SOCIAL EFFICIENCY OF INTRODUCTION OF ATHEROSCLEROSIS SCREENING PROGRAM IN KAZAKHSTAN. SYSTEMATIC REVIEW

Bekbossynova M.[1], Duisekova S.[2], Zeinoldina A.[2], Daniyarova G.[1], Akzholova K.[3]

1 - University Medical Center, Corporate Fund, Astana, Kazakhstan,
2 - Astana Medical University, Astana, Republic of Kazakhstan
3 - Nazarbayev University School of Medicine, Astana, Kazakhstan

DOI: 10.35805/BSK2025I009
Bekbossynova M.
https://orcid.org/0000-0003-2834-617X
Duisekova S.
https://orcid.org/0000-0001-7644-145X
Zeinoldina A.
https://orcid.org/0009-0009-8248-3539
Daniyarova G.
https://orcid.org/0000-0001-5876-7528
Akzholova K.
https://orcid.org/0009-0000-2527-8947

recieved: 14.02.2025
accepted: 12.03.2025

Author for correspondence:
Zeinoldina A.
Bachelor in Public Health, Master student in Astana Medical University Postal address: Republic of Kazakhstan, 010000, Astana, Kazakhstan
E-mail: talgatkyzy55l@gmail.com
Phone: +77784104307

Conflict of interest:
The authors declare no potential conflict of interest requiring disclosure in this article.

Keywords:
atherosclerosis, dyslipidemia, cardiovascular diseases, lipid profile, screening

Abstract

Background. Atherosclerosis, a major cause of cardiovascular disease, has a significant impact on morbidity and mortality in Kazakhstan. The increasing burden of this disease, combined with a high prevalence of dyslipidemia, underscores the importance of effective screening to reduce associated health risks. The aim of this study is to evaluate the social efficiency of implementing a nationwide atherosclerosis screening program in Kazakhstan and to assess its potential to improve public health outcomes and reduce mortality from cardiovascular disease.

Methods. A literature review was conducted, and global screening approaches and protocols for atherosclerosis and cardiovascular disease were analyzed for their applicability in the local context.

Results. Results suggest that targeted and cascade screening programs, particularly those focused on high-risk individuals and familial hypercholesterolemia, are effective in reducing disease incidence and mortality. Implementation of similar protocols in Kazakhstan could improve early detection, allowing for preventive interventions and treatment. The study concludes that a structured, government-sponsored screening program would not only save lives but also provide substantial economic benefits by reducing long-term health care costs associated with cardiovascular complications.

Conclusion. Screening is the convenient and economically efficient way to prevent atherosclerosis, and its effectiveness is demonstrated by worldwide practice and the history of early disease prevention. However, the effectiveness and social value of screening need to be demonstrated before it can be incorporated into medical practice. If established as a regular practice, widespread population screening could dramatically reduce cardiovascular disease, the leading cause of death worldwide.

Introduction

According to gerontologists, a person can live up to 120 years. However, under the influence of many factors, this indicator decreases. For example, according to the National Bureau of Statistics in 2022, the expected average life expectancy of residents of the Republic of Kazakhstan was 74.44 years (*National Bureau of Statistics. Life expectancy in Kazakhstan: 2022)*. According to UN data, in the early 1950s, the share of people living in countries with a life expectancy of more than 70 years was only 1% of the total world population. In the early 2000s, it exceeded 50% *(World Population Ageing 2023).* The only reason for the increase of this indicator is the early detection of various diseases, that is, the development of screening. Today, the World Health Organization (WHO) recognizes that one of the primary operational functions of public health is disease prevention, including screening.

In general, the wide distribution of screening in the world begins in the 20th century. That is, mass fluorography was started after the Second World War to identify people with tuberculosis.[1] According to the WHO, the United States

was one of the first to introduce the concept of screening for the prevention of various diseases.[2]

As a result, this study aims to evaluate the social efficiency of implementing a nationwide atherosclerosis screening program in Kazakhstan, assessing its potential to improve public health outcomes and reduce cardiovascular (CVD) disease mortality.[3]

According to the National Bureau of Statistics, the main causes of death in Kazakhstan in 2023, which forced the introduction of this screening, were disorders of the circulatory system - 22.7%, tumors - 10.4%, diseases of the lung-respiratory system - 9.8%, accidents, poisoning and injuries - 8.4% and diseases of the digestive system - 8.0%.[4]

Atherosclerosis is the main cause of cardiovascular diseases here. It kills more people every year than the most common diseases, such as cancer, pneumonia, and diabetes. According to the definition of the World Health Organization, atherosclerosis is a variable combination of changes in the inner lining (intima) of arteries, including the accumulation of lipids, complex carbohydrates, fibrous tissue, blood components, calcification, and accompanying changes in the middle layer (media).[5] And the main reason for the development of ischemic diseases of the cardiovascular system is atherosclerosis. Therefore, atherosclerosis can be said to be the main indicator of total mortality. When conducting research on the problem of atherosclerosis in Kazakhstan, the incidence is considered to be relatively young.

