2018, 76% in 2020, 76% in 2022), constantly exceeding 2/3 of the total deaths in 0-1 year age group.

The trends of the ratios of the infant and neonatal mortality prove that the decrease of the infant mortality in 1990-2022 was mostly accompanied with the decrease of the ratio of deaths in the neonatal period (51% in 1990, 24% in 2022) against the background of the relative growth of specific weight of neonatal mortality (49% in 1990, 76% in 2022).

In the **structure of infant mortality,** the main causes of neonatal mortality are some conditions developing in the perinatal period, and the post-neonatal mortality is mainly due to respiratory infections and diarrheal diseases.

Figure 32. Trends of the age structure of the child mortality, %, 1999- 2022

Legend: Postpartum ▪ Neonatal
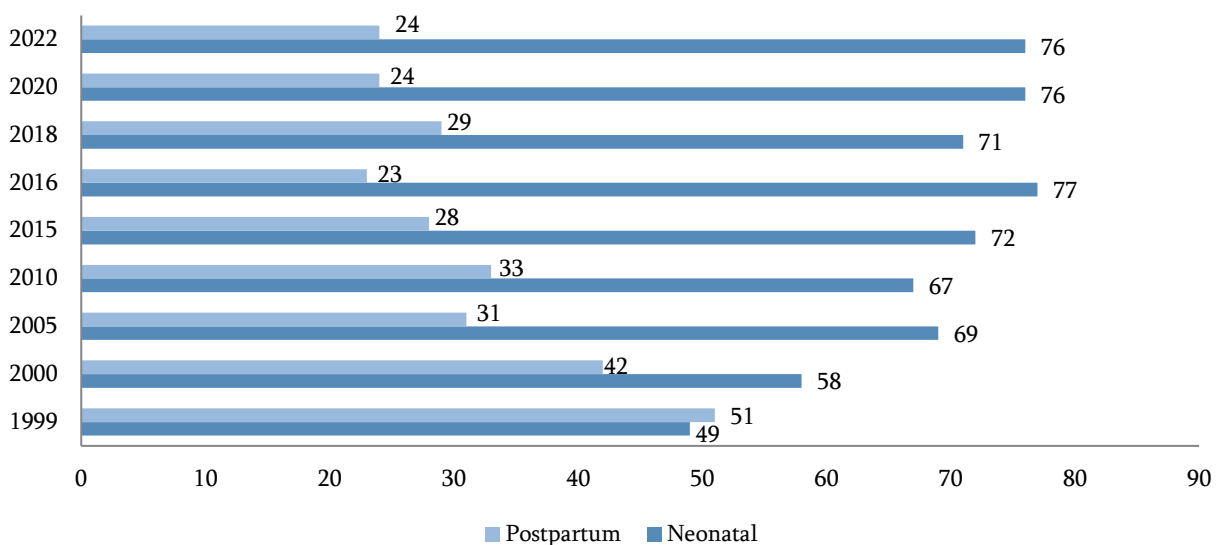
According to the offical data of the RA Statistical Committee, in 2022, in the causal structure of the infant mortality, the first position is held by the diseases, typical to the pernatal period with intensive indicator: 4.2‰ (of 1000 live births), the second position: birth defects 1.24‰, and the third and fourth prositions are respiratory infections and diarrheal diseases with 0.55‰ and 0.06‰ rates, respectfully.[28]

Figure 33. The causal structure of child mortality, ‰, 1990-2022
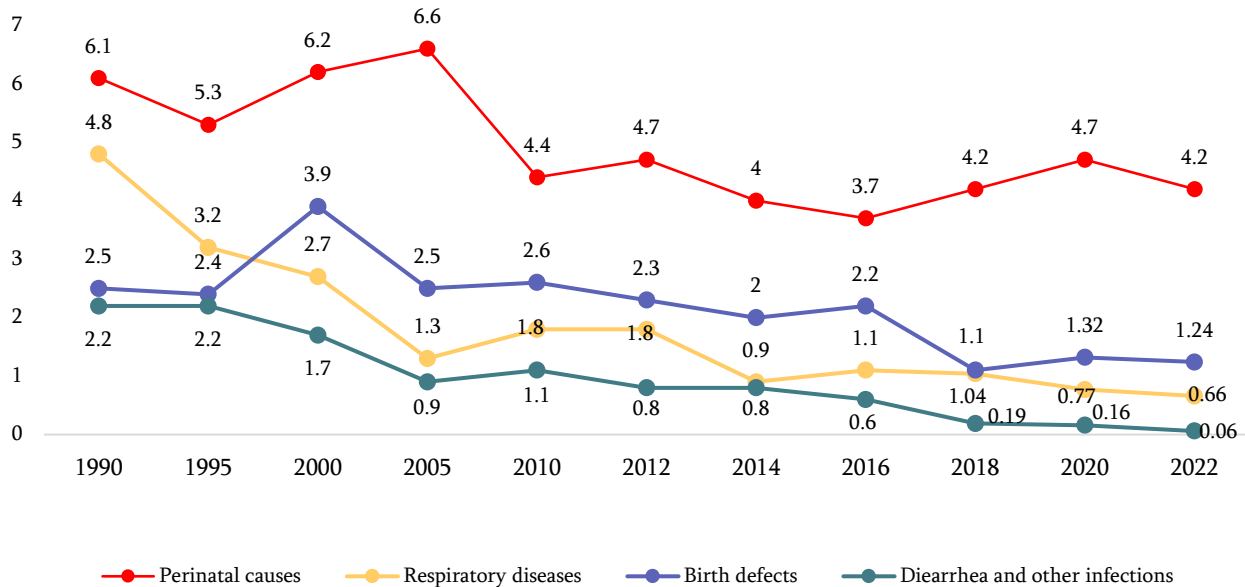
The trends of both the intensive and extensive rates of the causes of child mortality prove that child mortality mostly decreased in the s of deaths caused by respiratory (4.8‰ in 1990, 0.55‰ in 2022) diarrheal (2.2‰ in 1990, 0.06‰ in 2020) diseases, at the expense of which the of mortality in the postpartum period reduced twice as much, and to the contrary, against this background the specific gravity of deaths caused by birth defects increased more than 2 times. During the recent decade more than 2/3 of neonate infant mortality cases have been caused by the main reasons: in 2022 the specific gravity of pernatal causes in the total cases was 60.5%, and the birth defects caused 17.9% of the reletive cases of deaths.

The trends of both intensive and extensive rates of the causes of child mortality prove that child mortality has been reduced mainly thanks to decreasing numbers of deaths caused by respiratory (4.8‰ in 1990:, in 2022: 0.55‰) and diarrhea (in 1990: 2.2‰, in 2020: 0.06) ‰) from diseases, due to which the deaths in the post-neonatal period decreased by more than half, and vice versa, against this background, the proportion of deaths from perinatal causes and birth defects increased by 2 or more times. In the last decade, more than 2/3 of all child deaths are due to the main causes

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[28] The socio-economic situation of the Republic of Armenia in January-December, 2022, RA Statistical Committee, https://www.armstat.am/file/article/sv_12_22a_510.pdf

of infant mortality, and in 2022, the share of perinatal causes will be 60.5%, and birth defects will be 17.9%.

The differences and trends of these rates are clearly seen in time. The following comparative data on the causes of infant mortality in 1990, 2000 and 2020 is evidence of this.

Figure 34. The causal structure of child mortality by ages
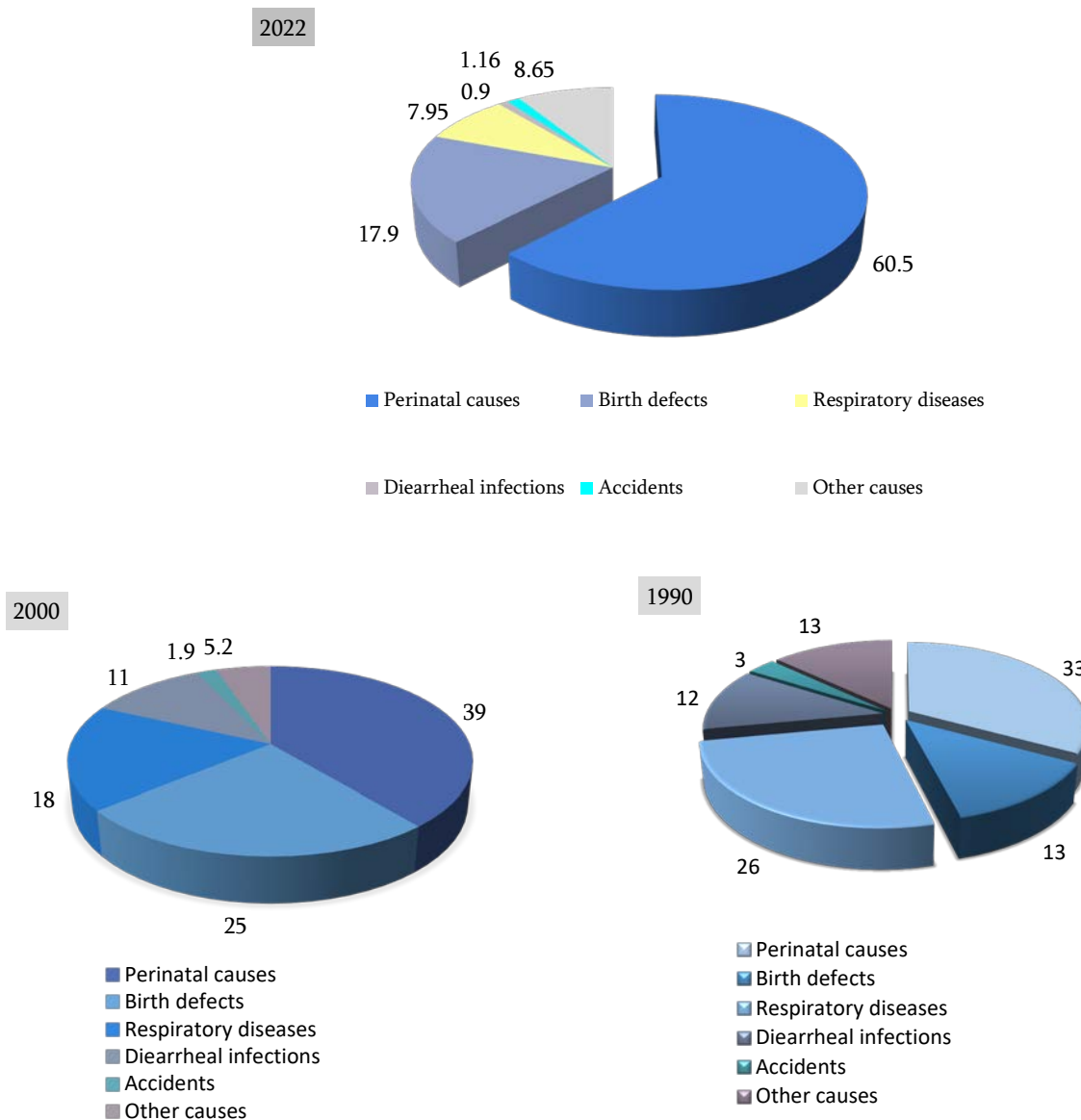
3) In-hospital mortality of children of 0-1 year age group

The analysis of the trends in child mortality rates in the years after 2010 points out that along with the continuous decreas of the child mortality, the rates of at-home mortality of infants of the 01 year age group and in-hospital mortality of children of the same age group also decreased

nearly 3 times (12.6% in 2010, 8.7% in 2015, 4.6% in 2020, 4.4% in 2022) and [29] (3.1% in 2010, 1.6% in 2015, 1.55% in 2020, 0.97% in 2022), respectively, and in the recent years the decrease of this rate displayed less tempo. During the same period, there was a progressing decrease in the pre-24-hour mortality of children of 0-1 year age group[30] (15.4% in 2010, 11.3% in 2015, 5.97% in 2020, 1.68% in 2022).

Figure 35. In-hospital child mortality of 0-1 year age group, 2010-2022

In-hospital and home mortality of children of the 0-1 year age group, %

- 0-1 y/o pre-24-our mortality
- 0-1y/o in-hospital mortality
- 0-1y/o at-home deaths

In-hospital mortality of children of the 0-6 days age group, %

- deaths of 0-6 d/o infants after birth within 24 hours
- percentage of deaths of 0-6 d/o infants within in-patient deaths of 0-1 y/o infants
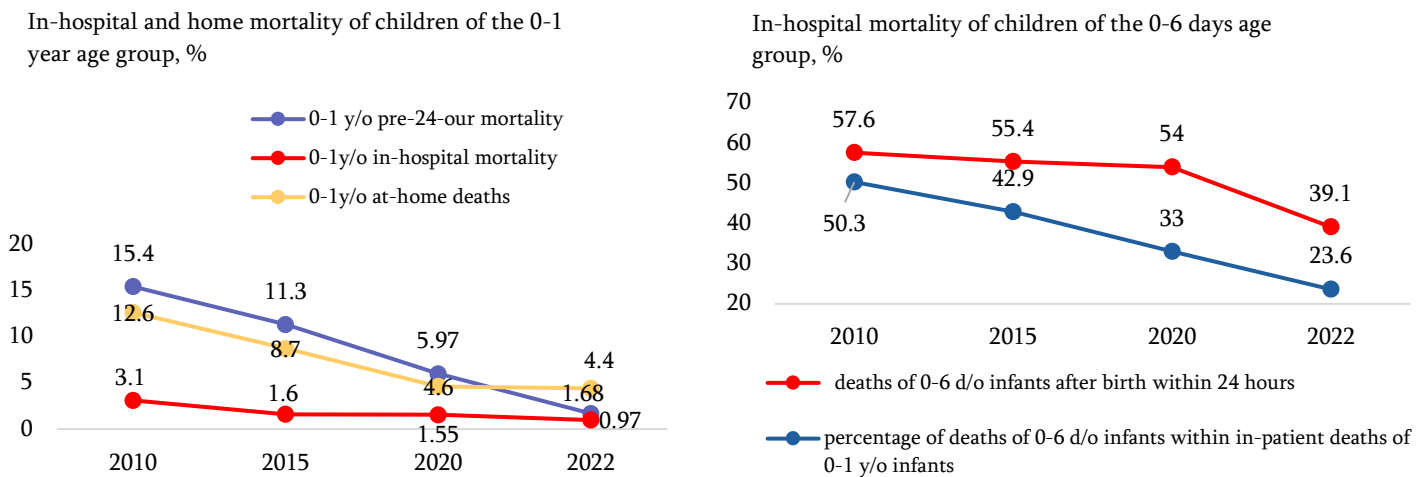
The analysis of rates of hospital mortality of infants in the neonatal period 2010-2022 proves that if in 2010 more than half of the hospital deaths of children in the 0-1 year age group (57.6%) were in the early neonatal period, then in 2022 it reduced to about 1/3 (39.1%). Moreover, in 2010, almost half of these deaths (50.3%) were recorded within 24 hours after birth, and in 2022 the same indicator did not exceed 1/4 (23.6%).

It is noteworthy that at the regional level, almost all deaths in the 0-6 days age group occur within 24 hours after birth. Improvement of the index was recorded mainly in the capacities of neonatal services of medical facilities in Yerevan and Gyumri. The need to strengthen the neonatal service in regional maternity hospitals is obvious:

Thus, from the analysis of trends in the infant mortality and structural components, it follows that the current situation is alarming in terms of the low tempo of decline in the infant mortality ratio, the high proportion of child deaths from perinatal causes and birth defects, as well as the still high infant and child pre-24-hour mortality rates. Therefore, strengthening pediatric/neonatal emergency and resuscitation services and increasing the performance of prenatal care and screenings and improving neonatal care should be among the priorities of the healthcare system.

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[29] The ratio of deaths of children from the 0-1 year age group (%) in the total number of hospitalized children in the same age group

[30] The ratio of deaths registered during 24 hours after hospitalization (%) in the total number of in-hospital deaths of children from the 0-1 year age group

2. The health and mortality of >5 y/o children

The most comprehensive indicator describing the problems of early childhood is the mortality rate of children aged 0-5 years. This period is the most important part of a child's life in terms of his livelihood and survival. It is no coincidence that improving the health of children under 5 and reducing the mortality rate is one of the target indicators of the Sustainable Development Goals.

1) Trends in the mortality rate of children under 5

According to the data of th Statistical Committee,[31] the mortality rate of children under 5 (<5 y/o) decreased in the period of 1990-2022by nearly 3 times (23.4‰ in 1990, 19.9‰ in 2000, 13.4‰ in 2010, 8.2‰ in 2020, 7.5‰ in 2022). During 6 months of 2023, the mortality rate of <5y. children a little increased compared to the similar period, reaching 8.7‰ (8.2‰ in 2022 + 6 months).[32]

The calculated data published by the UN WHO/UNICEF/WB interpublic health sector expert group point out greater, nearly 4 times, decrease of the mortality rate of the children under (41.9‰ in 1990, 10.7‰ in 2022).[33]

Figure 36. The calculated rates of mortality of >5 y/o children[34]

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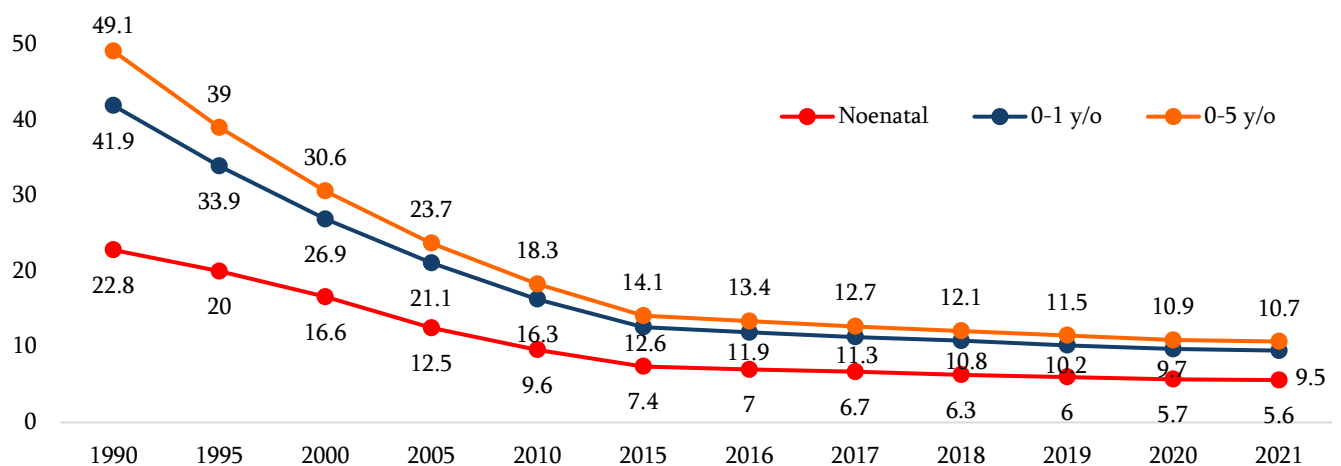
[31] RA Statistics Committee, Publications by years https://www.armstat.am/am/?nid=82

[32] The socio-economic situation of the Republic of ArmeniaJanuary-June, 2023, RA Statistics Committee, https://www.armstat.am/am/?nid=82&id=2583

[33] United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) Member agencies: UNICEF, the WHO, the UN Population Division and the World Bank Group August 2022, data sources are the latest UN IGME estimates , https://childmortality.org/profile

[34] Women's, children's and adolescents' health country profiles and dashboards, UNICEF, September 6, 2022 https://data.unicef.org/resources/health-country-profiles-and-dashboards/

According to the WHO latest available data,[35] in Armenia the calculated rates of infant, child and <5 year old children's mortality were 5.64‰, 9.54‰ and 10.72‰, respectively. These figures to some extent exceed the officially published datae, but at the same time, their comparison proves that in the period of 1990-2021 the difference between official and calculated rates has been significantly reduced. In particular, if the rates in 1990 differed 2,3 times (41,9‰ against 18,6‰), then in 2021 they differed 1.3 times (9.5‰ against 6.9‰), which is a result of introduction of international definitions of births and child mortality, legislative reformation of their registration improvement of this whole process (At present 99% of births in Armenia are registered in the CRO bodies). These calculation rates make the assessment of their trends more reliable from the view of comparability with international data.

Child mortality in under 5 years age group by sex

In Armenia, the mortality s of girls both 0-1 years and up to 5 years age groups have consistently been lower than for boys, displaying the natural inequality and proving that children are not discriminated against by gender, and that girls receive the same care as boys.[36]

Table 9. Child mortality rate by sex, ‰

Year	Child (0-1 years) mortality			Child mortality age under 5		
	total	girls	boys	total	girls	boys
2010	11.4	9.6	13	13.4	11.3	15.2
2015	8.8	8.2	9.4	10.4	9.5	11.2
2020	7.4	6.4	8.2	8.2	7.1	9.2
2021	6.9	5.9	7.8	8.1	7.1	9

2) Causes of child mortality in various age groups

According to ofccical data of 2022, within the total number of cases of child death 89% are related to 0-1 years age group, 67% are related to the deaths of neonate infants of 0-28 days age group. In essence, 2/3 of the cases of death among children <5 years were related to neonate infants.

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[35] WHO, The Global Health Observatory, latest data, Armenia-Profaile, 2022.
https://www.who.int/data/gho/data/countries/country-details/GHO/armenia ?countryProfileId=b36fc47a-744e-4e14-82de-85b7a3a1bdde
[36] The RA Statistical Committee, The Demographic Handbook of Armenia, 2022
https://www.armstat.am/am/?nid=82&id=2535

According to the last data given by the RA SC,[37] the causal structure of child mortality in the <5 years age group in 2021 is similar to the relevant structure of infant mortality: perinatal causes are in the first position, birth defects are in the 2nd position, respiratory infections are in the 3rd position, followed by diarrheal diseases and accidents.

Figure 37. Causal structure of mortality of children under 5 years of age, %, 2022

Perinatal causes   Respiratory diseases   Birth defects   Accidents   Diearrheal infections   Other causes
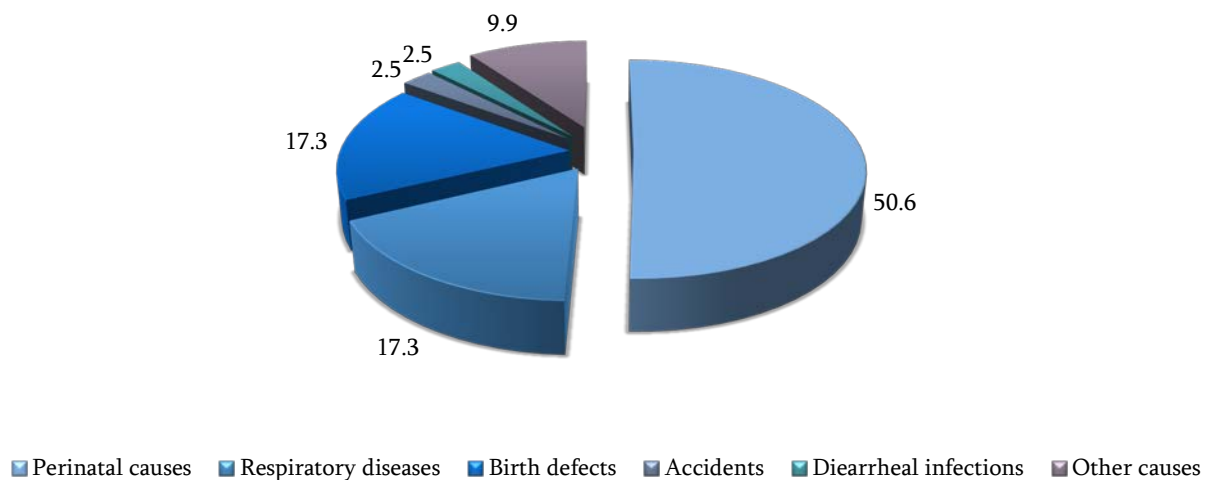
If we consider the causes of death of children in the 0-5 years of age sepaly, in the 0-1 and 1-5 age groups, the picture changes dramatically: perinatal causes of death make up only 2%, compared to 64.4%, giving way to respiratory diseases. (41%), the share of accidents increases sharply (11% against 0.4%).[38] The cause of death of almost every 10th child in this group is an accident, which is preventable if the child's safety is ensured. Accidental death s for children increase with growing age groups. Accoring to the NIH data,[39] in 2021, in the group of children under 5 years of age accidents and traumas reached 2.7% of all mortality causes, in the 5-14 years age group it was 26.7%, and in the 15-19 years age group it made 59.7% (every third child), which occupies the highest position in the mortality structure of this age group.

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[37] The socio-economic situation of the Republic of Armenia in January-December, 2022, The RA Statistical Committee, 2023. https://www.armstat.am/file/article/sv_12_22a_510.pdf

[38] The Demographic Handbook of Armenia, 2021, RA SC, December, 2021, https://www.armstat.am/am/?nid=82&id=2446

[39] Database of the RA MoH NIH National Health Information Analytical Center http://nih.am/am/subdivisions/health_analytical_center

Figure 38. Causal structure of the mortality of children under 5, separated by age groups, %, 2020

0-1 y.

64.4 · 17.9 · 10.5 · 3.8 · 0.4 · 3

- Perinatal causes
- Birth defects
- Respiratory diseases
- Diearrheal infections
- Accidents
- Other causes

0-5 y/o

50 · 18 · 17 · 2.4 · 2.4 · 9.8

- Perinatal causes
- Birth defects
- Respiratory diseases
- Diearrheal infections
- Accidents
- Other causes

1-5 y/o

41 · 2.6 · 11 · 28.1 · 2 · 11.8

- Perinatal causes
- Birth defects
- Respiratory diseases
- Diearrheal infections
- Accidents
- Other causes

In the 5-14 age group, boys' mortality from accidents is 2.5 times higher than the girls' mortality, and among 15-19-y/os the boys' mortality is 6 times higher than that of girls' mortality. Majority of accidents in older age groups of children are traffic accidents.

It is obvious that all the causes of accidents at an early age (trauma, poisoning, burns, accidents, etc.) are preventable with the implementation of appropriate program measures aimed at the safety of children and with sufficient awareness and proper care by parents.

3) Adolescent mortality

According to the calculated data by UN/UNICEF, the causes of deaths among older children substantially differ from relevant rates of various age groups of children,[40] and as for the teenagers, by gender. In all age groups of these children (5-9 y/o, 10-14 y/o and 15-19 y/o) the main causes of mortality are oncological diseases (with the share of 17-20%), accidents, including traumas (11-12%) and traffic accidents (14-29%), and among the teenager boys, it is also violence, the highest rate in the list of causes of deaths (42%).

Among the causes of death of adolescents, the increasing number of self-harm cases, caused by the mental health disorders, is a matter of special consideration (5 in 2020, 7 in 2021, 10 in 2022).

According to the RA SC,[41] 18 children under 18 committed suicide in 2020-2022: 16 of them were boys and 6 were girls. Among the children who attempted suicide,[42] 34 were girls and only 8 were boys. Basically, boys are more determined in making their decisions, but it is obvious that the mental health issues are problematic for girls as well. In both cases, mental health is a serious challenge, especially during adolescence.

It is a fact, that all mentioned causes of death among children are preventable, so keeping elementary safety rules by the parents and their knowledge by children are most important to avoid them. Medical workers can play a big role in this process. Therefore thestrategy aimed at preserving safety of children, preventing traumatism and imporving the mental health of adolescent should be among priorities of the Ministry of Health.

Thus, although globally, the dynamics of reducing early childhood mortality is encouraging, the situation is alarming in terms of the still high level of deaths from perinatal causes and birth defects in the structure of child and neonate mortality. From what has been said, it is assumed that the further reserve for reducing child mortality is the reduction of infant mortality, and as for the case of 1-5-year old children, ensuring the safety of children and preventing accidents is of utmost importance. A key way to reduce adolescent mortality is to reduce traumatism and improve their mental health.

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[40] Countdown to 2030. Women's, Children's & Adolescens' Health, Country Profile and Dashboards, 2020 https://data.unicef.org/countdown-2030/country/Armenia/1/

[41] The socio-economic situation of the Republic of Armenia in January-December 2022, RA Statistical Committee, 2023 . https://www.armstat.am/file/article/sv_12_22a_510.pdf

It is obvious that in the conditions of minimum budget allocations, due to the implementation of policies and strategic programs directed by the government, as well as effective international and intersectoral cooperation, Armenia has managed to collect maximum resources, implement targeted program measures aimed at improving children's health, and as a result, continuously reduce child mortality.

Trends in child morbidity rates

According to the Annual report by the RA MoH NIH National center for health statistics and research (2022),[42] 331.811 cases of primary diagnosis of under 18 y/o children's diseases were recorded in 2022, of which 1/5 are related to the adolescent 15-18 y/o age group (17.4%). Compared to the previous year, the pimary morbidity cases increased by nearly 15530.

In the structure of the primary morbidity of children, diseases of the respiratory organs are the most common, the share of which in 2022 was 52.5%. Infectious and parasitic diseases accounted for 11% of total cases. During the period of 2020-2022, among children 10,599 cases of Covid were recorded, the maximum number of which (41%) occurred in 2021 (4,302 cases).

In 2022, compared to the previous year, there was an increase in the primary morbidity rate (per 100,000 children of the given age group) by about 1/3, from diseases such as metabolic and endocrine system disorders (34.5%), neoplasms (34 %), injuries and accidents (27.8%). An increase in the relative rates of total morbidity was also recorded from the following diseases: diabetes (92.3 against 89.2), neoplasms (213.7 against 187.9), mental disorders (507.1 against 475 against), diseases of the musculoskeletal system and connective tissue (825.5 against 756.4), congenital abnormalities and chromosomal diseases (775.1 against 713.2). The increase in the overall morbidity rate from injuries and poisoning is unprecedented (2030.8 against 1666.7).

During 2015-2022, positive results were recorded in terms of the primary morbidity rate of children with active tuberculosis: it was reduced 3 times in the 0-15 age group (1.5 against 4.6) and 1.3 in the 15-17 age group (20.7 and 16 .in front of 1). The number of children registered in the dispensary has also decreased, both 0-15 years old (the index is 14.4 against 24.3) and 15-17 years old. in the group of children (indicator 49.0 against 136.5). The latter is an obvious result of the measures implemented in the field of pediatrics within the framework of the "Fight against Tuberculosis" national program.

Since 2015 an increase in prevalence of chronic non-infectious diseases was recorded among the children. The situation related to children's mental health is especially disturbing.

Thus, in 2015-2022 the absolute number and the relative ratio of these children of 0-15 years age grew up almost three times (85:8 in 2015, 223:3 in 2022). The picture is more problematic in the case of teenagers. If in 2015, 15-17 y/o 76 children children with primary diagnosis of mental

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[42] «Health and Healthcare» Statistical Yearbook, 2023, RA MoH NIH,
https://nih.am/am/statistical_yearbooks/165/am

disorders were registered (72:0), then in 2022 such children' number was 225 (200:0). At the end of the year, the number of adolescent children under dispensary control with this diagnosis also increased (225.1 in 2015, 361.3 in 2022).

In the case of malignant neoplasms, the picture is different. 2015-2022 In the case of relatively stable rates of children registered with the primary diagnosis in the interval, the number of children registered at the dispensary at the end of the year has increased significantly, including 0-15 years. 1.7 times for children (56.5 against 32.8), and 2.5 times for 15-17 year olds (126.9 against 50.3). These statistics proves the success of the fight against cancer in children and the improvement of their survival rates:

Thus, despite the program successes recorded in certain areas, the growth of a number of diseases of non-infectious origin among children is problematic. As a final result, in the absence of appropriate treatment and dispensary control, these diseases lead to disability in most cases. Therefore, the increasing burden of disease in the face of declining birth rates and declining child populations dictates increased programmatic efforts and additional resources for childhood disease prevention, early detection, and early intervention.

3. Child disability

1.3% of the children under 18 in Armenia have the status of disabled children. This rate was within the range of 1.1-1.3% for decades. Meanwhile, the national survey of children's disability, conducted by UNICEF in 2005, showed that prevalence of developmental disorders and delays in 8-y/o children was 11.6%, which corresponds to the data of similar studies in different countries. The above mentioned proves that the real number of children with limited abilities is at least 1 dozen times higher than the official data.

According to the official datae of the RA SC[43] , 9012 disabled children under 18 were registered in Armenia by July 1, 2023 (in 2018 there were 8233 children), 2/3 of them were boys. Nearly 40% of disabled children live in the rural areas. According to the same source, three groups of the most frequently occurring diseases, causing disability, are mental and behavioral disorders: 33.4% (25% in 2018), nervous system diseases: 22% (27% in 2018), birth defects and developmental disorders: 15% (17% in 2018).

These statistics indicate that the cases of child disability have increased by about 10% in the last 5 years. The causal structure of the latter has also changed due to the dominant role of mental and behavioral disorders (every 3rd child with disabilities).

More than 70% of disabled children have diseases that limit the child's functional abilities. As a result, the child is unable to perform activity expected of the given age, which negatively affects his or her further development and social engagement.

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[43] The socio-economic situation of the Republic of Armenia in January-June, 2023, RA Statistical Committee, https://www.armstat.am/am/?nid=82&id=2583

According to expert estimates, up to 7,500 children need continuous rehabilitation care. More than 2/3 of officially registered disabled children have locomotor or mental problems, almost all of whom need rehabilitation. Overall, 77% of children with developmental disabilities need medical, rehabilitation or psychological help.[44]

The real demand for pediatric rehabilitation services exceeds the available opportunities by 3-4 times. And although these children's rehabilitation services are provided within the framework of the state order and are continuously expanding, the problem of availability and accessibility of these services remains on the agenda due to the scarcity of centers providing such a care, low capacity of the existing ones, and limited government allocations. As a result, due to the need to ensure the continuity of this specialized medical aid, parents are forced to purchase it on a paid basis, which is not affordable for children from poor families.

This problem is especially relevant for rural and socially insecure children. According to the data of the Ministry of Internal Affairs of the Republic of Armenia, in 2022 the poverty prevalence index of the population was 26.5%, the highest level of which was recorded in Shirak marz: 42.9%. In the case of children, this indicator is higher: it is 36.7% in the 0-5 age group, 36.9% in 6-9 year olds and 35.8% in 15-17 year olds. Basically, every third child of the republic lives in a poor family.

Thus, the problem of accessibility of children's disability and rehabilitation services remains one of the key issues of the health sector policy, and the need for continuous expansion of the volumes of these services and ensuring further developments should be fixed in the strategic documents for the improvement of children's health.

7. Prevention of children's diseases, vaccinations, neonate screenings

The role of preventive pediatrics is huge in maintaining children's health and prevention of diseases. Ensuring proper control of child growth and development, high coverage of vaccinations, screenings aimed at early detection of diseases and implementation of early intervention programs are a guarantee for healthy growth and development of children, prevention of diseases and disabilities, as well as reduction of child mortality.

1) Immune prevention

Among the successes recorded in the field of children's health care in the Republic, the positive trends in the prevention of manageable infectious diseases are most notable. The morbidity of children with these diseases, thanks to the National immunization program implemented in the republic since 1994, remains favorable. The current national vaccination calendar was approved by the Government in 2020 within the framework of the National immunization program for 2021-2025.[45]

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[44] «Trends in the indicators of moternal and child health, problems and the strategic directions of the sphere», Report, RA MoH NIH, 2020. http://nih.am/am/reports/115/am

[45] Decision N2129-N of the RA Government of December 17, 2020, on approving the National immunization program. https://www.arlis.am/

The WHO strategy «Immunization Agenda 2030»[46] plans a number of initiatives such as "Overcoming meningitis by 2030", "Radical eradication of poliomyelitis", "Cervical cancer prevention and control", "Seasonal flu preparedness" and others. Importance of the immunization was reinstated by the WHO/UNICEF Globalstrategy for Women's, Children's and Adolescents' Health (2016–2030), according to which it is planned to introduce 10 vaccines against manageable diseases up to 2030. It can prevent nearly 25 million deaths all over the world.

Provisions of the National immunization programm and the goald and targets, planned for 2021-2025 are in line with the WHO commitments and adequate to the present situation and challenges of the country.

Immunization services in the republic are available and accessible for all groups of the population, which is proved by the data of the survey of demographic and healthcare issues (DHS) 2015-2016, according to which 89% of 18-29 month-old children received all main vaccines, recommended by the WHO. At least of 97% of children, covered by the survey, received first dozes of BCG, hepatitis B, polio and pentavalent vaccinations.

As a result of the successful implementation of the National immunization program, no cases of poliomyelitis and diphtheria have been registered in the country since 1995. Cases of wooding are recorded very rarely, and whooping cough is recorded in rare cases. Cases of epidemic parotitis (mumps) have decreased significantly after 2010. There are no cases of viral hepatitis B among children under 14 years of age. Due to the implementation of pentavalent and pneumococcal vaccinations with Haemophilus B component, the incidence of meningitis among children under 5 years of age in the republic decreased by 2.4 times.

Measles, rubella, and mumps program measures, including 96 percent coverage in 2007 of additional vaccinations among 6- to 27-y/os, as well as more than 90 percent coverage of measles vaccination among women of childbearing age, enabled the country to not only eliminate measles and rubella, but also to prevent cases of congenital rubella syndrome.

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[46] The European Immunization Agenda 2030. WHO Regional Office for Europe. Copenhagen, https://whodc.mednet.ru/ru/osnovnye-publikaczii/infekczionnye-bolezni-i-borba-s-nimi/vakcziny-i-immunizacziya/3810.html

Figure 39. Manageable infectious diseases of children; per 100,000 child population, 1990-2022
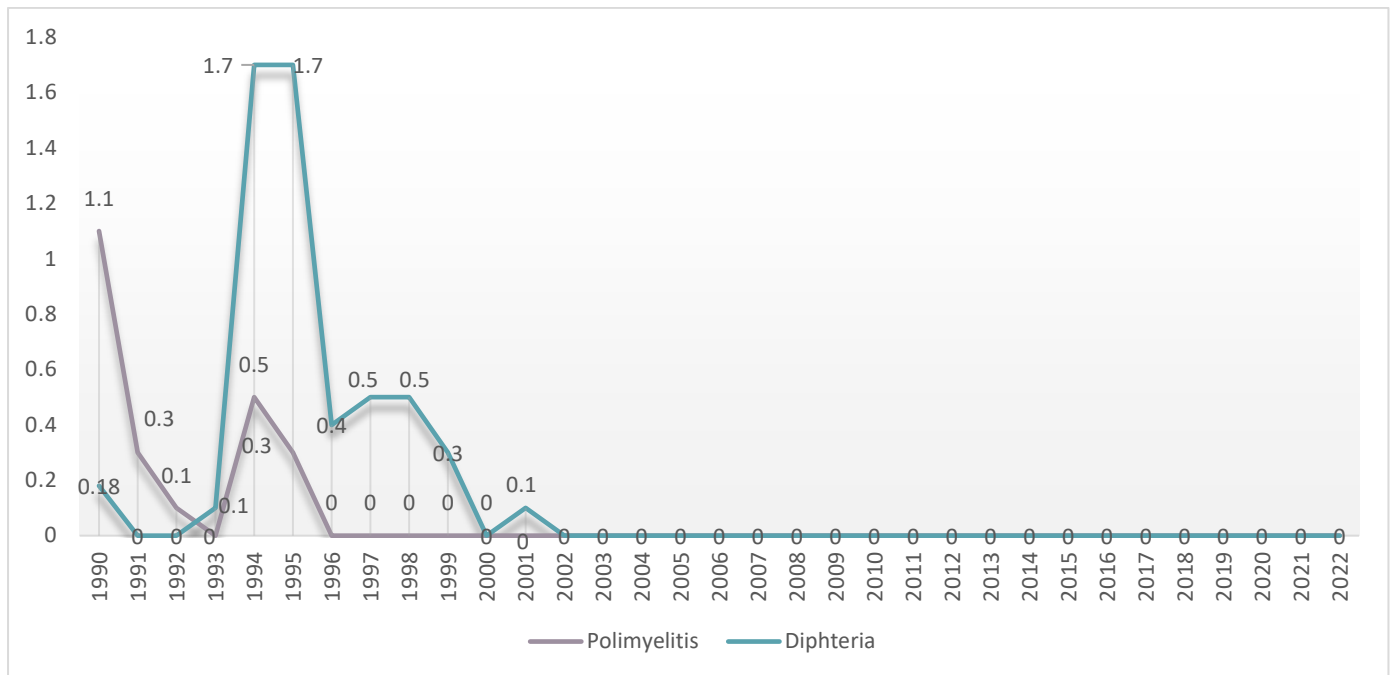
Due to the aforementioned, local cases of measles and rubella have not been registered in the republic since 2007; only imported cases from countries unfavorable in terms of measles were recorded. However, in 2023 already in March, a tense epidemiological situation occured in the republic, contributing to the spread of local measles cases: 452 cases of measles in adults and children were registered in the republic by October 5, 2023.

