DOI: 10.24412/2311-1623-2025-48-5-12

Trends in cardiovascular mortality in CIS countries between 1990 and 2022

Mamedov M.N.[1], Serpytis P.[2], Tsinamdzgvrishvili B.V.[3], Seisembekov T.Z.[4], Podpalov V.P.[5], Istrati V.[6], Annayev B.H.[7], Alekperov E.Z.[8]

[1] Federal State Budgetary Institution National Medical Research Center for Therapy and Preventive Medicine of the Ministry of Healthcare of the Russian Federation, Moscow, Russia.
[2] Clinic of Emergency Medicine, Vilnius University Hospital Santaros Clinics, Vilnius, Lithuania.
[3] Cardiology Centre named after Akad. M.D. Tsinamdzgvrishvili, Tbilisi, Georgia.
[4] Astana Medical University, Astana, Kazakhstan.
[5] Vitebsk State Medical University, Vitebsk, Belarus.
[6] State University of Medicine and Pharmacy of the Republic of Moldova, Chișinău, Moldova.
[7] Hospital with Scientific Clinical Centre of Cardiology, Ashgabat, Turkmenistan.
[8] The Scientific-Research Cardiology Institute named after J. Abdullayev, Baku, Azerbaijan.

AUTHORS

Mehman N. Mamedov*, MD, PhD, Professor, Head of the Department of Secondary Prevention of Chronic Non-infectious Diseases, Federal State Budgetary Institution National Medical Research Center for Therapy and Preventive Medicine of the Ministry of Healthcare of the Russian Federation, Moscow, Russia. ORCID: 0000–0001-7131-8049

Pranas Serpytis, MD, PhD, Professor, Head of the Cardiology Department, Clinic of Emergency Medicine, Vilnius University Hospital Santaros Clinics, Vilnius, Lithuania. ORCID: 0000-0003-4333-7263

Bezhan V. Tsinamdzgvrishvili, MD, PhD, Professor, Director of the Cardiology Centre named after Akad. M.D. Tsinamdzgvrishvili, Head of the Department of Internal Diseases of Tbilisi State Medical University, President of the Georgian Society for Hypertension, Tbilisi, Georgia. ORCID: 0000-0002-5407-1264

Telman Z. Seisembekov, MD, PhD, Professor, Department of Internal Diseases № 2, Astana Medical University, President of the Association of Physicians of the Republic of Kazakhstan, Astana, Kazakhstan. ORCID: 0000–0002-2129-7128

Vladislav P. Podpalov, MD, PhD,of the Department of Internal Medicine № 1 of Vitebsk State Medical University, Vitebsk, Belarus. ORCID: 0000–0001-9177-0163

Valeriu Istrati, MD, PhD, State University of Medicine and Pharmacy of the Republic of Moldova, Chișinău, Moldova. ORCID: 0000–0002-9507-367X

Begench H. Annayev, MD, PhD, Hospital with Scientific Clinical Centre of Cardiology, Ashgabat, Turkmenistan.

* Corresponding author. Tel. +7(926)228-33-09. E-mail: mmamedov@mail.ru

Elman Z. Alekperov, MD, PhD, Senior Researcher of the Department of Myocardial Infarction of the Scientific-Research Cardiology Institute named after J. Abdullayev, Baku, Azerbaijan. ORCID: 0009-0001-2927-6970

Objective. The aim of this analytical review is to analyze cardiovascular disease (CVD) mortality and its trends from 1990 to 2022 in the countries of the Commonwealth of Independent States (CIS).

Methods. This review analyzes data from CIS countries belonging to the Eastern European and Central Asian regions. The study employed data from the research group of the "Global Burden of Disease" (GBD) project. The GBD generates time series of comprehensive health metrics, including CVD prevalence, cause-specific mortality rates (CSMR), years of life lost (YLLs), years lived with disability (YLDs), and disability-adjusted life years (DALYs). Based on GBD results, we analyzed CVD mortality from 1990 to 2022 in the Central Asian and Eastern European regions, whose countries joined the CIS in 1991–1994.

Results. In 2022, the age-standardized CVD mortality rates among CIS countries in the Central Asian region ranged from 331.8 to 542.3 per 100,000 population. The 1.6-fold difference between the minimum and maximum rates indicates high variability within the region. From 1990 to 2022, over 32 years, CVD mortality in the Central Asian region decreased by 16.5%.