Atherosclerotic cardiovascular disease (ASCVD) affects more than 135 million people worldwide. More than 2 billion people are at high risk of atherosclerosis. They cause more than 85% of all deaths from cardiovascular diseases. Deaths from ASCVD account for 31% (17.9 million) of all deaths worldwide,[6] including 45% (3.9 million) of all deaths in Europe,[7] 23 of all deaths in the US % (0.65 million) is due to this disease.[8] ASCVD is also a leading cause of sudden death (6.2 million sudden deaths worldwide among people aged 30–70 years).[9,10]

Dyslipidemia, characterized by high levels of blood lipids, is an important global health problem associated with cardiovascular disease. As a preventive measure, screening for dyslipidemia plays a crucial role in identifying individuals at risk. According to WHO experts, 85% of cardiovascular complications are caused by a healthy lifestyle, timely examination and identification of risk factors, early prevention and treatment, including lowering the level of "bad" cholesterol in the blood.[11]

Blood pressure measures the force of circulating blood against artery walls. High blood pressure can damage arteries supplying blood to vital organs like the brain, heart, and kidneys. Cholesterol plays a central role in atherosclerosis—the buildup of fatty deposits in the arteries of the heart and brain. High cholesterol is responsible for an estimated 4.4 million deaths globally, or 7.9% of the total, primarily due to its impact on high blood pressure. It accounts for 18% of strokes and 56% of coronary artery disease worldwide. According to WHO, 40% of global deaths are due to just 10 major risk factors, with the remaining factors contributing less than 10%. Addressing these key risks could add 10 years to healthy life expectancy.[12,13,14] (Figure 1.)

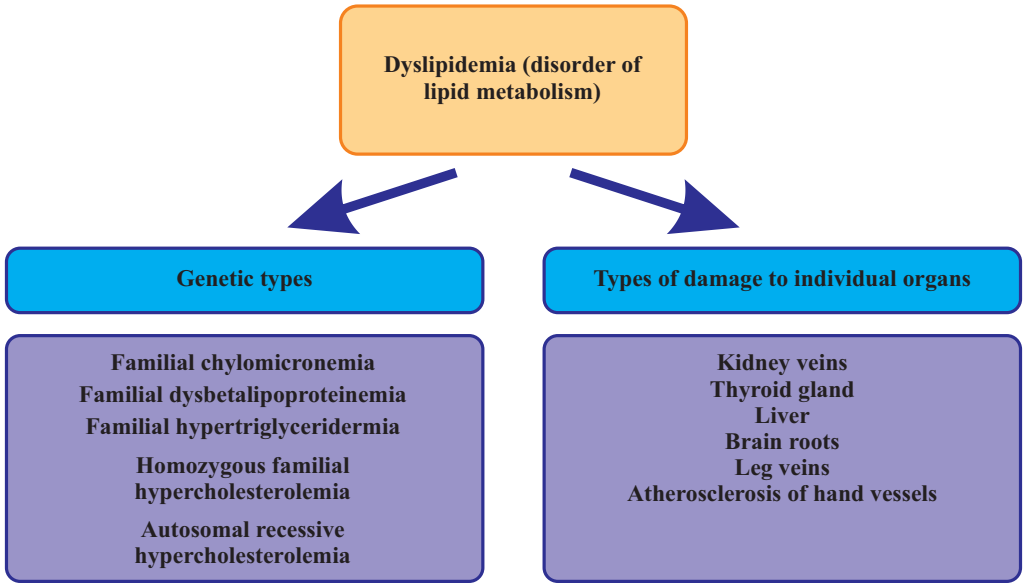

Figure 1.
A representation of genetic types and damage types of dyslipidemia

Materials and methods

This systematic review was conducted to assess the social efficiency of implementing a nationwide atherosclerosis screening program in Kazakhstan. A comprehensive literature search was performed across multiple databases to ensure a broad and relevant selection of studies. The databases included PubMed, MEDLINE, Scopus, Web of Science, and the Cochrane Library. Search terms encompassed combinations of keywords such as "atherosclerosis screening," "cardiovascular disease," "dyslipidemia," "public health," "screening programs," and "Kazakhstan." Studies were included based on their relevance to atherosclerosis screening programs, particularly in the context of public health outcomes and economic efficiency. To avoid bias, studies from various geographical regions were considered, focusing on screening models and their effectiveness in countries similar in healthcare infrastructure and demographics to Kazakhstan. Inclusion criteria emphasized studies from the past 15 years, systematic reviews, meta-analyses, and original research articles. All retrieved articles were screened by title and abstract, with relevant studies reviewed in full text. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were adhered to throughout the review process, ensuring a structured and transparent approach.

Results

The results of the study selection process: at the initial stage of study selection 1187 studies were identified. After the removal of duplicate studies, titles and abstracts of 974 studies were screened for relevance. After title and abstract screening, 54 studies were selected for full-text review. Finally, 20 papers that met inclusion criteria were included into the final systematic review as presented in Figure 2.