In general, coverage levels by individual vaccinations in the Republic of Armenia correspond to the WHO recommended targets: around 90% of the target groups receive the full set of vaccinations they need. However, on-time vaccination coverage (according to the national calendar) is still low.

Currently, the healthcare system is facing new problems due to both anti-vaccination activity and the co-infectious effects of the coronavirus disease. As a result, we face a new challenge to sustain hard-won gains in terms of manageable infectious diseases. If this situation continues, it is predicted that already eliminated (absence of local cases) and eradicated (poliomyelitis, diphtheria) diseases will return and an unfavorable epidemic situation will arise in terms of manageable infectious diseases.

Considering the importance and effectiveness of vaccinations in the prevention of infectious diseases, the Ministry of Health has adopted the strategic approach of introducing new vaccines into the WHO national immunization calendar. The long-term vision and final result of the National immunization program is the radical reduction of the incidence of communicable diseases in Armenia and the decrease in deaths caused by them.

Thus, the effective fight against manageable infectious diseases, including the organization and implementation of immunization activities, remain one of the agenda issues of the healthcare system of the Republic of Armenia and require maximum investment of resources and efforts.

The neonate screening tests

Neonate screening tests began to be carried out in the republic in 2005, initially with the support of international, public and/or donor organizations. Then the state's participation increased year by year, which made it possible to gradually expand both the volumes and types of screening tests, as well as the geographical coverage by them. At present 6 screening programs are carried out for neonates to detect congenital hypothyroidism, phenylketonuria, severe congenital hearing impairment, retinopathy of prematurity, hip dysplasia, and critical congenital heart defects.

In the period of 2005-2021, around 1,372,000 neonates were screened, as a result of which nearly 5,000 neonates with the above pathologies were found. During the last 3 years, the volumes of screening tests have increased, 346,733 screenings were carried out and 1,216 sick neonates were found, of which 49 with hypothyroidism, 12 with phenylketonuria, 62 with congenital hearing impairment, 126 with retinopathy of immaturity, and 967 with hip dysplasia.

In general, as a result of the screenings carried out during the period of 2005-2022, almost all children with early-detected pathologies were given appropriate medical aid within the framework of the state order: they were continuously provided with the necessary medication and special food, and thanks to their conservative and/or surgical treatment and organized dispensary control, further development of diseases or their complications and the resulting disability and/or possible death were prevented.

The cost-effectiveness of neonate screenings has been proven by the experience of many countries of the world and is fixed as an important preventive program direction in WHO/UNICEF strategic documents. It is documented also by the example of Armenia. Thus, according to expert estimates, the cost-effectiveness of screening for congenital hypothyroidism is 1:8, for phenylketonuria - 1:6, and for hearing screening - 1:10. In the case of pelvic-femoral joint screening, the cost-effectiveness is 1:8.5 (the difference between screening and treatment costs for one case is about AMD 925,000).

In the case of screening the prematurity retinopathy, the total annual cost of the program of screening and treating the mentioned problem makes 22.7 million AMD. The amount to be spent by the state, if these children are not saved from blindness, will be equal to 49.7 million drams. Therefore, by implementing the program, the state saves about 27 million drams.

Thus, in the context of the upcoming RA MoHstrategy, it is more than justified to ensure the continuity of neonate screenings, moreover, further developments in the direction of their expansion, the implementation of targeted program measures.

2) Children's safety, their environment: accidents, injuries, traffic accidents

The problem of the safety of children and their environment has been repeatedly highlighted by the international community. The world is concerned about the increasing rates of childhood traumatism and the resulting child disability and mortality.

Road traffic accidents are the leading cause of death among children and adolescents worldwide. Yearly in the world 0-19-y/o 220,000 children and adolescents die from injuries resulted in road traffic accidents. It means that more than 600 preventable deaths among children and young people per day, or one death almost every two minutes.[47]

The issue of children's environmental safety is also topical for Armenia. By order of the Minister of Health No. 36-N of 2017, the Form of the annual administrative statistical report "On injuries recorded in institutions providing outpatient and in-hospital medical aid and services and other consequences of the influence of external causes" was introduced, which makes it possible to count all injuries, including children's, according to gender, cause, geographic distribution and to analyze and identify their patterns.

In the 0-5 y/o children's motrality composition, mortality due to injuries, poisoning and other external causes has been decreased by 1/3 in the recent years. However, the numbers of accidents and children's traumatism in the higher age groups remains high (in the recent years up to 18,000 new cases have been registered among children), unfortunately, sometimes with the lethal end.

In Armenia only in 2022 thirty-one children died and 804 were injured as result of road accidents. By age groups, statistics on children's mortality caused by traffic accidents is different/ presented above.

Globally, the prevention of accidents and road accidents is an interagency task of state concern. The World Bank estimates that countries that do not invest in road safety lose between 7 percent and 22 percent of their potential growth in GDP per capita.

Program measures aimed at child safety should be targeted according to the characteristics of age groups. If for the 1-5 age group (when the child begins to walk) the safety of the environment is important at home, in the yard and in the kindergarten, then for school-age children - on the street and at school. In both cases, measures to prevent accidents and traffic accidents, including legislative changes and enforcement, are very important.

ADOLESCENT HEALTH AND BEHAVIOR

According to the legislation of the Republic of Armenia, the age of adolescence is defined as 11-18 years. Adolescence is characterized by physical, psychological, emotional and social turning points. According to the RA law on medical aid and service of the population, from May 2020, a 16 y/o adolescent person has the right to make an independent decision regarding consent to

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[47] Road safety rules for children, https://www.unicef.org/armenia

medical intervention. A trend analysis of adolescent health morbidity and mortality s is presented above. In the present-day RA official statistics only the data, related to (including) 0-14 and (including) 14-17 age groups are availble, but statistical summary data for adolescents aged 11-18 years are lacking. The groups of children of junior, middle and high school age are also not separated in the official data, therefore the available statistics on their health are not complete.

The available data on the health, behavioral and nutritional habits of adolescents are mostly based on sample surveys, the most comprehensive of which is conducted by the Arabkir Medical Center - Institute of Child and Adolescent Health, using the WHO methodology. It is the Survey of the school-age children's health behavior (the last SCHBS was conducted in 2017/2018),[48] which gives detailed information categorized by age and sex, helping to develop relevant actions for various target groups.

1. Harmful habits, risk factors

The School-aged Children's Health Behavior Survey (SCHBS) of 2017/18 documented an increase in behavioral risk factors with growing age children. In the period of this survey almost 16% of 15-y/o boys smoked, and the number of smokers was higher than in 2013/14.

The longterm cohort survey, conducted in 2015-2018 among 10-12 y/o Yerevan scoolchildren to study the impact of most wide-spread risk factors of non-infectious revealed that although 90% of respondents find the smoking a harmful habit, 6.8 of them tried smoking and 6.7% continue smoking.

The SCHS 2017/18 showed 13% of 15-y/o boys and 2% of girls of the same age at least once in their life tried hemp. According to the same source, hooka use has been increased in the recent years: 19% of 17-y/o boys and 12% of 17-y/o girls at least once tried it.

2. Eating behavior and physical activity

Unhealthy eating behaviors and low physical activity are among the main factors contributing to adolescent health problems. Only 42% of 15-y/o girls and 53% of boys of the same age eat breakfast every day on their way to school, according to a recent SCHBS. The daily consumption of sweets is high: 70% of 13-y/o girls and 61% of boys eat sweets several times a day. Only 56% of 15-y/o girls and 33% of boys of the same age follow proper dental hygiene.

Overweight and obesity registered among 9% of 15-y/o girls and 23% of boys of the same age. Meanwhile, it is known that obesity of children, with its immediate and remote manifestations, contributes to the increase in the prevalence of non-infectious diseases at an older age.

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[48] The School-age Children's Health Behavior Survey, Arabkir MCICAH, Yerevan, 2019 https://arabkirmc.am/files/6228897996212.pdf

Although 77.2% of children value physical activity, only 69.6% exercise regularly and only 22.2% exercise in the morning.

Consumption of carbonated drinks among Armenian teenagers exceeds the European average, reaching 24% among 15-y/o girls and 33% among boys.

3. Mental health of the adlolescents

Mental health problems of children are actually more common than people think. Fortunately, most of them are treatable with proper and timely professional help. Worldwide, 10-20% of the adolescents experience mental health problems, but many remain underdiagnosed and untreated.[49] The growing problem of adolescent mental health disorders is also a challenge for Armenia.

According to the SCHBS, although around 90% of teenagers are satisfied with their lives, 50% of 15-y/o girls and 36% of boys of the same age report that they have multiple complaints about their mental health more than once a week. 41% of 15-y/o girls and 22% of 15-y/o boys reported feeling hopeless more than once a week. 20% of adolescents had depression, and up to 8% reported suicidal thoughts.

Estimates of official data on morbidity and mortality due to mental disorders among children and relevant treands are shown above. The situation is particularly disturbing in terms of the increasing trends of adolescent s and the limited availability of appropriate professional help and the acute shortage of child psychiatrists.

4. Sexual education and behavior

According to the SCHBS, 27% of boys and 1% of girls among 15-y/o adolescents informed about sexual relations, and among 17 year old ones 43% of boys and 1% of girls reported about it. Apparently, boy are much more experienced as regards to teh sexual life. From another point of view, it is the evidence of the differrence in beliefs and attitudes in the traditional Armenian society to the sexual behavior of boys and girls. Sexual experience is important for boys, while most girls at least "need" to report no experience in order to demonst virginity.

According to the same source, the level of knowledge of adolescents about sexually transmitted infections is insufficient: only 17% of 15-y/os and 13% of 17-y/os correctly answered the questions about the ways of HIV transmission and prevention.

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[49] WHO – adolescent mental health
https://www.who.int/news-room/fact-sheets/detail/adolescent-mental-health

5. Chronic diseases

Some data on the prevalence of chronic diseases among adolescents in Armenia are commented above, which is reflected in the SCHBS results. 8% of the respondent schoolchildren answered positively to the question about the presence of any chronic health problem requiring continuous medical supervision. 7% of them stated that due to the health problems take medicines daily.

The current system of managing chronic diseases among children is as follows: after diagnosis of a chronic disease, children are referred to specialized medical centers, where continuous (dispensary) medical supervision is carried out until the child turns 18. These centers provide services to about 12,000 children, about half of whom are teenagers. In general, adolescents with chronic diseases and disabilities need a special approach and care, especially in cases of mental health problems and sexually transmitted infections.

Comparison of the results of all four SCHBS surveys indicate negative trends in the general health behavior of adolescents. In particular, they have insufficient information and knowledge of mental health, eating behavior, oral hygiene, STD and HIV prevention, physical violence.

Adolescents do not have sufficient understanding of the changes in their bodies during transition period, they are unaware of the risks of pregnancy, sexually transmitted infections, methods of their prevention, and clinical signs of diseases. They also do not know where they can turn to for benevolent services in isolated conditions if needed.

6. Adolescent-friendly health services

From early 2000s, widespread program events were carried in the Republic with aim of improving the medical services, provided for the adolescent, and some models of "adolescent-friendly" health services (AFHS) were tested, which, however, have not had a systemic implementation in the future.

By order of the RA Minister of Health N5688-L (December 9, 2022), "The evidence-based and cost-effective model of health care services for school-aged children and adolescents" was approved, envisaging availability of the position of adolescent doctor-school coordinator (pediatrician, family doctor), who has undergone AFHS training in marzes, regional and Yerevan polyclinics and will be occupied with referrals of mild and mode cases from attached schools and other PHC medical organizations and coordinate the work of attached school nurses.

In order to implement this cost-effective model at the systemic level, as well as taking into account the lessons learned in the past, it will be necessary to have sufficient political will, in the conditions of securing legal regulations in the PHC sector and collecting additional financial resources. It is also important to teach these professionals the necessary knowledge and skills to provide friendly medical services in a secluded and friendly environment. In this process, a wider inclusion of school nurses can be an additional guarantee of success.

Nutrition children and women

Nutrition-related issues are priority for children's health care. In this regard, 1000 days of an infant's life (pregnancy and two years after birth) are particularly important, because it is this period proper and adequate nutrition of the mother and child guarantee the best start of the child's life and are decisive for the whole lifetime. At the same time, the nutrition issues are important for almost periods of the infant's life. The proper nutrition of the school age child contributes to the comprehensive display of the child's mental potential, development of educational and cognitive abilities.

It is not by chance that the international community, giving particular importance to the problems of nutrition, has referred to them many times at the global level. In particular, the UN General Assembly and the World Health Assembly have adopted a number of declarations addressing the improvement of nutrition issues, calling on UN member states to consolidate resources and implement programs aimed at overcoming global nutrition problems, with an emphasis on mothers' and children' nutrition issues.

1. Child nutrition profile in the world

According to results of the Global Burden of Disease longterm study, published by "The Lancet" journal in April 2019,[50] "the registered 11 million deaths and 255 million cases of diseases in 2017 were attributable to dietary risk factors. Every year, hunger kills more people worldwide than malaria, tuberculosis and AIDS combined."

Despite the efforts undertaken by the international community and some progress recorded in the world in overcoming malnutrition, there are still many unresolved issues. According to the publications of UN specialized agencies,[51] in the last decade stunting (33% in 2012, 22.3% in 2022) and underweight (8.7% in 2012, 6.8% in 2022) of up to 5 year old children in the world decreased by about 1/3, but the number of overweight children increased by about 4 million (33 million children in 2012, 37 million in 2022). In 2022 148.1 million children are still stunting, 45 million children are underweight (6.8%), 13.6 millions of them suffer from malnutrition (2.1%). In the European region, overweight children prevail 1.5 times over underweight children (1.4 million children are underweight compared to 2.1 million overweight children).

According to WHO, the exclusive breastfeeding did not exceed 38% in the world, and 13% in the European region[52], meanwhile its is well-known that the morbidiy and mortalitiy rates of breastfed infants are more than 10 times higher than the artificially fed ones.

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[50] Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Published April 3, 2019, https://www.thelancet.com/article/S0140-6736(19)30041-8/fulltext

[51] The global health observatory, UNICEF-WHO-The World Bank: Joint Child Malnutrition Estimates (JME) — Levels and Trends – 2023 edition, https://data.unicef.org/resources/jme-report-2023/

[52] Promoting breastfeeding and complementary foods, WHO Euro, 2023 https://www.who.int/europe/activities/promoting-breastfeeding-and-complementary-foods

2. Infants and women nutrition profile in Armenia

The measures aimed at improving the nutrition of children and women and reducing malnutrition have been continuously highlighted in the strategic program directions of the RA Ministry of Health. By its protocol decision N40, adopted on September 25, 2014, the RA Government approved "The concept of improving children's nutrition and action plan to implement the concept for 2015-2020", where goals were set to improve the situation related to children's nutrition, including reducing malnutrition, and a number of relevant measures and actions were carried out.

In 2015, the RA Law "On promoting the breastfeeding and the circulation of infant food" came into force, regulating the circulation, labeling, sale, and advertising the infant food and related products.

Official data on the nutritional status of women and children are scarce and do not always reflect the current situation, as they rely mostly on availability and are only summarized in end-of-year reports. An alternative data source for assessing the nutritional status of children and women is the Armenian Demographic and Health Survey (ADHS), which has been conducted in Armenia since 2000, once in every 5 years. The analysis given below is based on the results and comparative analysis of for surveys, conducted during the 2000-2015 period. According to the data of the ADHS for 2015-2016, almost all main rates, defining the status of early age infant nutrition in Armenia were improved.

1) Breastfeeding

Information related to the children's breastfeeding in the RA Moh NIH database is available in several rates: 6 month exclusive breastfeeding (EBF), 4 months EBF and 1 years and more also BF. According to the report data for 2022,[53] the EBF was Է 69%, and 51,6% for 1 year and above. According to the same source, the of exclusively breastfed infants is 83% this year (percentage of 1 year old and above infants exclusively breastfed 4 months).

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[53] Database of the Health Statistical and Research National Center, RA MoH NIH, http://nih.am/am/subdivisions/health_analytical_center

Figure 40. The trends of breastfeeding , %, 1988-2022
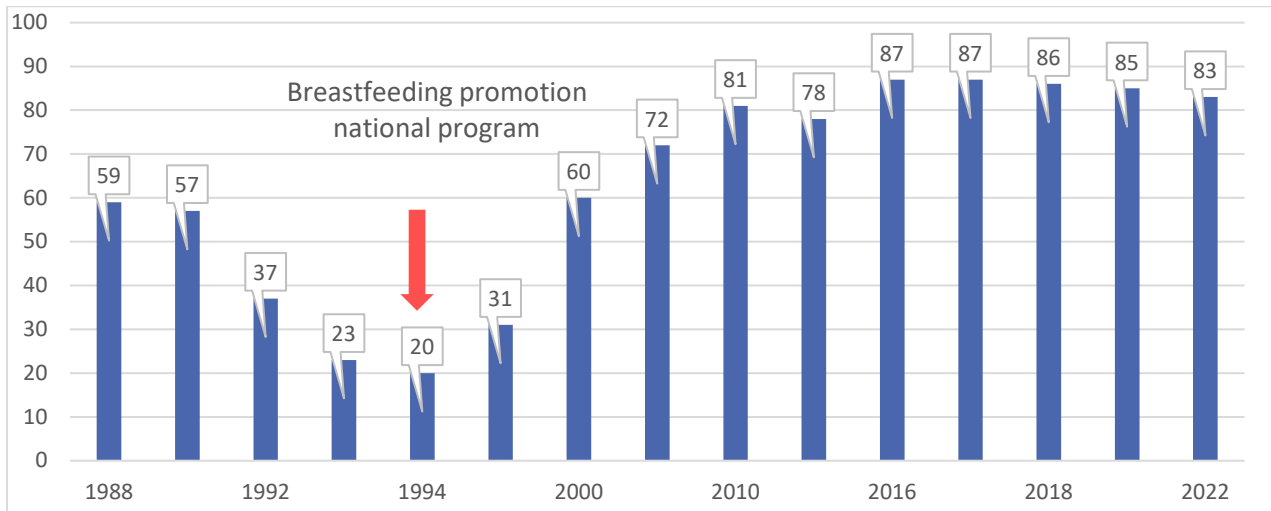
These at first glance favorable rates do not reflect the real picture, which becomes clear during the evaluation of BF trends. The figure presented above provides the effectiveness of program measures aimed at encouraging breastfeeding, but the gradual decline of this indicator in the last 5 years is a cause for concern.

This negative dynamic is explained both by the consequences of the Covid pandemic and inappropriate practices of BF support in maternity care facilities. And although the RA legislation prohibits the advertising and promotion of artificial milk formulas, due to the lack of monitoring of the law and because of the lack of motivation and/or knowledge and skills of health care workers in BF counseling, unnecessary prescriptions of prelactal fluids or milk mixtures have become much more active in recent years. The latter is also a consequence of their cooperation with organizations importing and distributing baby milk formulas, as a result of which a significant number of infants are discharged from maternity hospitals on mixed or artificial nutrition.

Figure 41. The trends of the exclusively breastfeeding by ADHS
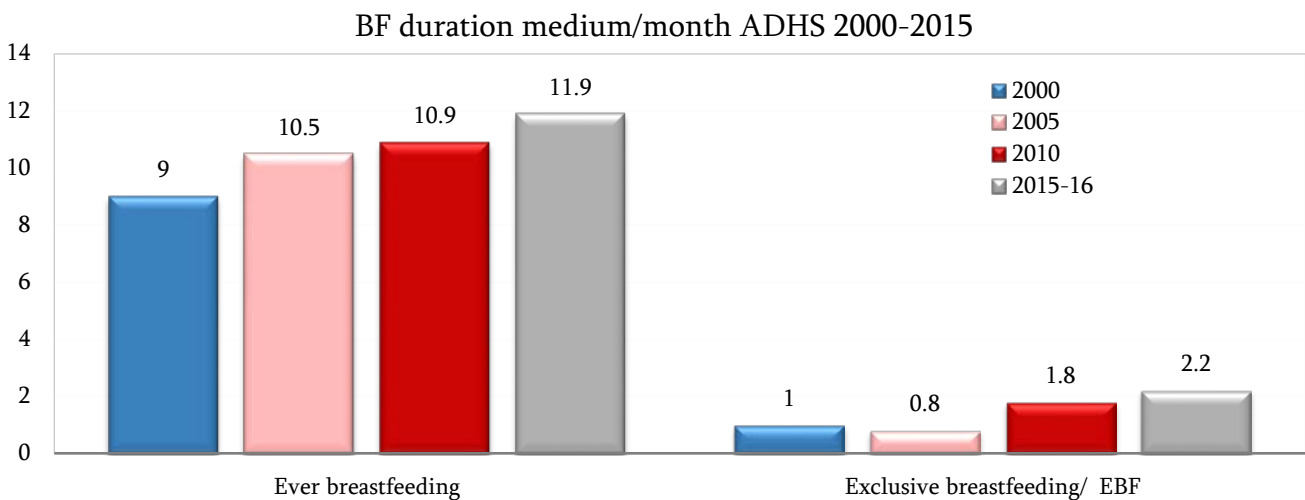
As it can be seen in the figure, the 33% of exclusive breastfeeding in 2005 was significantly improved in 2015, reaching 45%. Some progress was also registered from the view exclusively breastfeeding "median" value of duration (1.8 in 2010; 2.2 in 2015); however, the situation remains far from being sufficient, as far as exclusive breastfeeding is still recommended during the first 6 months of the infant's age. The "median" duration of ever breastfeeding also increased by one month (10.9 in 2010, 11.9 in 2015).

During 2000-2015 the situation also slightly improved with early putting of the neonate to breast (during one hour): in 2010 it was 36%, and 41% in 2015. Since then 35% of infants were breastfed one year and more, and 22% for 2 years or more. The use of a bottle with a pacifier by infants aged 2-3 months to some extent decreased: 25% in 2015, compared to 37% in 2010. However, 11% of infants received prelactal food during the first 3 days of life, and 13% of breastfed infants under 6 months of age were given water.

2) *Breastfeeding and infant mortality*

The beneficial effect of breastfeeding on infant mortality s has been proven by many studies. According to these data, 12% of infant mortality cases in the world can be prevented through the proper arrangement of the breastfeeding process. The problem has also been studied in this context within the framework of ADHS.

Table 10. Breastfeeding and infant mortality[54]

Up to 1 year children	Breastfeeding %	Average breast feeding period
All children N=372	80.6	4.5 months
Live children N=305	90.8	53 months
Dead children N=67	34.3	1.1 month
Reliability P-coefficient	<0.001	<0.001
Correlation coefficient	-3.313	0

Source: ADHS , 2010

The connection between infant mortality and breastfeeding was analyzed, and according to the results, the proportion of breastfed children in the group of surviving children was almost 3 times

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[54] «Trends, problems and future strategic directions of the maternal and child health sphere», Report, RA MoH NIH, 2020. http://nih.am/am/reports/115/am

higher compared to dead children, and the average duration of breastfeeding was about 5 times longer.

The presented data prove that improving the situation with breastfeeding, in particular, increasing the of exclusive breastfeeding can be the best reserve for reducing infant mortality.

Thus, despite some progress in breastfeeding rates, the need to improve infant care and feeding practices in maternity facilities remains. After 2010, the implementation of the "Baby friendly maternity hospital" initiative almost stopped, not all maternity hospitals have staff with breastfeeding counseling skills.

3) Complementary feeding

The ADHS data on complementary feeding procedure show that compared to the previous survey the situation has not been imporved. To the contrary, compared to the year of 2010 every third 6-23 month-old child had (32%) adequate complementary feeding (age-appropriate selection, volume and frequency), in 2015 every forth child (24.5%) had it, meanwhile in the case of breastfed children the is slightly better, than those not breastfed ones (21%). From the view of correct arrangement of complementary feeding, it is very important to start it on time (since 6 months).

The ADHS – 2015 data show that the situation is problematic in this regard as well, and that 15% of children aged 2-3 months already receive solid or semi-solid food, and 11% of those aged 6-8 months still do not receive the necessary complementary food. It is clear that early childhood nutrition practices, particularly complementary feeding, need significant improvement, both through professional training and public awareness.

2. The situation with mother and child nutrition

Only the data related to anemia in the official statistic are available to characterize the state with the mother and child nutrition. Accoring to the RA MoH NIH data,[55] in 2000 the anemia among the women, finished pregnancy, was 15.7%, in 2005 it decreased by 1/3 (10.7%), and then up to 2020 it remained almost the same (12.8% in 2010, 12.9% in 2015, 12.2% in 2016, 12.5% in 2018, 12.6% in 2019), decsreasing since 2000 by nearly 20%. During the last three years, the level of anemia of the women, who finished pregnancy, increased up to 17.1%, the highest level in the last two decades, which partly can be explained by the Covid and the war situation in the country.

According to the same source, in 2000 anemia of the children up to 15 age group was 32.7 by 10,000 population, and in the following 15 years this level displayed a slowly growing trend: 39.7 in 2005, 49.4 in 2010 and 52.2 in 2015). In 2020-2022 the level remained almost the same (45.4 in

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[55] Health and healthcare. Statistical yearbook, Armenia 2023, RA MoH NIH, https://nih.am/assets/pdf/atvk/2d5537b6227666a32f97571d7dd15420.pdf

2020, 45.6 in 2021, 46.6 in 2022). In the 0-1 age group the anemia level in 2022 was higher: 53.2, which can be explained by the incorrect arrangement of breast child nutrition: by insuffcent breast feeding, early or lateradditional nutrition, etc.

The data on prevalence of children's and women's anemia are also available in the results of the research made by ADHS in 2005-2015, according to which prevalence of anemia of children in the 0-5 year age group decreased almost twice as much: 16% in 2015, compared to 37% in 2005. The level of prevalence of anemia of women in repoductive age decreased nearly by the same proporotion: 13% compared to 25% in 2005.

There are no official data on children's physical growth and nutritional status. Alternative sources for the data assessing the nutritional status of children and women are "Armenia Demographic and Health Surveys."

According to ADHS, the stunting growth in the 0-5 years age group children, which defines the child's chronic stunting growth, was 9% in 2015 compared to 19% in 2010. However, the problem of unbalanced and protein-deficient stunting growth of children remains on the agenda, as the still exceeds the standard population average (≤ 8%).

Figure 42. Trends in the nutritional status of children by ADHS, %
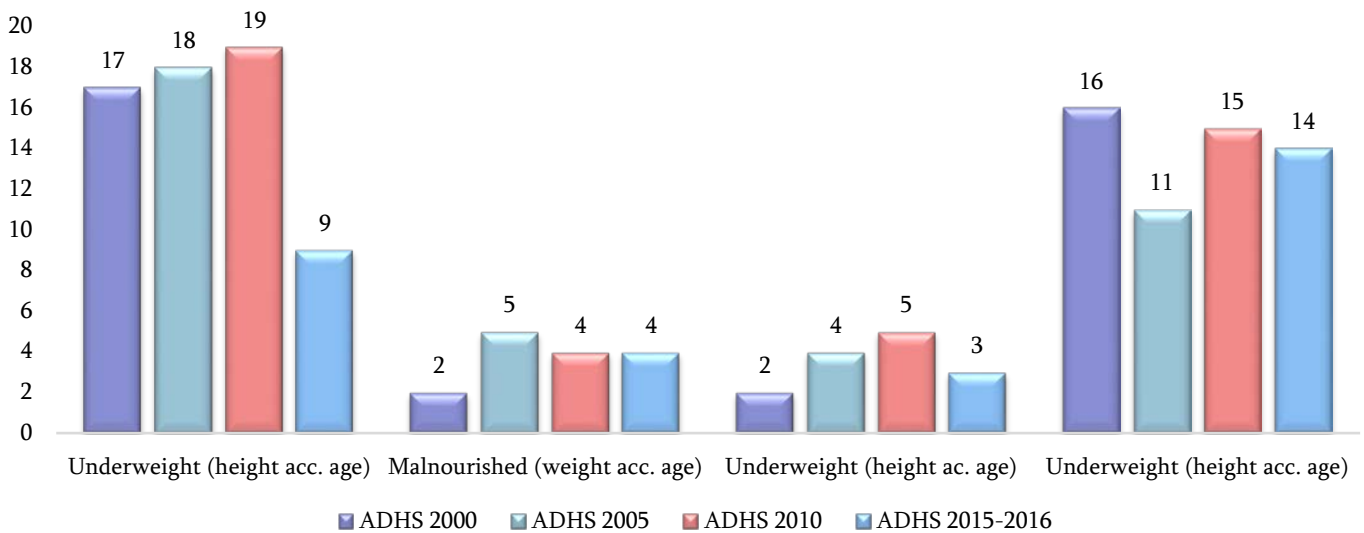
According to the same source, the of underweight (acute malnutrition) among children slightly decreased (4% in 2005, 5% in 2010, 3% in 2015-16). The persistently high level of children's obesity index (11% in 2005, 15% in 2010, 14% in 2015-16) and the growth trend compared to 2005 is worrying. Obesity combined with stunting is repeated in almost the same, poorer marzes. In the framework of this study, the nutritional status of reproductive age was also determined through anthropometric measurements. According to ADHS 2015 data, 51% of women had a normal weight, 4% were underweight (BMI ≤ 18.5), and 45% were overweight (BMI > 25).

The data of the international survey on obesity control of school children, conducted in 2019 for the first time in Armenia, showed that 27.7% of 7-8-y/o children are overweight, and 12.6% are obese.[56]

The data of the biological monitoring, which was carried out in 2017 among school children confirmed the satisfactory level of their median value of ioduria (iodine excretion in urine). At the same time, according to the ADHS 2015-2016 data, the use of iodized salt in households was 99 percent.

Thus, despite the positive trends recorded in the field of children's nutrition, the issue of the double burden of stunting and obesity caused by malnutrition of children remains on the agenda. Moreover, in recent years, there has been a worsening of the BF , which puts in doubt the achievements of the national breastfeeding promotion program. The problem of unhealthy eating behavior of school-age children also exists in Armenia:

By the way, after 2015, no survey of demographic and health issues was conducted in Armenia, official data on children's nutritional disorders are missing. In fact, there is no nationally representative data on the current status of early childhood nutrition, so the situation in this regard needs to be assesse:

Thus, highlighting the most urgent problems of children's nutrition and evaluating the effectiveness of implemented programs, developing new strategic programs aimed at improving the situation, should be one of the priority health problems of the country and fixed at the level of the national program.

It is obvious that the effective implementation of strategies and programs aimed at improving child nutrition currently requires consolidation and doubling of the efforts of government agencies and international partner organizations.

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[56] «Childhood obesity surveillance inititiatve» (COSI), Armenia, 2019, Results of national survey, Report, Yerevan, 2021 https://arabkirmc.am/files/630739a4c87bc.pdf

MOTHER AND CHILD HEALTHCARE SERVICES, HUMAN RESOURCES

Since gaining the independence, the RA government has always focused on children's and mothers' health and healthcare issues and supported their solution at the national level, fixing them in the list of its policy priorities. After 2020, due to Covid and the war, the policy emphasis of the health system has shifted to the implementation of more urgent and emergency management program measures, among which women's and children's health issues have also been included.

1. Legislative regulations in the field of child and adolescent health care

Since the first years of independence, the legislative framework regulating the field of health care for children and adolescents has been continuously improved, a number of laws and strategic documents were adopted, as well as many normative legal acts, due to which this field was maximally measured. The main laws related to children's health care are listed below:

The RA Law "On child's rights" (1994), by which the age definition of «child» changed from 15 to 18 years in compliance with the International Convention on Child's Rights, and according to which the children's service in children's medical institutions was enlarged to the age of 18 years.

The RA Law "On the medical aid and population services" (1996), which regulates the legal relations between patients and service providers. According to this law, according to this law, the right to make a decision on a child's medical aid and to receive information in this regard is reserved for his parent or legal representative. On May 2020 this law was adopted by the National Assembly in a new edition, according to which after turning 16, children are entitled to exercise their right to medical aid independently.

The RA Law «On the human reproduction health and reproduction rights» (2002), which sets up the the reproductive and sexual health rights of adolescents and the relevant legal relations with regard to their implementation. The law provides the term "adolescent" as a medical-biological (physiological) definition, including people of the 11-18 year age group. It also defines the transit period from childhood to complete adulthood. According to this law, the adolsecents have the right for awareness on the issues related to sexual and reproductive health and to receive affordable and complete medical advice and care in secluded and confidential conditions.

The RA Law "On promotion of breastfeeding and baby food circulation" (2014), which prohibits advertising and donating artificial milk formulas and associated products. It also prohibits cooperation mother and child health workers and milk formula manufacturing and/ or importing organizations. Administrative penalties are established for violation of these provisions.

2. Organization of maternal and child healthcare services, infrastructure, resources

After gaining independence, despite the difficult socio-economic conditions of the country and the critical state of the healthcare system, the fact that obstetric-gynecological and pediatric services are sufficiently equipped with infrastructure and personnel played a major role in the continuous reduction of child and maternal mortality in the country.

Since the second half of the 1990s, the sphere of maternal and child health care, in line with the general healthcare system, has experienced a number of changes. Namely: reforms in the primary care, including introduction of a family medicine system, integration of children's and adult polyclinics, changes in the children's hospital services, including part of them in medical units, reductions in children's departments and/or beds in regional hospitals.

Currently, healthcare services for women and children are organized within primary health care (PHC), including women's consultations, and hospital, including maternity facilities. There is a problem of physical access and affordability of narrow professional services in this field. Both ambulatory and inpatient specialized healthcare facilities are mainly concentrated in Yerevan and not fully in several regions. At the regional level, specialized maternal and child services are very limited and unavailable.

According to the latest data published by the National Center for Health Statistics and Research of the Ministry of Health of the RA Ministry of Health,[57] the medical service of women and children in the PHC is carried out by 625 is carried out by medical-midwifery points and 278 ambulatory-polyclinic institutions, 53 ones of which within hospitals. 239 rural medical clinics and 30 independent polyclinics, 1 of which is a children's clinic, operate in the republic.

The general practice pediatrician (family doctor in the villages) at the primary healthcare level supervises a healthy child by assessing the child's growth and development, examining children of pre-conscript age, organizing laboratory-instrumental diagnostic tests and, if necessary, treatment, assessing physical development and sexual health of 15-18 y/o children, organizing referral of the child to other specialized facilities, if required. Adolescent medical aid and support is also provided through the child's pediatrician or family physician. Out-of-hospital narrow professional services are performed by relevant specialists of existing polyclinics or narrow specialists of medical associations.

Children's hospital care is provided in Yerevan by four large children's hospitals and nearly 10 multiprofile or specialized medical centers. At the regional level, there are mother and child healthcare centers (in Shirak marzes) and departments or beds in 53 regional medical institutions. The children's bed fund in the republic in 2022 was 1397 beds, which is more by 48 beds than in the previous year. The medical aid is provided to children by 1175 pediatricians and 229 surgeons, having children's profile narrow specialty.

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[57] «Health and Healthcare» Statistical Yearbook, RA MoH NIH, 2023.

Obstetrics and gynecology services are provided by obstetric and gynecology departments of 56 regional hospitals and 3 mother and child centers, as well as 3 independent regional maternity hospitals. There are 10 maternity hospitals in Yerevan. Maternity care services are located in 7 multi-specialty hospitals and 3 independent maternity hospitals. 2022 The total number of obstetric-gynecological beds in the republic was 1,552, including 1,108 obstetric and 444 gynecological beds.

Obstetrics and gynecology beds were reduced by 87 compared to last year. Women's consultations operate within 53 regional health centers, 10 maternity hospitals and 26 polyclinics in Yerevan. Medical aid for women is provided by 922/792 obstetrician-gynecologists, 349 of whom work in inpatient facilities, and 421 work in women's consultations. Specialized care for children and adolescents is organized through 22 pediatric gynecologists.

3. Quality and availability of services

Starting in 1994-95, the program management model was implemented in the maternal and child health sector, implying setting a clear schedule and expected results based on situational analysis, raising issues with needs assessment, outlining strategies for overcoming them and defining goals and targets and developing an action plan aimed at achieving them.

Thanks to effective international and interpublic health sector cooperation, it was possible to implement about two dozen targeted programs aimed at improving the quality and accessibility of maternity and children's medical aid. Multi-level public awareness and professional education programs were implemented, evidence-based patient management guidelines and procedures were implemented, which significantly contributed to the improvement of women's and children's health rates.

The continuous increase in the volumes of free medical aid and services provided to children and mothers within the framework of the state-targeted program also significantly contributed to the improvement of rates of the mother and child health. Thus, the 2-3 times increase in budget allocations within the framework of the state target program for mother and child health care made it possible to develop and introduce since July, 2008, the State Certificate of Maternity Assistance, and then, since January, 2011, the program of the State Certificate of Children's Health, which was based on the development and implementation of all 4 functions of the healthcare system. As a result, really affordable and quality services were provided in the fields of maternity care and children's hospital services, the results of which were reflected in both the quantitative and qualitative rates of these fields.

In particular, informal payments made in maternity hospitals were reduced by 8-10 times, and in children's hospitals by 3-4 times, the hospital mortality of children aged 0-1 years decreased by 30%, and the pre-24-hour mortality rate was reduced by almost 5 times, the cases of maternal mortality were significantly reduced.

From 2019, the age limit for children to receive hospital medical aid within the framework of the state order was increased to 18 years. Inpatient services became free for all children, regardless of their social status and age.