Among the CIS countries in Eastern Europe in 2022, the age-standardized CVD mortality rates ranged from 215.0 (Estonia) to 553.0 (Ukraine) per 100,000 population; the difference between the minimum and maximum rates was more than 2.6-fold. Over 32 years, CVD mortality in these countries decreased by 24.3%. Eastern European countries ranked first among 21 global regions in terms of age-standardized CVD mortality in both 1990 and 2022. Across all CIS countries over the entire observation period, CVD mortality decreased on average by 20.4%. This reduction is three times smaller compared to Western European countries, where the decrease amounted to 60.2%.

Conclusion. Over the past decades, a substantial global decline in CVD mortality has been observed. This trend is more pronounced in regions with high levels of economic development compared to countries with lower economic levels, which include the CIS countries of Central Asia and Eastern Europe. To reduce cardiovascular morbidity and mortality in the CIS countries, it is necessary to develop effective, innovative, and widely accessible preventive, diagnostic, therapeutic, and rehabilitative technologies for CVD prevention and control.

Keywords: cardiovascular mortality, trends, risk factors, Eastern Europe, Central Asia.

Conflict of interest: none declared.

Received 20.09.2025
Accepted: 10.11.2025

For citation: Mamedov M.N., Serpytis P., Tsinamdzgvrishvili B.V. et al. Trends in cardiovascular mortality in CIS countries between 1990 and 2022 International Journal of Heart and Vascular Diseases. 2025; 13(48):4-9. DOI: 10.24412/2311-1623-2025-48-5-12

Introduction

Since the second half of the 20th century and into the early 21st century, the leading causes of death worldwide have been chronic non-communicable diseases. Among these, cardiovascular diseases (CVDs) hold the leading position, followed by malignant neoplasms, as well as external causes: injuries, poisonings, and accidents [1, 2]. Up to 20 million people die annually from CVDs, the world's leading cause of death.

Socio-economic problems, population aging, and inadequate management of risk factors (RFs) are among the reasons for this unfavorable epidemiological picture [3]. In countries that were part of the USSR, CVD morbidity and mortality rates are among the highest in the world. According to experts, the collapse of the USSR, along with political, social, and economic changes, negatively impacted population health indicators and led to increased mortality among adults. The healthcare system also underwent significant changes; previous state-run screening, prevention, and rehabilitation programs for chronic diseases were effectively discontinued. Collectively, this had a detrimental effect on demographic indicators in the post-Soviet countries [1].

Over the past decade, the CVD situation in the Commonwealth of Independent States (CIS) has somewhat stabilized, with a noted decline in cardio-

DOI: 10.24412/2311-1623-2025-48-5-12

vascular mortality [2]. However, according to WHO data, cardiovascular morbidity and mortality rates in this region remain among the highest globally.

The aim of this analytical review is to analyze CVD mortality and its trends from 1990 to 2022 in the CIS countries.

Methods

The article analyzes data from CIS countries belonging to the Eastern European and Central Asian regions. According to the definition by an international expert commission, these regions comprise countries and territories that are geographically proximate and epidemiologically similar. The Central Asian region includes Azerbaijan, Armenia, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, and Mongolia (the latter is not a CIS member). The Eastern European region includes Russia, Ukraine, Belarus, Moldova, Lithuania, Latvia, and Estonia.

The article utilizes data from the research group on the Global Burden of Disease, Injuries, and Risk Factors (GBD). For each region, the GBD generates time series of summary health indicators, including CVD prevalence, cause-specific mortality rates (CSMR), years of life lost (YLLs), years lived with disability (YLDs), and disability-adjusted life years (DALYs). CVD mortality was analyzed across eighteen specific cardiovascular diseases. Each epidemiological measure of interest was estimated for 23 age groups, from birth to 95 years and older, for males, females, and both sexes combined, from 1990 to 2022. Age standardization was performed using the direct method with the world standard population age structure. This standard population is defined using the population structure of all locations with a population >5 million. This involves calculating the proportion of the population in each age group for a specific location. Furthermore, these age proportions are averaged across all such locations [4–8].

Results

Cardiovascular mortality in Central Asia

In 2022, age-standardized CVD mortality rates among countries in this region ranged from 331.8 to 542.3 per 100,000 population. The more than 1.6-fold difference between the minimum and maximum rates indicates high variability in mortality within the region. Over the 32-year period from 1990 to 2022, CVD mortality in this region decreased by 16.5 %. Notably, the region's relative standing was high: in 1990, Central Asia ranked 4th, and in 2022, it ranked 2nd in age-standardized CVD mortality among 21 global regions. Furthermore, in 2022, Central Asia ranked first worldwide in terms of CVD prevalence.