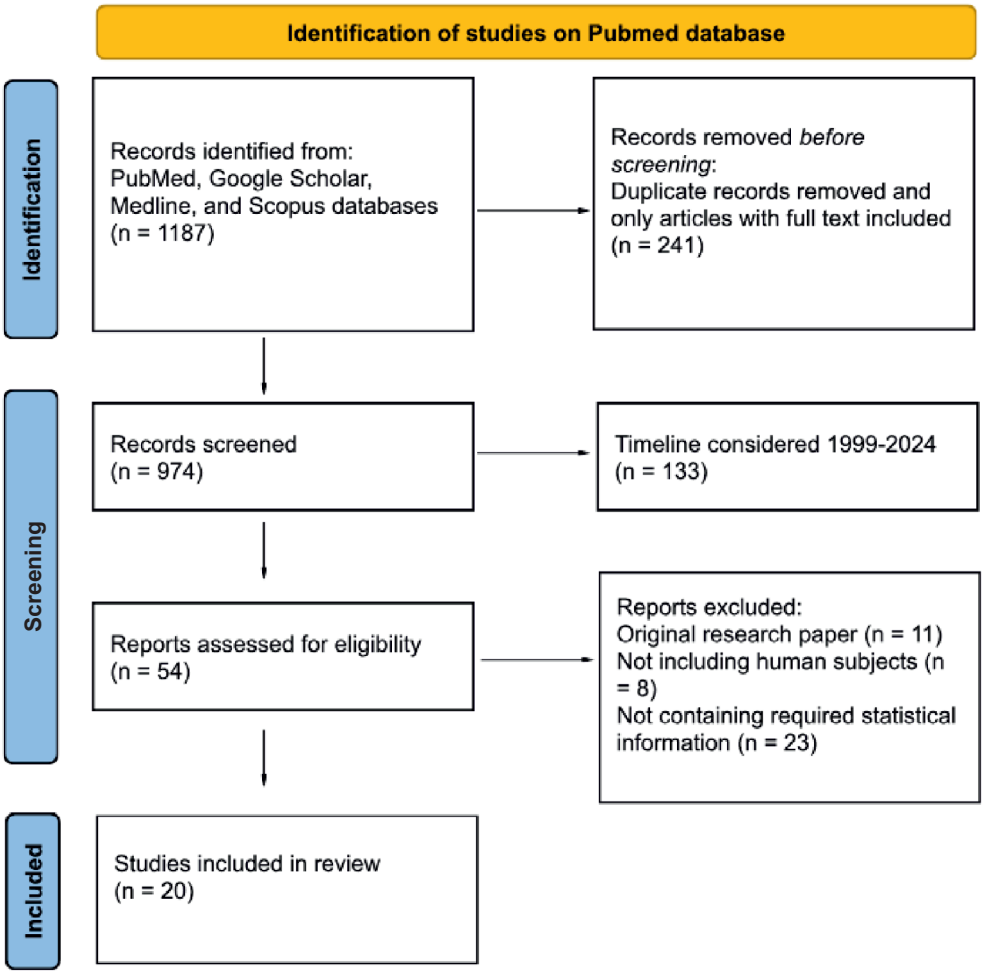

Figure 2.
Flow chart showing selection of studies for review

1. Screening programs for atherosclerosis and cardiovascular diseases

Atherosclerosis and cardiovascular disease screening programs are implemented in various countries, with significant differences in their development. For example:

The U.S. tracks atherosclerosis statistics through the Centers for Disease Control and Prevention (CDC) database, which is the leading data-driven public health service. The "National Survey of Ambulatory Care: 2019 Summary Tables by Country" reports the annual number of outpatient visits by diagnostic group, with over 12,000 visits for coronary atherosclerosis and other chronic ischemic heart diseases.[15] The overall comparison of screening programs are illustrated in Table 1.

Table 1.
Screening Programs for Atherosclerosis and Cardiovascular Diseases

Country / Region	Program / Organization	Screening Methods / Key Features	Notable Outcomes and Comments
USA	CDC Database	Tracks outpatient visits for conditions like coronary atherosclerosis	Over 12,000 outpatient visits for coronary atherosclerosis annually. [15]
UK	National Health Service (NHC), England	CVD screening includes cholesterol and blood pressure checks	Provides lifestyle recommendations alongside screenings.[16,17]
Canada	Provincial Programs	CVD screenings at the provincial and territorial levels	Screening recommendations vary by province/territory.[16,17]

France	National/Regional Levels	Screening programs vary by inclusion criteria and age groups	Implements a combination of national, regional, and local-level screenings.[16,17]
Russia	National Cardiology Center	Led by Marat Vladislavovich Yezhov; focuses on familial hypercholesterolemia (FHC)	Highlights that 20% of myocardial infarction cases involve undiagnosed FHC.[14]
Switzerland	Novartis	Uses innovative medicines for treatment and management	Focuses on improving patient outcomes and extending life expectancy.[18]
Europe (General)	European Atherosclerosis Society (EAS)	Provides guidelines, consensus documents, and public education resources	Established lipid modification guidelines and consensus documents since 2007.[18]
Uzbekistan	Tashkent Cardiology Center	Cascade screening for FHC	Approximately 1 in 200 people are affected by FHC, with cascade screening aiding diagnosis.[19]

In the UK, the NHS runs cardiovascular screening programs, including cholesterol and blood pressure measurements, with lifestyle recommendations. Canada has provincial and territorial-level CVD screening programs and recommendations. France has introduced screening programs for atherosclerosis and other cardiovascular diseases, varying by scope, inclusion criteria, and age groups, and implemented at national, regional, and local levels.
In Russia the National Medical Cardiology Research Center, is a key figure in the field of atherosclerosis. In Switzerland, Novartis, an international company, focuses on improving and extending lives through innovative medicines like Zolgensma, Cosentyx, and Incliziran.[15]

In Europe, the European Atherosclerosis Society (European Atherosclerosis Society) works actively. The EAS was founded in 1964 as a forum for the exchange of ideas among researchers on the study of atherosclerosis, and scientific meetings have been held throughout Europe for many years.[16] Since 2007, the Society has produced Atherosclerosis Guidelines, and since 2010, consensus documents, and in 2012, a public resource Academy as a collection of online lectures, presentations, and talks recorded at congresses, courses, and webinars.