4. Organization of the pediatric service in the primary healthcare facilities

In the healthcare system, in particular, at the primary healthcare level, the problem of the shortage of specialists is a global challenge in many countries of the world. Strengthening the PHS, making it more attractive for professionals and developing and implementing a policy to provide it with human resources is imperative for many European countries.:

For Armenia, the issue of primary care human resource deficit is topical in the current situation, and the deepening problem of the shortage of specialists providing medical aid and service to children is already on the agenda.

The experience of European countries proves that there are various models of organization of medical aid for children at the primary healthcare level.[58]

41% of European countries have a general practice model, 35% have a mixed model - general practice and pediatrics - in primary health care, and 24% of countries provide medical services for children in primary care. In Sweden, a mixed model works. family doctors work with children in rural areas, and pediatricians in densely populated areas of the country: In Sweden, a mixed model works: family doctors work with children in rural areas, and pediatricians in densely populated areas of the country.

The process of reforming the PHC system and introducing the institute of family medicine started in Armenia in 1997. The works were mainly directed to the improvement of the building conditions of the rural medical institutions of the marzes, as well as to the creation of favorable conditions for the introduction of family medicine as the most affordable and appropriate structural model. About 25 years after the beginning of the reforms, it is recorded that the family medicine system was established only in rural areas.

Currently, the medical aid of children in rural areas is provided by family doctors, most of whom are former pediatricians. In most of the regional polyclinics, and in almost all of Yerevan's PHC institutions, children's medical aid is provided by pediatricians. There are also about a dozen private family doctor's offices that primarily serve the adult population.

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[58] Strategic Pediatric Alliance. Paediatric primary care in Europe: variation between countries. Diego van Esso,1 Stefano del Torso,2 Adamos Hadjipanayis,3 Armand Biver,4 Elke Jaeger-Roman,5 Bjorn Wettergren,6 Alf Nicholson7; Published online, last accessed 20.06.2023, http://www.strategic-pediatric-alliance.org/content/page/13/paediatric-primary-care-europe-variation-between-countries

Human resources of the pediatric service, professional training, background and future developments

During the Soviet years, the medical aid of children in the primary health care sector was carried out by pediatricians who received their university education at the pediatric faculty of the Yerevan State Medical Institute, where in the 1980s the admission reached 150 students per year. In the early 1990s, the country's health system employed about 2,000 pediatricians.

Due to the introduction of international standards, particularly the Bologna educational system, the pediatric faculty of the medical institute was closed within the system of higher education, (the pediatric faculty was opened in Yerevan Medical Institute in 1958[59]). Enrollment stopped in 1999, the last graduation of 250 pediatricians was 2004.

Pediatric faculties were also closed in a number of countries of the former USSR, in the medical institutes of the Baltic countries, Georgia, Moldova, and Kazakhstan. Pediatric faculties were preserved in Russia, Belarus, Central Asian countries, and independent Pediatric Institutes continued to ope in St. Petersburg and Tashkent. In 8 out of 10 medical universities of Ukraine, pediatric faculties were preserved. In Kazakhstan in 2011 the closed pediatric faculty was reopened in 2017 under the name of "School of Pediatrics". In the State Medical University in Moldova, pediatrics is separated from the 5th year by an advanced program.[60]

According to the statement of the Moldovan Ministry of Health,[61] from March, 2023, «pediatricians will be transferred from hospital consultative polyclinics to primary care/family medicine centers, where they will perform care of all children of 0-5 years age group and care and management of of 0-18 years old chronically ill children.»

The European Union of Medical Specialties (UEMS) offers a five-year postgraduate training program for pediatricians, which is divided into three-year basic and two-year specialized education. Specialized education is developed in the following three directions: primary care (general practice paediatrics), general hospital paediatrics and narrow specialties of the paediatrics profile.

In most European states, with the exception of those CIS countries having pediatric faculties, pediatricians and narrow pediatric specialists are trained through postgraduate education. In almost all countries, higher education or post-graduate education programs are licensed either by the Ministry of Health or another competent authority. The duration of postgraduate education

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[59] Raphael S. Parsadanyan. *Medical staff, higher and secondary medical education, improvement of doctors in Armenia, Armenian Medicine Daran, Armenian Journal of Health and Medicine*, #2/Volume II /2022, p. 60 (In Arm.)

[60] Business of Russia. *Higher medical education in the Republic of Moldova.* April 2019. *https://glavportal.com/materials/vysshee-medicinskoe-obrazovanie-v-respublike-moldova/*

[61] Zoya Dubaeva, *Since March paediatrician in Moldova will work in the centers of family doctors, but not in hospitals.* February 2023. *https://nokta.md/v-moldove-s-1-marta-pediatry-budut-rabotat-v-tsentrah-semejnyh-vrachej/*

in pediatrics varies between 3-5 years in different countries. An outpatient component is mandatory in educational programs.

In most of the CIS countries there outpatient polyclinic or departments of preventive pediatrics. In a number of European countries, quite a lot of time is allocated to the outpatient pediatrics course.

For example, in Slovenia, three of the five years of postgraduate training in paediatrics are dedicated to general practice paediatrics, with another 2 years of continuing education for hospital paediatrics training. In Israel, a 6-month cycle is mandatory in the 4-year post-graduate program of pediatrics education in primary care. In Sweden, the residency education program also has a separate course for general practice pediatrician training.

Duration of the professional qualification of family doctors in Estonia is 3 years, in which enough hours are singled out for pediatrics. Since 2014, in order to improve the performance of the primary care level in Estonia, 2 nurses are attached to 1 family doctor, one of them is for patronage work.[62] Since 2017, the Government of Estonia has been promoting a group practice of FD with differentiated models for urban and rural areas.[63]

In Armenia, since 2005, pediatric personnel have been trained through a three-year clinical residency. After the closure of the pediatric faculty, the subject of pediatrics was taught in the pre-diploma education system with the number of hours previously planned for the medical faculty. In the implemented three-level system of higher medical education, 4 weeks for undergraduate and 6 weeks for master's were planned for issues related to pediatrics.

Although the closure of the Faculty of Pediatrics and the changes in the curriculum were explained by the introduction of European education standards, the curriculum of pediatrics for the Faculty of General Medicine of YSSU did not meet the norms of the educational programs approved and taught in most of the European HEIs in terms of hours and content.[64]

Currently, the total duration of the pediatrics curriculum at the Faculty of General Medicine is only 6 weeks. Another 6 weeks are planned for pediatrics in the 2-year educational program of the clinical residency of family doctors.

 It is clear that family physicians trained in only a 12-week educational program will not be able to have sufficient professional confidence to manage children and master the fundamentals of outpatient pediatrics.

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[62] World Health Organization, Technical assistance to the reform of primary health care organisation in Estonia. Report with main findings and recommendations. 2016, WHO Regional Office for Europe: Copenhagen.

[63] The development of family practice to support universal health coverage, WHO, 2018,Country case studies oh Praimary health care Estonia, https://apps.who.int/iris/bitstream/handle/10665/326088/WHO-HIS-SDS-2018.23-eng.pdf

[64] Report on the analysis of infrastructure and human resources in the field of maternal, neonate and child healthcare in Armenia, RA MoH, SC Armenia, 2011.

It should also be noted that in the current three-year educational program of clinical residency in pediatrics, the issues of preventive pediatrics and managing a healthy child are almost absent or are presented with a minimum number of hours. And this is despite the fact that almost 70 percent of the burden of non-communicable diseases in adulthood is due to health problems and harmful behavioral habits from childhood and adolescence. On the other hand, after the closure of the pediatric faculty, only a few graduates were admitted annually to the pediatric residency program. Medical graduates are not excited about the prospect of becoming pediatricians, they are not motivated in terms of expected income, they avoid the responsibility of caring for children, they are not confident in their knowledge, they are "afraid" of children.

Even a targeted clinical residency did not alleviate this problem. For years, even the free places allocated for targeted residency in pediatrics and children's specialties remain vacant. In response to an oral question about the reasons for not choosing pediatrics,[65] first-year residents mostly mentioned low-paying and very responsible work.

Although the number of clinical residents choosing pediatrics or a pediatric subspecialty has somewhat increased in recent years, the latter primarily see their future work in the field of hospital service and prefer to pay for this option. Pediatricians who choose to work in the ambulatory polyclinic system are unique. And this is in the event that the expected result of the activity of the PHC system is the early detection and early intervention of their health problems through the prevention of diseases and the continuous monitoring and screening of the growth and development of healthy children, while pediatrics in the hospital is aimed exclusively at the management of sick children.

It should be noted that the postgraduate system of higher medical education in Armenia does not have sufficient legal regulations. The list of active professions is in the process of revision, the qualitative characteristics of the professions are almost absent. Post-graduate medical education issues are addressed in the RA Law on Higher Education and Science "adopted" by the RA NA, which was not approved by the Constitutional Court and was returned to the NA for revision.

Among systemic problems of medical professional education is the minimum of requirements and the quality of assessment of educational programs. Post-graduate education programs implemented in the country do not have quality assurance and quality control mechanisms.[66] Clinical residency programs are developed by the respective chairs and approved by the Scientific Councils of the same institutions. The external evaluation and monitoring of the content of medical educational programs and training courses, the problem of identifying their content, ensuring the evidential basis of the delivered material, as well as the issues of teaching quality and efficiency, do not have universal regulations at the national level, which is also very relevant for Armenia.

[65] Surveys of first-year clinical residents during a lecture Karine Saribekyan.
[66] Decision N174-L of the RA Government «On approving the developmentstrategy of the healthcare system of the Republic of Armenia for 2023-2026» (Feb.9. 2023), https://www.arlis.am/

As a result of systemic changes implemented in 2000-2020 (integration of children's and adult polyclinics, significant reduction of children's beds in regional hospitals, re-profiling of some pediatricians as family doctors as a result of the introduction of the family medicine system, etc.), as well as due to the closure of the pediatric faculty, the number of pediatricians in the republic has continuously decreased, reduced by 2 or more times compared to 1990-s (2000 in 1990, 946 in 2020).

However, in the last decade, the provision of pediatricians in terms of hospital-polyclinic shows the opposite trend. Thus, while the number of hospital pediatricians has gradually increased (118 pediatricians in 2013, 129 in 2016, 138 in 2017, 141 in 2018, 149 in 2019, 151 in 2020, 176 in 2021), the number of pediatricians working in the primary care unit has continuously decreased (505 in 2013, 468 in 2016, 449 in 2017, 445 in 2018, 439 in 2019, 425 in 2020, 414 in 2021). This deviation has been deepening especially in recent years:

This problem is on the agenda at the ambulatory-polyclinic level, where in recent years, against the background of the decrease in the number of working specialists, unique cases of replenishment with young specialists are recorded. According to the data presented above, the number of pediatricians in primary care is reduced by 8-10 specialists annually. As a result, there is a growing shortage of young personnel in the polyclinics, against the background of the continuous aging of the existing pediatric staff. Thus, if in 2017, 49% of the total number of pediatricians were 55 and older, then in 2021 it will be 61%.

Figure 43. Human potential in pediatric care service, outpatient and hospital organizations, 2017-2021
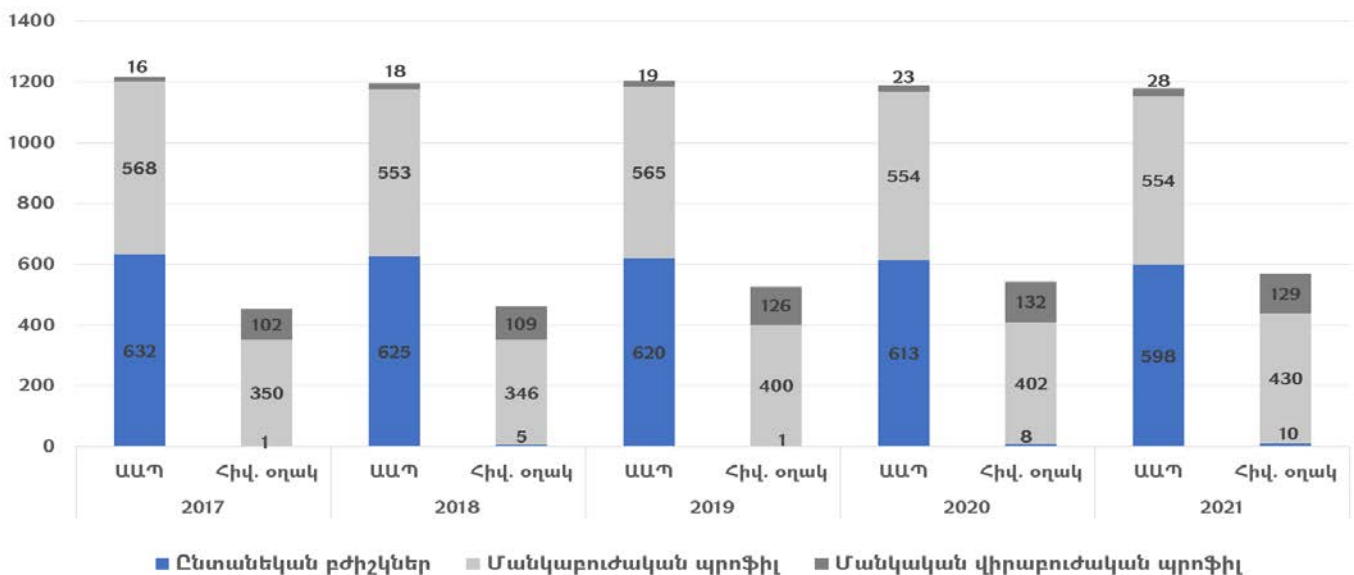
The problem of human resources of the pediatric service became more relevant in the last decade, as a result of which the deficit of pediatric specialists deepened not only in the regions, but also in the city of Yerevan.

At the regional level, particularly in rural areas, family doctors mainly work with children, whose "aging" and insufficient supply of young doctors has also become a problem from the view of providing health services both to children and the entire population.

The lack and/or absence of pediatric specialists serving children is also a particular problem. The limited knowledge and experience of "adults" serving children in regional medical organizations about children's pathologies is often not enough to provide proper medical aid to children. The proof of this is the large flow of unnecessary referrals from the marzes to narrow specialized clinics in Yerevan, in which in 50% or more cases no pathological problems are found in children (according to the specialists of the surgical profile of Arabkir BH, about 70% of cases).

On January 1, 2022, the number of 0-18 year old children in Armenia was nearly 635,000, of which 367,000 children live in urban areas and 260,000 children lived in rural areas.[67] According to the data given by the ARMED electronic healthcare system, the number of childrens on January 1, 2023, was 718,072.[68]

The number of children served by pediatricians and family doctors in the republic is on average 700 to 1000 children by a pediatrician and 350-500 children by a family doctor. If the current mixed model of medical aid and service organization at the PHC level is considered applicable (that is: in cities - by a pediatrician, and in rural areas - by a family doctor), then the demand for primary care doctors in the republic will be on average 524 pediatricians and 766 family doctors.

According to the official data of the RA MoH NIH,[69] in 2021 the number of pediatricians in the primary healthcare level was 414 (284 of whom in the city of Yerevan) with number of children in the capital city: 262,000, meanwhile in the marzes their number was 130 (in the regional towns the number of children is 104,700). The total number of family doctors is 598 (in the villages of the marzes, children's population is 268,000), of which 54 were in Yerevan.

From what has been said, it is assumed that there is a shortage of both pediatricians and family doctors in Armenia: about 110 pediatricians and 166 family doctors. If we also take into account the "aging" factor of pediatricians (decrease by 8-10 pediatricians per year), the additional demand for pediatricians necessary for children's medical aid will be about 120 on average.

In terms of the republic, in case of the full implementation of the institute of family fedicine in the healthcare system, their demand for children's services will be about 1270 doctors, and the deficit will be about 670, of which 500 family doctors will be needed for the children's population of urban areas.:

It is obvious that instead of 670 family doctors for the primary care, it will be much more cost-effective to train 120 pediatricians through two-year pediatric postgraduate education programs (family doctor's clinical residency is of the same duration, during which pediatrics is taught: 6-20

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[67] RA SC, Demographic survey of Armenia, 2022, https://www.armstat.am/file/article/demog_2022_2.pdf

[68] ARMED electronic healthcare system, https://armed.am

[69] Health and healthcare. Statistical yearbook, Armenia 2022/ D. Andreasyan, A. Bazarchyan and others – Yerevan, RA MoH «National Health Institute after Academician S. Avdalbekyan» CJSC, 2022.– p. 299.

weeks), the supervision and medical aid of children will be more cost-effective, comprehensive and high-quality, and the trust of the population towards the primary healthcare system will increase.

6. The continuous increase in the burden of children's hospital services caused by the staffing deficit of the PHC system

The deepening deficit of pediatric specialists in PHC and this crisis related to outpatient pediatrics are on the agenda not only in the regions, but also in the capital city, which undoubtedly leads to the ever-increasing burden of a much more expensive children's hospitals, against the background of reducing trust in the PHC system and the lack of motivational mechanisms among medical workers. The proof of this is the continuous increase in the consumption rates of children's hospital services, in particular the number of hospitalizations in recent years. :

According to the basic data of the RA Ministry of Health and the ARMED e-health system, the cases of hospitalization of children within the framework of the state-ordered "Children's medical aid services" program have progressively increased: 51,820 in 2010, 70,787 in 2015, 72,000 in 2018, 72,814 in 2019, 75,452 in 2020 and 89,890 in 2021, and this, in the conditions of the decline in the birth and the consequent reduction of the child population and relatively stable child morbidity s.

Figure 43.1. Increase in the burden of children's hospitals, 2017-2021
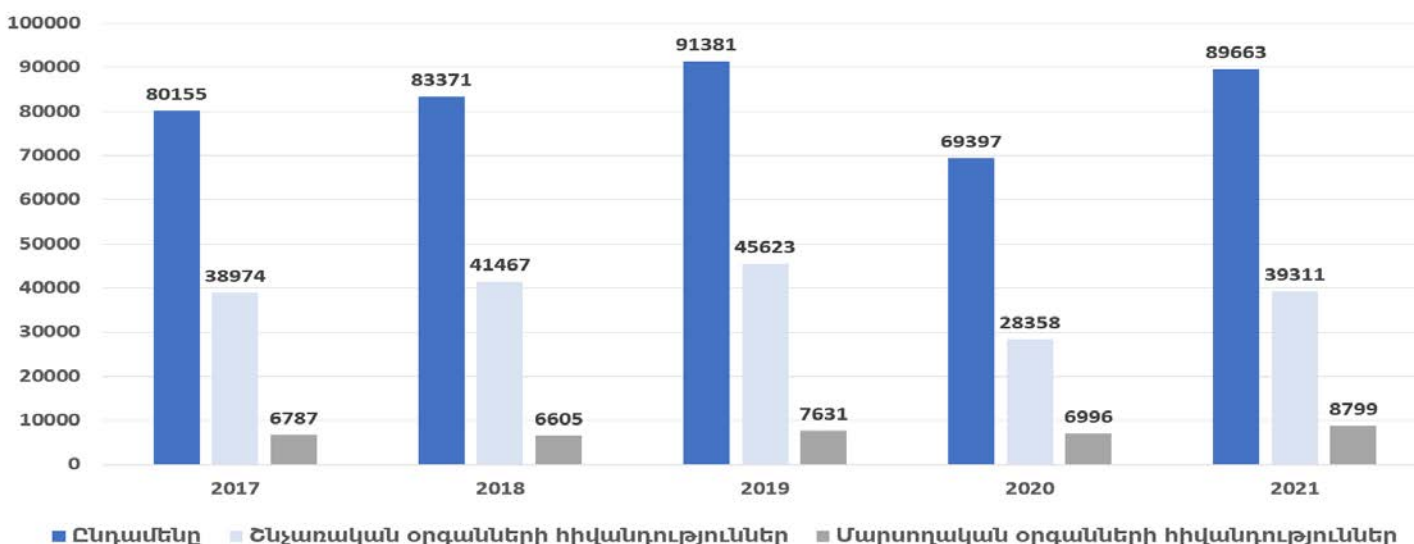
The problem of lack of human resources, uneven distribution and "aging" of doctors in primary care is present not only in the mother and child sphere, but it is one of the global challenges of the healthcare system of Armenia. Meanwhile, it has been proven that the availability and

efficiency of health services, as well as development of the health system are directly determined by the availability and effective work of human resources.

7. Health system funding for women and children medical service

Since independence, maternal and child health care, as a priority sector, has continuously been central to the state's expenditure policy. For years, the share allocated to this sector in the total volume of the annual budget of the Health System was 25-30%.

Budget allocations for maternal and child health care services are reflected in the RA annual budget and the RA state medium-term/three-year expenditure plans. Calculations are based on the state target program for maternal and child health care, which sets the priority program directions for that sector, within the framework of which the state guarantees free medical aid and service. They are listed below:

- ➢ Obstetric, in full scale
- ➢ Prenatal control of pregnant wome
- ➢ Hospital medical aid of 0-18 year old children
- ➢ Ambulatory polyclinic medical aid for 0-18 year old children
- ➢ Women and children emergency medical aid
- ➢ Preventive and screening programs
- ➢ Immunization national program

Although the health care budget allocation in Armenia have been insufficient for many years and low allocations from GDP (0.8% in 2000, 1.52% in 2005, 1.56% in 2010, 1.61% in 2015, 1.46% in 2020, 1 .47% in 2021, 1.5% in 2022), program directions aimed at mothers and children have always been highlighted.

Despite the international economic crisis and scarce resources in the general healthcare budget, the budgetary allocations for the mother and child target program increased dramatically from 2008, thanks to which it was possible to launch and continue implementation of the «National certificate of maternity assistance» program (budget in billions AMD: 2.33 in 2007:; 4.09 in 2008; 6.05 in 2010; 6.88 in 2015; 6.95 in 2019), as well as the «Child health state certificate» program (budget in billions AMD 1.64 in 2007; 3.13 in 2010; 6 .38 in 2011; 7.88 in 2015:; 8.2 in 2019).

In 2019, the allocations of the state program for mother and child health care increased by about 1 billion drams (including the budget 210 million drams an increase for overcoming infertility and 700 million drams for maternity care), and again for children's hospital care by 1.75 billion drams, which made it possible to fully include the 0-18 age group in the program. Since 2019 positive developments in the budget allocations became continuous (19.7, 20.1 and 20,2 billion drams in 2020, 2021 and 2022, respectively), thanks to which positive program results in this field were ahieved.

It should be noted that the budgetary resources of the healthcare sector, with few exceptions, are directed to financial compensation for medical services provided within the framework of the

state order. Budgetary allocations for development programs (strengthening of human resource capacity, improvement of service quality, public awareness, etc.) were almost absent in the financial documents of the system.

Developments in those directions were ensured mainly at the expense of financial investments of international organizations, which, by the way, have continuously decreased in recent years, and in 2019, donor funds were mainly directed to program measures for addressing the epidemic and overcoming emergency situations.

Thus, during the last decades, thanks to the sectoral priority policy and implemented targeted programs, it was possible to solve a number of systemic problems and register positive trends in individual rates characterizing children's health. Despite this fact and the recorded positive developments, a certain part of the systemic problems in the field of children and adolescents health remain unresolved.

PROBLEMS IDENTIFIED ON THE BASIS OF SITUATION ANALYSIS AND RECOMMENDATIONS FOR IMPROVEMENT

The highlighted problems, given below, are based on the presented analysis:

I. Maternal and child health issues

1. The deepening crisis of the country's demographic situation, with an unprecedentedly low birth , not even providing a simple reproduction of the total fertility rate (1.6) a continuous reduction in the number of children with the alarming trend of the aging of population,

2. High maternal mortality with an increasing trend,

3. High intensive and extensive rates of extragenital pathologies in the structure of maternal mortality,

4. Progressively increasing of caesarean sections,

5. The ongoing problem of sex-selective abortions,

6. High prevalence of infertility, in conditions of limited availability of assisted reproductive technologies,

7. Limited volumes of prenatal screenings, in particular non-invasive screenings and limited opportunities for research using expensive and complex technologies

8. Low rates of decline in the infant mortality, with a high proportion of infant deaths from perinatal causes and birth defects,

9. In the age structure of infant and neonatal mortality, a large proportion of mortality falls in the early neonatal period, as well as still high level of pre-24-hour mortality of 0-1 year old children,

10. High rates of in-hospital, particularly in pre-24-hour in-hospital mortality of children at the regional level,

11. A certain trend of increasing mortality in the last 3 years of the children of the up to 5 years, with a high proportion of deaths of 1-5 year olds from accidents and poisoning,

12. High rates of death of school-age and adolescent children caused by traffic accidents and incidents of violence. Child mortality rates from these causes grow with the growing age groups.

13. Significant increase in birth of children with low weight and birth of premature babies;

14. Increase in the number of infants born with birth defects;

15. An apparent increase in the rates of developmental disorders, chronic diseases, and related disabilities in the face of limited access to rehabilitation services;

16. Increase in the prevalence of individual chronic diseases of non-infectious origin among the children's population, with limited possibilities of dispensary control;

17. Challenges due to lowering the rates of timely and complete coverage of childhood vaccinations and difficulties in introducing new vaccines due to counter-propaganda. The ever-increasing challenge of maintaining hard-won gains in terms of manageable infectious diseases;

18. Unprecedented increase in rates characterizing children's mental health, in the conditions of limited availability of appropriate professional help and acute shortage of child psychiatrists. Mental health is a serious challenge, especially during adolescence;

19. Declining trend in the breastfeeding , which puts in doubt the achievements of the national breastfeeding promotion program. Widespread incorrect procedures for arrangement of breastfeeding and complementary feeding of children, an imperfect system of banning the advertising of milk mixtures;

20. The issues of women's and children's nutritional disorders continue to remain on the agenda, in particular, the problem of women's overweight and the double burden of stunting and obesity caused by children's malnutrition. Obesity is particularly high among children of younger school age;

21. The prevalence of anemia among women and children remains high;

22. The health status of school-aged children and adolescents is insufficient due to unhealthy lifestyle, including bad eating habits, low physical activity, harmful behavioral habits.

II. Maternal and child healthcare /systemic issues

The systemic problems identified in this analysis are presented below by the main functions of the health sector:

1. Management and arrangement

1)   Inadequate level of availability and quality of services provided in the field of mater and child health care and limited opportunities for access, especially in marzes;

2)   Inadequate level of human resources and equipment and supplies of regional medical organizations providing services to children and women;

3)   Inadequate level of necessary infrastructure and conditions, human resources and professional abilities for assessment of child development, early detection of deviations and early intervention, prevention of diseases and disabilities;

4)   Continued increase in pediatric hospital burden, the number of hospitalizations for children. Not all children's hospitals in the capital city have out-patient emergency care facilities with appropriate equipment and conditions, which can partially contribute to the reduction of unnecessary loading of round-the-clock care beds;

5)   The problem of accessability of medical aid is relevant, especially in terms of resuscitation and intensive care services in regional hospitals. Except for the city of Gyumri, the marzes have practically no facilities for resuscitation and emergency medical aid for children and/or infants;

6) In the field of specialized pediatric medical aid, there is a lack of clarity regarding the organization of medical aid according to levels, the separation of infrastructures, functions and volumes. The professional consultation and referral system for sick children is imperfect;

7) Imperfection in the process of assessment and continuous monitoring of growth and development in child and adolescent health care. The republic lacks an active system for routine monitoring of children's nutrition and assessment with periodic data collection and analysis;

8)   Imperfection of national legislation enforcement mechanisms on breastfeeding promotion, marketing of artificial milk mixtures, and the lack of monitoring;

9)   Serious problems of ensuring the quality of medical aid provided in the field of mother and child health care, weak quality management system, lack of control mechanisms and evaluation standards;

10) The need to review the clinical guidelines and procedures developed on the basis of the principles of modern, evidence-based medicine, limited use of existing ones.

2. Provision of services

1)   There is a need to improve the quality of maternity care services, to review and update procedures and guidelines in order to introduce patient-friendly health practices, in particular natural and assisted birth management;

2)   There is a problem of access to specialized health services for children and women. Both ambulatory and inpatient specialized medical facilities are mainly concentd in Yerevan and not fully in several regions (Gyumri, Vanadzor);

3)   Although procedures related to the referral and transfer system for sick neonate infants have been somewhat regulated, implementation of the process often becomes problematic due to limited resources;

4)   The need to improve infant care and breastfeeding practices in maternity facilities remains a challenge. 2010 After that, the implementation of the "Baby friendly maternity hospital" initiative almost stopped, the maternity hospitals do not have the conditions to support breastfeeding and the staff with BF counseling skills;

5)   Limited opportunities that are 3-4 times less than the demand for free rehabilitation medical aid, severe lack of regional and community rehabilitation services both in terms

of volume and location. Inadequate access to regional and community services for child development assessment and rehabilitation;

6)   In the sphere of mother and child healthcare, the possibilities of enlarging preventive program directions and screening programs are limited. There is still an insufficient level of early detection, comprehensive diagnosis and early intervention of developmental problems and diseases that lead to disability;

7)   Possibilities for arrangement of pediatric palliative care are limited, almost non-existent, except for the pilot program of the palliative care unit for children suffering from oncological diseases;

8)   Despite the attempts to introduce various models of "adolescent-friendly" health services in the republic and availability of adolescents' cabinets in polyclinics, they mainly deal with pre-conscription problems of boys and lack the skills and abilities to provide "friendly" services.

3. Human resources and professional skills

1)   In general, the issue of availability of medical personnel, and particularly, the specialists in the pediatric sphere, is one of the most topical problems. The lack of obstetrician-gynecologists, neonatologists, specialized pediatricians, particularly resuscitators and anesthesiologists operating in some regional medical institutions has become a priority issue.

2)   The problem of "aging" of pediatric personnel/medical staff and the lack of young specialists exists not only in marzes, but even in the capital as well.

3)   Another specific problem is the lack of narrow specialists in regions. The knowledge of the narrow specialists of "adults," serving children, regarding the child growth and development and children's diseases is not enough to provide proper quality medical aid.

4)   There is a need for continuous development of professional skills of medical workers and implementation of evidence-based practices.

5)   The question of assessing the quality of professional activity is an acute problem as far as there are no job descriptions of outpatient and inpatient medical service providers with the definition of duties and rights.

6)   The postgraduate system of higher medical education in Armenia does not have sufficient legal regulations. Post-graduate educational programs implemented in the country do not have quality assurance and quality control mechanisms. The list of active professions is in the process of revision, the qualitative characteristics of the professions are almost absent.

4. Financing

1)   Budget allocations for medical aid and service within the framework of the mother and child target program are still insufficient to properly organize the necessary services, especially at the primary health care level.

2)   The prices reimbursed by the state, significantly different from the realistic costs, are insufficient to cover the real costs of medical services, to pay self-sufficient salaries to health workers, which becomes the main reason for shadow circulation in the system and limited access to medical aid.

3)   The trend of increasing burden of expensive hospital services against the background of the diminishing role of PHS is disturbing.

4)   There is a need in increasing the salary of health workers providing services to children at the PHS level and to improve payment mechanisms aimed at improving motivated work and quality.

III.   **Main recommendations for improving maternal and child health and healthcare services**

1.   **Improvement of healthcare services**

1) Continuous improvement of quality and accessibility of maternal and child health services, strengthening of the infrastructure and human resource capacity.

2) Ensuring the continuous growth of financial allocations necessary for the services provided in the maternal and child health care within the framework of the state order, expansion of the packages of provided services;

3) Continuous work of matching maternity care and children's hospital services to the established standards according to the levels, ensuring saturation with equipment and personnel potential;

4) Strengthening the capacities of primary health services in the maternal and child health care, emphasizing the needs of regional medical institutions;

5) Overcoming the constantly growing problem of human resources, especially improving availability of specialists in the sphere of maternal and child healthcare in the regions;

6) Implementing continuous professional development programs of medical workers in the sphere of maternal and child health care in cooperation with international organizations and professional associations.

2. Maternity

1) Improving health-related fertility s through the implementation of targeted health program measures, including programs to reduce perinatal losses and improve women's reproductive health;

2) Modernization of maternity services, with strengthening of emergency and outpatient obstetric services;

3) Works on improving the knowledge and skills of medical workers, implementing proven procedures aimed at providing safe and secure maternity care services;

4) Strengthening the capacity and performance of prenatal care services for pregnant women, as a result, continuous expansion of activities aimed at early detection of prenatal pathologies and prevention of complications within the framework of state allocations;

5) Improving the quality of management/monitoring of pregnant women, expanding the possibilities of early detection and treatment of pregnancy and fetal pathologies, increasing the performance of antenatal screenings, revising and reviewing procedures for early diagnosis and treatment of fetal and maternal diseases;

6) Implementation of "patient-friendly" health services in maternity care facilities in accordance with international experience and standards. In particular, creation of a benevolent and friendly environment, ensuring the process of birth management with the participation of a natural and supportive person;

7) Development and implementation of legal regulations for introduction of the "Doula institute" with reimbursement of doula services at the expense of state funds in all maternity care institutions;

8) Development and implementation of complex program measures aimed at reducing caeserean sections, based on WHO commitments;

9) Continuous implementation of the program to overcome infertility, including the use of assisted reproductive technologies, with further developments;

10) Continuous implementation of the program to struggle against selective abortions, in the conditions of intersectoral cooperation, implementation of measures to reduce sex-related fetal losses, ensuring the implementation of legislation.

3. Childhood

1) Strengthening of pediatric resuscitation and neonatal intensive therapy and care services, taking into account the fact that neonatal mortality has a dominant share in the structure of child mortality;

2) Ensuring the creation, review and implementation of evidence-based practices and professional guidelines for the management of healthy and sick children;

3) Promotion of motivated work of medical personnel in primary health care medical organizations, strengthening of patronage activities;

4) Implementation of effective measures aimed at reducing the s of neonatal mortality and morbidity, especially among children born prematurely and with low birth weight;

5) Reducing the mortality of children under 5 years of age, including those caused by diarrheal and respiratory diseases, as well as by accidents;

6) Development and implementation of breastfeeding support programs. Improving child nutrition and care practices in maternity hospitals and subsequently at home;

7) Improvement of early detection and diagnosis of diseases, expansion of neonatal screenings;

8) Implementation of the national program of immunoprevention, increasing the effectiveness of the struggle against manageable infectious diseases;

9) Improving availablity and accessibility of the preventive and rehabilitative care for child development disorders and child disabilities;

10) Improving the health condition of adolescents and their relevant knowledge, implementing measures to reduce traffic accidents and violence;

11) Improving knowledge and behavior related to healthy lifestyle, physical activity, nutrition, risky behavior, sexual and reproductive health, physical and mental health among school-aged children;

12) Increasing the availability and quality of professional medical aid aimed at improving the mental health of children, expanding the infrastructure for the training of child psychiatrists and the provision of services;

13) Continuous implementation of child traumatism and accident prevention programs;

14) Clarification of the volumes of pediatric palliative care, expansion of pediatric palliative care service.

CHAPTER 4

CLIMATE CHANGE AND HEALTH

Manifestations of climate change by impact factors

The territory of Armenia is located in the north-eastern part of the Armenian Highlands, on the border of the Caucasus and Central Asia. Armenia borders Georgia to the north, Azerbaijan to the east, Turkey to the west and southwest, and Iran to the south. The territory of RA is 29,743 km2. Armenia is a mountainous country. 76.5% of the area is located at an altitude of 1000-2500m above sea level. Armenia is a country of climatic contrasts: significant differences in climate due to complex relief are observed even on the smallest distances. Almost all types of climate are present in the territory of the republic, from dry subtropical to cold highland.

Temperature. The average annual air temperature is 5.50 C. The average annual maximum temperature is 12-140 C. Average annual negative temperatures are observed at altitudes of 2,500 m and above. Summer is tempe, the average temperature in July is 16.70C, and in the Ararat Valley it ranges from 24-260C. The absolute maximum temperature recorded is 43.70C. Winter is cold. January is the coldest month of the winter with an average temperature of -6.70C. The absolute minimum temperature observed was -420C. Winter is tempe in the north-eastern and south-eastern regions of the republic.

Figure 44. Air temperature profile, 2020.
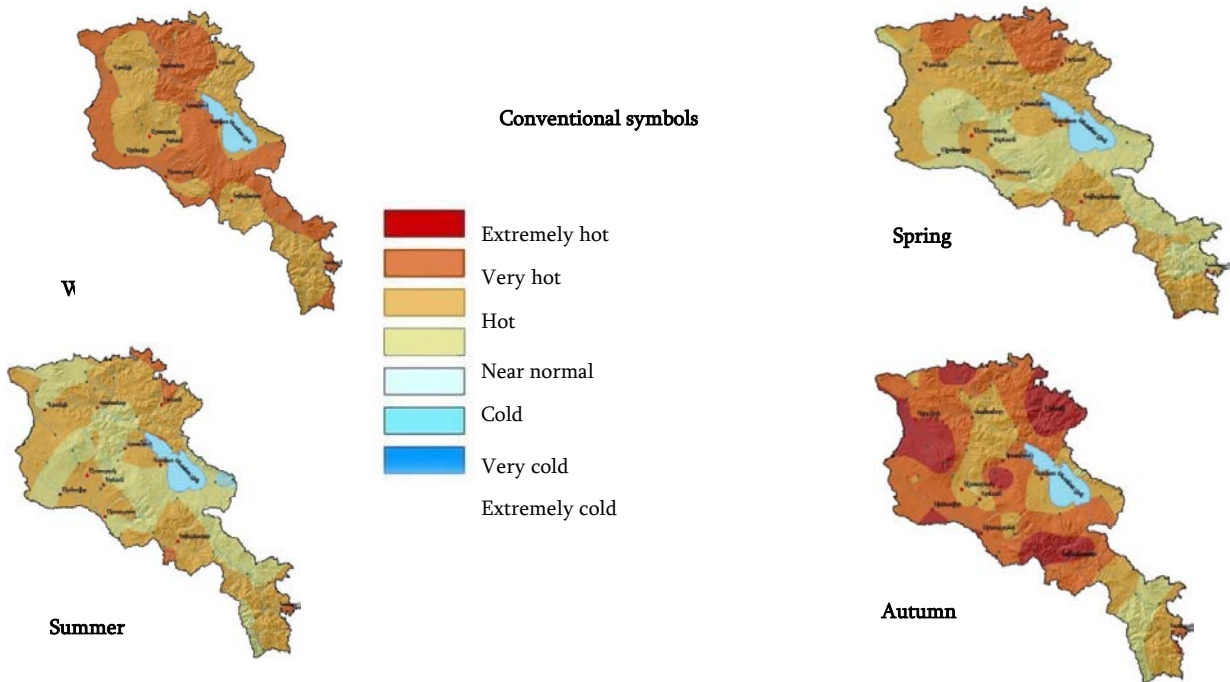
In 2020 and 2021, the trends of previous years were preserved.

The average annual air temperature was 6.9 and 7.60C, respectively, and the deviation was 1961-1990 from the norm of the years73: 1.4 and 2.1 (the norm of average temperature 1961-1990, 5.50C). 2021 has been classified as hot years, it is the third warmest year after 2010 and 2018 (deviations from the norm were 2.7 and 2.50C, respectively).