The leading causes of age-standardized disability-adjusted life years (DALYs) were coronary heart disease (CHD) and subtypes of stroke (table 1). High systolic blood pressure (SBP) was associated with the highest number of attributable age-standardized CVD DALYs - 4875.3 per 100,000 population.

The top three countries for age-standardized CHD mortality were Uzbekistan, Turkmenistan, and Azerbaijan. For age-standardized mortality from ischemic stroke, the leading countries were Georgia, Kazakhstan, and Turkmenistan. Regarding the analogous indicator for arterial hypertension (AH), the top countries were Georgia, Tajikistan, and Azerbaijan.

The following are recognized contributors to CVD. In the development of CHD and ischemic stroke, behavioral risk factors such as dietary risks, smoking, and secondhand smoke play a significant role. Among metabolic risk factors for CHD development, systolic hypertension, high LDL cholesterol, kidney dysfunction, high body mass index (BMI), and high fasting plasma glucose are prominent. The contribution of these risk factors to stroke development is less pronounced. Another important factor influencing mortality from CHD and stroke is environmental air pollution.

Cardiovascular mortality in Eastern Europe

According to the analysis, in 2022, age-standardized CVD mortality rates among Eastern European countries ranged from 215.0 (Estonia) to 553.0 (Ukraine) per 100,000 population; the difference between the minimum and maximum rates was more than 2.6-fold. Over 32 years (from 1990 to 2022), CVD mortality in this region decreased by 24.3 %. Among 21 global regions, Eastern Europe ranked first in age-standardized CVD mortality both in 1990 and in 2022.

Notably, in the structure of adult mortality, the proportion of alcoholic cardiomyopathy is higher compared to other regions. Following CHD and all stroke subtypes, alcoholic cardiomyopathy had the highest age-standardized disability-adjusted life years (DALYs) in 2022 — 521.2 per 100,000 population (Table 2). Among all risks in Eastern European coun-

Table 1. **Cardiovascular disease indicators in the Central Asia region for 2022: counts and age-standardized rates per 100,000 population**

Cardiovascular Disease, Type	Prevalence (Count)	Deaths (Count)	Prevalence (Rate)	Mortality (Rate)	Disability-Adjusted Life Years (DALY, Rate)
Rheumatic heart disease	618,471	2,480	624.3	2.8	119.3
CHD	7125,865	182,604	8573.3	268.9	5,135.8
Ischemic stroke	951,108	45,226	1091.5	69.6	1,330.9
Intracerebral hemorrhage	184,547	34,154	194.0	45.2	1,008.4
Subarachnoid hemorrhage	102,912	4,109	109.7	5.2	147.4
AH	71,919	12,724	96.4	19.0	337.4
Non-rheumatic degenerative mitral valve disease	375,266	246	500.0	0.3	14.7
Myocarditis	6,279	303	6.8	0.3	12.0
Other cardiomyopathies	54,216	7,598	60.3	8.7	272.5
Atrial fibrillation and flutter	424,061	1,571	565.6	2.6	79.6
Lower extremity peripheral artery disease	612,533	349	835.5	0.5	13.2
Other cardiovascular diseases	427,924	2,008	497.1	2.6	90.7

Note. The DALY (Disability-Adjusted Life Year) coefficient is a health metric measuring the burden of disease, expressed as the total number of years of healthy life lost due to premature death, disability, or ill health. One DALY equals one lost year of "ideal" healthy life, combining losses from mortality (Years of Life Lost, YLL) and years lived with disability (Years Lived with Disability, YLD).

Table 2. **Cardiovascular Disease Indicators in the Eastern Europe Region for 2022: Counts and Age-Standardized Rates per 100,000 Population**

Cardiovascular Disease, Type	Prevalence (Count)	Deaths (Count)	Prevalence (Rate)	Mortality (Rate)	Disability-Adjusted Life Years (DALY, Rate)
Rheumatic heart disease	241,126	3,324	73.9	1.0	28.6
CHD	25389,496	914,066	7243.7	254.3	4,882.7
Ischemic stroke	3074,246	348,195	924.7	95.7	1,642.8
Intracerebral hemorrhage	467,843	90,934	159.3	26.4	680.1
Subarachnoid hemorrhage	317,276	16,751	108.9	5.0	154.7
AH	171,771	27,760	46.8	7.7	138.5
Non-rheumatic degenerative mitral valve disease	949,952	832	259.7	0.2	9.6
Myocarditis	17,479	743	7.7	0.2	8.6
Alcoholic cardiomyopathy	177,153	38,801	63.6	13.2	521.2
Other cardiomyopathies	157,875	25,924	76.2	8.9	339.9
Atrial fibrillation and flutter	2384,327	19,282	663.1	5.3	119.9
Lower extremity peripheral artery disease	4018,233	13,208	1,099.9	3.6	66.3
Other cardiovascular diseases	2914,750	16,721	863.9	4.9	164.1