In 2019, the European Society of Heart (ESC) / EAS guidelines for lipid modification to reduce cardiovascular risk for the treatment of dyslipidemia were established: The authors are the Dyslipidemia Treatment Working Group of the ESC and EAS.[17]

In Uzbekistan, much attention is paid to the global challenge of familial hypercholesterolemia (FHC). He notes that the prevalence of FHC is about 1 in 200 people, which translates to an estimated 165,000 individuals affected in Uzbekistan, with a population of 33 million.[19]

2. Activities aimed at the prevention of atherosclerosis in Kazakhstan

The "Clinical Diagnosis and Treatment Protocol for Atherogenic Disorders of Lipid Metabolism (Dyslipidemia)" was approved by the National Scientific Center for Healthcare Development named after S. Kairbekova and published on its website. Approved by the Joint Commission on Medical Services Quality (Ministry of Health, Kazakhstan, 2023), the protocol recommends targeted screening for familial hypercholesterolemia and cascade screening for first- and second-degree relatives of diagnosed FHC patients.[19,20]

According to statistics, over 36,000 people die from atherosclerosis annually in the Republic, and this number contin-

ues to rise. WHO experts state that 85% of cardiovascular disease complications can be prevented through a healthy lifestyle, timely screening, early prevention, and treatment, as well as reducing "bad" cholesterol. Individuals over 40 should undergo cardiovascular screenings every two years, free of charge, as part of a national program. These screenings help assess the 10-year risk of developing cardiovascular disease. If cholesterol levels are high, preventive treatment is prescribed in Kazakhstan.[21]

3. Review of clinical scientific works on the study of atherosclerosis and its screening

According to the study, every second person among men and women aged 30-69 who took part in the research had hypercholesterolemia, and hyperglycemia was found in every fourth man and fifth woman.[22]

The results of the lipid metabolism screening study for timely diagnosis and prevention of atherosclerosis showed that cardiovascular diseases, primarily caused by atherosclerosis, were identified as the leading cause of death globally.[23,24] The study followed 2,000 individuals over 18, monitoring blood cholesterol, lipoproteins, triglycerides, and other factors. It was found that cholesterol levels decrease in those aged 60-69. Only 28% had normal high-density lipoproteins, 54% were at risk, and 18% had pathology. ASCVD changes were seen in one-third of patients over 40 during angiological screening. The study concluded that apolipoprotein disorders begin at age 18-29, emphasizing the importance of early screening to prevent disease.[25]

It is important to highlight the importance of detecting tendon and skin xanthomas, xanthelasma, or lipoid corneas in individuals under 45, as these symptoms suggest lipid metabolism disorders like familial hypercholesterolemia, a common cause of early dyslipidemia.[26] The screening algorithm involves identifying risk factors and clinical signs of atherosclerosis, determining lipid profiles via blood tests, assessing cardiovascular risk using the SCORE scale, and confirming atherosclerosis with instrumental methods. Screening is recommended for men over 40 and women over 50. The SCORE scale, used in Europe, categorizes cardiovascular risk into very high, high, moderate, and low. Countries with high cardiovascular risk (death rates from CVD >350 per 100,000) include Azerbaijan, Belarus, Bulgaria, Egypt, Georgia, Kazakhstan, Kyrgyzstan, North Macedonia, Moldova, Russia, Syria, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan.[27,28]

According to a last study, blood lipid spectrum was taken from 95 volunteers aged 20 to 65 years. Risk factors were found in 55.6% of people. The lower limit of the risk factor is considered to be 30 years. In conclusion, the authors showed the social importance of preventive measures, especially the effectiveness of lipoprotein testing.[29]

In Vienna, Austria, a pilot project combined selective screening with cascade testing for children aged 5-7, using standardized questionnaires and cholesterol measurements. Cascade screening is implemented in several countries, including Bulgaria, Denmark, Ireland, Kosovo, Latvia, Malta, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and Ukraine, with some programs being institution-based and others national. The Czech Republic introduced universal newborn screening, and Estonia offers universal screening for all ages. Germany combines universal and cascade screening through the Fridolin Program (ages 2-6) and the Vroni study (ages 5-14), while Greece implemented this approach at institutions. Cascade screening is also used in Ireland, Luxembourg, the Netherlands, Norway, and Sweden.[18,30,31,32] The cascade and screening programs overview are presented in Table 2.