Figure 45. The average monthly air temperature and norms, 2021
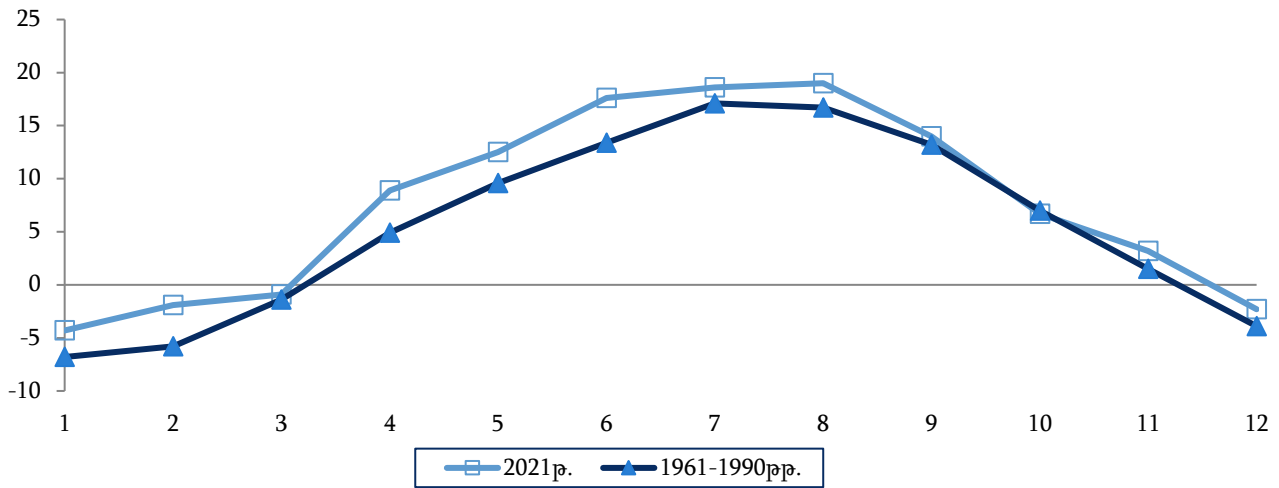
Precipitation. Comparison of estimates of the changes in the total precipitation for various periods since 1935 shows that the decreasing trend of precipitation remained the same in 2020 as well.

**Figure 46. Annual amount of precipitation and deviations regarding the norm of 1961-1990 in 1935-2020, mm.**
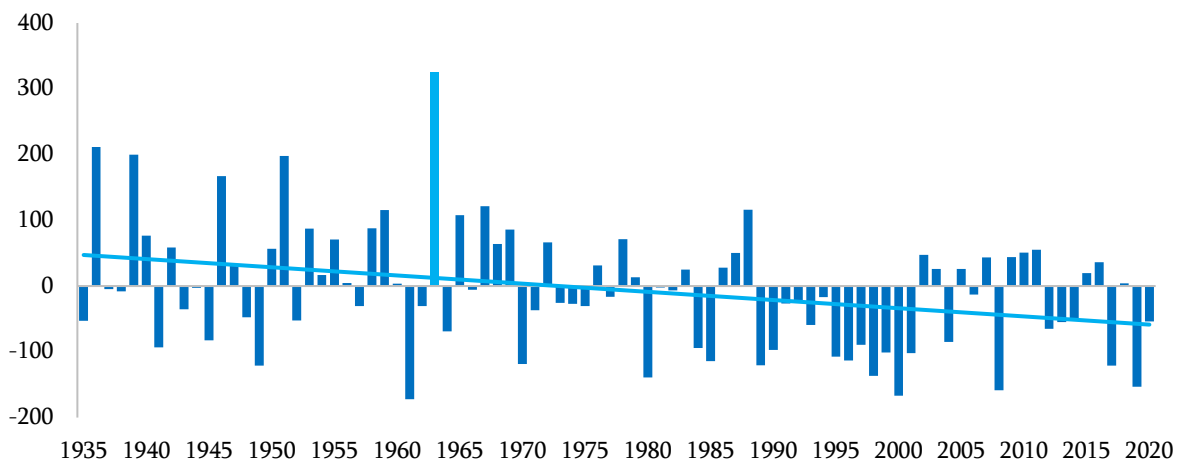
The amount of precipitation was 538.0 mm, which was less than the relevant norm in 1961-1990 by 54.0 mm. Except April, the amount of precipitation in all months was less than the norm, which creates a significant problem for water collection in winter months, and causes drought in spring-autumn.

Figure 47. Monthly amount of precipitation and norms, 2021, mm
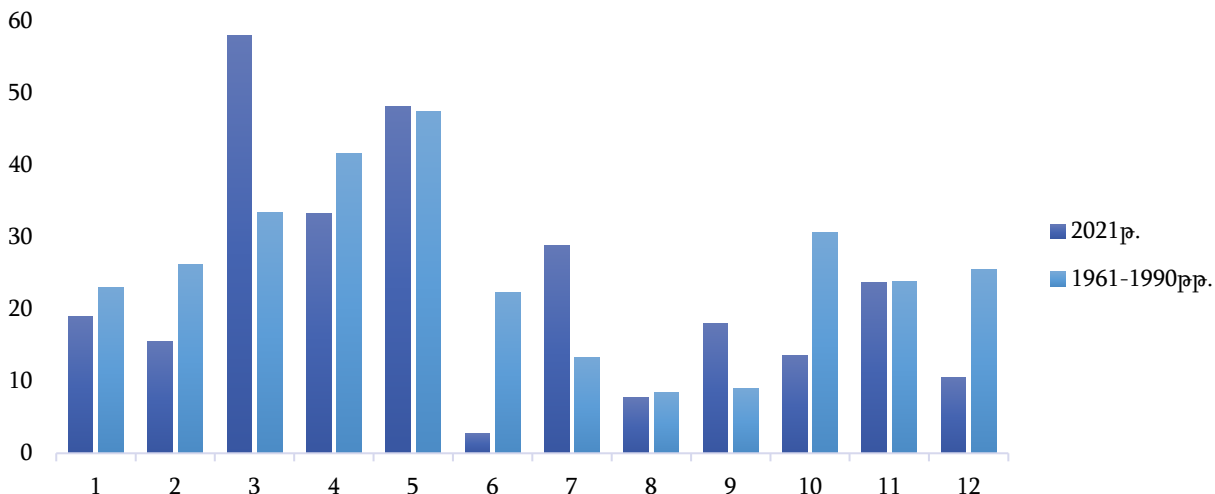
The territorial distribution of the precipitation change was quite irregular: during the years 1935-2021 the climate in the northern (Vanadzor, Stepanavan), southern (Meghri) and central (Ararat valley) regions of the country has become drier, meanwhile the amount of precipitation in Shirak valley, Sevan lake basin, Aparan-Hrazdan regions has increased.

Figure 48. Precipitation profile, 2020.
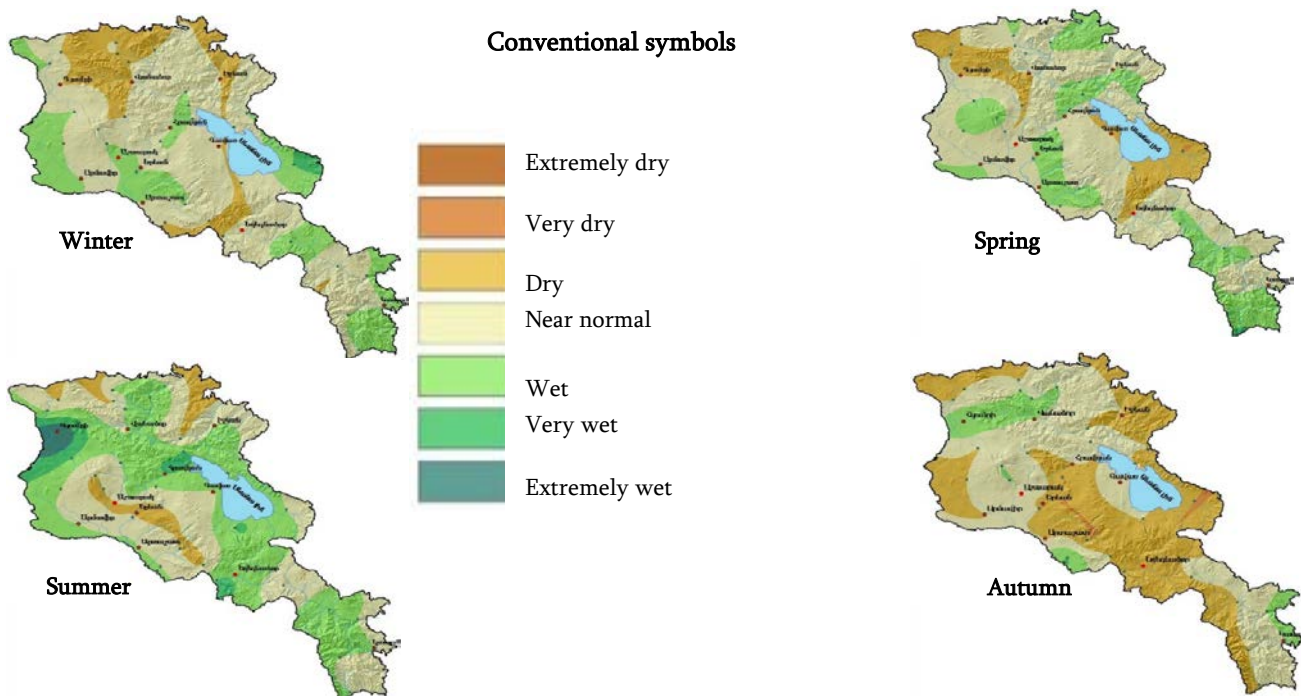
RA Ministry of Environment,

«Hydrometeorology and Monitoring Center» SNCO.

Hydrometeorological phenomena. Hazardous hydrometeorological phenomena are among those climatic factors that pose a threat to health. As shown in the table below, a cyclical frequency of dangerous hydrometeorological phenomena has been recorded in recent years.

Table 11. Number of dangerous meteorological phenomena, 2016-2021. cases

|	2016	2017	2018	2019	2020	2021
Strong wind (speed 25 m/s and more	23	14	11	35	8	8
Heavy fog (visibility no more than 50 m)	16	43	29	21	24	29
Heavy rain (30 mm or more in up to 12 hours)	8	7	9	4	16	5
Heavy snow (20 sm or more in up to 12 hours)	10	3	2	1	1	3
Hailstorms (diameter 20 mm or more)	7	5	1	5	-	-
Severe heat (in the valley regions: ≥ +400C, in the foothills: ≥+350C, in mountainous regions: ≥ +320C)	1	14	17	10	1	2
Heavy snowstorm (≥10 m/s, lasting 12 hours, ≤; with 50m visibility)	…	2	-	-	-	-
Total	65	88	69	76	50	47

Dangerous natural phenomena. In the context of the above factors, from the view of direct impact potential for health, the next group of natural phenomena is In terms of impact potential, the next group of natural phenomena are natural distaters, which in 2020 accounted for 3.3% of registered emergency cases (6 people were affected: 5 dead, 1 injured, 1932 people were evacuated).

Table 12. Number of the registered dangerous natural phenomena and the number of relevant victims, by type, 2020

	Number of emergency cases	Number of people affected			People evacuated
		total	including		
			died	injured	
Strong wind, storm, whirlwind, tornado, dust storm	70	-	-	-	-
Thunder, lightning	5	1	1	-	-
Hail	53	-	-	-	-
Heavy rain	18	-	-	-	37
Heavy snow	1	-	-	-	-
Landslide	8	-	-	-	-
Snowstorm, snowwind	9	-	-	-	1665
Ice	32	-	-	-	210
Snowfall	2	4	3	1	-
Frost in the vegetation season	8	-	-	-	-
Flood	4	-	-	-	-
Flooding, flooding of rivers	9	-	-	-	1
Erosion (collapse, sedimentation)	6	1	1	-	-
Rock fall	47	-	-	-	19
Forest fire	30	-	-	-	-
Earthquake	33	-	-	-	-
Attacks of wild animals	163	-	-	-	-
Total	498	6	5	1	1932

Sources: RA SC Environment and Natural Resources in RA, 2020. Bulletin
https://www.armstat.am/am/?nid=82&id=2420

The average number of cumulative cases of dangerous phenomena observed in the RA territory during 1975-2016 compared to the average of 1961-1990 (168 cases) increased by about 40 cases, which was 23.5% of the multi-year average value. It is worth noting the fact that after the continuous reduction in the number of cases in 2016 and 2017, a significant increase in the total number of registered dangerous natural phenomena was recorded in subsequent following years. The number of registered cases in 2020 exceeded the 2017 figure by 209 cases or 72.3%.

Figure 49. Total number of registered dangerous natural phenomena, 2015-2020, cases
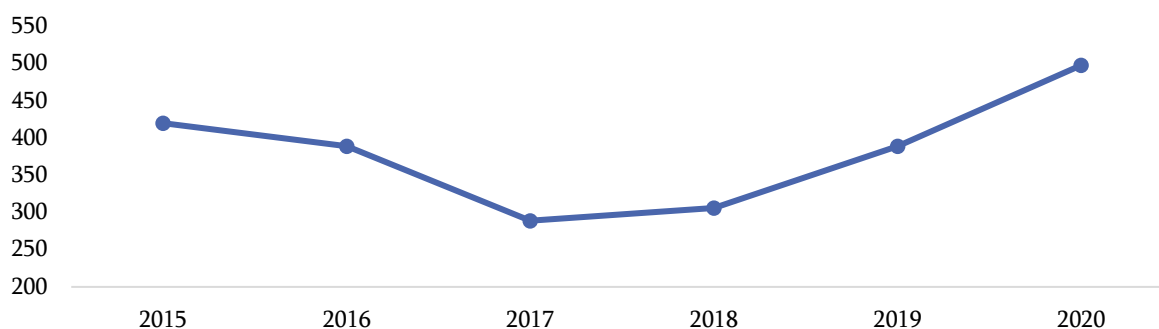
Impact of the climate change on health

Depending on the geographical, climatic and other features of the living environment of the country, as well as on the socio-economic and demographic characteristics of the population, the impact of climate changes and weather conditions on the health of the population can be significant and diverse. The range of influencing factors is very comprehensive, including the impact of weather and temperature conditions to influence hydrometeorological and elemental hazards.

Climate change threats also differ in terms of the scope of their target (individual, group, national, regional), the time of impact (short or long term), the extent and form of manifestation of consequences (morbidity, mortality, reduced quality of life, etc.) and the format of impact (individual, combined, group, etc.).

In summary, the impact of climate change on health manifests itself in two ways. The first is a change in the severity or frequency (prevalence) of health problems that are already affected by changes in climate and weather factors. And second, unprecedented or unpredictable health problems or health threats are emerging in places and populations where they have never existed before.[70]

Regardless of the realities of each specific situation and moment in time, the extent to which the impacts of climate change risks on health are apparent and measurable, generally leads to the vulnerability of populations and individuals to climate change. Accordingly, some definitions and concepts may be useful for developing actions or individual behavior for both vulnerability and adaptation and response to the climate change.

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[70] USGCRP, 2016: The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, Eds. U.S. Global Change Research Program, Washington, DC, 312 pp. http://dx.doi.org/10.7930/J0R49NQX

The following concepts have been developed by the Intergovernmental Panel on Climate Change (IPCCC) and are presented in methodological guidelines for climate change mitigation and adaptation.[71]

Vulnerability related to the climate change reveals itself by relevant effects to health. It includes three elements: impact, sensitivity, and the ability to adapt to or resist change.

Impact is effect of one or more biological, chemical or physical stressors caused by climate change on a person and/or a group of people. That effect may occur once or multiple times in a single location or a wider geographic area.

Sensitivity is the degree of positive or negative impact of climate variability and change on a person or community.

Adaptive capacity is the capacity of communities, institutions or people to adapt to the potential risks of climate change, to take advantage of opportunities to protect against those risks, or to respond to their consequences. Along with the ability to adapt, the flexibility to respond to changes in the external environment is also considered, which is the at which people prepare, prevent, recover and adapt more successfully to adverse events.

The risk is the potential for the development of the consequences of climate change, the possibility of danger or damage to human health. Risk is often expressed as the probability of a hazardous event occurring multiplied by the expected severity of the effects of that event.

Stressors are events or trends related to climate change or other factors that increase health vulnerability. In the context of the impact of climate change on health, the identification of vulnerable population groups is also important. For example, those age groups of the population whose body is physiologically unable to quickly respond to external thermal pressures and regulate the internal body temperature are most vulnerable to temperature changes. These groups are adults, infants and children, those with chronic diseases and patients taking medications that interfere with the regulation of internal heat and the functioning of vital organs in conditions of high temperature.

In addition to the direct effects of climate change on health, associated contributing or limiting factors or community characteristics are also important. People or communities may be more or less vulnerable to health risks depending on social, political and economic factors, collectively known as the social determinants of health.

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[71] IPCC, 2014: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (Eds.), 1132 pp. Cambridge University Press, Cambridge, UK and New York, NY. http://www.ipcc.ch/report/ar5/wg2/ .
Планы действий по защите здоровья населения от воздействия аномальной жары, Руководство, Европейское региональное бюро Всемирной организации здравоохранения, 2011, ст. 6.

Some groups are disproportionately disadvantaged by health and social determinants that limit resources and opportunities for health behaviors and everyday living conditions. Among such factors are living and working conditions, social, transport and other infrastructures of the region, availability and accessibility of health services, etc. When assessing the vulnerability, it is necessary to pay attention to the factors that contribute to the strengthening of the impact of climate change. These factors include:

a/ Type of occupation: some occupations have a greater risk of climate exposure. People who work outdoors or perform work in extreme weather conditions, such as emergency responders, utility repair crews, farm workers, construction workers, etc.

b/ Places prone to risk where people spend a significant amount of time, such as urban areas (e.g. due to the heat island effect or air quality risks), areas where airborne allergens and other air pollutants occur, communities where there are is a problem of water resources, etc.

c/ the state of energy and transport infrastructures in areas affected by natural disasters (landslides, floods, forest fires, droughts).

Socio-economic status matters, as people living in poverty are more likely to be exposed to extreme heat and air pollution. At the same time, their ability to respond and adapt to climate risks is extremely low.

Due to atmospheric pollution combined with climate change, urban population and chronic patients are particularly vulnerable to diseases of the cardiovascular and respiratory systems.

In the case of natural outbreaks, including particularly dangerous infections, the population of rural areas, population groups in direct contact with natural landscapes or natural products are vulnerable, and in the case of intestinal infections, those people whose place of residence has insufficient water quality, sanitation and personal hygiene levels.

Children and the adult population are vulnerable to weather conditions, air pollution and the risk of vector-borne infectious diseases.

As a result of migration processes, rural areas of the country lack men of working age, who are replaced in agricultural work by adults and women, who are more vulnerable to the risk of temperature changes.

Selection of climate-sensitive diseases caused by driving forces of climate change in Armenia

Armenia is the most vulnerable country to climate change due to its geographical location, climatic conditions and the degree of sensitivity of ecosystems. Hydro-meteorological observations of the last 100 years have recorded increase in air temperature and decrease in atmospheric precipitation, dangerous hydro-meteorological phenomena (drought, heat waves, frost, hail, strong winds and precipitation) and the resulting increase in frequency and intensity of natural disasters (landslides, floods, forest fires, etc.). According to Armenia's 4th national report

on climate change,[72] the increase in temperature, changes in the amount of precipitation and the increase in the occurrence of dangerous hydrometeorological phenomena can have serious negative consequences on the health of the population. The adverse effects of climate change, when combined with high levels of atmospheric air pollution, especially in cities, contribute to an increase in the number of circulatory and respiratory diseases and deaths.[73] Especially dangerous is the combination of abnormally high temperature with two air pollutants: ozone and PN10 (solid particles with a diameter of up to 10 microns), which have a synergistic effect on the mortality (according to research, a similar effect of the combined effect of high temperature and other air pollutants was not observed).

In the conditions of Armenia, from the point of view of temperature changes and weather conditions, the population of low-lying areas of the country (Ararat and Armavir marzes of RA, Yerevan city and Meghri region of Syunik marz of RA), and especially the population involved in outdoor field, construction and other works, is most vulnerable.

As it was mentioned, due to atmospheric pollution combined with high temperature, the population of those settlements where the levels of air pollution exceeding the Maximum Allowable Concentration (MAC) are recorded are vulnerable to diseases of the cardiovascular and respiratory systems.

There is a risk of spread of a number of infectious diseases related to climate change in the republic. In particular, it is predicted that the structure of infectious diseases will change, water-related diseases will increase in regions where the level of water quality, sanitation and personal hygiene is already insufficient.

At the same time, it is worth noting the fact that there are still infectious diseases in Armenia, which, due to climate change, have the inherent potential to spread. These diseases include leishmaniasis, brucellosis, enteric and airborne infections.

In the case of natural outbreaks, including particularly dangerous infections, residents of rural areas, population groups in direct contact with natural landscapes, farm animals, stray and wild animals or natural products are vulnerable, and as for the intestinal infections, those people, lacking of sufficient quality of water, sanitary and personal hygienic levels in the places of their residence. In addition, the movement of "southern" arthropods and rodents to the north, which can spread dangerous diseases to humans and animals, is already noticeable in the northern regions of the republic.

At the same time, according to Armenia's 4th National Report on Climate Change, national and regional health organizations, within the scope of their functions, implement measures necessary to prevent and mitigate the effects of climate change on the health of the population, in particular,

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[72] Fourth National Communication on Climate Change. Yerevan, UNDP Armenia, 2020

[73] Ibid.

assessment of the spread of infectious diseases and risk management, early notification of the population about possible adverse weather conditions, preparation for natural disasters, changes in epidemic situations, etc. The fight against carriers and transmitters of infectious diseases, as well as non-communicable diseases is also carried out. Potential health risks of climate change are also regularly assessed as part of the National Climate Change Program.

Based on the data on the causes of morbidity and mortality of the population in the country, the goals of the health developmentstrategy and the conclusions on health risks and vulnerabilities in the national messages on climate change, as well as the results of discussions with political decision makers (MoH of Armenia) and HCMC officials, the diseases affected by climate change and relevant climate risks were determined.

Changes in temperature and weather conditions, air pollution and factors contributing to the spread of various infectious diseases were considered among the main risks of climate change impact on health. The following types of diseases were selected for the survey:

- Diseases of the circulatory system (I00 – I99) and from that group

- Hypertensive diseases (I10 – I13)

- Ischemic heart disease (I20 – I25)

- Cerebrovascular diseases (I60 – I69)

- Diseases affected by atmospheric air pollution

- Melanoma and other malignant neoplasms of the skin (C43 and C44)

- Infectious diseases.

For all the listed diseases, factors influencing climate change, the following were considered:

- Temperature change and abnormal temperature,

- The change in the amount of precipitation,

- Change in seasonal weather conditions,

- Level of atmospheric air pollution.

And as ways of impact of climate change the following were considered:

- Temperature increase, number and duration of seasonal heat waves,

- Deterioration of air quality,

- Deterioration of water and food quality,

- The change of ecosystems and the following caused by it:

- Changes in the population, prevalence and infection abilities of rodents and carriers of infectious diseases,

Health implications of exposure to observed drivers of climate change are the following:

- Mortality

- Morbidity

- Hospitalization

- Change of the number of calls for medical emergency.[74]

For further analysis, it should be taken into account that there are a number of other diseases that are also subject to the risk of temperature changes. The probability of death from the listed diseases increases with maximum temperature values or during heat wave days:

➢ Diabetes and other diseases of the endocrine system: E10–E14,

➢ Organic, including symptomatic, mental disorders, Dementia, Alzheimer's disease: F00–F09,

➢ Mental and behavioral disorders associated with the use of psychoactive substances: F10–F19,

➢ Schizophrenia, schizotypal and delusional disorders: F20–F29,

➢ Disorders of extracranial and locomotor system: G20-G26,

➢ Some diseases of the genitourinary system, kidney failure, urolithiasis: N00–N39.[75]

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[74] The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. pp. 44, 133.

[75] Action plans to protect public health from heat waves, Guidelines, World Health Organization Regional Office for Europe, 2011, Art. 6.

4.1 ASSESSMENT OF HEALTH VULNERABILITY TO CLIMATE CHANGE

Temperature change and impact on health

During the recent decades, a significant increase in temperature has been observed both on the whole planet and in Armenia. In particular, in the period of 1929-1996, the average annual temperature rose by 0.4 ℃, in 1929-2007 by 0.85 ℃, in 1929-2012 by 1.03 ℃, and in 1929-2016 by 1.23 ℃. In various seasons of a year the changes in air temperature have different trends. In the years of 1966-2016 the summer average temperature rose by nearly 1.3 ℃; as for Armenia, during the last century hot summers have been observed in the recent 20 years. For the territory of Armenia, compared to the average of years (5.5 ℃), it is predicted the annual rise of average temperature by 1.6 ℃ in 2040, by 3.3℃ in 2070 and by 4.7 ℃ in 2100.[76]

Figure 50. Annual average air temperatures in the RA in the years of 1935-2020 and deviations from the norm of 1961-1990
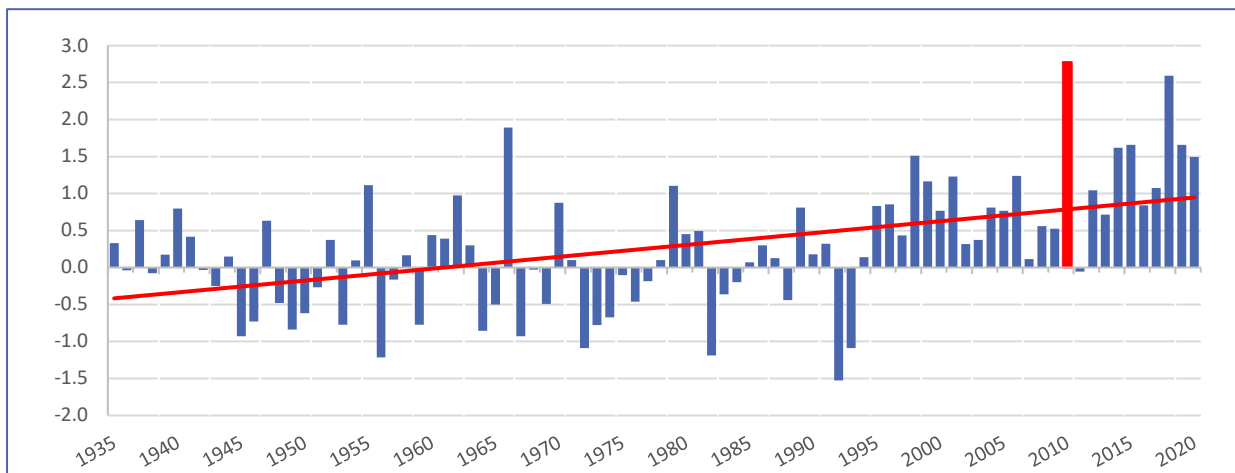
Source: Ministry of Environment, Hydrometeorology and Monitoring Center" SNPO.

Figure 50 presents the data, showing that average annual deviations of temperature in the last 28 years, except in 2011, have the trends of rising over the norm. As it was already mentioned, 2021 is also considered as a hot year: in the period of observation, it is the third hottest year after 2010 and 2018 (displayed deviations from the norm are 2.7, 2.5 and 2.1 ℃, respectively).

The effect of temperature change, theoretically and according to trends observed in regions of the

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[76] 4th National communication on climate change, according to the UN Framework Convention on Climate Change, UN DP, RA MoE, GEF, Yerevan, 2020, p. xxx:

world, is twofold: negative in the summer months and positive in the winter months. The overall conclusion is that by the end of the century, from an increase in average annual and seasonal temperatures, deaths from extreme heat will increase and deaths from extreme cold or frostbite will decrease.[77]

In addition to the gradual change in temperature, the effect of sudden temperature fluctuations on the human body is also significant, which can be manifested not only in the form of extremely hot or cold temperatures, but also in the form of high and low heat waves. In the case of heat waves, both the number of cases during the year or season and the duration of each case (number of days) are important.[78]

Trends in the number and duration of heat waves in the city of Yerevan from 1961 to 2020 are presented in Figures 5.2 and 5.3.

Figure 51. Number of heat waves in Yerevan, 1961-2020
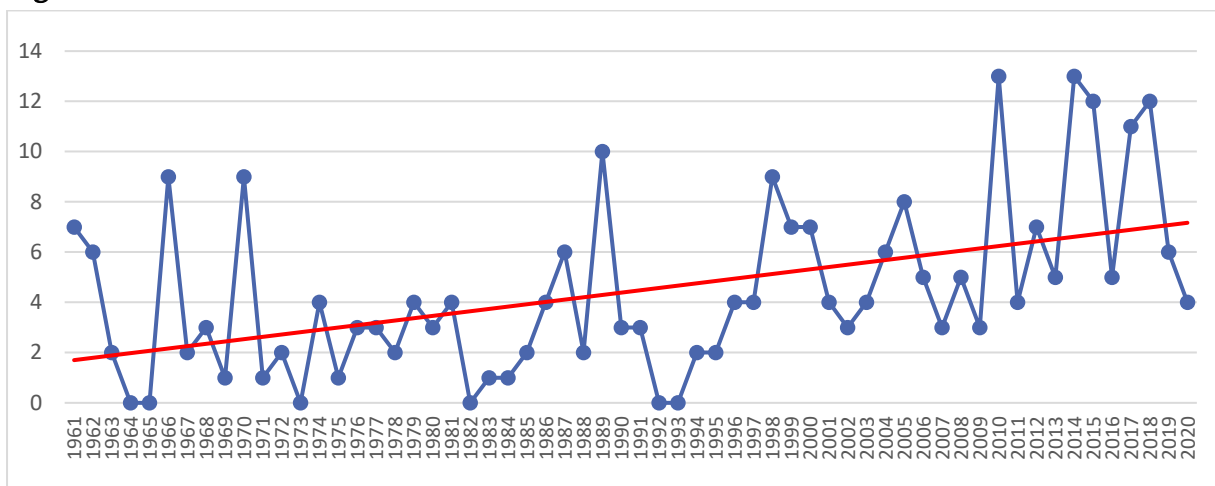
Source: Ministry of Environment, Hydrometeorology and Monitoring Center" SNPO.

Figure 52. Number of days of heat waves in Yerevan, 1961-2020

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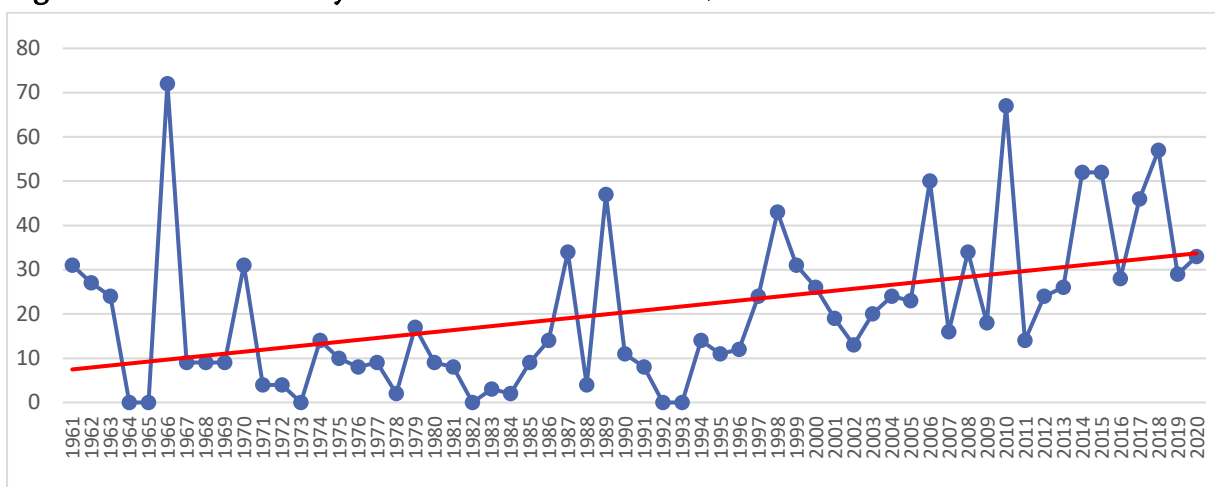
[77] *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. p. 57.*

[78] Acton plans to protect public health from the effects of abnormal heat, Guidance, WHO Regional Office for Europe, 2011, pp. 3-6.

Source: Ministry of Environment, Hydrometeorology and Monitoring Center" SNPO.

Sharp fluctuations in temperature from average monthly or annual indicators (extremely hot and cold days, heat waves) have a direct impact on health, because they threaten the ability of the body to quickly adapt to sudden changes in atmospheric air temperature and regulate the body's internal temperature. As a result of such situations, heat cramps, heat exhaustion and stroke, hyperthermia due to extreme heat and hypothermia due to frostbite or extreme cold can occur. It should be noted that extreme temperature values pose an additional threat in the presence of a number of chronic diseases (diseases of the blood circulatory system, in particular, hypertensive diseases, ischemic heart and cerebrovascular diseases, chronic obstructive pulmonary diseases – chronic bronchitis, asthma respiratory diseases, diabetes and mental and behavioral disorders).[79]

Fluctuations in temperature extreme values can lead to increased hospitalizations and deaths, raising the burden on the health care system.

According to the Statistical classification of diseases and health problems, 10th Revision (HD10), diseases and deaths caused by exposure to high and low temperatures are given in subsection «Exposure to the forces of nature» (X30-X31): «X30 Exposure to excessive high natural temperature» and «X31 Exposure to excessive cold natural temperature».[80]

According to the official statistics, there have been no deaths with the two codes mentioned in Armenia in recent years, there is no reason to assume their absence. In order to collect more accurate information on this issue, it is necessary to carry out additional studies.

Analysis of international data suggests that underdiagnosis of heat and cold deaths may happen due to diagnostic difficulties, particularly with the definition of diagnostic criteria for death and with difficulty of case identification. Analysis of international data shows that heat-related deaths are often underreported as such if there is another cause of death and no additional information is available about the heat wave. In such cases, it is necessary to consider the change in temperature as the cause of death, since the latter worsened the pre-existing illness of the deceased, which was considered as the direct cause of death. In this sense, it becomes important to collect data on temperature changes, diseases and deaths in a specific area (residence, geoFigureical area) on a daily basis, observe and analyze dependencies, taking into account the socio-demographic characteristics of the population of the target area.

In contrast to death diagnosis methods, statistical analysis of data can reveal both outwardly observable relationships between temperature and morbidity and premature mortality, as well as reveal the magnitude of the effect of temperature change. The available statistical dependence between the two factors makes it possible to assess the correlation of morbidity and mortality

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[79] Protecting health from climate change: vulnerability and adaptation assessment, WHO, 2013, p. 19.

The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. p. 46.

[80] Հիվանդության և առողջության հետ կապված խնդիրների վիճակագրական դասակարգիչ, 10-րդ վերանայում, ՀՀ ԱՆ, Երևան 2013:

rates from temperature fluctuations, as well as whether this correlation is sufficient for future predictions. Models developed with the help of statistical data can also be the basis for predicting the increase of diseases and premature deaths corresponding to the trends of climate change. The availability and availability of statistical data, and statistical studies based on them, may include data on temperature variation and mortality and morbidity for all days of the observation period and compare them with the seasonal averages of the base period.

Other methods of the the research are limited with the collection and analysis of the data, related to only those days, when the actual temperature exceeds the threshold indicators of extremely hot or extremely cold conditions. Another approach is the combined health effects of hazardous hydrometeorological events, particularly when extreme temperatures are combined with air pollution.[81]

Impact studies of temperature changes on the health of the population of Armenia

Impact studies of temperature change (rise) on the health of the population in Armenia were carried out in the past as well. In particular, a study of hygienic features of climate change and their impact on the health of population was carried out in 2012.[82] Within the framework of the research in Yerevan in 2004-2007, average air temperature, extreme wheather cases and correlation of heat waves with the mortality level and causes of deaths were studied witha special attention to cardiovascular diseases As a result of the study it was registered that the most frequent average daily fluctuations were observed in winter and spring months, which allows to assume that this period is the most unfavorable for the population from the view of occurence of cardiovascular diseases. In the framework of the research, in 2004-2007 c. Average daily air temperature in Yerevan, and the association of extreme weather events and heat waves with mortality rates and causes of death, with special reference to cardiovascular diseases. As a result of the study, it was recorded that daily average temperature fluctuations were most often observed in the winter and spring months, which allowed us to assume that this period is the most unfavorable for the population in terms of the occurrence of cardiovascular diseases. The results showed that the 31.4% and 25.9% of mortality from the ischemic heart diseases and 30.4% and 27.6% of from acute myocardial infarctions occur in winter and spring months, respectively. The lowest rate of deaths caused by these diseases was registered in summer and autumn. A similar picture could be seen in the statistics of deaths caused by diseases of the repsiratory system and genitourinary system. The highest mortality rate from diseases of the endocrine system was recorded in winter, and the deaths caused by diseases of the digestive system in winter and summer. Examining the mortality rate and causes observed in the hottest month of that period

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[81] The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. pp. 45-51.

[82] Ավետիսյան Լ. Ռ, Քոթանյան Ա. Հ, Մկրտչյան Ս. Հ, Մելքոնյան Հ. Ա. Կլիմայական փոփոխությունների հիգիենիկ առանձնահատկությունները և նրանց ազդեցությունը բնակչության առողջության վրա. 2012; http://medsci.asj-oa.am/572/1/130.pdf. Առողջապահության հարմարվողականության պլանավորման համար արկա ռեսուրսների գնահատում/զուգբագրում և բացերի վերլուծության հաշվետվություն, ՀԱՀ, Կանաչ կլիմայի հիմնադրամ, ՄԱԶՌ, Ե. 2020, էջ 49:

(August 2006), it was found that the most significant increase was recorded in the following cases: ischemic heart disease - 25%, gastrointestinal diseases - 88%, respiratory diseases - 70%, accidents, injuries and poisonings, 54%. Based on the results of the study, it was concluded that in 2006 August's extreme heat caused 143 additional deaths:

The regression analysis carried out in the framework of a scientific study aimed at revealing the effect of atmospheric air temperature on the basis of morbidity indicators of the population and predicting morbidity depending on this factor revealed reliable relationships between the average annual air temperature values in individual regions and the relevant morbidity indicators. In particular, such a connections was found out between the environemtal temperature factor and indicators of general population morbidity ($R2=0.945$, $P<0.05$), morbidities of the digestive system ($R2 = 0.966$, $P<0.01$), nervous system ($R2=0.78$, $P<0.05$), endocrine system ($R2=0.742$, $P<0.05$) and genitourinary system ($R2=0.87$, $P<0.05$). In addition, the regression equations derived from the research ($Y_{general}= 32114\text{-}4445x+402x2,$ $Y_{digestive}= 4622\text{-}992x+72x2,$ $Y_{genitour.}=4474\text{-}1245x+93x2,$ $Y_{nervous}=547+114.6x,$ $Y_{endocrin.}=242+212x$) provide with the opportunity to predict the dynamics of morbidity of the population (y) depending on the temperature factor (x).[83]

At the same time, with that research, it was revealed that the prevalence of diseases of the nervous and endocrine system of the population has a clear linear dependence on air temperature. Non-linear relationships between the general morbidity of the population, as well as the morbidity of the digestive and genitourinary system and the average annual temperature indicators were recorded, which indicates that the frequency of these diseases increases in regions with both high and low average annual air temperatures.