Note. The DALY (Disability-Adjusted Life Year) coefficient is a health metric measuring the burden of disease, expressed as the total number of years of healthy life lost due to premature death, disability, or ill health. One DALY equals one lost year of "ideal" healthy life, combining losses from mortality (Years of Life Lost, YLL) and years lived with disability (Years Lived with Disability, YLD).

tries, high systolic blood pressure (SBP) caused the greatest number of age-standardized CVD DALYs — 4619.4 per 100,000 population.

In this region, the top three countries for age-standardized CHD mortality are Ukraine, Belarus, and Moldova. For age-standardized mortality from ischemic stroke, the leading countries are Russia, Latvia, and Ukraine. Regarding the analogous indicator for hypertensive heart disease, the top countries are Estonia, Moldova, and Latvia.

It is known that in the development of CHD and ischemic stroke, among behavioral risk factors, dietary risks and smoking play a significant role, while alcohol use plays a major role in the development of intermittent claudication. Among metabolic risk factors for CHD development, the following are prominent: systolic hypertension, high LDL cholesterol, high body mass index (BMI), kidney dysfunction, and high fasting plasma glucose. The contribution of these risk factors to stroke development is less pronounced. Furthermore, important factors influencing mortality from CHD and stroke are environmental air pollution and cold climate.

DOI: 10.24412/2311-1623-2025-48-5-12

Discussion

According to international parameters, CIS countries were divided into two regions based on geographical location: Central Asia and Eastern Europe. In 2022, the maximum CVD mortality rates in these regions were similar, while the minimum mortality rate in Eastern Europe was 1.5 times lower than in Central Asia. In Western Europe, the comparable indicators (ranging from 80.2 to 199.9 per 100,000 population) during the analyzed period were 2.5 times lower than in the CIS countries [3].

Over the 32-year observation period, CVD mortality in the CIS countries decreased by an average of 20.4 %, which is three times less than the 60.2 % reduction seen in Western Europe. By this measure, Western European countries have one of the best indicators among 21 global regions, ranking 19th in 2022, while both CIS regions ranked the worst, occupying 1st and 2nd place.

In the structure of CVD mortality in CIS countries, CHD is the leading cause, accounting for 30 % to 75 %, compared to a range of 25 % to 55 % in Western Europe. In Western Europe, arrhythmias, cardiomyopathies, and valvular heart diseases also contribute to the mortality structure. The primary behavioral risk factors in both the CIS and Western Europe are dietary risks and smoking. Among metabolic risk factors, hypertension and hypercholesterolemia occupy the top two positions, while the negative impact of environmental factors on cardiovascular mortality is more pronounced in CIS countries than in Western Europe. It should be emphasized that Western Europe already had low CVD mortality rates among 21 global regions in 1990, ranking 15th [3].

The economic development level of countries influences the structure and rates of socially significant causes of death, which undoubtedly affects life expectancy. Overall, in economically developed countries over the past three decades, there has been a clear trend of a decreasing proportion of CVDs in the overall mortality structure. One in five deaths is registered before the age of 70. In developing countries, the picture is somewhat different. The trend in CVD mortality changes slowly, with nearly every second death resulting from CVD complications occurring before the age of 70. The less social stratification in a society and the larger the proportion of people belonging to the so-called middle class, the greater the effect of prevention programs. Success in the positive trend of CVD mortality in Western countries can be attributed to several factors: healthcare funding, effective primary prevention, screening, and the accessibility of high-tech/advanced treatments for CVD. In developing countries, along with social problems, insufficient control and high prevalence of risk factors play a significant role in the rise of morbidity [9, 10].

A large study conducted in Russia in the early 21st century demonstrated a close correlation between cardiovascular mortality and the number of people over working age, as well as the proportion of the population with low economic income. Undoubtedly, changes in the demographic situation also played a role in the increased CVD mortality in the Russian Federation at the turn of the century. Specifically, declining birth rates and an increasing proportion of elderly people, among whom the frequency of CVD is high. Furthermore, improvements in diagnostic methods in recent decades have contributed to better detection of CVD and, consequently, an increase in the proportion of diagnosed patients [11]. We believe that in CIS countries, especially those in the Eastern European region, the problems are similar [12]. However, in CIS countries belonging to the Central Asian region, the situation with high CVD mortality is primarily due to insufficiently effective implementation of primary and secondary CVD prevention [13]. Strengthening the preventive focus within the healthcare systems of CIS regions will help reduce the morbidity and mortality from CVD among the population. On the other hand, in recent years, these countries have also been successfully implementing high-tech diagnostic and treatment methods for a number of CVD. This provides hope for subsequent improvement in the epidemiological situation regarding CVD mortality in both CIS regions.