Table 2.
Cascade and Familial Screening Programs

Country / Program	Target Population / Method	Results	Significance
Vienna, Austria [18]	Children aged 5-7; cascade screening	Cascade screening detected familial hypercholesterolemia cases effectively	Demonstrates the success of selective screening in early childhood

Germany: Fridolin and Vroni Programs [32]	Fridolin (ages 2-6); Vroni (ages 5-14)	Combined universal and cascade screening approach.	Integration of genetic testing improves familial screening efficiency
Czech Republic: MedPed Project [30]	Universal newborn screening	Significant contribution to identifying FHC	Establishes universal screening as a model for effective detection
Slovenia [18]	Universal FHC screening for 5-year-olds	Covers 91% of pediatric population; integrated genetic testing	Reduction in cardiovascular mortality through systematic screening

Groselj U. et al. work in the European Journal of Cardiology discusses successful familial hypercholesterolemia screening models in Europe. In the Netherlands began a program identifying genetically confirmed FHC patients (index cases) and conducting cascade screening for their relatives, which reduced mortality over 20 years. Slovenia introduced universal FHC screening, measuring cholesterol in 5-year-olds during primary care visits. The program now covers 91% of the pediatric population and integrates genetic testing. Cascade screening has also been implemented in Norway, the Czech Republic, Spain, and the UK, with the Czech Republic's MedPed project significantly contributing to FHC identification.[17,33]

An epidemiological, cross-sectional study was conducted to assess the prevalence of dyslipidemia in adolescents from Montes Claros, Minas Gerais, and compare the results with a study of the Brazilian population.[34,35] A total of 77,833 students from 63 schools across four geographical areas participated, and data from 635 adolescents aged 10 to 16 years were evaluated. Blood samples were collected to measure total cholesterol, triglycerides, low-density lipoprotein (LDL) cholesterol, and High-density lipoprotein (HDL) cholesterol. The study found that 26.8% of adolescents had high total cholesterol, 15.7% had high triglycerides, 6.5% had high LDL cholesterol, and 40.8% had low HDL levels. The authors concluded that the prevalence and mean values of dyslipidemia, except for HDL cholesterol, were higher in adolescents from Montes Claros compared to the Brazilian population study used for comparison.[35]

A study devoted to the study of the method for estimating the cumulative cardiovascular death risk in women aged 25-64 and the creation an algorithm incorporating both traditional and socio-economic risk factors.[36] The research included 1,000 women in an epidemiological study and concluded that the developed algorithm, which considers economic risk factors, provides an effective means to assess individual cardiovascular death risk at the local level.[37] This and other regional studies are summarized in Table 3.

Table 3.
Regional Studies on Atherosclerosis Risk and Screening

Study/Region	Methodology	Findings	Recommendations
Lakunchykova, O. et al.[36]	SCORE-based risk algorithm for women aged 25-64	Developed an algorithm incorporating socioeconomic risk factors	Provides a localized tool for assessing 10-year cardiovascular death risk
Collins, D. et al.[38]	Risk factor assessment in Vankal'a village	44.5% overweight, 37.6% hypertensive, 25.8% hyperglycemic	Highlights need for community-focused health promotion

Serebryakova et al.[39]	Screening among 483 female teachers	High prevalence of lipid and carbohydrate metabolism disorders	Workplace screening is effective for identifying metabolic risk factors

The method of computed tomography (CT) angiography remains the "gold" standard for diagnosing vascular pathology. The next advancement was the use of intravascular ultrasound, an invasive technique, which revolutionized our understanding of atherosclerosis and enabled early detection of pathological changes in vessel walls. Today, comprehensive diagnostic information for identifying atherosclerosis includes blood serum lipid levels, HS CRP, coronary risk factors, ultrasound of brachiocephalic vessels, and CT angiography. In cases with clinical manifestations of atherosclerosis, invasive methods like intravascular ultrasound should also be used for specific arterial regions.[13,33]

In a study familial hypercholesterolemia as a leading cause of early cardiovascular diseases and a frequent disorder of lipid metabolism in children. Cascade screening on the "child-parent" path for the diagnosis of familial hypercholesterolemia. As a result, 34 children diagnosed with "heterozygous familial hypercholesterolemia" with an average age of 8.7 years were identified during the indicated period. After screening relatives, 33 parents, 15 siblings, and 56 second relatives were diagnosed with FHC. Most of the parents diagnosed with FHC also had cardiovascular disease. In conclusion: "child-parent" cascade screening led to the detection of three new cases of FHC per child-proband, which highlights the importance of early diagnosis and control of this disease in a family context.[40-42]

The high value of determining early cardiovascular disease risk in both children and adults using Electrocardiography (ECG) Dispersion Mapping Method for Screening the Risk of Cardiovascular Diseases is evident. Screening methods are vital in this process, but issues with accessibility and efficiency remain. The study explores the use of ECG dispersion mapping for cardiac screening to identify individuals at high risk of CVD. The study involved 500 adults and 300 children, with informed consent and ethics committee approval. Results demonstrated the effectiveness of ECG dispersion mapping in identifying at-risk patients, highlighting its potential to improve early detection, prognosis, and prevention of cardiovascular diseases when integrated into medical practice.[34] The advances in diagnostic methods are thoroughly described in Table 4.