The relationship between temperature increase and intensity of UV-rays with skin neoplasms, particularly melanoma and other malignant skin neoplasms, was observed. As a result of the correlation analysis, a reliable relationship was recorded only between the average temperature values of July and the incidence rates of other malignant neoplasms of the skin ($r_s=0.714$, $P<0.05$), on the basis of which it was proved that high summer temperatures are correlated with a high prevalence of other (non-melanoma) malignant neoplasms of the skin.

It is worth noting the fact that, as it was found out from the analyzes carried out to reveal the seasonal characteristics of morbidity and mortality of the population of Yerevan, the highest rates of morbidity and mortality, especially with diseases of the cardiovascular system, are recorded in the winter-spring months. As the days of heat waves increase in the summer period, the number of deaths from all causes, including accidents, injuries and poisoning, reliably increases. Moreover, each additional day of a heat wave can lead to five additional deaths from all causes. According to the results of the research, it was concluded that the maximum threshold levels of air temperature, which can be observed only in the hottest period of the year, are more important in terms of the

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[83] Kotanyan A., Medical-ecological issues of environmental natural factors in the territory of RA, Zh. 00.05 Transcript of dissertation for the Doctor of Medical Sciences degree in "Hygiene, Occupational Pathology and Toxicology", Yerevan - 2015, page 14.

impact of such climatic phenomena on the health of the population. By the regressive analysis trustworthy connections have been registered between the environmental temperature factor and all causes of deaths ($R^2=0.822$, $P<0.01$), as well as indicators of deaths caused by cardiovascular diseases ($R^2=0.777$, $P<0.01$), including ischemic heart diseases ($R^2=0.732$, $P<0.01$), diseases of respiratory organs, ($R^2=0.742$, $P<0.01$), diseases of digestinal organs ($R^2= 0.602$, $P<0.05$).[84]

Assessment of health vulnerability to temperature change

In the context of the assessment of health vulnerability to climate change, the impact of the increase in atmospheric air temperature and temperature anomalies (extreme temperature values, heat waves, etc.) on diseases and deaths was assessed according to the groups of diseases mentioned below (HD-10):

a/ I00-I99 Diseases of the blood circulatory system, and from that group:

    I10 – I13 Hypertensive diseases,

    I20 – I25 Ischemic heart diseases,

    I60 – I69 Cerebrovascular diseases.

As well as:

b/ C43 Malignant melanoma of the skin

    C 44 Other skin malignancies

The effect of temperature on health in Armenia was assessed by descriptive, correlation and regression analysis methods using the average annual and monthly temperature values for the years 2010-2021, the number of extremely hot days, the number of heat wave cases and days in the city of Yerevan, as well as yearly, monthly and daily data on diseases and deaths.

Moreover, in order to evaluate the differences between new cases and previous health conditions, both the general morbidity of the mentioned diseases and the cases recorded for the first time in life were observed.

The influence of the incidence and duration of heat waves on the dynamics of deaths from diseases of the blood circulatory system was observed with the data of the city of Yerevan.

Impact on diseases. Based on the primary observation of the results of descriptive statistics, the dynamics of changes in atmospheric air temperature and diseases of the blood circulatory system (I00-I99) and deaths have general trends. Figures 5.4 and 5.5 show the trend of increasing average annual indicators of temperature and blood circulatory system diseases, especially general morbidity, during 2010-2021.

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[84] Քոթանյան Արմենուհի, ՀՀ տարածքում միջավայրային բնական գործոնների բժշկաէկոլոգիական իմնահարցերը, էջ 20:

Figure 53. Dynamics of average annual temperature values and BCSD prevalence and cases, 2010-2021
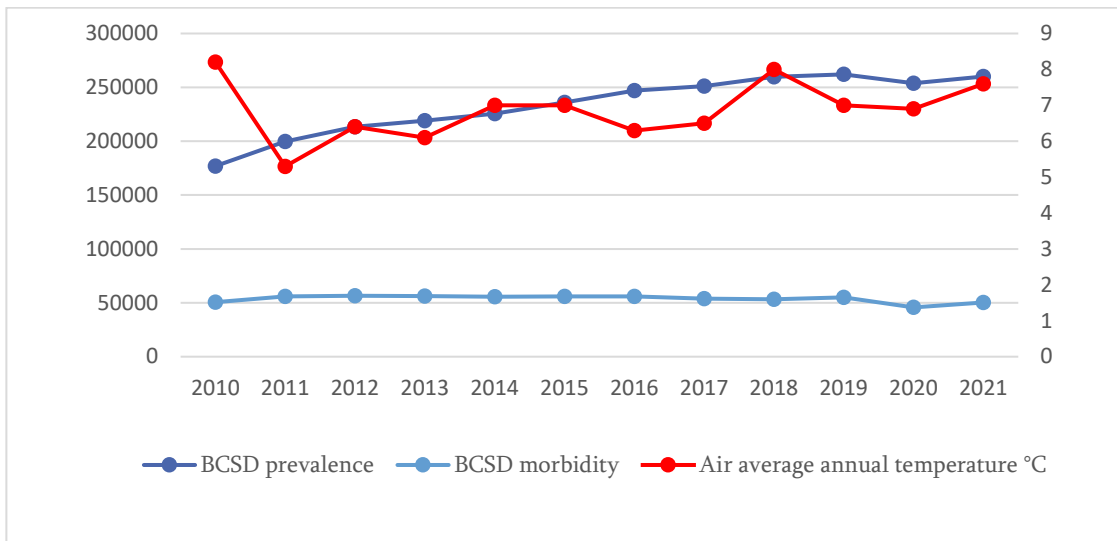
It is noteworthy that the dynamics of a steady increase in annual BCSD cases is noticeable since the hottest year recorded in the past 30 years (2010), although differences in trends are noticeable in each specific year. This circumstance may be explained by the time difference between the exposure to temperature and the periods of onset and/or diagnosis of the disease. In the dynamics of BCSD cases in 2010-2021, a deviation from the general trends is noticeable only in 2020, which is due to the Covid-19 pandemic and military events.

The same picture of morbidity dynamics in the same period is present only in the case of hypertensive diseases.

Figure 54. Dynamics of average annual temperature values and overall morbidity of BCSD group diseases by nosologies, 2010-2021
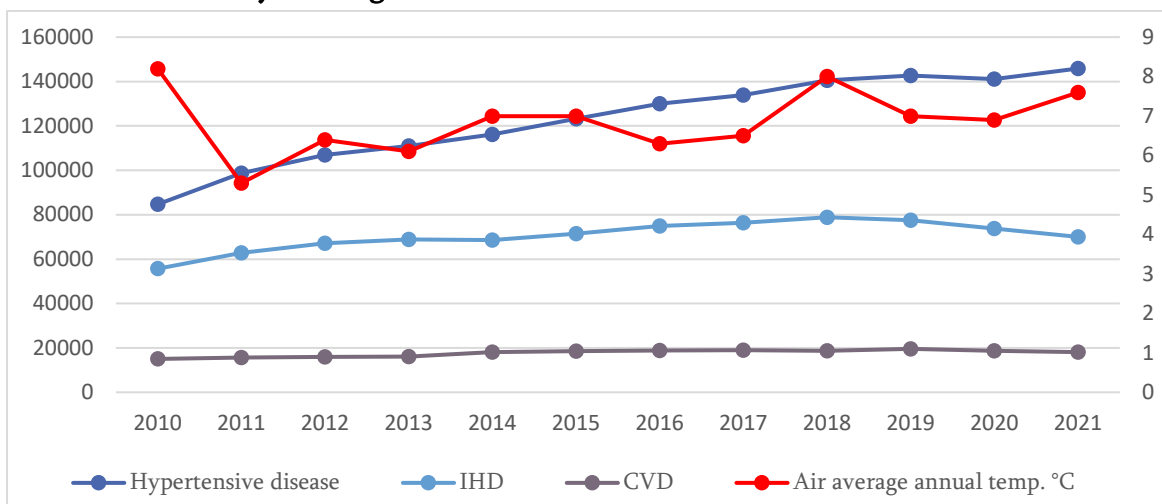
Annual changes in temperature are more associated with the incidence of hypertensive diseases (I10-I13) within the BCSD group (Figure 5.5). In contrast to hypertensive diseases, the rate of growth of which continues throughout the observed period, from the point of view of IHD and CVD diseases, a decrease in cases is noticeable since 2018 and 2019, respectively. It should be

noted that compared to the indicators of 2018, a decrease in mortality rates from all causes was recorded in 2000-2017. However, between 2020 and 2021, there was a 1.4-fold increase in BCSD deaths compared to 2010.

When evaluating the possible correlation between temperature change and BCSD group disease indicators by analyzing statistical data (excluding the influence of other factors), a significant dependence between the two variables is noticeable.

Figure 55. Correlation connections between mean annual temperature values and the BCSD, HD, IHD and CVD annual prevalence, 2010-2021
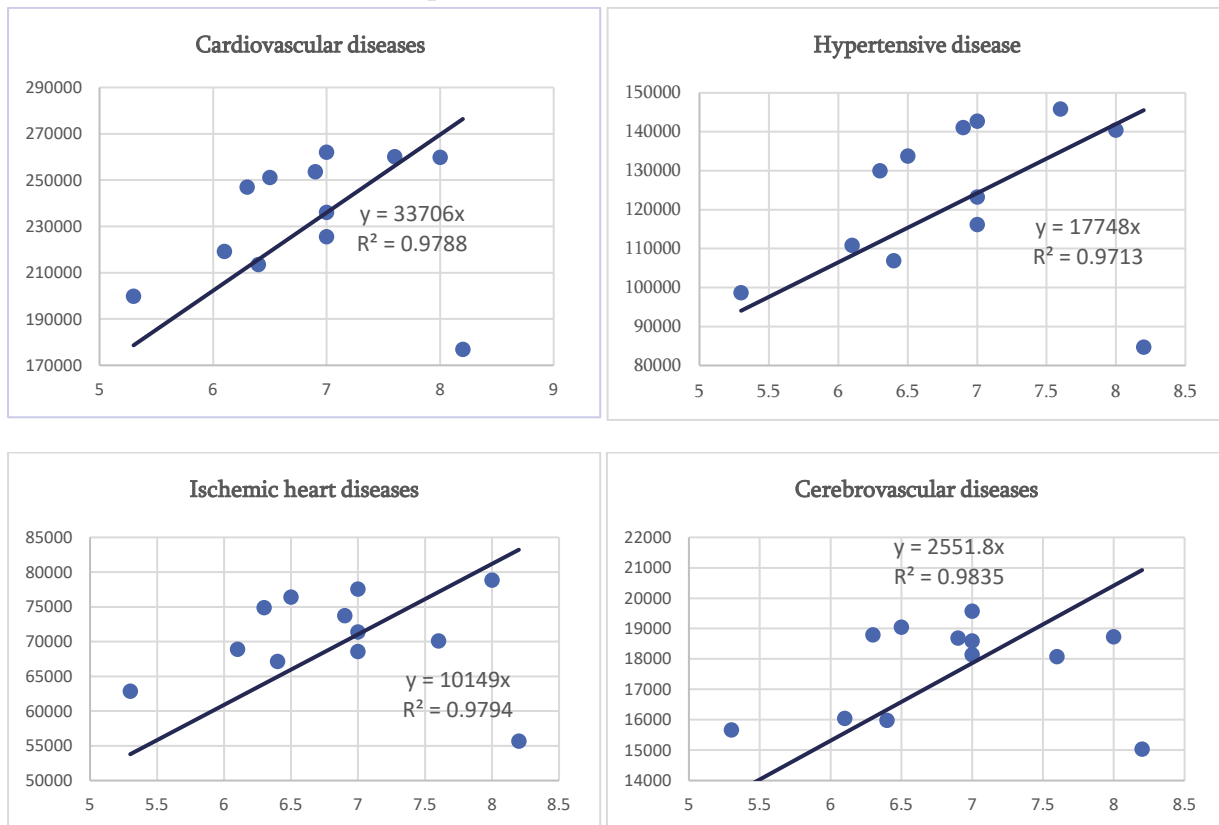
However, the regression analysis of the average annual values of atmospheric air temperature and the annual incidence of BCSD of the population covering the same period showed a non-linear and non-significant relationship ($R^2=0.023$, $P>0.05$). The obtained results indicate that, firstly, only 2.3% of the BCSD variation can be explained by the change in atmospheric air temperature; secondly, in the conditions of the complex effect of all factors on this group of diseases, although the obtained regression equation (Figure 5.7) is not suitable for prediction. Nevertheless, the temperature every 1 point increase could cause 4,986 new cases of the disease. The *F* and *t* values, characterizing the statistical relationship between the two variables in the regression analysis, appeared in the non-rejection part of the 95% confidence interval, thereby confirming the absence of a statistically significant linear relationship between the annual average temperature values and changes in BCSD cases.

Figure 56. Results of regression analysis of the average annual temperature values and annual incidence of BCSD prevalence, 2010-2021
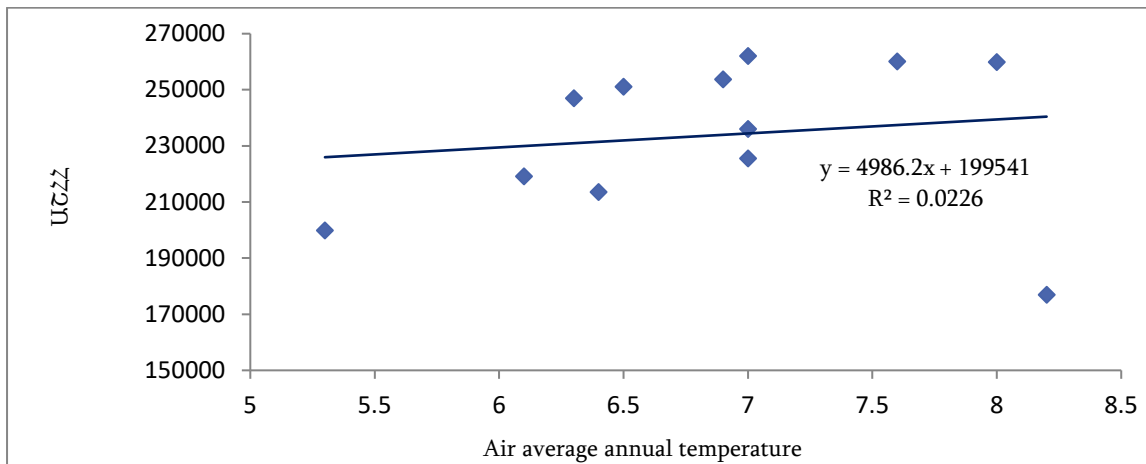
On the other hand, we get a completely different picture of the regression dependence between the two variables in the case of assumption of excluding the influence of non-climatic factors. By the results of regression analysis ($R^2=0.979$, P<0.05), 97.9% of variations of BCSDcases can be explained by the change in the average annual temperature values. And according to the regression formula, an increase of 1 point in the average annual temperature will increase the number of disease cases by 33,706 points.

Figure 57. Evaluation of regression analysis results of average annual temperature values and annual BCSD incidence when excluding the influence of non-climatic factors
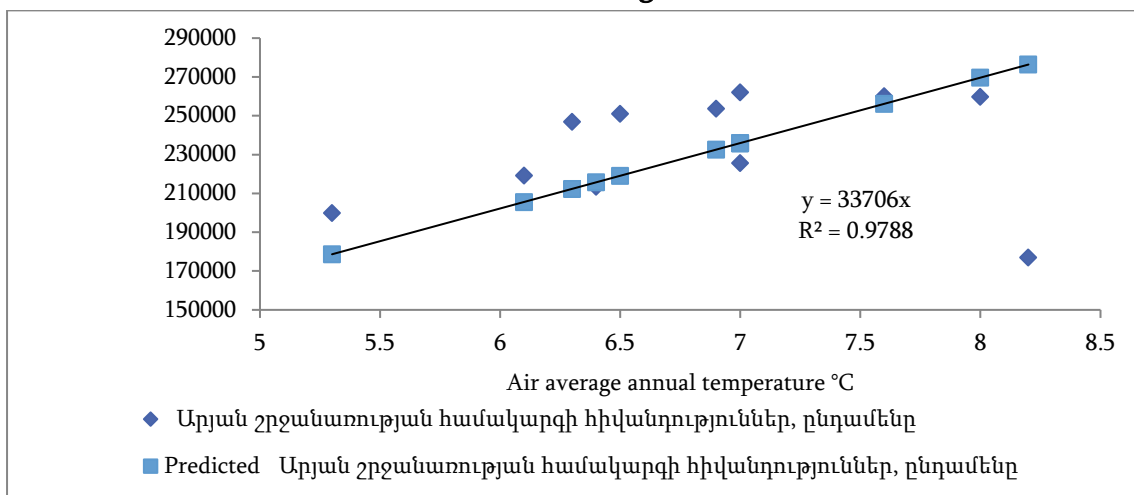
   Diseases of blood circulatory system, total

   Predicted   Diseases of blood circulatory system, total

Results of the regression analysis by nosologies of BCSD general and HD ($R^2=0.039$, P>0.05), IHD ($R^2=0.000$, P>0.05), CVD ($R^2=0.032$, P>0.05) diseases are similar.

 Within the framework of the research, the impact of changes in atmospheric air temperature and maximum temperature values on skin melanoma (C43) and other malignant skin neoplasms (C44) was also considered.

Melanoma of the skin is the leading cause of deaths from skin cancer. The main cause of this disease is the sun's ultraviolet (UV) rays and exposure to the sun (especially at an early age). The disease is risky for the population of Armenia considering both the temperature change, the frequency and days of heat wave occurances, as well as the color of the skin, being in the open air often and for a long time, etc. The visible increase in the disease began in the 70s of the last century and continues to this day. Melanoma belongs to the group of diseases most vulnerable to the effects of direct sunlight and extreme temperatures.

Collation of the dynamics of atmospheric air temperature changes and the cases of skin malignant melanomas with cardiovascular diseases in 2010-2020 in contrast to the blood shows the trend of commonalities and concidences (Figure 5.9).

Figure 58. Dynamics of the temperature change and the cases of skin malignant melanoma and prevalence of other malignant neoplasms of the skin in the RA, 2010-2021
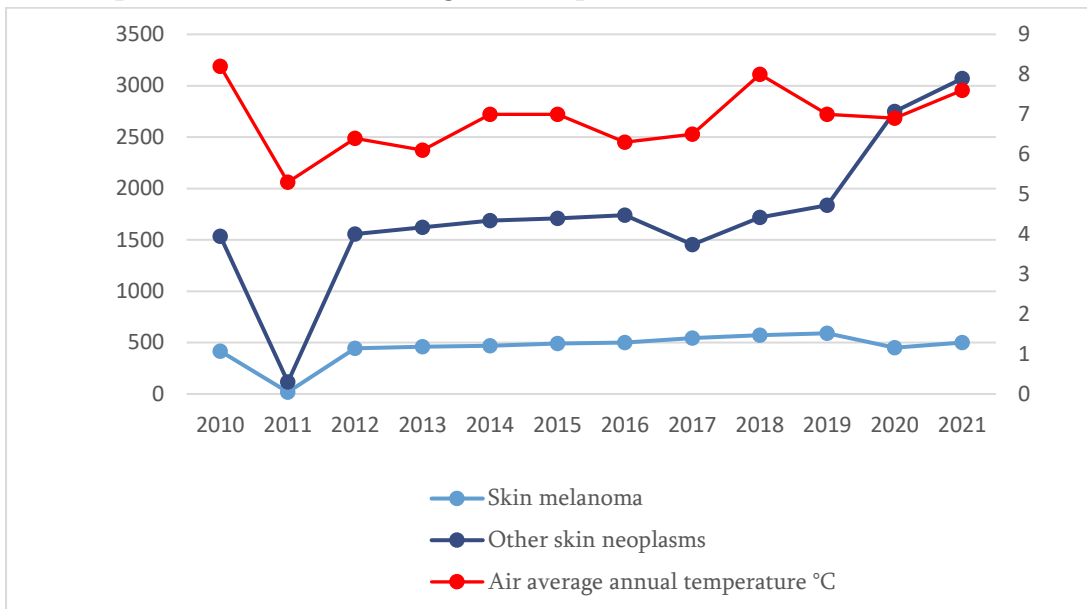

Statistical analysis showed a clear correlation between the change in average annual temperature values and skin melanoma and other malignant neoplasms of the skin (excluding the influence of other factors).

Figure 59. Correlations between temperature change and rates of skin melanoma and other skin malignancies
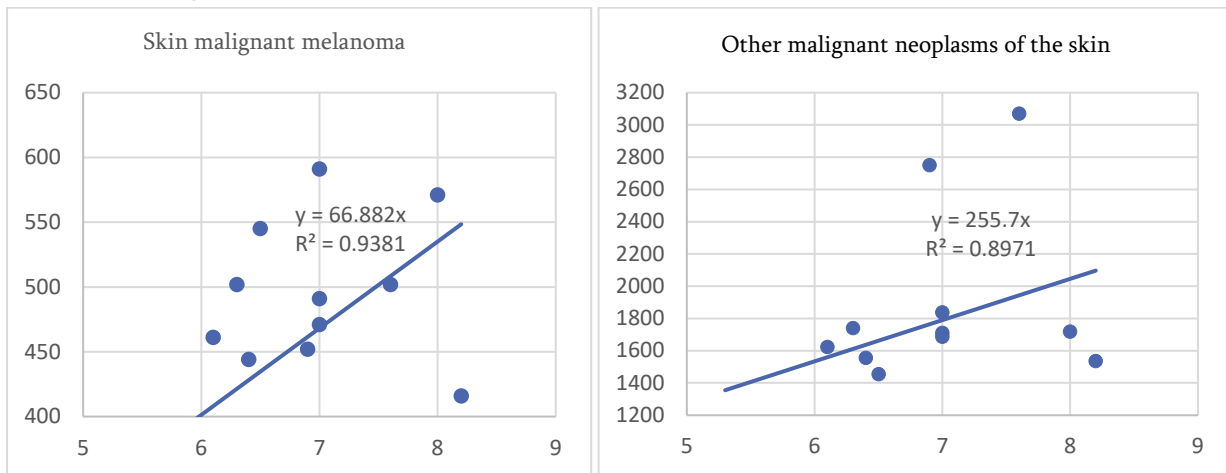
Regression analysis of 2010-2021 average annual air temperature and skin melanoma incidence showed a significant relationship (R^2=0.332, P<0.05). As far as criterion t, reflecting the linear dependence between two variables is within the rejectable segment of the 95%-reliability interval (*$t_{critical\ value}$ = 2.228, $t_{statistics}$ = 2.230*), there the statistically significant linear dependence between two variables is proved and the obtained regression equation (model) can be used for predictions of future impacts. The obtained results suggest that, first, 33.2% of variations of the melanoma skin diseases can be explained by changes in atmospheric air temperature; second in the conditions of the complex effect of all factors on this disease, every 1 unit increase in annual temperature can cause 103 new skin malignant melanoma cases. (Figure 5.11). Moreover, in the absence of factors affecting the occurrence of malignant melanoma of the skin caused by temperature changes (heat shock, UV radiation, etc.), the number of cases of the disease will be reduced by 254.

Figure 60. Results of the regression analysis of average annual temperature values and annual cases of malignant melanoma of the skin
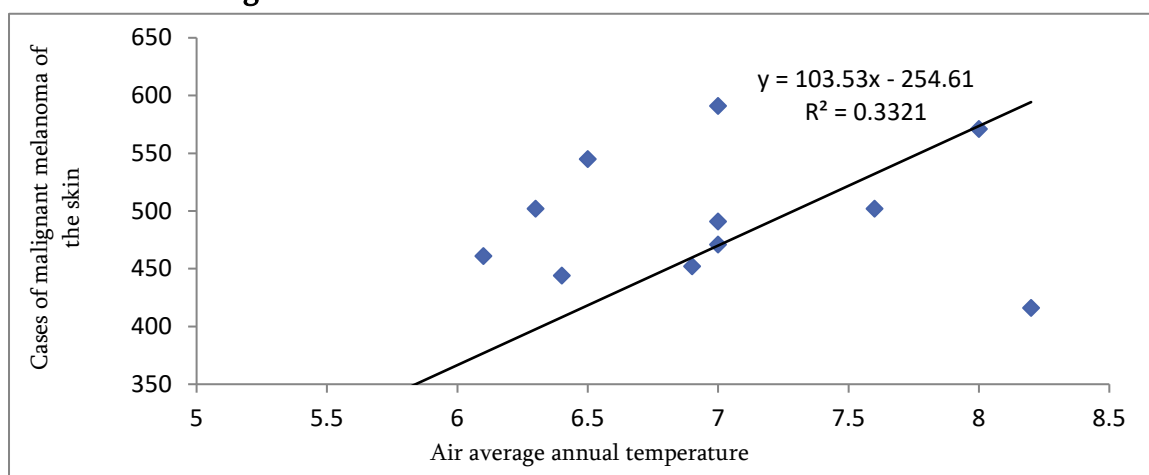
The impact on mortality. According to the WHO guidelines, the experience of other countries and the results of previous research conducted in Armenia, the increase in atmospheric air

temperature and temperature anomalies caused by climate change have a certain measurable effect on the dynamics of mortality, especially from climate-sensitive diseases. The observation of annual temperature values and annual CVD mortality in 2010-2020 shows that the dynamics of indicators have a pronounced cyclical upward trend.

Figure 61. Dynamics of the average annual temperature values and CVD deaths, 2010-2021
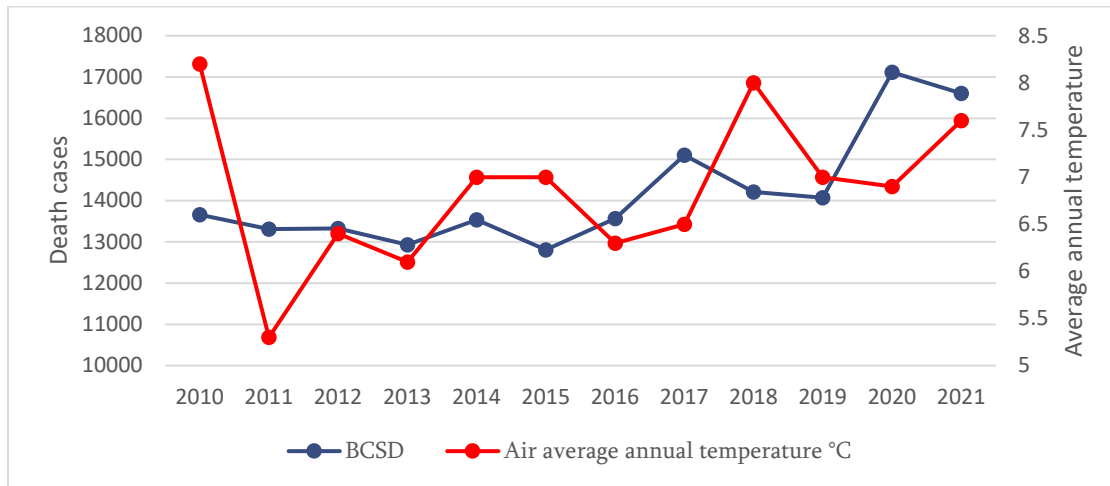
In 2010-2020, in contrast to BCSD in general and according to the observed diseases, the dynamics of deaths shows a noticeable upward trend only in the case of BCSD deaths (Figure 5.13).

Figure 62. Dynamics of deaths from hypertensive, ischemic heart and cerebrovascular diseases 2010 -2020
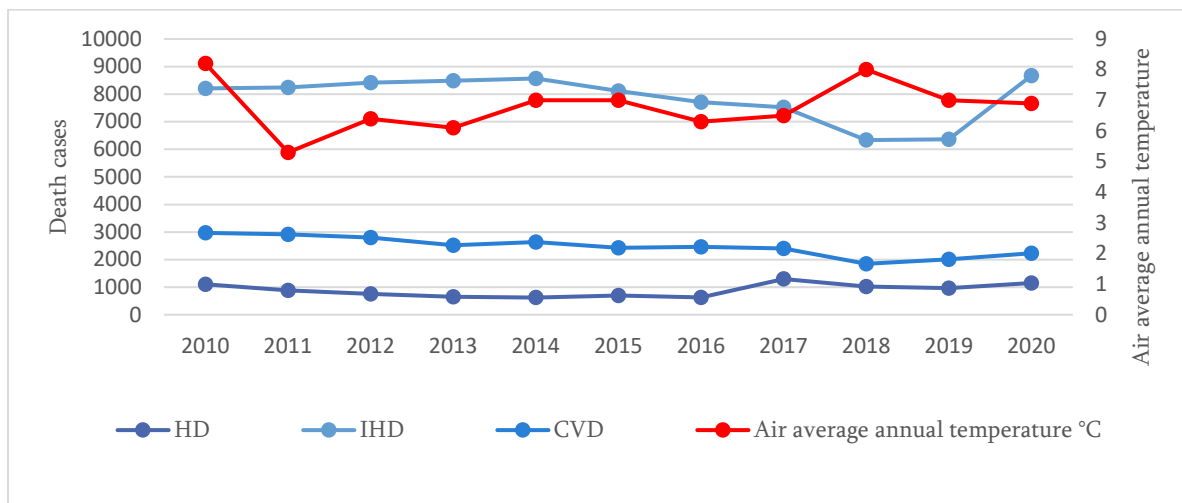
During 2010-2018, a decrease of CVD by nosologies was registered, however, since 2019 the increase of IHD and CVD deaths was recorded. It is especially noticeable in the case of deaths caused by ischemic heart diseases: the mortality rate in 2020 grew up by 5.6%, compared to 2010, the highest for the period under review.

Statistical analysis revealed a clear correlation between the change in average annual temperature values and the annual incidence of deaths from diseases of the blood circulation system (if the influence of other factors is excluded).

Figure 63. Correlations between temperature change and rates of skin melanoma and other skin malignancies
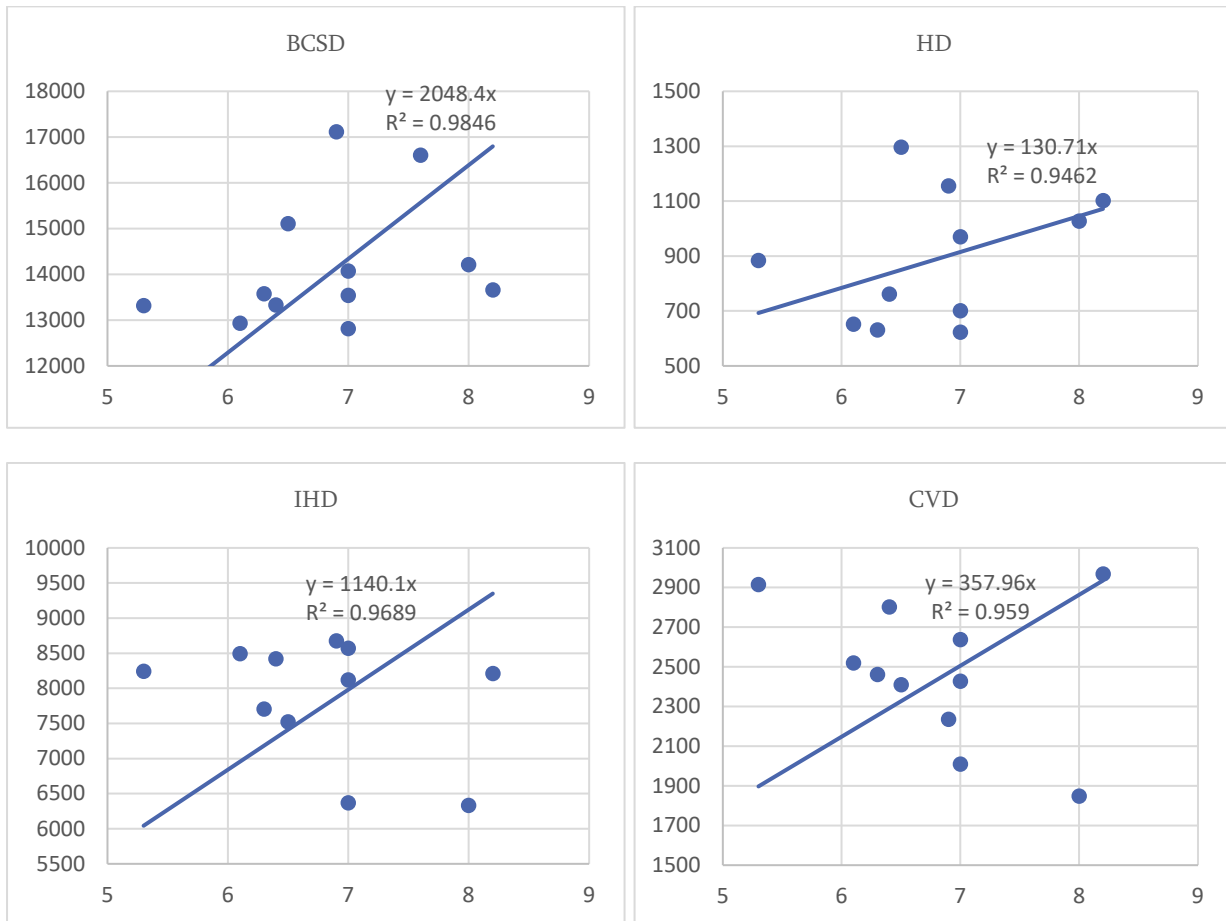
Regression analysis of the annual average values of atmospheric air temperature and annual deaths from diseases of the blood circulatory system for the period 2010-2021 showed that there is no statistically significant linear relationship between the two variables, (R^2=0.0845, P>0.05). The conclusion is also proved by the value of criterion t, reflecting the linear dependence between two variables, which is available in the non-deniable segment of the 95%-reliable interval $(t_{critical\ value} = 2.228, t_{statistics} = 0.9604)$, proving by this the zero-value version of the regression analysis: there is no linear relationship between average annual temperature values and changes in deaths from diseases of the blood circulatory system.

Figure 64. Regression analysis of the average annual teperature values and cases of annual deaths caused by BCSD
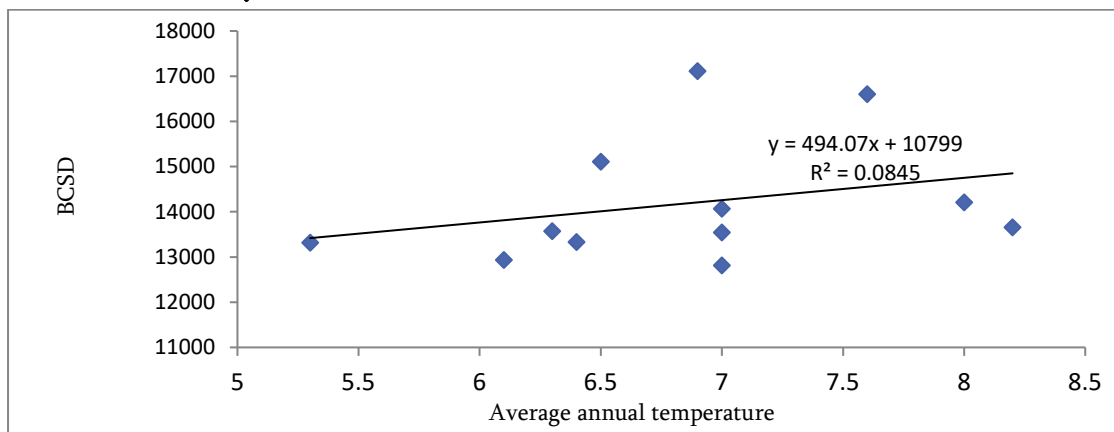
A similar picture appears with CVD as well: hypertensive diseases ($R^2=0.1125$, $P>0.05$,), IHD ($R^2=0.1257$, $P>0.05$), BCSD ($R2=0.1070$, $P>0.05$). The values of the F and t criteria for statistically significant linear dependence in the regression analysis of the relationship between deaths from all three diseases and the mean annual temperature values fell within the non-rejection segment of the 95% confidence interval, thus indicating the absence of a reliable linear relationship between the two variables. In addition to annual averages, monthly average values of atmospheric air temperature and monthly BCSD mortality were also considered to assess health vulnerability to climate (temperature) change.

Previously, the analyzes carried out to clarify the seasonal characteristics of morbidity and mortality of the population of Yerevan showed that the highest rates of frequency and mortality caused by diseases of the cardiovascular system are recorded in the winter-spring months, which was the basis for studying the vulnerability of individual diseases to the change in temperature in hot summer days. The aim of the research is to find out the possible impact of heat waves on mortality and morbidity rates of the population. As a result, it was concluded that the number of deaths from all causes reliably increases with the increase of heat wave days in the summer period.[85]

With the aim of assessing the impact of changes in atmospheric air temperature on the dynamics of BCSD deaths, average monthly data of non-hot (2020) and hot (2021) estimated years, covering the period 2010–2021, were used.

Table 13. Average monthly values of atmospheric air temperature and monthly incidence of CVD death, 2020-2021

| Months	Average monthly temperature, 2021	Deaths by months, 2021	Average monthly temperature, 2020	Deaths by months, 2020
January	-4.3	1644	-5.4	1461
February	-1.9	1329	-4	1393
March	-0.9	1410	3.1	1269
April	8.9	1452	3.9	1157
May	12.5	1258	10.9	1114
June	17.6	1200	15.6	1425
July	18.6	1161	18.1	1293

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[85] A. Kotanyan, Medical-ecological issues of environmental natural factors in the RA territory, p. 19-20. (Arm.)

August	19	1095	15.9	1026
September	14	1124	15.7	1027
October	6.7	1528	9.8	1422
November	3.2	1867	2	2451
December	-2.3	1534	-3	2076
Annual	7.6	16602	6.9	17114

Source: RA SC

A comparison of average monthly temperature values and BCSD death cases across the country showed that, unlike the previous study, more deaths are recorded in the winter and autumn months and less in the summer months. Moreover, the share of deaths recorded in the hot summer of 2021 was one percentage point less than the corresponding indicator of 2020.