Conclusion

In recent decades, a substantial global decline in cardiovascular disease CVD mortality has been observed. This trend is more pronounced in regions with high levels of economic development compared to countries with lower economic levels, which include the CIS countries of Central Asia and Eastern Europe.

To reduce cardiovascular morbidity and mortality in the CIS countries, it is essential to develop effective, innovative, and widely accessible preventive, diagnostic, therapeutic, and rehabilitative technologies for CVD prevention and control. The long-term

implementation of a comprehensive set of measures could contribute to lowering mortality among the adult population.

Conflict of interest: none declared.

References

1. Maslennikova GYa, Oganov RG, Drapkina OM Modern global regional and national priority strategic directions for the prevention and control of non-communicable diseases. Preventive medicine. 2020; 23 (2): 7–12. DOI: 10.17116/profmed2020230217
2. Drapkina OM, Kontsevaya AV, Kalinina AM, et al. 2022 Prevention of chronic non-communicable diseases in the Russian Federation. National guidelines. Cardiovascular Therapy and Prevention. 2022;21(4):3235. DOI: 10.15829/1728–8800-2022-3235
3. Mensah, G, Fuster, V, Murray, C. et al. Global Burden of Cardiovascular Diseases and Risks, 1990–2022. J Am Coll Cardiol. 2023 Dec, 82 (25) 2350–2473. DOI: 10.1016/j.jacc.2023.11.007
4. Murray CJL. Protocol for the Global Burden Of Diseases, Injuries, And Risk Factors Study (GBD). Institute for Health Metrics and Evaluation. 2020. 1–31.
5. Stevens GA, Alkema L, Black RE, et al. Guidelines for accurate and transparent health estimates reporting: the GATHER statement. The Lancet. 2016;388:e19–e23.
6. Wang H, Abbas KM, Abbasifard M, et al. Global age-sex-specific fertility, mortality, healthy life expectancy (HALE), and population estimates in 204 countries and territories, 1950–2019: a comprehensive demographic analysis for the Global Burden of Disease Study 2019. The Lancet. 2020;396:1160–1203.
7. Gibson G, Blumer V, Mentz RJ, Lala A. Universal Definition and Classification of Heart Failure: A Step in the Right Direction from Failure to Function. Accessed November 8, 2023.
8. Johnson SC, Cunningham M, Dippenaar IN, et al. Public health utility of cause of death data: applying empirical algorithms to improve data quality. Springer Nature. 2021. 21(175): 1–20. DOI: 10.1186/s12911-021-01501-1
9. Starodubov VI, Ivanova AV, Semina VG et al. The health of the nation: dynamics and forecasts of the health of the Russian population in the social context of the 90s. Glavvrach. 2002; 8: 13–32.
10. Visseren FL, Mach F, Smulders YM et al. 2021 ESC Guidelines on cardiovascular disease prevention in clinical practice: Developed by the Task Force for cardiovascular disease prevention in clinical practice with representatives of the European Society of Cardiology and 12 medical societies With the special contribution of the European Association of Preventive Cardiology (EAPC), European Heart Journal. 2021. 42(34): 3227–3337. DOI: 10.1093/eurheartj/ehab484
11. Bokeria LA, Stupakov IN, Samorodskaya IV, Botnar YuM Cardiovascular diseases in the Russian Federation at the turn of the century: mortality, prevalence, risk factors. Bulletin of the A. N. Bakulev National Agricultural Research Center, Russian Academy of Medical Sciences, 2007. 5 (8): 5–10.
12. Lui M, Safiri S, Mereke A, et al. Burden of Ischemic Heart Disease in Central Asian Countries, 1990–2017. Int J Cardiol Heart Vasc. 2021 Feb 7;33:100726. DOI: 10.1016/j.ijcha.2021.100726
13. Mamedov MN, Arabidze GG The contribution of cardiovascular diseases and their complications to the mortality of the working-age population in the countries of the South Caucasus and Turkey, Atherosclerosis and Dyslipidemia. 2024; 2(55). 17–21. DOI: 10.34687/2219–8202.JAD.2024.02.0002