Table 4.
Advances in Diagnostic Methods

Study/ Author	Method	Key Outcomes	Clinical Implications
Fedotova E., et al.[22]	Contrast enchanced CT angiography	Precise quantification of vessel narrowing	Gold standard for vascular surgical planning
Bulanova N. et al.[43]	ECG dispersion mapping	Effective in identifying high-risk patients for CVD	Promotes early detection and prognosis improvement
Shaw L. J. et al.[44]	Subclinical atherosclerosis imaging	Plaque prevalence often exceeds traditional risk factors	Calls for more intensive assessment to improve risk stratification
Abbott A. L. et al.[45]	Routine imaging for subclinical atherosclerosis	Raised concerns over complications and incidental findings	Routine imaging not yet recommended due to insufficient data

A study to assess how atherosclerosis impacts functional activity in elderly patients involved 99 patients aged 65 and older with atherosclerosis, treated at a hospital in Belgorod. Functional activity was evaluated using the Barthel index, and ASCVD were identified through clinical examination and history. The study

found that the severity of functional impairment depended on which arteries were affected, with lower extremity atherosclerosis causing the most significant limitations in activities such as dressing, moving, and climbing stairs. Factors like previous myocardial infarction or coronary artery bypass surgery also influenced functional activity. These findings are valuable for optimizing treatment and rehabilitation strategies for elderly patients with atherosclerosis.[46]

In a study aimed to investigate the relationship between total cardiovascular risk and fracture risk in women without clinical signs of atherosclerosis involved 200 women aged 45-69, with cardiovascular risk assessed using the SCORE scale and fracture risk evaluated through the FRAX calculator. Bone mineral density (BMD) was measured by X-ray absorptiometry. Results showed that 36% of women had low, 62% had average, and 2% had high cardiovascular risk. Among 128 women with a SCORE ≥1, 26% had osteoporosis and 34% had osteopenia. An inverse relationship between BMD and cardiovascular risk and a positive relationship between BMD and fracture risk were found. The study suggests that assessing both CVD and fracture risk together can aid in early prevention and improve patient care.[47]

A survey of young people who did not visit a cardiologist and patients diagnosed with vascular atherosclerosis showed that women (53.3%) predominated among the respondents, most of them (60%) were overweight. Only 20% of respondents smoked, but 80% drank alcohol frequently. All respondents had a blood relative who had a stroke or heart attack. Most of them (73.3%) had high blood pressure, only 33.3% knew what atherosclerosis is. The vast majority (66.7%) did not visit a neurologist, only 33.3% monitored their blood sugar level. Despite this, only 33.3% were aware of atherosclerosis. The results of the study indicate the need to increase public awareness of the risk factors and prevention of atherosclerosis through educational materials and a more intensive medical dialogue with patients.[48]

An analysis of the effectiveness of screening for lipid metabolism disorders and obesity in health centers, analyzing data from 3,049 working-age individuals between 2015 and 2016 determined that 50.9% had health risk factors, and 49.1% were healthy. Additionally, 65.2% had body parameter abnormalities, and 34.8% had hypercholesterolemia. After attending health school, 48% of participants saw a reduction in cholesterol, and 5.5% lost weight, particularly among those aged 18-30. This underscores the importance of screening in preventing cardiovascular diseases.[49]

Andrew H. et al . highlight the importance of assessing vascular health in children with cardiovascular risk factors. It reviews recent research showing that these children exhibit adverse changes in vascular health indicators, such as pulse wave velocity, arterial distensibility, and carotid intima-media thickness, which may signal an increased risk for cardiovascular disease. Despite challenges in measuring vascular condition due to children's physiological differences and insufficient normative data, the authors suggest that such assessments could be valuable for risk stratification and early intervention. The article calls for future research to expand normative data, improve measurement standardization, and conduct longitudinal studies linking childhood risk factors to adult cardiovascular outcomes.[50]

Lozano, P. et al. reviewed evidence on childhood and adolescent lipid screening to update USPSTF recommendations. The review found no direct evidence linking screening to adult health, intermediate outcomes, harms, or treatment effects, as no randomized controlled trials were conducted. A total cholesterol level of 200 mg/dL is a strong predictor of dyslipidemia. Screening was most effective in overweight children (9-11 years) and adolescents (16-19 years), with successful results in Appalachian communities. Dietary changes showed no negative impact on growth. However, studies did not find a clear association between cholesterol levels in youth and early death, though high cholesterol in women, especially with familial hypercholesterolemia, may be linked to early death. The article concludes that while some effectiveness was found (5.8%), long-term studies are needed to assess health risks and revise cholesterol standards.[51]

Shaw L.J. et al. emphasizes the need to study atherosclerotic plaques and their link to cardiovascular risk. Research shows plaque prevalence often exceeds traditional risk factors, suggesting more intensive assessment is needed. The results showed even low-risk patients can have atherosclerosis, indicating the need for further evaluation. Data from SCOTT-HEART2 and ROBINSYA will help clarify the role of CTO in screening asymptomatic patients and reducing cardiovascular events.[44]

Abbott A.L. concluded that while imaging of "subclinical" atherosclerosis could be an independent risk factor for future complications, routine screening of asymptomatic individuals is not yet advisable. The article highlights concerns, such as potential complications from screening (e.g., cerebral ischemic events, radiation side effects in 12% of cases) and incidental findings in 36% of cases. Abbott calls for further research to assess the ability of imaging to improve risk stratification, personalize care, and determine optimal screening methods to predict complications.[45]

The screening methodology for FHC and pediatrics are described in Table 5.