Figure 65. BCSD morbidity ratio (%) by year seasons,
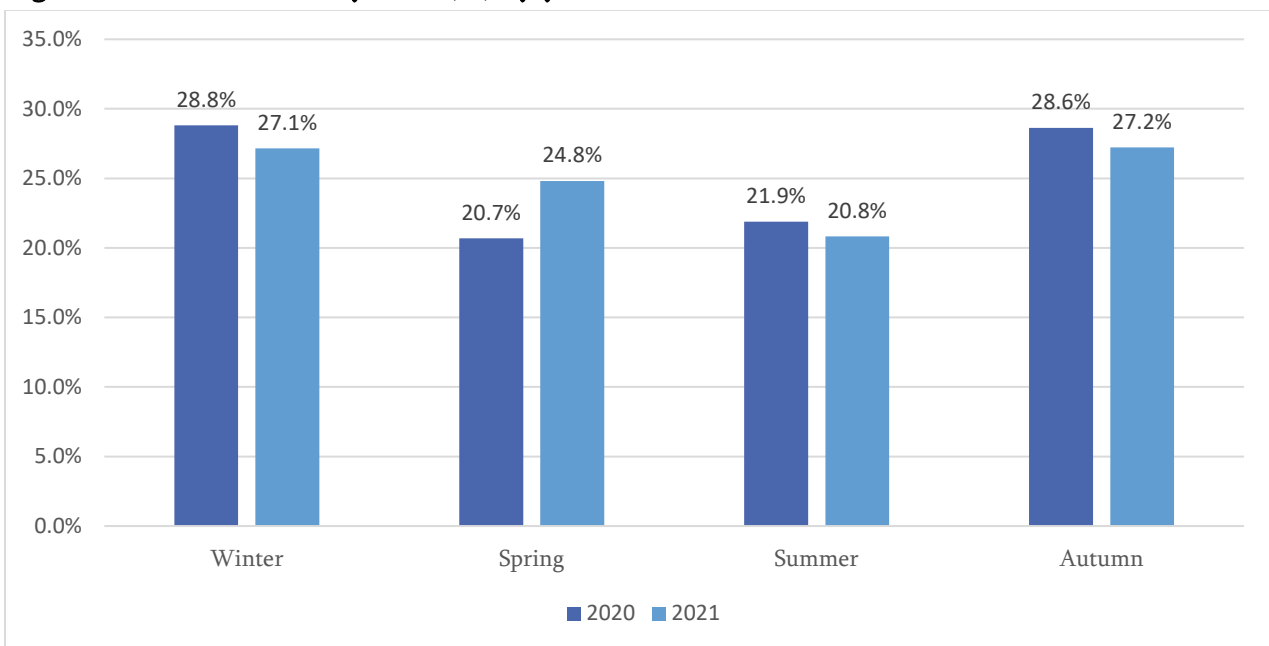
Different approaches to determining causes of death typically lead to differences in the relative numbers of extreme heat- and cold-related deaths. Studies, based on statistical approaches, showed that although the majority of diagnosed deaths are caused by cold rather than extreme heat, and that higher mortality rates are registered in the winter months, however, the connection between mortality and an additional extreme (abnormally) hot day is more significant than the connection between mortality and an additional extreme cold day.[86]

Taking this reality into account, the impact of changes in atmospheric air temperature and anomalous extreme values on the dynamics of mortality from concrete diseases is more important.

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[86] The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. p. 48-49.
Medina-Ramón, M. and J. Schwartz, 2007: Temperature, temperature extremes, and mortality: A study of acclimatization and effect modification in 50 US cities. *Occupational and Environmental Medicine,* **64,** 827-833.
http://dx.doi.org/10.1136/oem.2007.033175

With the aim of evaluating such influence, the data on heat waves, their duration, and BCSD morbidity and mortality, as well as the dynamics of daily temperatures daily BCSD deaths were used. The dynamics of changes in BCSD cases in Yerevan by years are associated with the same indicators of heat wave cases.

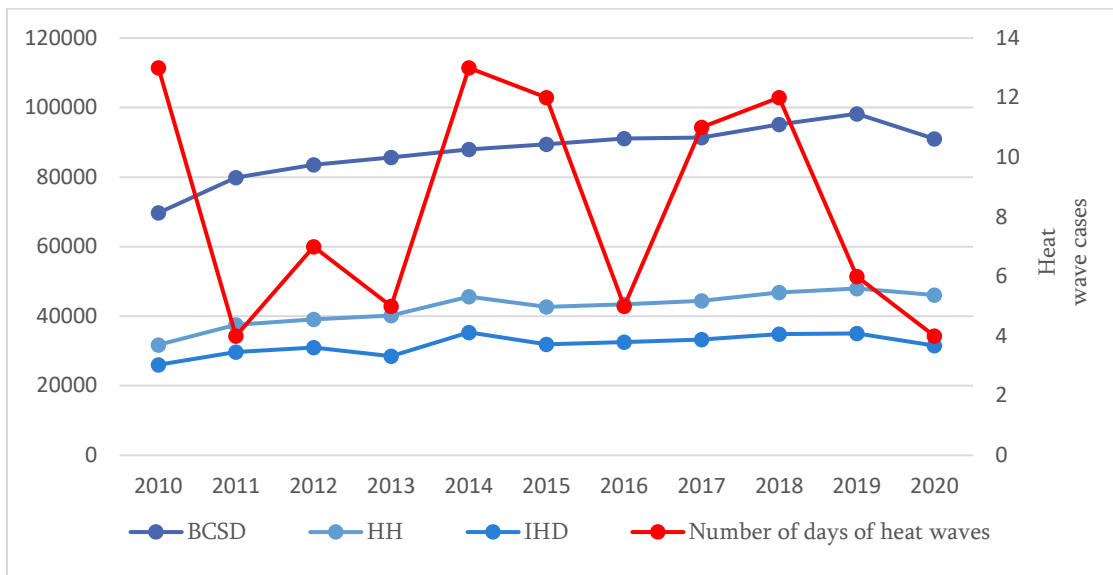**Figure 66. Dynamics of heat wave cases and CVD incidence according to nosologies in Yerevan, 2010-2020**
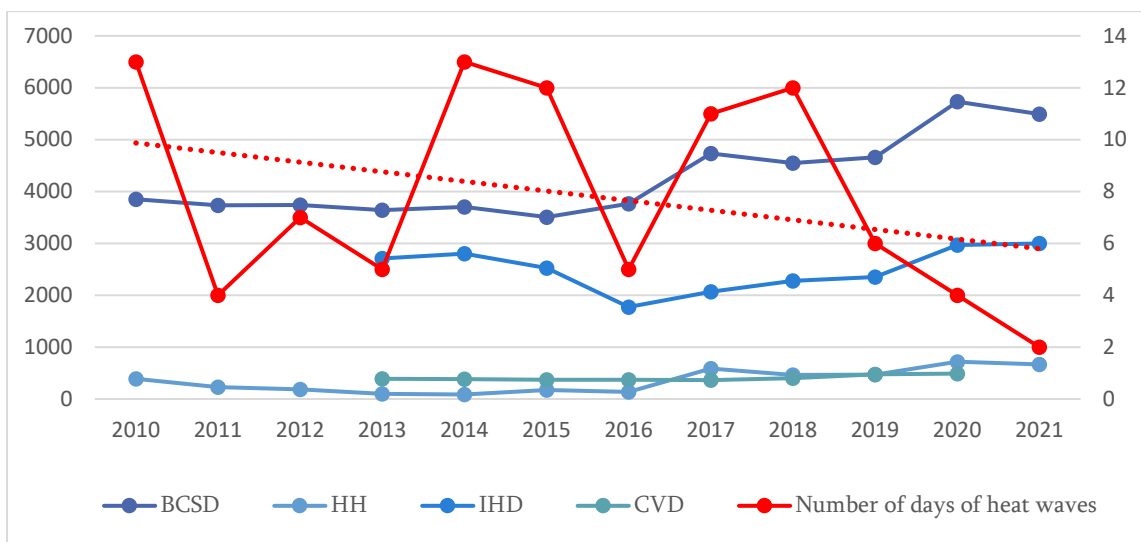

Figure 67. Dynamics of heat wave cases and BCSD and deaths by nosology in Yerevan, 2010-2020.

In the years 2010-2021, a general decreasing trend of heat waves is noticeable (dotted curve in Figure 5.18). However, compared to previous years, 2020 and 2021, BCSD deaths increased by 3,045 and 2,025, respectively.

Figure 68. The dynamics of the number of heat wave days and BCSD and morbidities by nosologies in Yerevan, 2010-2020
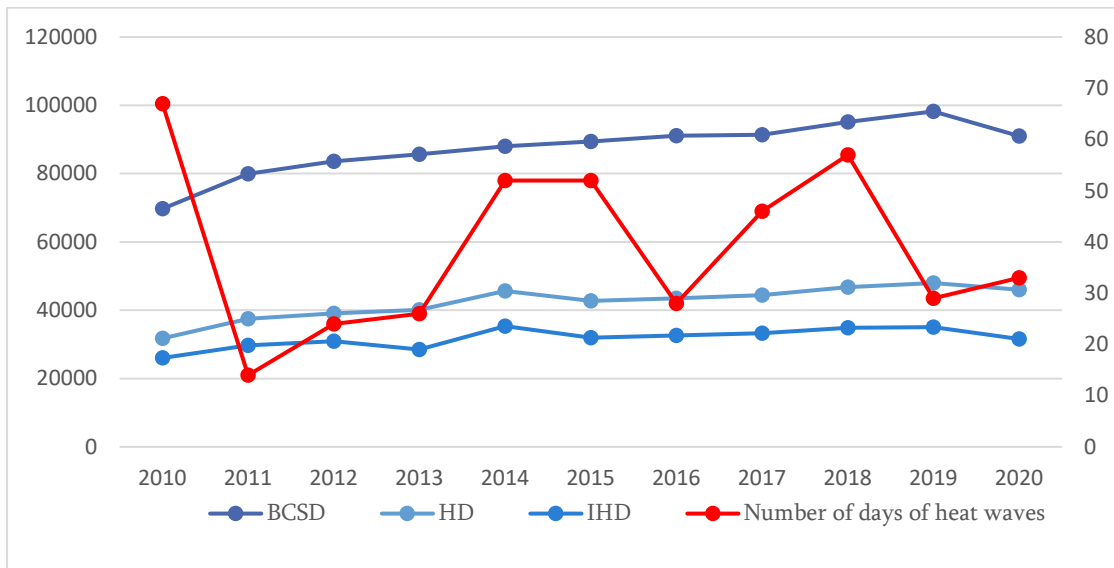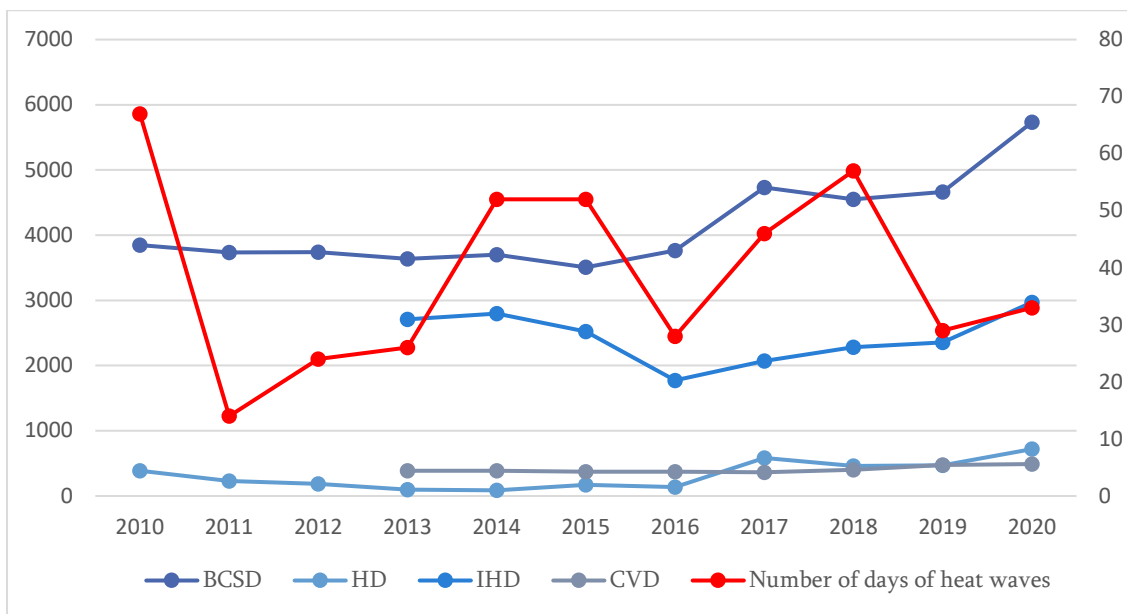

Figure 69. Dynamics of the number of heat wave days and deaths caused by BCSD and nosology in Yerevan, 2010-2020

Statistical analysis revealed a clear correlation between the change in average annual values of heat waves and days and the annual incidence of BCSD deaths in Yerevan (excluding the influence of other factors).

Figure 70. Correlation links of the heat wave cases, days and CVD deaths in Yerevan
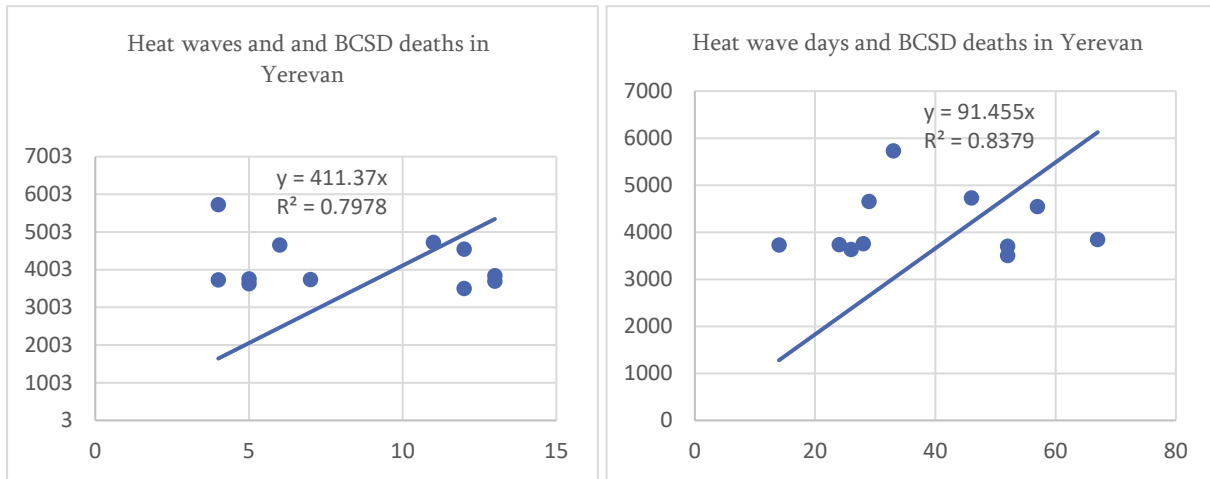
By primary observation, the correlation dependence coefficient is quite significant: about 80% in the cases of heat wave occurrences, and 84% in the case of heat wave duration (days).

The regression analysis of the cases of heat waves and days and BCSD annual deaths in Yerevan in the period of 2010-2020 registers the lack of statistically significant linear dependence of the two variables (heat wave cases: $R^2=0.0447$, $P>0.05$, heat wave days: $R^2=0.0002$, $P>0.05$). The conclusion is also supported by the fact that the values of the F and t parameters of the statistically significant linear dependence of the regression analysis between the two variables are in the non-rejected part of the 95% confidence interval, thereby proving the absence of a reliable linear relationship between the two variables.

Figure 71. Results of regression analysis of annual values of heat wave events and BCSD deaths in Yerevan, 2010-2020
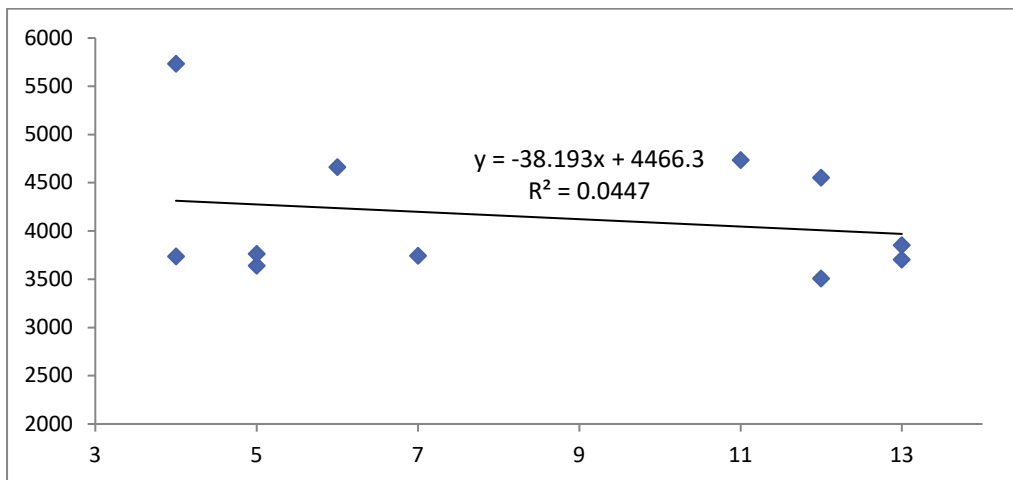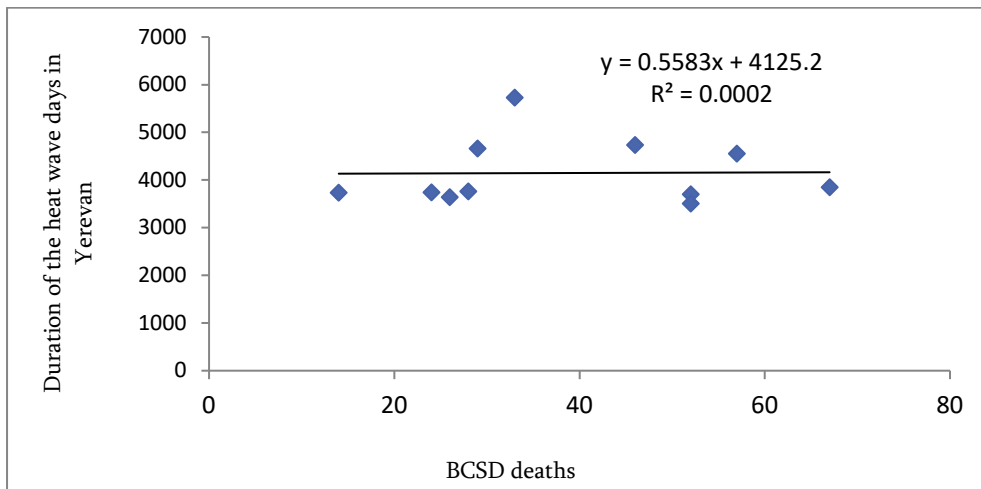
Figure 72. Results of regression analysis of annual values of heat wave days and annual incidence of BCSD deaths in Yerevan, 2010-2020

With the aim of estimating the effect of temperature on BCSD deaths, daily deaths in 2021 were also considered, which should somewhat reflect the possible relation between extremely high temperature days and deaths.

According to the Hydrometeorology and Monitoring Center of the RA Ministry of Environment, the winter of 2020-2021 was warm, the average seasonal temperature was -3.1 °C and was 2.4 degrees above the norm (-5.5 °C). The months of January and February were especially warm (average monthly temperatures were higher than the norm of 1961-1990 by 2.5 and 3.9 degrees, respectively).The spring of 2021 is the fifth hotest since 1935 (2018, 2014, 2008, 1989). The average seasonal temperature was 6.8 °C, which was 2.5 °C higher than the norm (4.3 °C).A very high temperature was recorded in April and May, when the positive temperature anomaly was 4.0 °C and 2.9 °C, respectively. April and May 2021 became the warmest months in the entire history of observations.

The summer season of 2021 was warmer than normal, with an average temperature of 18.2 °C, i.e. 2.5 degrees higher the normal 15.7 °C. High temperatures were recorded in all three summer months, the average monthly temperature deviations from the norm were 4.2 °C in June, 1.3 °C in July and 2.0 °C in August. monthly temperature deviations from the norm were 4.2°C in June, 1.3 °C in July and 2.0°C in August. Autumn was also warmer than normal: high temperatures were recorded in September and November, when the positive temperature anomaly was 0.8 °C and 1.7 °C, respectively, and in October, a temperature below normal was observed -0.3 °C.[87]

The daily dynamics of BCSD deaths during 2021 is shown below.

[87] Bulletin on the situation of the RA environment, 2021, RA MoE Hydrometeorology and Monitoring Center SNCO, http://meteomonitoring.am/publications/cat/16?type=monthly

Figure 73. Dynamics of the BCSD daily deaths, 2021

BCSD daily death cases, 2021
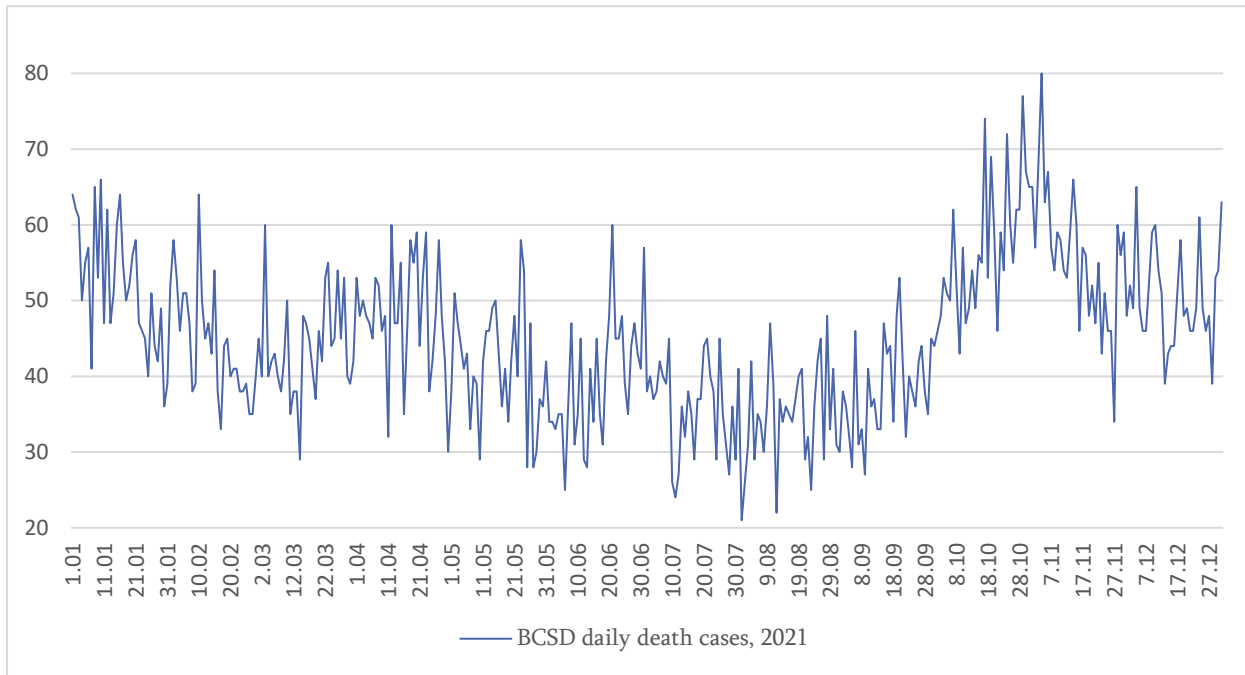
In the winter of 2021, a heat wave was observed on January 9-17 and February 1-17. The maximum temperature deviation from the norm was 13.2 ^{0}C, the average deviation from the norm was 8.3 ^{0}C. The maximum deviation of the average temperature from the norm was 13.7 ^{0}C. 2021 In winter, a cold wave was observed in the second decade of January. The number of cold wave days was significantly less than normal.

Figure 74. Dynamics of daily BCSD deaths, January-February 2021

BCSD daily death cases, January-February, 2021
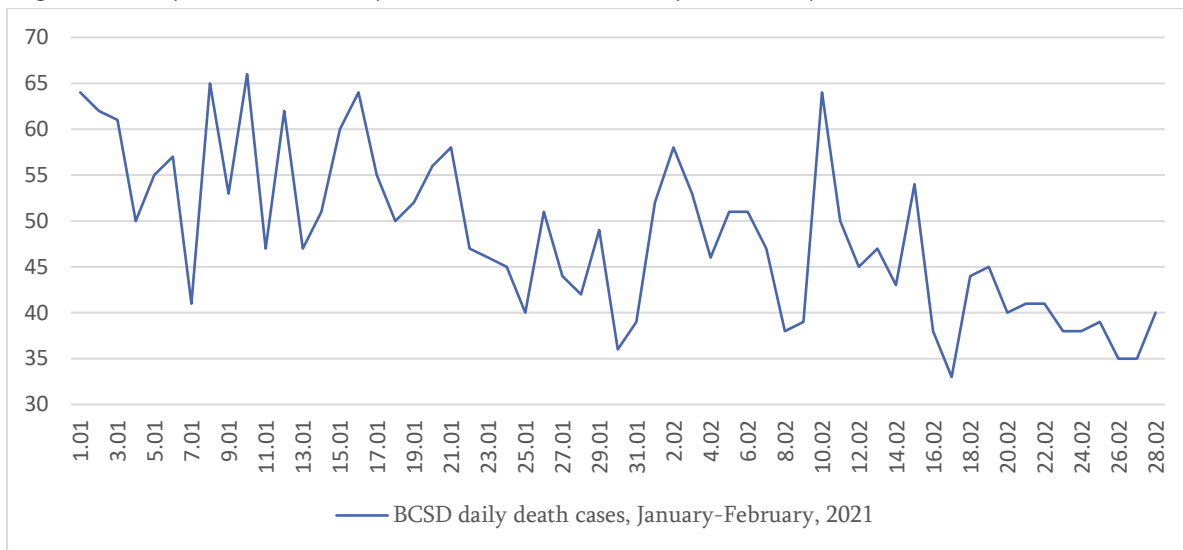
In the spring of 2021, a hot wave was observed on April 9-10, April 17-30, May 13-24 and May 28-31. The maximum deviation of the maximum temperature from the norm was 15.4 ^{0}C. The maximum deviation of the average temperature from the norm was 13.2 ^{0}C. The average deviation of the number of days with a heat wave compared to the norm was 20 days, and the largest deviation was in Hrazdan and was 32 days.

Figure 75. Dynamics of daily CVD deaths, March-May, 2021

Daily BCSD deaths in June-August, 2021
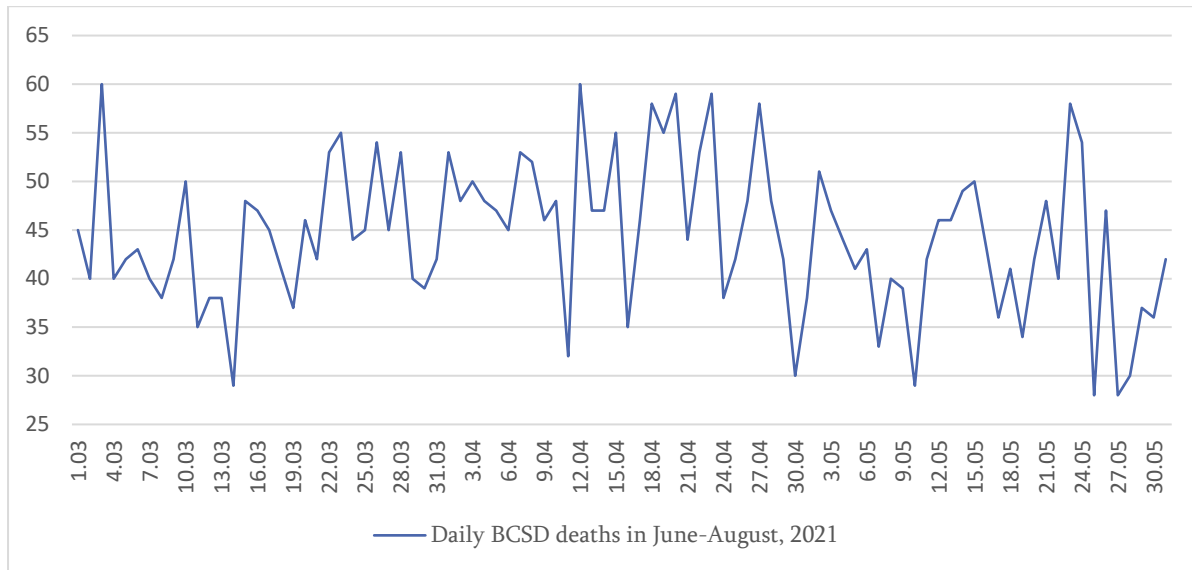
In the summer of 2021, a hot wave was observed on June 15-30, July 1-6, July 19-21, August 5-10, 27-31. The duration of the wave observed in June was quite long, 15 days. The maximum deviation of the maximum temperature from the norm was 14.9 ^{0}C, the maximum deviation of the average temperature from the norm was 19.1 ^{0}C. From the dynamics of daily BCSD deaths reflected in Figure 5.27, an increase in deaths is visible during heat wave days, especially June 15-30 and early July.

Figure 76. Dynamics of daily BCSD deaths, June-August, 2021

Daily BCSD deaths in June-August, 2021

Figure 77. Dynamics of daily IHD deaths, June-August, 2021

IHD daily death cases, June-August, 2021

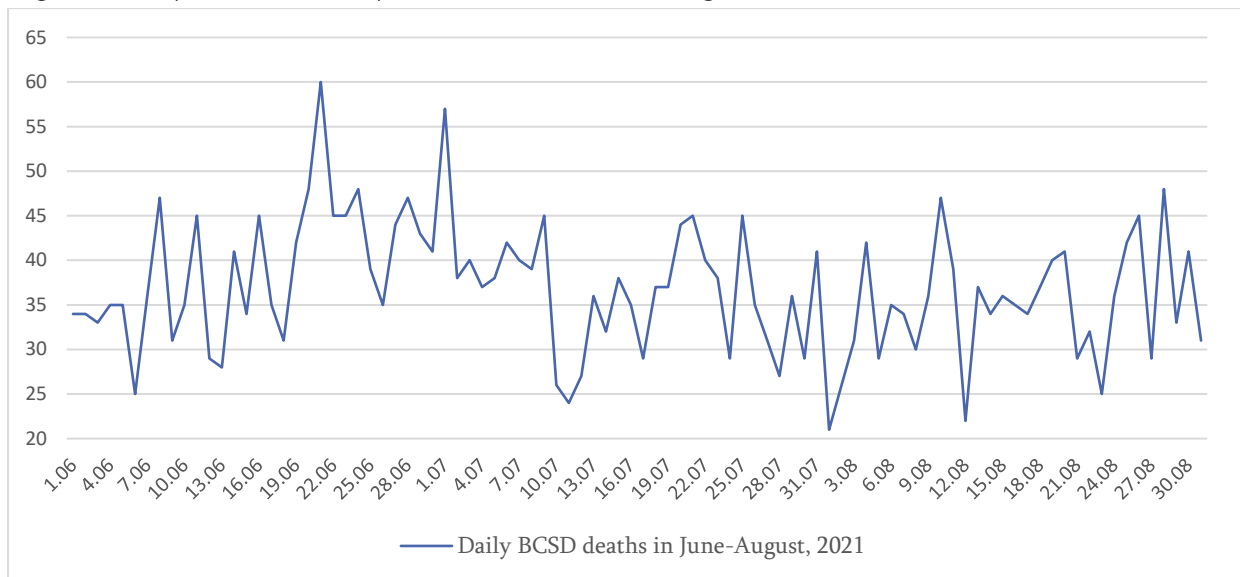**Figure 78. Dynamics of cases of CVD deaths, June-August, 2021**
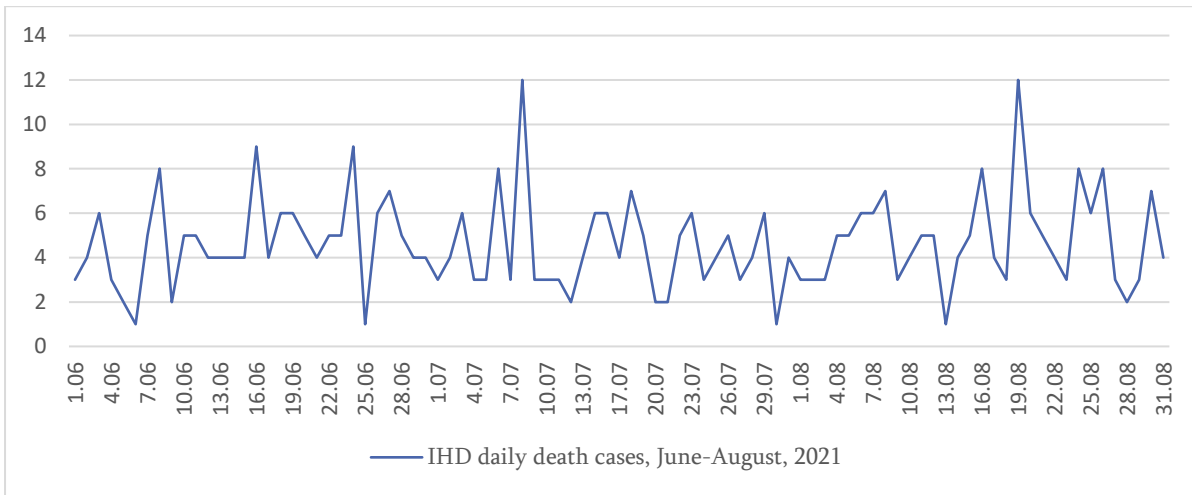

Daily cases of CVD deaths, June-August, 2021
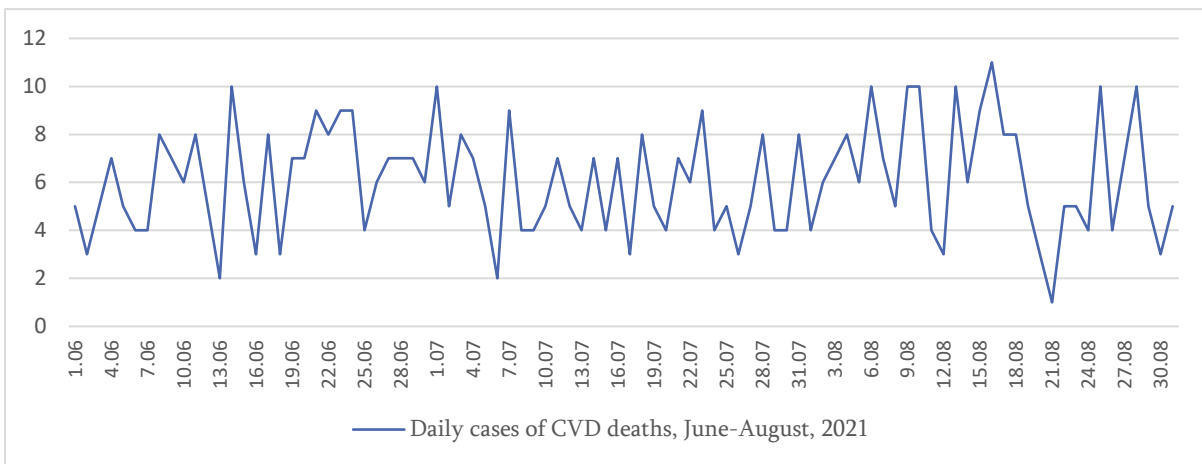
Figure 79. Dynamics of daily GH deaths in June-August 2021

Daily cases of HH deaths, June-August, 2021
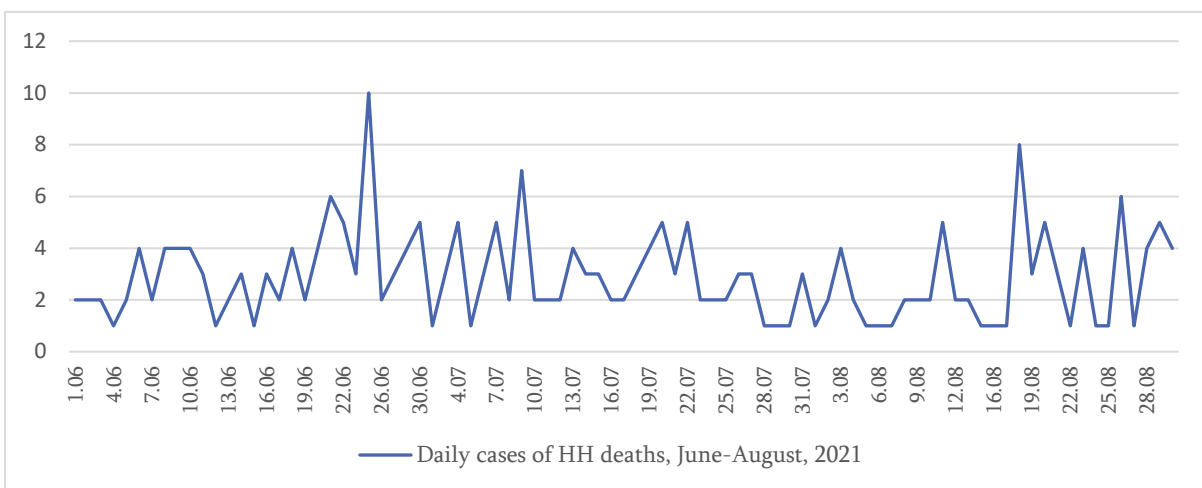
Figure 80. The dynamics of BCSD-related emergency calls in June-August 2021.

Number of daily emergency calls in June-August, 2021
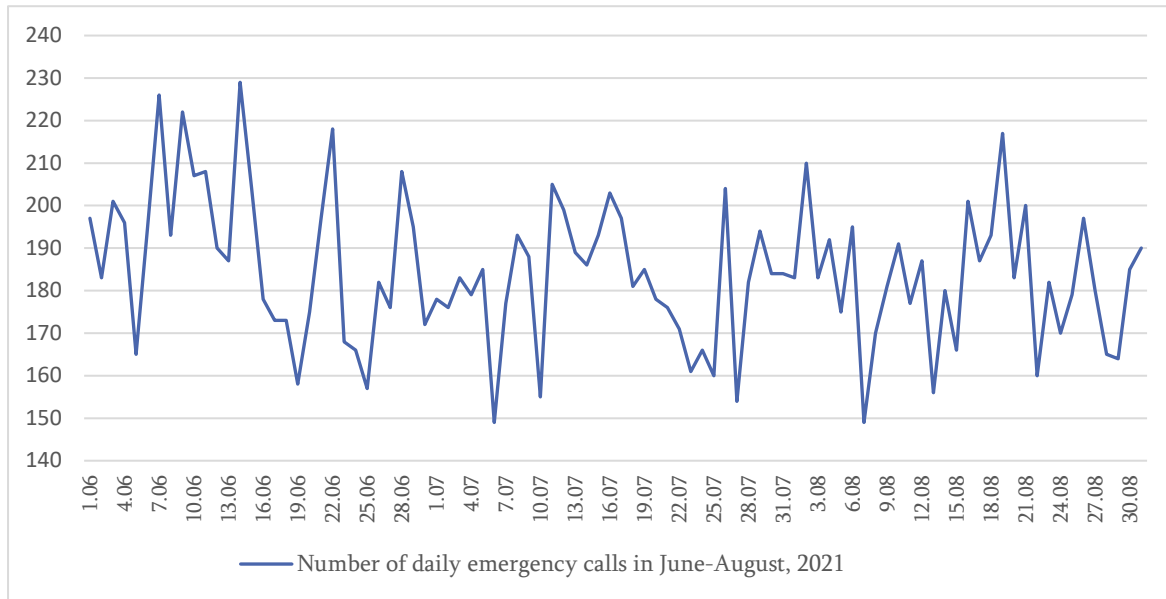
In the autumn of 2021 heat waves were observed in **November 1-5 and December 13-20**.

Figure 81. BCSD dynamics of daily deaths in September-December 2021

BCSD daily death cases in September-December, 2021
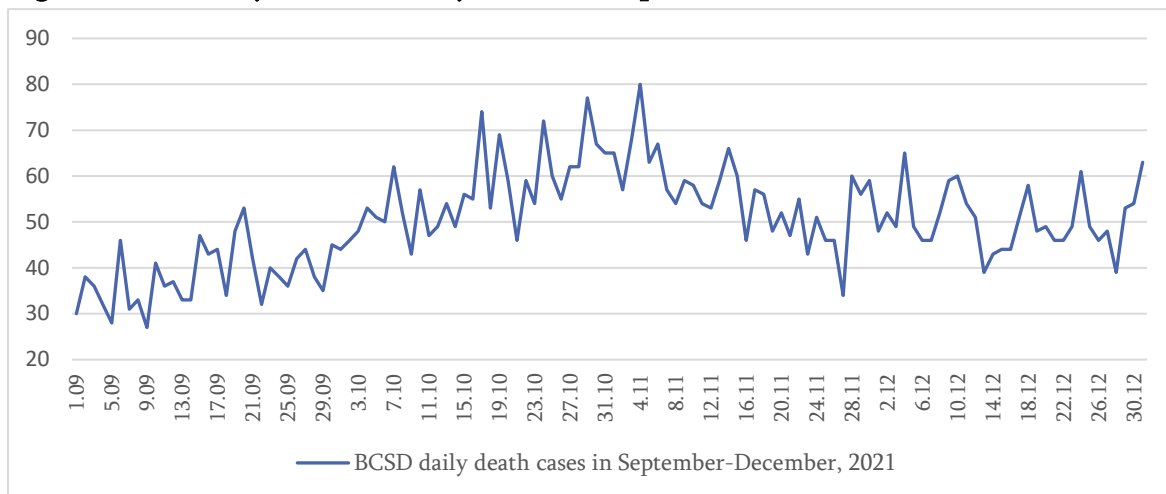
As expected, in all seasons of the year, there are coincidences in the daily dynamics of deaths with the dynamics of heat waves days or maximum temperature values of the month.

Effects of air quality changes on health

As mentioned above, the combination of abnormally high temperatures with two air pollutants: ozone and PN_{10} (solid particles up to 10 microns in diameter), is particularly dangerous, having a synergistic effect on the mortality rate (according to studies, a similar effect of combined exposure to high temperatures and other air pollutants was not observed).[88] According to the 4th National

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[88] Планы действий по защите здоровья населения от воздействия аномальной жары, Руководство, Европейское региональное бюро Всемирной организации здравоохранения, 2011, ст. 7.

Report on Climate Change, exposure to extremely small particles of 2.5 microns or less (PM 2.5) in dust causes cardiovascular, respiratory and oncological diseases.[89]

The main causes of pollution can be:

- o fuel burning (electricity generation, transport, industry and households),
- o industrial emissions, use of solvents, for example in the chemical and mining industries.
- o agriculture,
- o open burning of waste,
- o natural sources, including volcanic eruptions, the spread of mountain dust, emissions of volatile organic compounds from plants, etc.

As a result of human activities, various gases and particles of different sizes can be released into the atmosphere. Emissions can harm both human health and the environment, as well as the economy. There is a complex interrelationship between atmospheric emissions and air quality that includes the altitudes of emission sources, changes in chemical composition, solar radiation, weather and topographic effects. Sulfur dioxide, nitrogen oxides, carbon monoxide, dust, as well as ground-level ozone as a secondary pollutant are considered primary air pollutants.

According to the report of the National Hydrometeorology and Monitoring Center of the RA MoE, during 2020, atmospheric air quality observations were made in the cities of Yerevan, Gyumri, Vanadzor, Alaverdi, Hrazdan, Ararat, Tsaghkadzor, Kapan, Kajaran and Charentsavan. The contents of dust in atmospheric air, metals in dust (about 21 metals), Sulfur dioxide, nitrogen oxides, carbon monoxide and ground-level ozone were determined. In total, 33,216 air samples were taken in 2020, 36,012 observations were made. According to the results of the observations, in 2020 compared to 2019, the contents of dust in Vanadzor, Alaverdi and Hrazdan cities, nitrogen dioxides in Yerevan, Gyumri, Vanadzor, Kajaran and Charentsavan cities and Sulfur dioxide in Yerevan city increased.[90]

The individual, and more often simultaneous, effects of all these factors on air quality complicate the assessment of the impact of climate change. When identifying possible interdependence, it is necessary to take into account the high uncertainty of obtained data:

Climate change affects air quality three ways: by outdoor air pollution, by increased prevalence of aeroallergens, and by indoor air pollution. Factors affecting human health caused by changes in air quality include ground-level ozone (O^3), fine solid particles and carbon dioxide (CO^2). Some phenomena, caused by the climate change, have a dual impact. The increasing carbon dioxide levels leads to the growth of plants, which has a positive effect on the development of crop production in agriculture. On the other hand, it also leads to the growth of plants that release airborne allergens (aeroallergens) and thereby negatively affecting the human health. Deterioration of air quality is highlighted by the fact that the population in the most of Armenian

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[89] Fourth national communcation on climate change. Yerevan, UNDP Armenia, 2020, p. 151. (Arm.)

[90] Ամփոփագիր ՀՀ տարածքում 2020թ. մթնոլորտային օդի աղտոտվածության մասին, ՀՄԿ ՊՈԱԿ, Եր. 2021, http://www.armmonitoring.am/public/admin/ckfinder/userfiles/files/ampopag/Odi%20Obzor%202020.pdf

territory is totally not adapted to such changes, and secondly, both air pollutants and aeroallergens enter homes, schools and other buildings, increasing the risk of related diseases.[91]

Climate change affects air quality in two ways: a/ it directly affects the concentrations of toxic substances in the air, b/ it changes temperature, cloud cover, humidity, frequency of precipitation, wind strength and nature, each of which, in turn, can affect the air quality. The third indirect effect of climate change on the air quality is through fires, dust, and emissions from plants. In Armenia and, especially in individual areas of the country, the most serious sources of air pollution are various types of economic activities (for example, the mining industry, transport, etc.), which, however, are not included in the scope of this research.Air quality impacts in Armenia vary by impact force and region. The main impact forces are dust and nitrous oxide. For the years 2012-2018, information is available on the exceedance of air quality standards in urban areas and the proportions of the affected population by atmospheric air pollutants, regions and years. According to official statistics, the areas affected by the deterioration of air quality are mainly the city of Yerevan and the regions of Ararat, Lori, Kotayk and Shirak.

Table 14. Proportion of population exposed to exceeding air quality standards in urban areas, by atmospheric air pollutants and marzes, 2012-2018, percent

		2012	2013	2014	2015	2016	2017	2018
Dust	Yerevan	0.48	0.48	0.12	0.12	0	0.12	0.12
	Ararat	0.08	0.08	0.08	0	0	0.08	0
	Lori	0	0.42	0.06	0	0	0.42	0.42
	Kotayk	0.16	0.17	0	0	0	0.16	0.16
	Shirak	0.48	0.48	0.48	0.48	0.48	0.48	0
Sulfur dioxide	Yerevan	0	0	0	0	0	0	0
	Ararat	0	0	0	0	0	0	0
	Lori	0	0.06	0	0	0	0	0
	Kotayk	0	0	0	0	0	0	0
	Shirak	0	0	0	0	0	0	0
Nitrogen dioxide	Yerevan	0.35	0.12	0	0.12	0	0.12	0
	Ararat	0	0	0	0	0	0	0
	Lori	0.37	0	0	0	0	0	0
	Kotayk	0	0	0	0	0	0	0
	Shirak	0	0	0	0	0	0	0
Ground-level ozone	Yerevan	0	0	0	0	0	0	0
	Ararat	0	0	0	0	0	0	0
	Lori	0	0	0	0	0	0	0
	Kotayk	0	0	0	0	0	0	0
	Shirak	0	0	0	0	0	0	0

Source: MoE Center for hydrophysics and monitoring of SNCO

In the context of the UN Sustainable development goals, the Objective 3.9.1 "Mortality rates attributable to indoor and outdoor air pollution" was calculated by RA Statistical Committee of the Republic of Armenia by regions and years.

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[91] Fourth National Communication on Climate Change. Yerevan, UNDP Armenia, 2020, p. 147.

Figure 82. Mortality rate attributable to indoor and outdoor air pollution by region and year, death rate per 100,000 population
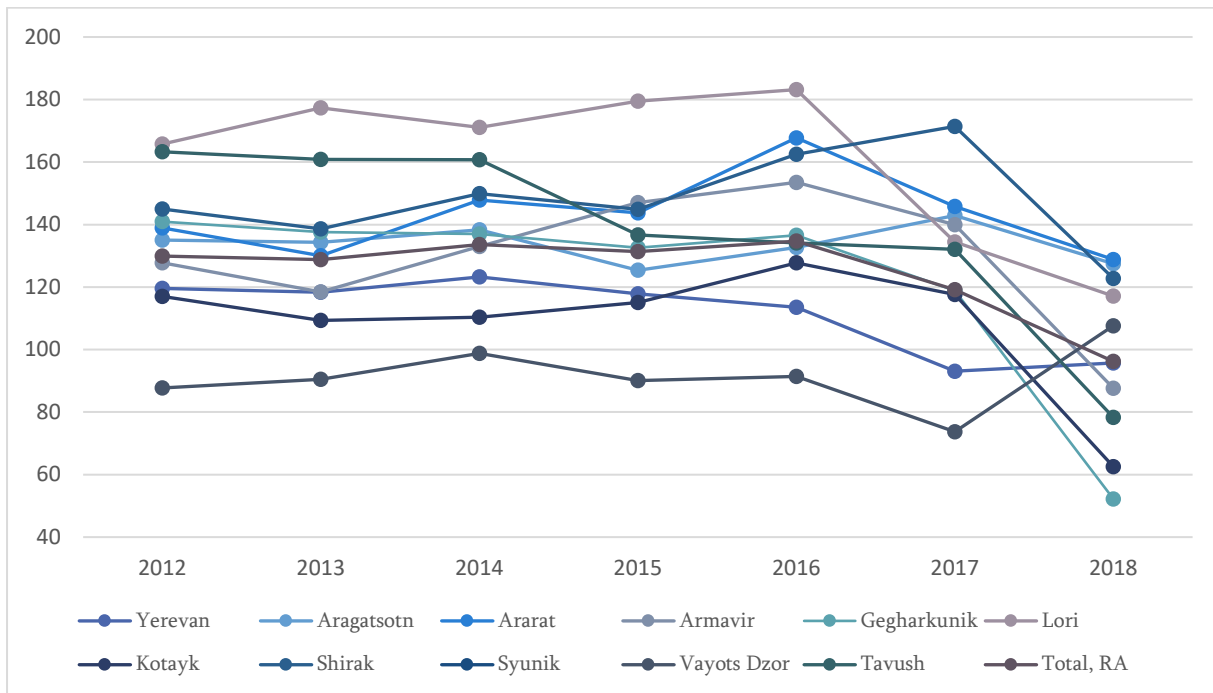
A clear assessment of the health damage caused by the deterioration of air quality due to the impact of climate change is difficult because of the complex effects of all factors. Some insight can be provided by the statistics under indicator 3.9.1 of the Sustainable Development Goals, which refer to the dynamics of the death rate from individual diseases attributable to indoor and outdoor air pollution.

Figure 83. Mortality attributable to indoor and outdoor air pollution by causes of diseases, 2015-2020, per 100,000 population
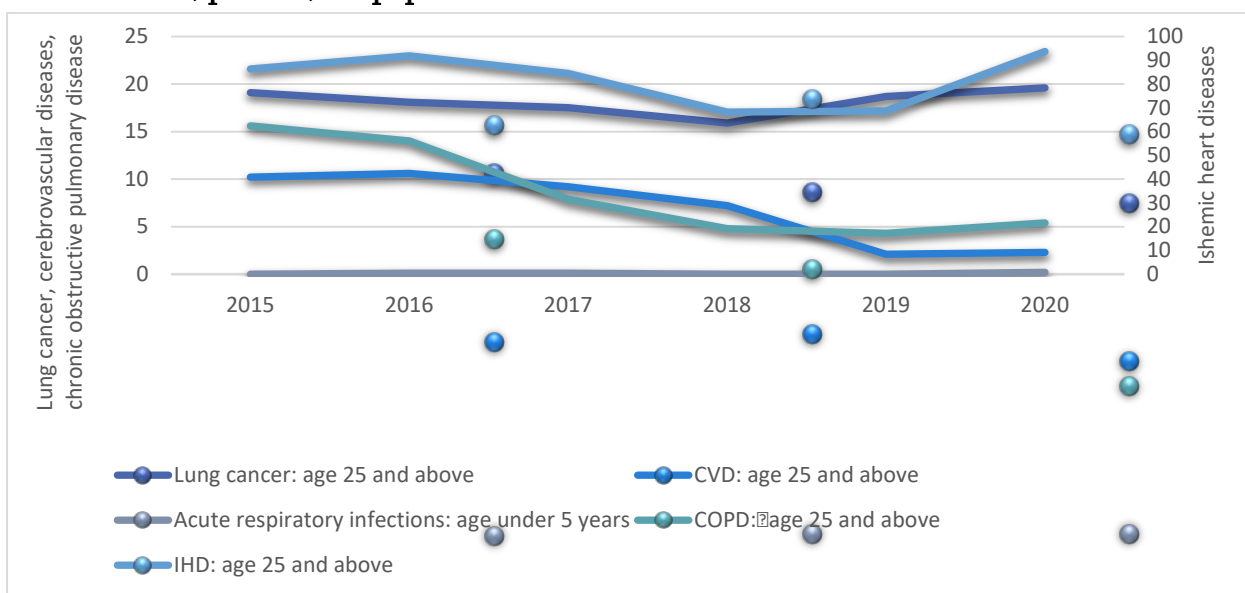
In the list of air pollution-related deaths, there can be seen an increase since 2018, especially related to two diseases: ischemic heart diseases and lung cancer of adults. The rates of these diseases in 2020 exceeded even the level of 2015.

CHAPTER 5

CONSUMPTION OF MEDICAL SERVICES

Visits to organizations providing outpatient medical aid and service

Out-of-hospital medical services have a key role from the point of view of providing primary care services, as one of its goals is to provide necessary free medical aid. The analysis of eligibility data clearly proves that thanks to the reforms implemented in 2004, the number of outpatient visits per person in Armenia increased in 2010-2019, and decreased in 2020 compared to 2019 (Figure 50) due to the restriction of movement in the conditions of the Kovid-19 pandemic and the 44-day war. In addition, the majority of the population bypasses primary health care facilities and, in case of health problems, turns to a narrow specialized hospital medical facility. In 2021-2022, the number of outpatient visits per person increased compared to 2020.

Figure 84. Visits to organizations, providing outpatient medical aid and services, per person, 1990, 1995, and 2000-2022
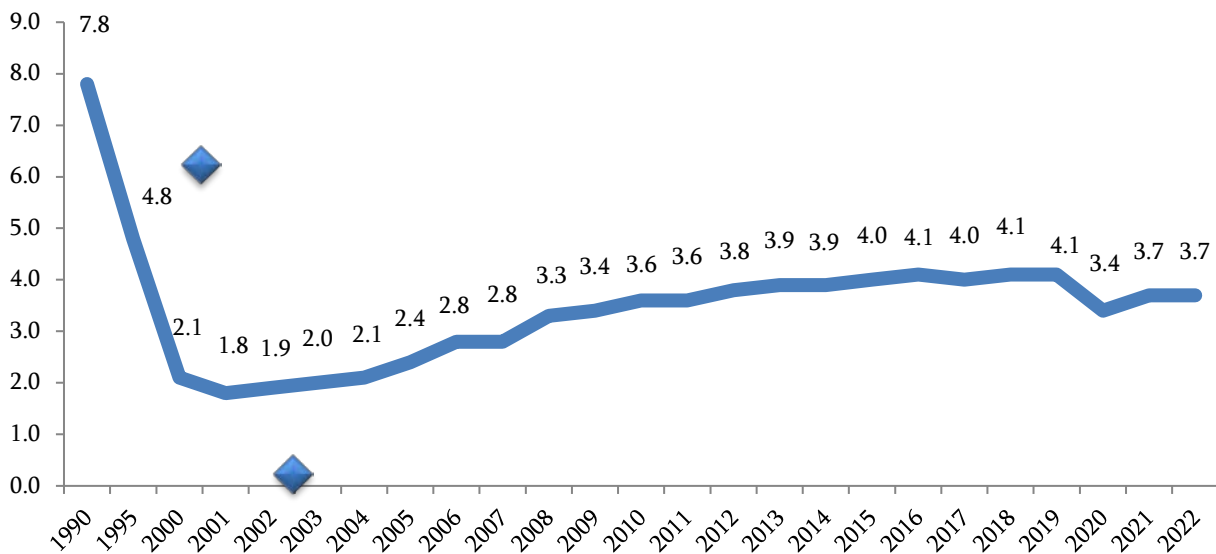
Source: NCHSR, 2022

Figure 85. Visits to organizations, providing outpatient medical aid and service, per person, by sample countries and groups of countries
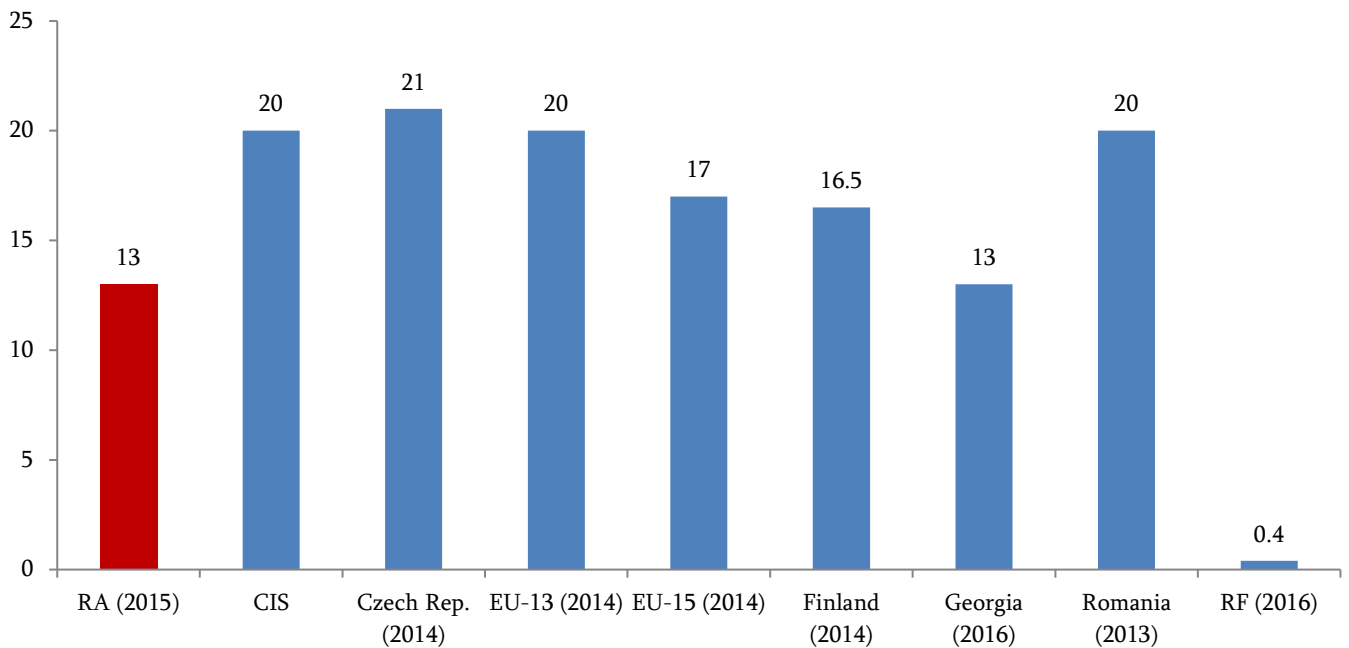
When comparing with international data, the index of outpatient visits in Armenia is almost equal to Georgia, but is less than in the Czech Republic, CIS, EU-15 and EU-13 countries (Figure 51):

In 2020, compared to 2019, a decrease in the number of outpatient visits was recorded in all marzes, which is also due to the Covid-19 pandemic and the war situation prevailing in the country (Figure 52):

In 2021-2022, an increase in the number of outpatient visits was recorded.

Figure 86. Visits to organizations, providing outpatient medical aid and service per person, per year, by regions, 2010-2022

	Yerevan	Aragatsotn	Ararat	Armavir	Gegharkunik	Lori	Kotayk	Shirak	Syunik	Vayots Dzor	Tavush
2010	4.2	2.4	3.0	3.0	2.9	3.2	2.9	3.0	5.0	3.3	2.8
2012	4.5	2.6	3.3	3.3	3.2	3.8	3.3	3.2	5.0	3.6	2.9
2013	4.6	2.5	3.3	3.4	3.1	3.7	3.4	3.2	5.3	3.5	2.9
2014	4.7	2.5	3.4	3.3	3.2	3.8	3.3	3.4	4.5	3.5	2.9
2015	4.8	2.8	3.5	3.6	3.4	3.9	3.5	3.5	4.2	3.7	3.1
2016	5.0	2.9	3.6	3.5	3.4	3.9	3.6	3.6	3.9	3.8	3.1
2017	4.8	2.9	3.5	3.4	3.1	4.3	3.4	3.9	3.7	3.7	3.2
2018	5.0	2.9	3.5	3.4	3.1	4.3	3.4	3.9	3.8	3.7	3.2
2019	4.9	2.8	3.6	3.5	3.3	4.3	3.7	4.1	3.8	3.7	3.1
2020	3.7	2.6	3.2	3.3	2.9	3.8	3.3	3.3	3.6	3.7	2.9
2021	4.4	2.6	3.0	3.2	2.9	4.2	3.5	3.4	3.6	4.3	2.8
2022	4.4	2.5	3.0	3.2	2.8	4.1	3.5	3.4	3.5	3.9	2.8

Source: NCHSR, 2022

Hospitalization

The hospitalization increased in 2000-2020 (Figure 53), but decreased compared to 2019, as far as hospital services were aimed at treating Covid-19 patients and war victims. Hospitalization increased in 2021-2022.

Figure 87. Level of annual hospitalization per 100 people in 1990, 1995 and 2000-2022
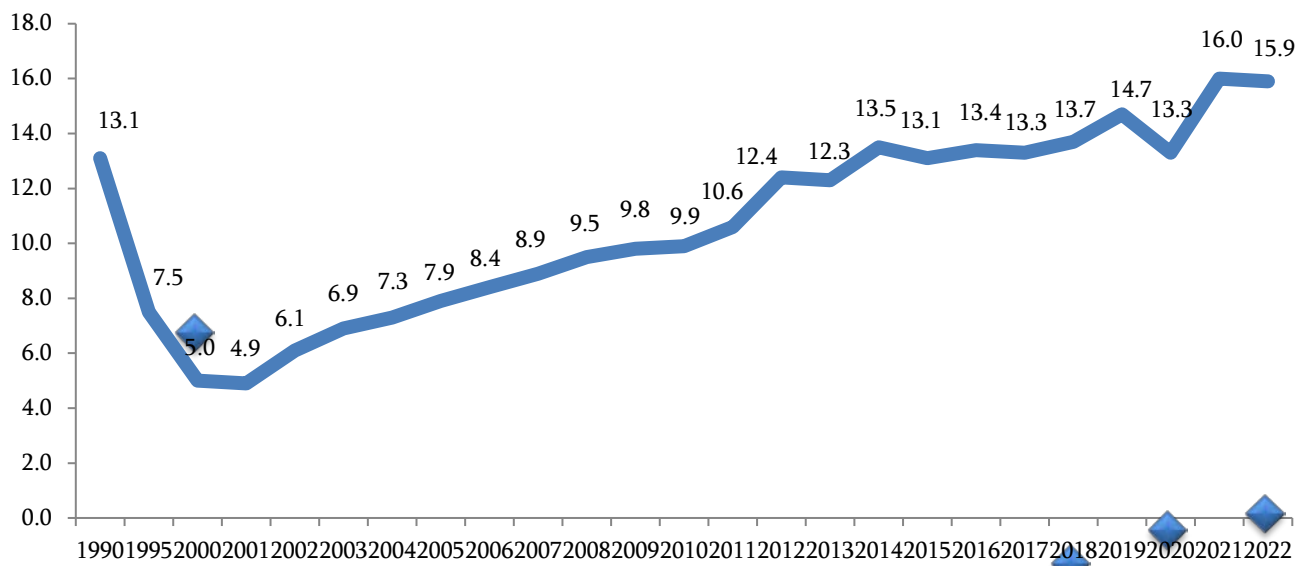
Source: NCHSR, 2022

Figure 88. Hospital discharges per 100 people by sample countries and groups of countries
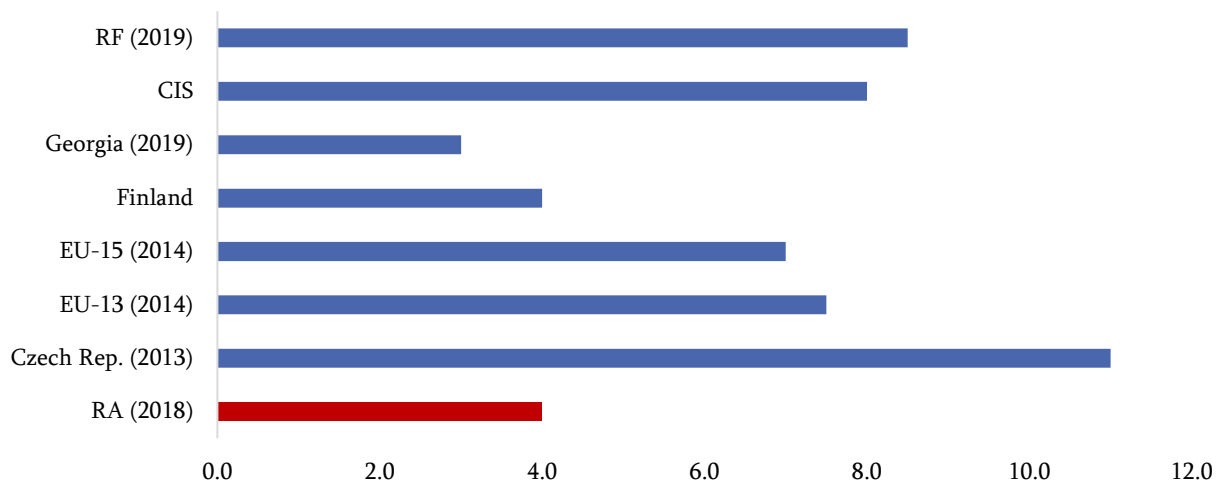
Sources HFA-DB, WHO, 2016

Figure 89. Mental and behavioral disorders hospital discharges, per 100,000 population, by sample countries and groups of countries
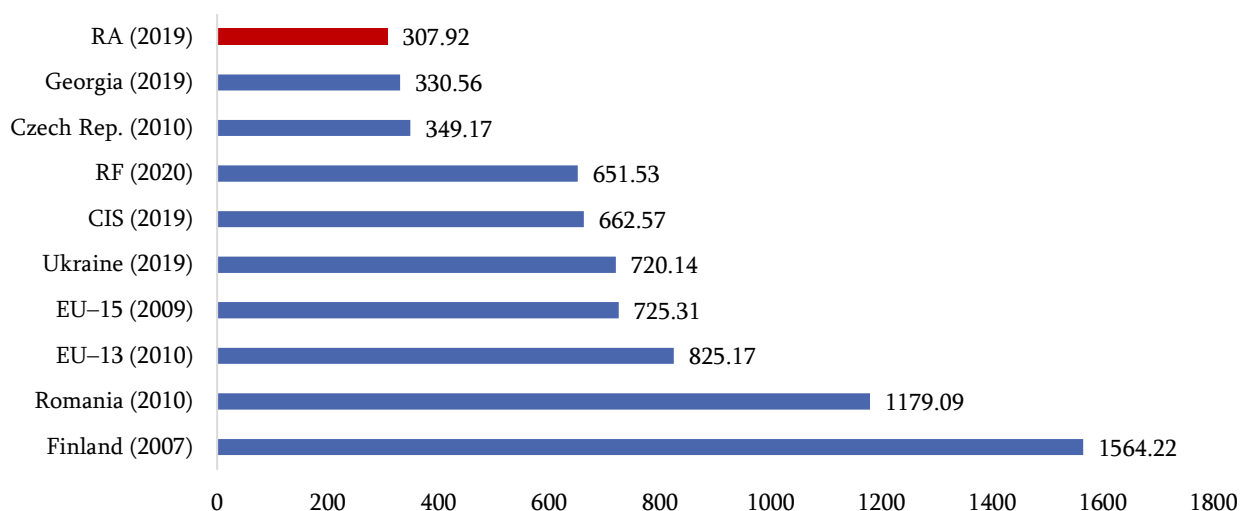
In 2016, according to international data, the highest of discharges of mental disorders was registered in Finland (1564.22), Romania (1179.09), in EU-13 (825.17), meanwhile in RA the highest was (307.92) (Figure 55).

Figure 90. Infectious disease hospital discharges by sample countries and groups of countries, per 100,000 population
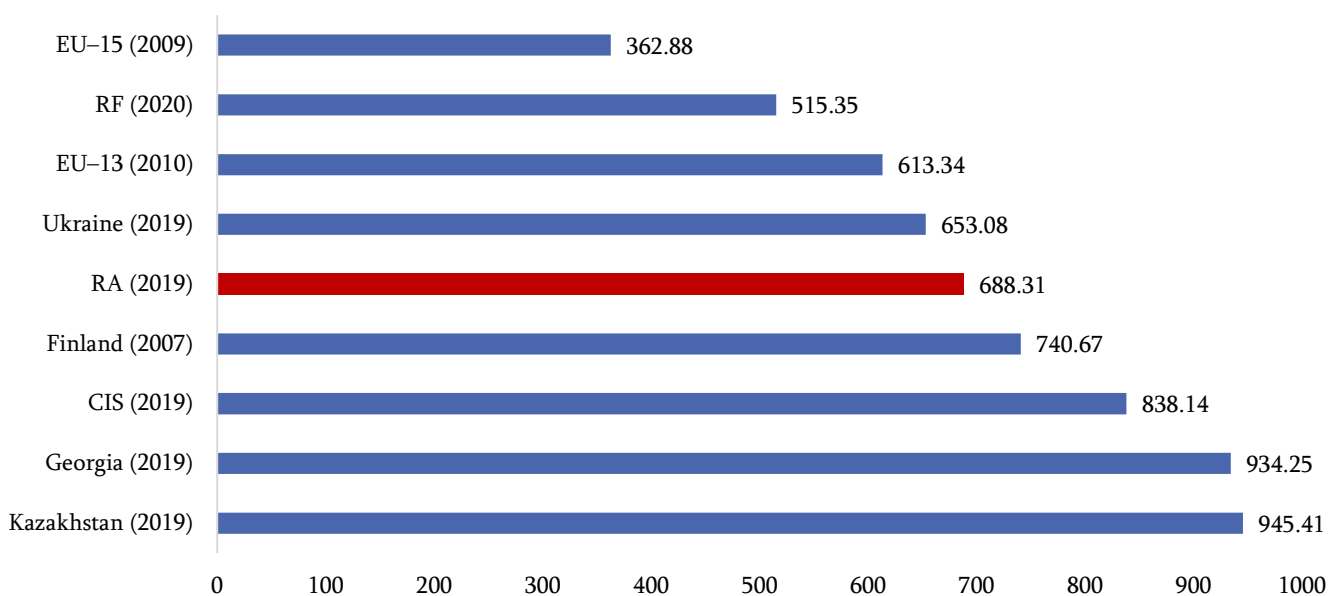
When comparing hospital discharge s for infectious diseases in sample countries and a pool of countries (Figure 56), we can see that the in RA (688.31) is higher than in Ukraine (653.08), but it is less than in Finland (740.67) and CIS states (838.14). In the Russian Federation, the of hospital discharges for infectious diseases is significantly lower than in other countries (515.35).

Hospitalization by marzes

Hospitalization in 2010-202 by marzes is given in Figure 55 (by 100 population)

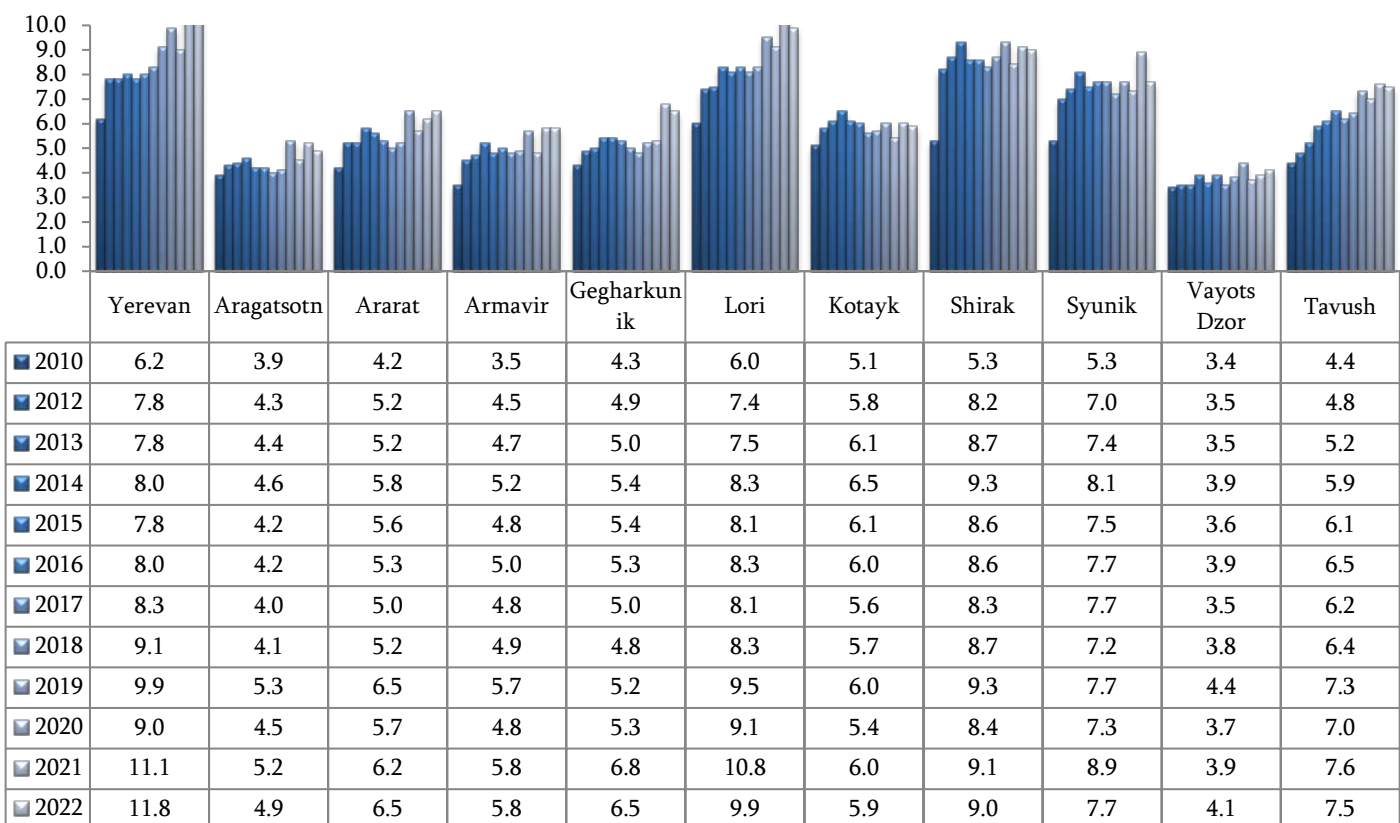According to the provided data, during 2010-2020, there was a trend of increasing hospitalization in all marzes, but in 2020, compared with the previous year, a decreasing trend was observed. The level of hospitalization in Ararat and Kotayk marzes has sharply decreased.

This phenomenon is probably due to the emigration of the regional population, the lack of relevant specialists in the regional medical institutions, as well as the covid-19 pandemic.

In 2021-2022, increase in hospitalization was observed.

Figure 91. Hospitalization rates by marzes, by 100 population, 2010-2022

	Yerevan	Aragatsotn	Ararat	Armavir	Gegharkunik	Lori	Kotayk	Shirak	Syunik	Vayots Dzor	Tavush
2010	6.2	3.9	4.2	3.5	4.3	6.0	5.1	5.3	5.3	3.4	4.4
2012	7.8	4.3	5.2	4.5	4.9	7.4	5.8	8.2	7.0	3.5	4.8
2013	7.8	4.4	5.2	4.7	5.0	7.5	6.1	8.7	7.4	3.5	5.2
2014	8.0	4.6	5.8	5.2	5.4	8.3	6.5	9.3	8.1	3.9	5.9
2015	7.8	4.2	5.6	4.8	5.4	8.1	6.1	8.6	7.5	3.6	6.1
2016	8.0	4.2	5.3	5.0	5.3	8.3	6.0	8.6	7.7	3.9	6.5
2017	8.3	4.0	5.0	4.8	5.0	8.1	5.6	8.3	7.7	3.5	6.2
2018	9.1	4.1	5.2	4.9	4.8	8.3	5.7	8.7	7.2	3.8	6.4
2019	9.9	5.3	6.5	5.7	5.2	9.5	6.0	9.3	7.7	4.4	7.3
2020	9.0	4.5	5.7	4.8	5.3	9.1	5.4	8.4	7.3	3.7	7.0
2021	11.1	5.2	6.2	5.8	6.8	10.8	6.0	9.1	8.9	3.9	7.6
2022	11.8	4.9	6.5	5.8	6.5	9.9	5.9	9.0	7.7	4.1	7.5

Source: NCHSR, 2022

Note that during 2006-2020, the visits to both public and private hospitals increased. But it showed a downward trend in 2020 due to the Covid-9 pandemic, as hospitals provided emergency medical aid to Covid-19 patients (Figure 58).

In 2021-2022, there was an increase in visits to both public and private hospitals.