Table 5.
Familial Hypercholesterolemia and Pediatric Screening

Study / Program	Methodology	Key Findings	Importance
Wald, D. et al.[42]	«Child-parent» cascade screening	Diagnosed 34 children and 104 relatives with hypercholesterolemia	Cascade screening significantly increases detection rates in families
Becker, M. et al.[52]	Targeted screening for FHC among relatives	24.1% diagnosed with FHC	Early diagnosis aids prevention of cardiovascular diseases
Groselj, U. et al.[33]	Genetic testing and cascade screening	Reduced mortality over 20 years but discontinued due to funding	Demonstrates the long-term success of national FH screening programs

Discussion

The findings from this systematic review emphasize the potential benefits of implementing a nationwide atherosclerosis screening program in Kazakhstan. Evidence from countries with established screening protocols, such as the United States, the UK, and Canada, demonstrates the effectiveness of targeted screenings in reducing cardiovascular disease prevalence and mortality. For example, the U.S. tracks atherosclerosis statistics through the CDC, showing a high number of outpatient visits for coronary atherosclerosis and ischemic heart diseases.[13] Similarly, the UK's NHS conducts regular cardiovascular screenings, including cholesterol and blood pressure checks, which have proven effective in reducing CVD risk.[14]

Introducing similar programs in Kazakhstan, particularly targeting familial hypercholesterolemia and other high-risk groups, could significantly reduce the incidence of atherosclerosis and related mortality. International studies have demonstrated the effectiveness of cascade screening for FHC, which allows for early detection and treatment within families, thereby reducing the long-term health burden.[3,11,21]

Limitations. This study has several limitations that should be considered when interpreting the findings. First, the generalizability of the results is somewhat limited due to the variability in healthcare systems between countries. Most of the studies included in the review were conducted in countries with advanced healthcare infrastructures, which may not be directly applicable to Kazakhstan's current healthcare con-

text. Second, while the review emphasizes the economic benefits of a nationwide screening program, more region-specific economic evaluations are needed, particularly considering Kazakhstan's diverse rural and urban populations.

What is Known? Globally, it is well-established that dyslipidemia, particularly elevated cholesterol levels, is a major risk factor for cardiovascular diseases. High cholesterol is responsible for approximately 4.4 million deaths annually and contributes significantly to strokes and coronary artery disease. Early detection through screening is a proven strategy to mitigate these risks. The World Health Organization highlights that 85% of cardiovascular complications can be prevented through timely interventions such as screening for dyslipidemia and hypertension.

What is New? This review provides a unique contribution by evaluating the applicability of international atherosclerosis screening models specifically for Kazakhstan. It underscores the need for a tailored approach that considers Kazakhstan's specific demographic and healthcare needs. Unlike previous studies that focused on high-income countries, this review addresses the gap in literature regarding the implementation of cardiovascular screening programs in low- and middle-income countries, particularly in Kazakhstan, where healthcare access is more variable.

Conclusion

The general literature review emphasizes that screening is the most effective way to combat atherosclerosis, and its success is evident in global practice and the history of early disease prevention. Demonstrating the societal value and effectiveness of screening, and subsequently integrating it into medical practice, remains critical. In the same way that early detection through screening has become standard practice for diseases such as breast cancer, cervical cancer and tuberculosis, atherosclerosis should also be detected at an early stage in cardiovascular disease. Widespread population screening, if made routine, could significantly reduce the global statistics of cardiovascular disease as the leading cause of death. The economics of screening have also been demonstrated.

Acknowledgements. None.

Authors contribution. Conceptualization – S.D., M.B..; methodology – S.D., M.B.; verification – S.D., G.D.; formal analysis – A. T.; writing (original draft preparation) – A.T., K.T.; writing (review and editing) – A.T., K.T., G.D.

Funding. The study was funded by the Committee of Science of the Ministry of Science and Higher Education of the Republic of Kazakhstan (grant No. BR21881970, Title: Development of new methods of screening, prevention and treatment of cardiovascular diseases of atherosclerotic genesis to prevent early mortality in patients with atherosclerosis). The sponsors had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

References

1. Sagan A, McDaid D, Rajan S, Farrington J, McKee M. Screening: When is it appropriate and how can we get it right? 2020. European Observatory Policy Briefs.
2. Weber W, Heins A, Jardine L, Stanford K, Duber H. Principles of Screening for Disease and Health Risk Factors in the Emergency Department. Ann Emerg Med. May 2023;81(5):584-591. doi:10.1016/j.annemergmed.2022.06.015
3. Bekbossynova MS, Ivanova-Razumova TV, Dzhetybayeva SK, Oralbekova ZO. Cardiology Service of Kazakhstan Today: Acute Coronary Syndrome, Chronic Heart Failure, Atherosclerosis. Kardiologiia. Jan 31 2024;64(1):34-36. doi:10.18087/cardio.2024.1.n2580
4. Shamsutdinova A, Turdaliyeva B, Tanabayeva S, et al. Screening for Breast, Cervical and Prostate Cancers in Kazakhstan: Key Factors and Psychological Aspects. Asian Pac J Cancer Prev. Jul 1 2023;24(7):2515-2522. doi:10.31557/APJCP.2023.24.7.2515
5. Roth GA, Mensah GA, Johnson CO, et al. Global Burden of Cardio-