Figure 92. Public and private hospitalizations (absolute number), 2006-2022
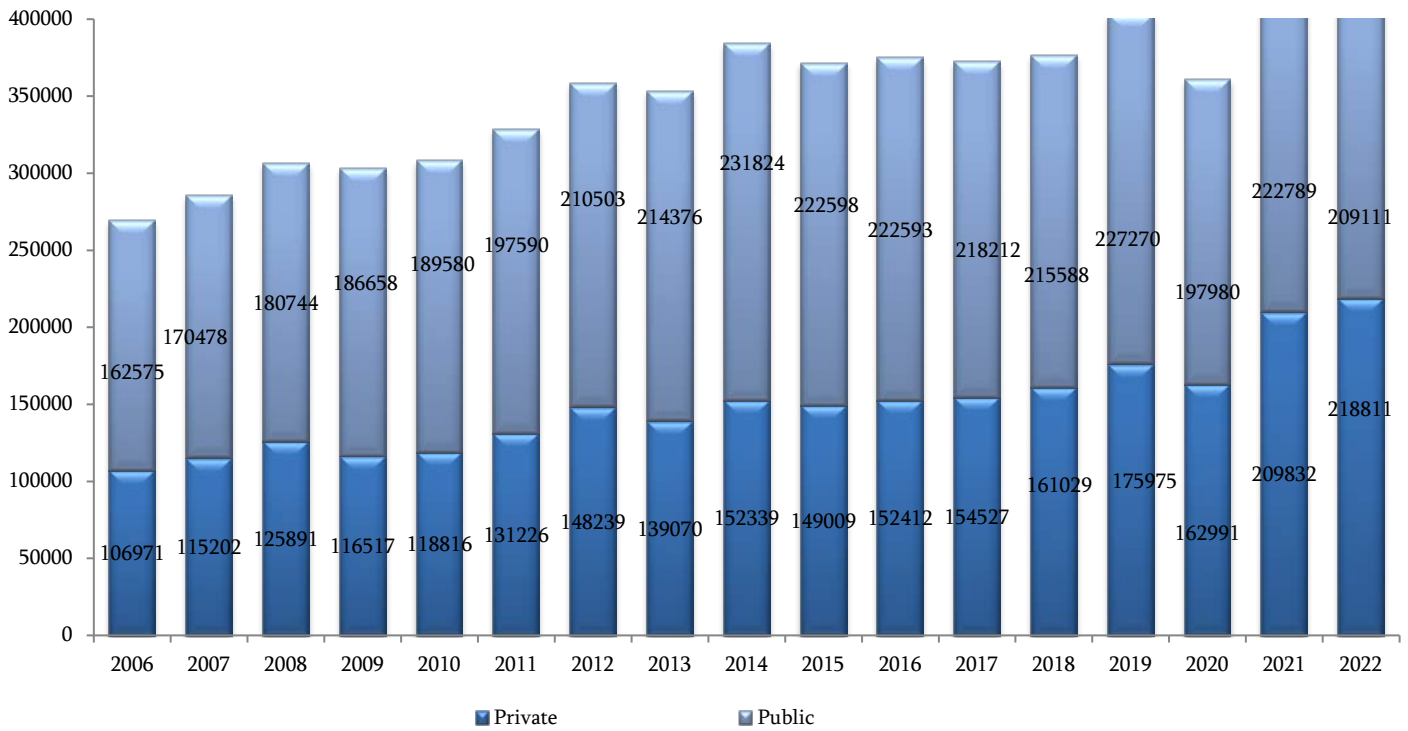
Source: NCHSR, 2022

CHAPTER 6

HEALTH SYSTEM STAFFING 2022

Preparation of personnel for the healthcare system

In the Republic of Armenia, the training of specialists with higher medical education is carried out at Yerevan Heratsi State Medical University and 4 non-state higher medical educational institutions:

Training of specialists with secondary professional medical education is carried out in 17 secondary professional medical institutions, 11 of which are state and 6 are non-state institutions.

Table 15. Number of graduates of higher medical state and non-state educational institutions by specialties, 2017-2022

Specialty	2017		2018		2019		2020		2021*		2022	
	YSMU	Private	YSMU	Private	YSMU	Private	YSMU	Private	State higher medical and non-medical	Private higher medical and non-medical	State higher medical and non-medical	Private higher medical and non-medical
Medicine	433	152	485	135	515	130	422	117	553	413	458	168
Medical work in the armed forces	-	-	-	-	-	-	-	-	-	-	-	-
Dentistry	155	232	138	132	148	227	194	310	174	242	179	175
Pharma-cology	61	31	84	34	152	124	121	39	286	54	200	7
Public health	6	-	-	-	95	99	-	-	30	11	26	25
Total	655	415	707	301	910	580	737	466	1043	720	863	375

Analyzes by experts in the fields of health and education showed that in the mid-1990s the health system had quite a saturated personnel potential, the number of doctors per 10,000 population was 41.3 (14,519), and the medium medical personnel was 99.4 (34,953).

Until 2002, the process of training doctors was carried out at YSMU, which was the only accredited higher education institution in RA providing medical education.

Since 2004, the process of training medical personnel was also supplemented by non-state higher and secondary medical professional institutions.

The data from 2021 also include the number of graduates of higher institutions implementing first and second degree educational programs. In 2022, the number of graduates of state and non-state

higher medical and non-medical institutions was 1238. About 70% of them graduated from YSMU, 21% of them in dentistry, and 53% in "medical work" specialties.

46.7% of graduates of non-state higher medical institutions are dentists by profession, and 45% are specialists in general medicine.

Figure 93. Number of graduate dentists per 10,000 population by sample countries and groups of countries, 2019
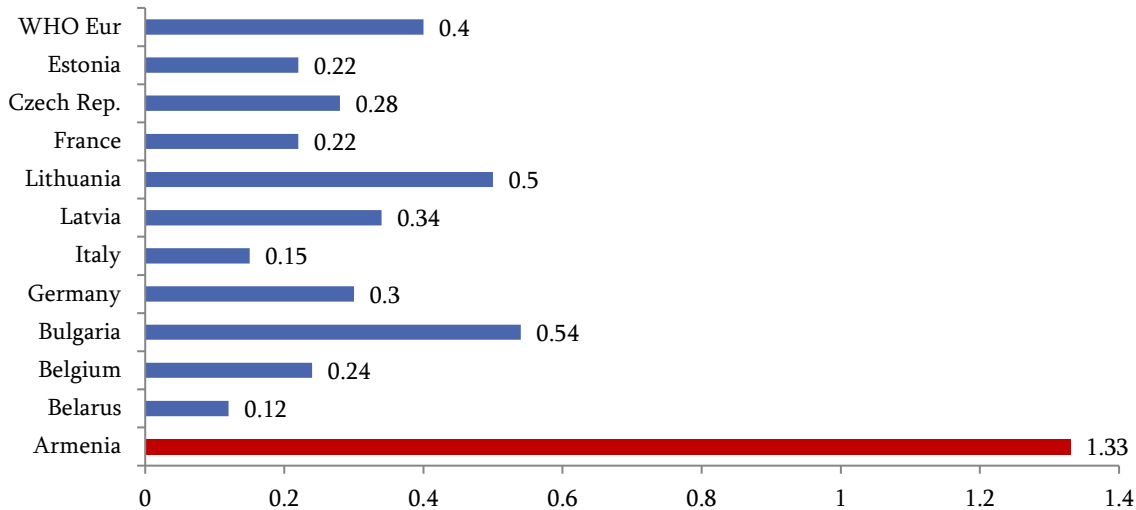

Figure 59 shows the distribution of dental graduates by countries. The presented data prove that RA has no competitor in the process of preparing dental graduates, it is 4-5 times higher than the presented countries.

Figure 94. Number of general practitioners per 10,000 population according to latest available data, sample countries and groups of countries, 2019
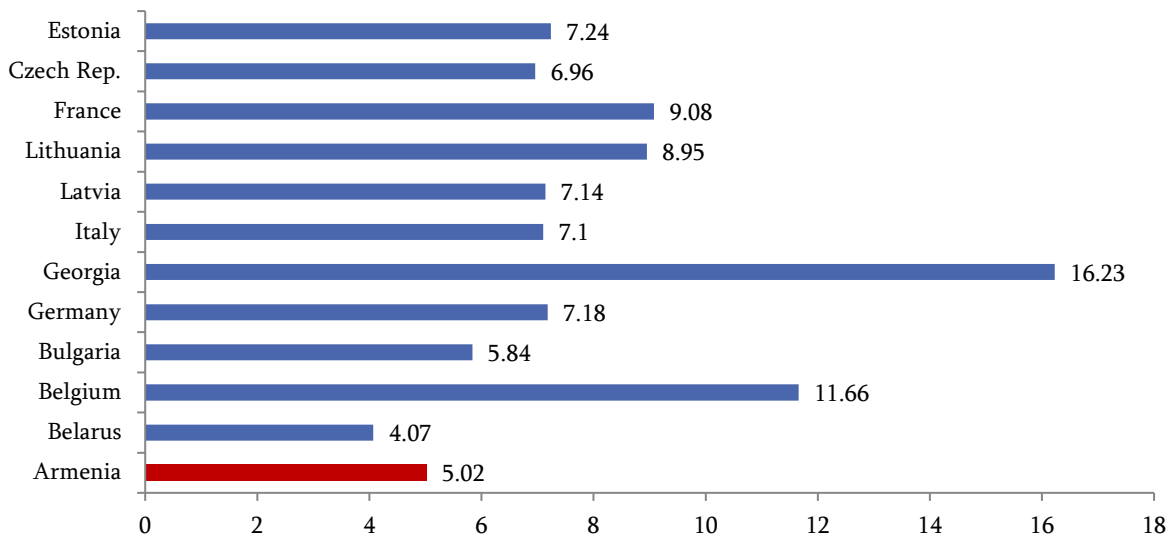
Comparing the Armenian and international data, it is obvious that in 2019, compared to the data of the countries of the neighboring and European region, Armenia recorded a below-average in training general practitioners (Figure 60).

Figure 95. Number of surgical professionals per 10,000 population by sample countries and country combinations, 2019
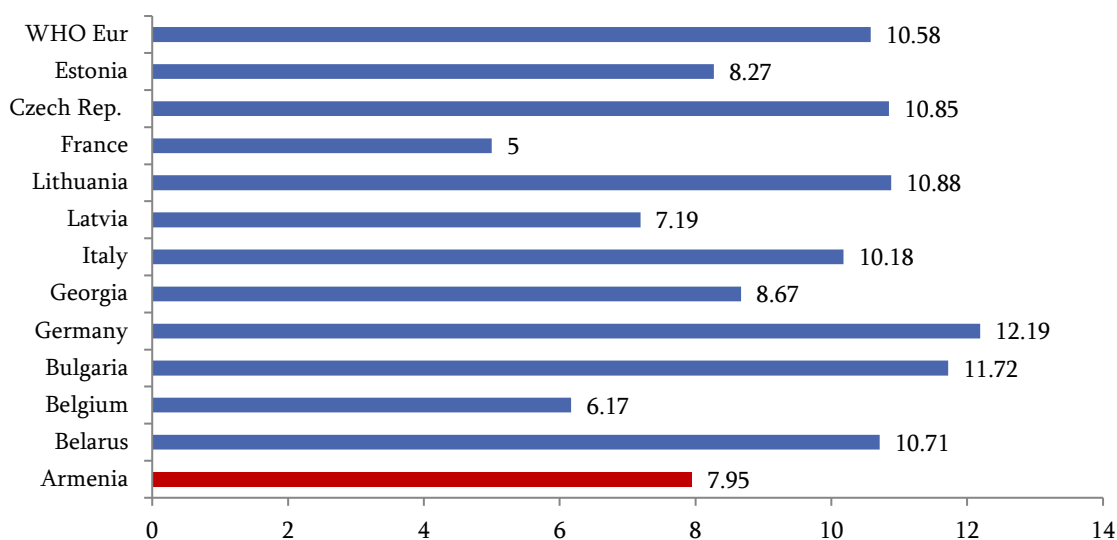

Figure 96. Number of medical graduates per 10,000 population by sample countries and groups of countries, 2019
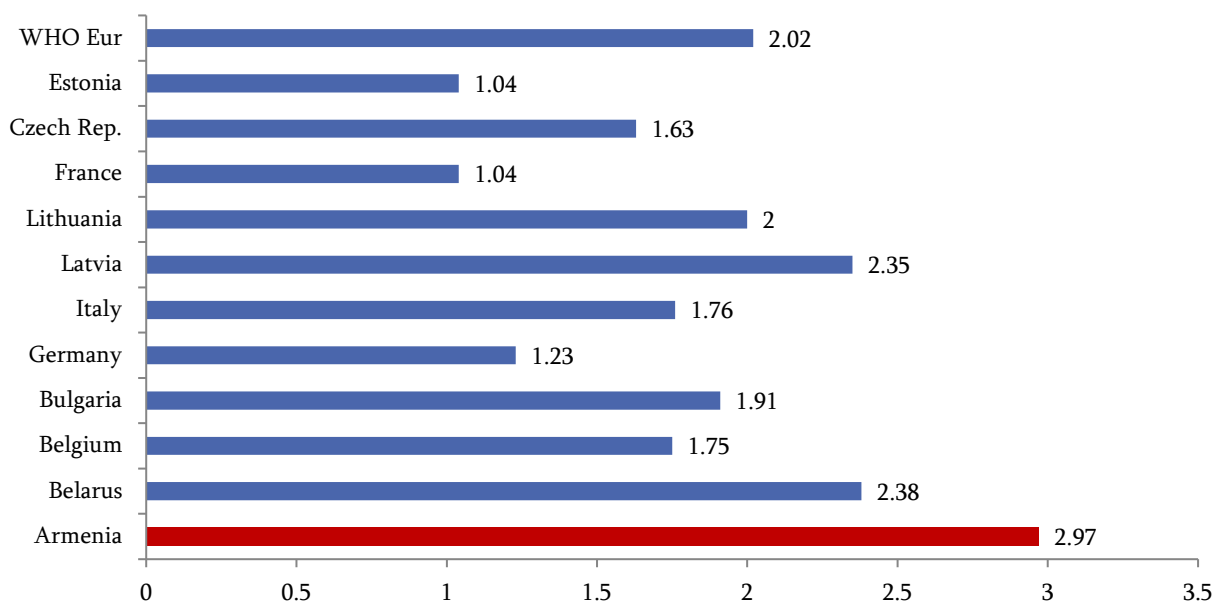
Figure 97. Number of graduate nurses per 10,000 population by sample countries and groups of countries, 2019
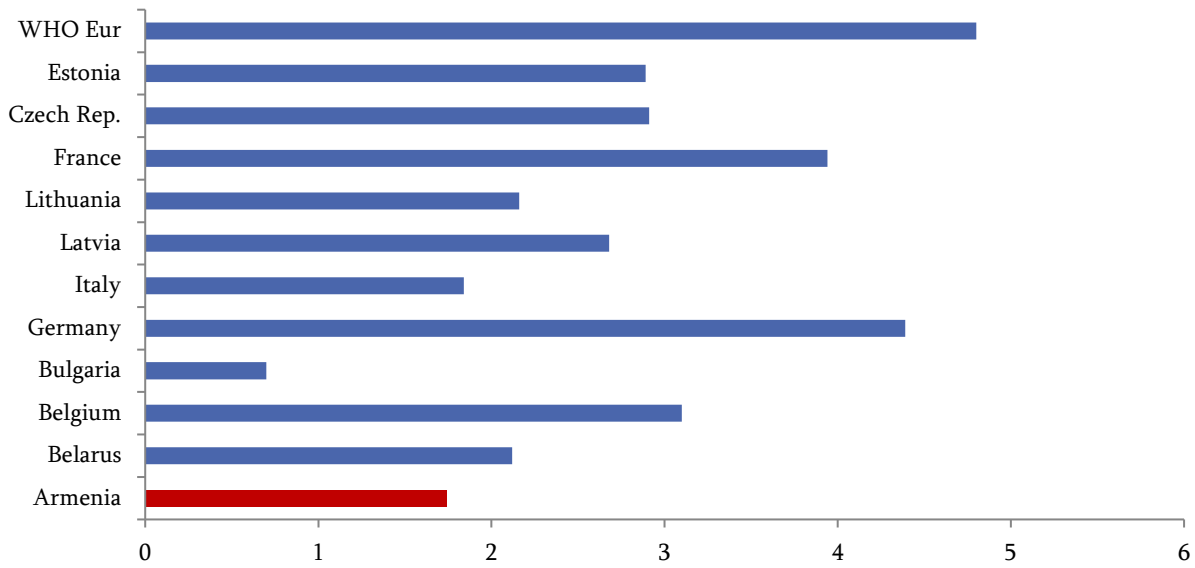

Figure 98. Number of therapeutic profile specialists per 10,000 population by sample countries and groups of countries, 2019
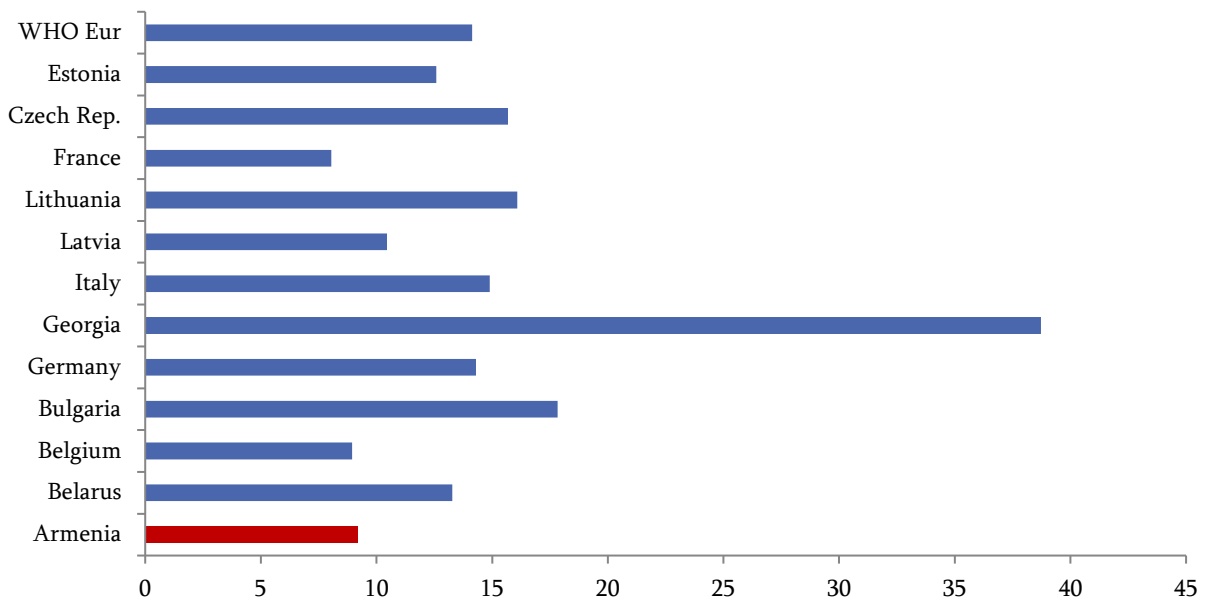
Table 16. The number of graduates of secondary professional medical state and private educational institutions by specialties, 2017-2022

|	2017		2018		2019		2020		2021		2022	
	State	Private	State	Private	State	Private	State	Private	State	Private	State	Private
Nursing	572	50	485	86	429	62	504	27	378	75	384	143
Obstetrics	215	21	187	23	118	27	128	20	92	16	98	14
Pharma-ceutical	420	40	289	114	358	102	356	120	414	111	371	88
Dental technical	251	72	131	86	214	102	262	103	256	131	193	130
Medical cosmetology	131	47	89	50	104	28	115	35	127	22	98	21
Organization of nursing	127	8	96	-	38	-	93	11	38	29	20	-
Therapeutic massage	8	-	11	-	6	-	14	-	1	-	2	-
General patient care	20	-	1	-	6	-	-	-	-	-	-	-
Medical diagnosis	-	-	-	-	-	-	25	-	23	-	8	-
Total	1744	238	1289	359	1273	321	1497	316	1329	384	1174	396

Distribution of personnel potential of the healthcare system

According to the data of 2022, the absolute number of personnel potential (doctors, nurses) operating in RA state and non-state medical, scientific and research, higher and secondary medical professional educational institutions was 31,384 medical workers, of which the absolute number of doctors in all specialties was 15,061 (50.59/ per 10,000 population), and number of nursing personnel is 16,323 (54.8/ per 10,000 population).

In 2022, compared to 2012, during the last 10 years, the number of doctors increased by 2139, but the number of medium medical staff decreased by 2461:

Table 17. Personnel and resources of the healthcare system (including private dental offices), 2012-2022

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Doctors with all specialties (including dentists)	12922	12664	12896	13117	13148	12964	13366	13958	14396	14548	15061
Nursing personnel	18784	18426	18053	17632	17464	16796	16595	16772	16744	16612	16323
Total	31706	31090	30949	30749	30612	29760	29961	30730	31140	31160	31384

Figure 99. Number of RA doctors, nursing personnel, nurse/doctor ratio, 2012-2022

■ Doctors of all specialties (including dentists)   ■ Nursing personnel
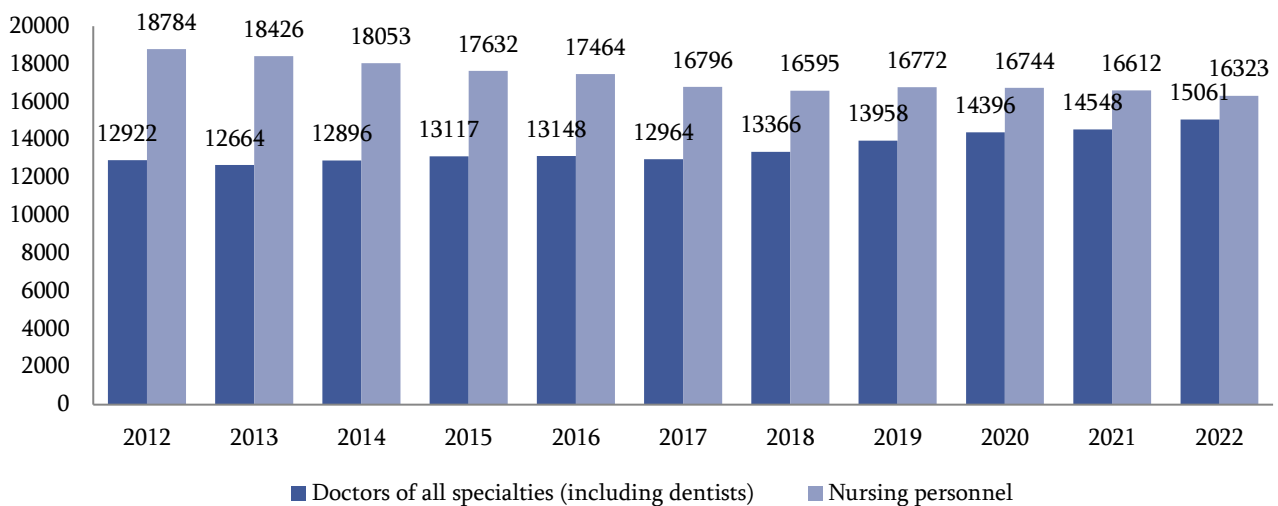
In 2012-2015, the doctor/nurse ratio stabilized at the same level: 0.74. And in 2016-2022, an increase was recorded, reaching 0.9.

The ratio of the number of doctors to nursing staff recommended by the World Health Organization is 1:4, which is achieved by increasing the role of nursing staff in the process of providing medical aid, depending on their qualifications. Increasing the ratio of doctors to nursing staff will certainly lead to an increase in the quality of medical services provided to the population.

Distribution of doctors and nursing personnel by marzes

In 2022, the number of doctors in all specialties (including dentists) in RA state and non-state medical, scientific and research, higher and secondary medical professional educational institutions was 15,061 (50.59/10,000 population), and the average number of medical staff was 16,323 (54.8/10,000 population).

The number of doctors in all specialties in organizations providing outpatient medical aid was 5,546 (18.63/per 10,000 population), the average number of medical staff was 7,141 (23.99/10,000 population), and the number of doctors in organizations providing hospital medical aid was 5,372. (per 18.04/10,000 population), the average number of medical personnel: 8,517 (28.61per 10,000 population).

Figure 66 shows the availability of doctors and nursing personnel in out-hospital and in-hospital medical aid organizations by marzes.

The presented data point out that availability of personnel providing medical aid to the population of Yerevan continues to be much higher compared with the region. The availability rate of doctors in Yerevan was 65.79 per 10,000 population, which is about 3-4 times higher than the relevant rates in marzes, and the availability rate of nursing personnel in Yerevan was 74.38, which is 1.5-2 times higher than such rates in marzes.

The lowest availability rates of medical personnel (doctors and nurses) were registered in Armavir and Gegharkunik marzes, and the highest rates were in Lori and Shirak marzes.

Figure 100. Distribution of doctors and nursing staff in organizations, providing outpatient and hospital medical aid, by marzes, per 10,000 population, 2022
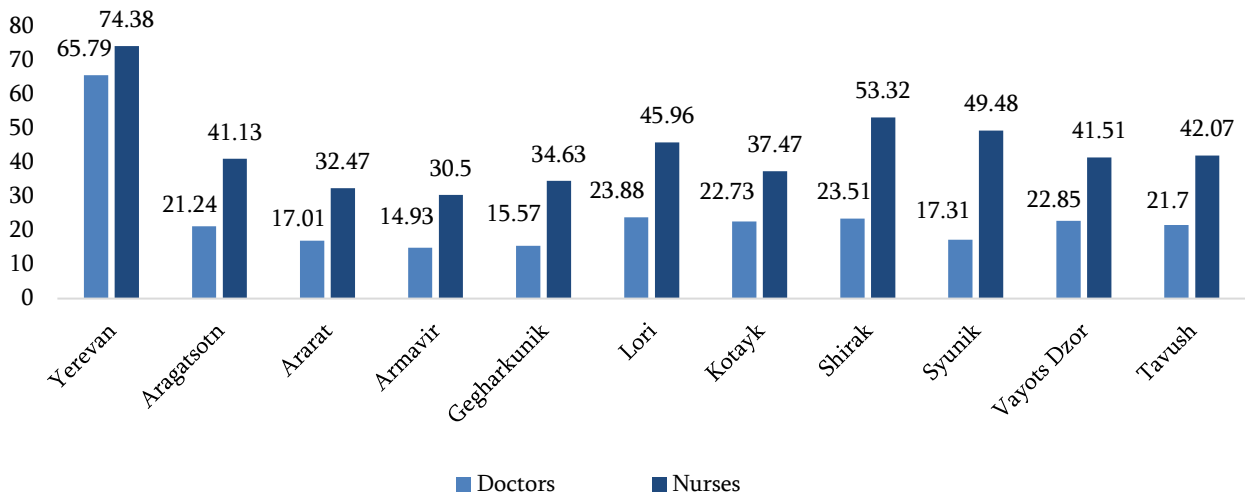
Distribution of personnel potential in primary health care and hospital medical aid organizations

In 2022 compared with 2010 the number of doctors providing medical aid in outpatient and hospital medical organizations increased by 2086, (from 8832 to 10918) (Figure 67), of which the number of doctors in outpatient organizations increased by 578, and number of doctors in hospital organizations increased by 1508.

Figure 101. Number of doctors of all specialties in organizations providing outpatient and hospital medical aid, 2010-2022
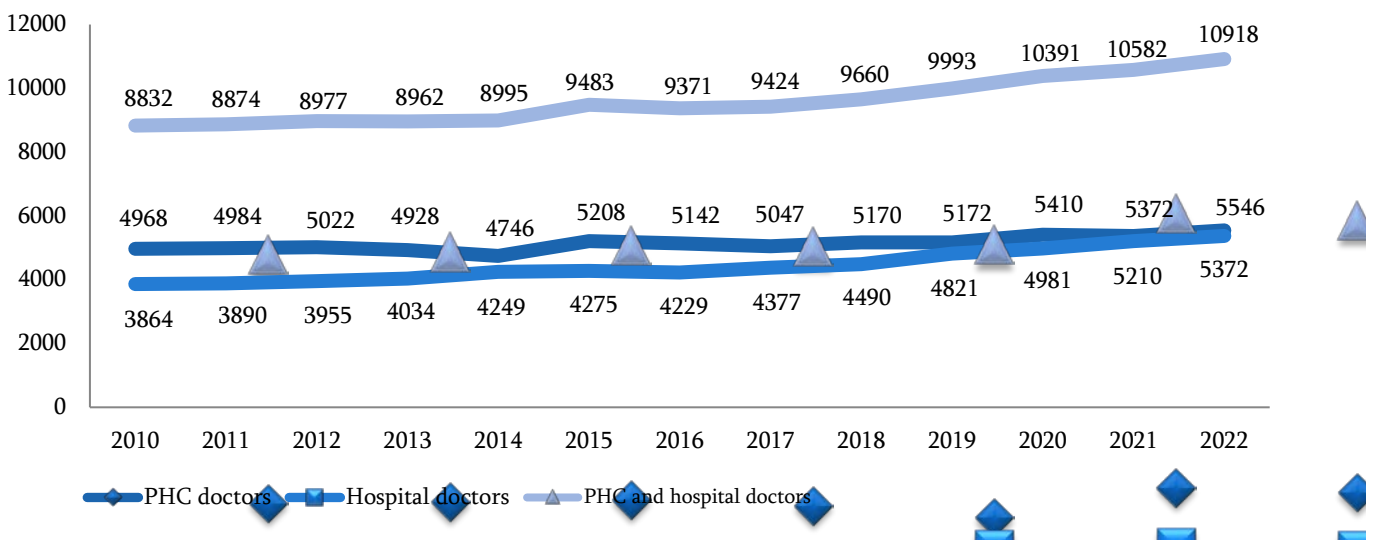
Distribution of doctors by main specialties and professional profiles   In 2022, supply of the population with doctors of the main specialties operating in outpatient and hospital level is presented in table 15.

Tables 18. The number of RA doctors by specialties, 2022

Specialties	2022					
	Medical staff			By 10 000 population		
	Total in RA	Doctors providing immediate medical aid		Total in RA	Doctors providing immediate medical aid	
		including			incliding	
		PHC level	Hospital levels		PHC level	Hospital levels
Doctors only (including dentists)	15061	5546	5372	50.59	18.63	18.04
including						
Head and deputies of the executive body	671	350	239	2.25	1.18	0.8
Therapeutic profile	4004	2024	1154	17.67	8.93	5.09
including						
Therapists	928	630	157	4.09	2.78	0.69
Family doctors	667	582	4	2.24	1.95	0.01
Cardiologists	595	145	293	2.63	0.64	1.29
Oncologists	163	45	50	0.72	0.2	0.22
Neurologists	352	130	145	1.55	0.57	0.64
Endocrinologist	297	167	62	1.31	0.74	0.27
Ophthalmologists	410	146	172	1.81	0.64	0.76
Otorhinolaryngologists	344	114	142	1.52	0.5	0.63
Psychiatric profile	188	71	69	0.83	0.31	0.3
Phthisiatrician	102	58	21	0.34	0.19	0.07
Dermatologist - venereologists	250	158	20	1.1	0.7	0.09
Obstetricians and gynecologists	922	349	421	5.87	2.22	2.68
Pediatric gynecologists	22	9	6	0.66	0.27	0.18
Surgical profile	2430	197	1589	10.72	0.87	7.01
Dental profile	1458	488	14	6.43	2.15	0.06
Pediatric profile	1175	544	417	16.53	7.65	5.87
Pediatric surgical profile	229	28	153	3.22	0.39	2.15
Pediatric dental profile	115	64	0	1.62	0.9	0
Hygienic epidemic profile	288	41	62	0.97	0.14	0.21
Instrumental and laboratory profile	1490	587	626	5	1.97	2.1

Table 19. Distribution of doctors in organizations, providing outpatient and hospital medical aid, by specialties, by regions, per 10,000 population, 2022

	Aragatsotn	Ararat	Armavir	Gegharkunik	Yerevan	Lori	Kotayk	Shirak	Syunik	Vayots Dzor	Tavush
Therapist	3.51	2.00	1.92	1.78	5.7	4.54	0.90	2.02	1.03	3.81	1.73
FD	3.18	2.82	2.51	2.01	0.53	0.90	4.73	3.21	3.19	1.47	3.26
Child doctor	2.83	4.80	4.29	3.47	14.36	8.71	2.18	3.68	5.34	6.36	5.13
Surgeon	1.60	1.28	0.54	1.09	2.18	1.39	1.16	1.44	1.13	1.91	1.41
Oncologist	0.11	0.15	0.10	0.11	0.85	0.19	0.26	0.23	0.09	0.27	0.11
Anesthesiologist	0.95	0.50	0.38	0.48	2.54	0.61	1.26	0.87	0.37	0.42	0.50
Cardiologist	0.32	0.51	0.59	0.46	3.86	1.07	1.00	0.98	1.31	1.09	0.97
Endocrinologist	0.53	0.26	0.29	0.46	1.8	0.69	0.79	0.81	0.38	0.54	0.76
Obstetrician-gynecologist	1.86	2.08	2.18	2.52	8.39	3.21	3.98	3.32	2.73	2.79	3.00
Epidemiologist	0.11	0.31	0.25	0.23	0.78	0.24	0.47	0.46	0.19	0.82	0.22

The given data show that Yerevan organizations are oversupplied with various medical specialists.

## Vacancies for personnel with higher medical education

Along with the enlargement of doctors training process in Armenia, the number of vacancies for doctors also increases (Figure 68). The data show that the demand for doctors in all specialties is greatest in Lori, Gegharkunik, Aragatsotn and Shirak.

Figure 102. Vacancies for doctors by marzes, as of September 2023.
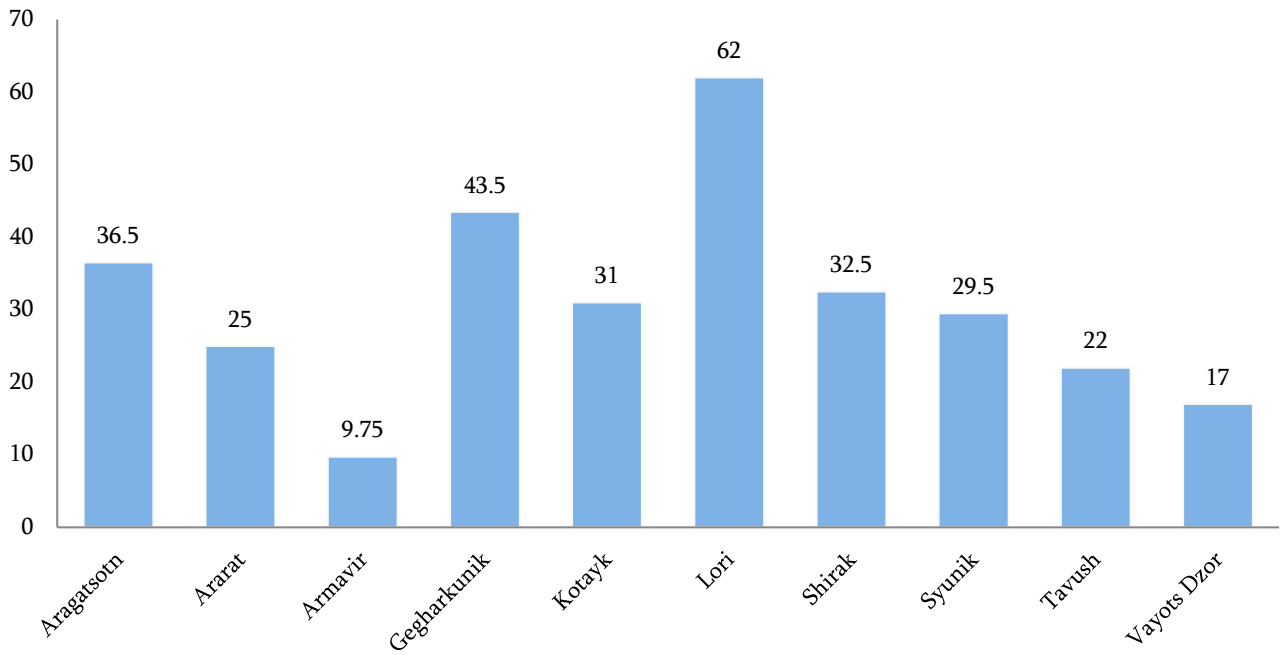
By professions, the most demamded are area therapists, anesthesiologists-reanimatologists, family doctors, infectious disease specialists, etc.

Figure 69 Vacancies for doctors by specialties, 2023, as of September
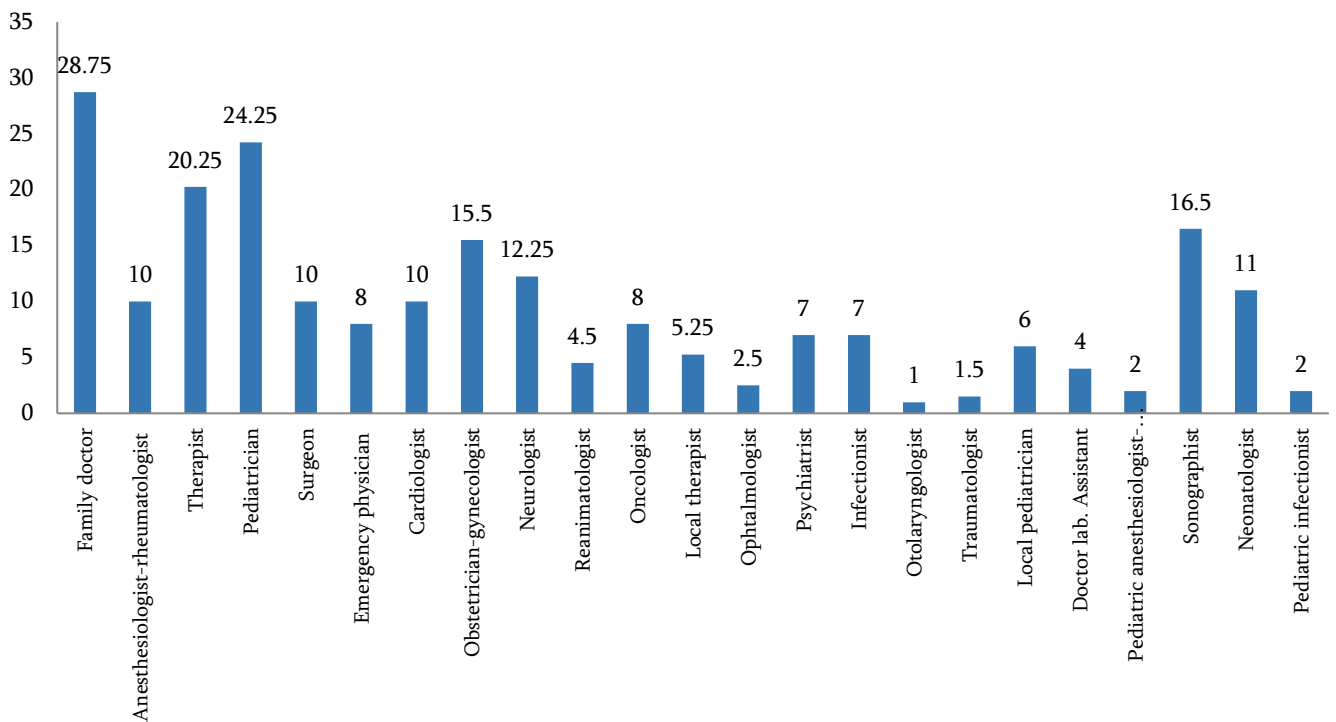
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