vascular Diseases and Risk Factors, 1990-2019: Update From the GBD 2019 Study. J Am Coll Cardiol. Dec 22 2020;76(25):2982-3021. doi:10.1016/j.jacc.2020.11.010
6. India State-Level Disease Burden Initiative CVDC. The changing patterns of cardiovascular diseases and their risk factors in the states of India: the Global Burden of Disease Study 1990-2016. Lancet Glob Health. Dec 2018;6(12):e1339-e1351. doi:10.1016/S2214-109X(18)30407-8
7. Brant LCC, Nascimento BR, Veloso GA, et al. Burden of Cardiovascular diseases attributable to risk factors in Brazil: data from the "Global Burden of Disease 2019" study. Rev Soc Bras Med Trop. 2022;55(suppl 1):e0263. doi:10.1590/0037-8682-0263-2021
8. Kochanek KD, Murphy SL, Xu J, Arias E. Deaths: Final Data for 2017. Natl Vital Stat Rep. Jun 2019;68(9):1-77.
9. Chen H, Liu L, Wang Y, et al. Burden of cardiovascular disease attributable to metabolic risks in 204 countries and territories from 1990 to 2021. Eur Heart J Qual Care Clin Outcomes. Oct 23 2024;doi:10.1093/ehjqcco/qcae090
10. Lv J, Yang C, Yang X. The global burden of cardiovascular disease attributable to diet high in sugar-sweetened beverages among people aged 60 years and older: an analysis for the global burden of disease study 2019. Front Public Health. 2024;12:1366286. doi:10.3389/fpubh.2024.1366286
11. Bekbossynova M, Ivanova-Razumova T, Ablayeva A, Oralbekova Z. Establishment of an Atherosclerosis and Dyslipidemia Program in Kazakhstan. Mayo Clin Proc. Nov 2024;99(11):1698-1701. doi:10.1016/j.mayocp.2024.05.023
12. Kulak MJ, Los Angeles WL, Daniels TE, et al. Increased Cardiometabolic Risk in Healthy Young Adults With Early Life Stress. Psychosom Med. Feb-Mar 01 2024;86(2):72-82. doi:10.1097/PSY.0000000000001273
13. Mehta A, Shapiro MD. Apolipoproteins in vascular biology and atherosclerotic disease. Nat Rev Cardiol. Mar 2022;19(3):168-179. doi:10.1038/s41569-021-00613-5
14. Mehta N, Myrskyla M. The Population Health Benefits Of A Healthy Lifestyle: Life Expectancy Increased And Onset Of Disability Delayed. Health Aff (Millwood). Jul 19 2017;doi:10.1377/hlthaff.2016.1569
15. Timmis A, Townsend N, Gale C, et al. European Society of Cardiology: Cardiovascular Disease Statistics 2017. Eur Heart J. Feb 14 2018;39(7):508-579. doi:10.1093/eurheartj/ehx628
16. Liu M, Yao C, Liu S, et al. Intelligent response micelles with high andrographolide loading for the effective treatment of atherosclerosis. Int J Pharm. Nov 15 2024;665:124705. doi:10.1016/j.ijpharm.2024.124705
17. Kronenberg F, Mora S, Stroes ESG, et al. Frequent questions and responses on the 2022 lipoprotein(a) consensus statement of the European Atherosclerosis Society. Atherosclerosis. Jun 2023;374:107-120. doi:10.1016/j.atherosclerosis.2023.04.012
18. Cuchel M, Raal FJ, Hegele RA, et al. 2023 Update on European Atherosclerosis Society Consensus Statement on Homozygous Familial Hypercholesterolaemia: new treatments and clinical guidance. Eur Heart J. Jul 1 2023;44(25):2277-2291. doi:10.1093/eurheartj/ehad197
19. Fan J, Kitajima S, Watanabe T, et al. Rabbit models for the study of human atherosclerosis: from pathophysiological mechanisms to translational medicine. Pharmacol Ther. Feb 2015;146:104-19. doi:10.1016/j.pharmthera.2014.09.009
20. Fernandez-Garcia P, Malet-Engra G, Torres M, et al. Evolving Diagnostic and Treatment Strategies for Pediatric CNS Tumors: The Impact of Lipid Metabolism. Biomedicines. May 5 2023;11(5)doi:10.3390/biomedicines11051365
21. Supiyev A, Nurgozhin T, Zhumadilov Z, Peasey A, Hubacek JA, Bobak M. Prevalence, awareness, treatment and control of dyslipidemia in older persons in urban and rural population in the Astana region, Kazakhstan. BMC Public Health. Aug 11 2017;17(1):651. doi:10.1186/s12889-017-4629-5
22. Fedotova EJ, Popov VA, Malyavsky LY,

Seyentsov VJ. Atherosclerosis of Abdominal Aorta in a Population of the Northern Part of European Russia. Klin Med (Mosk). 2016;94(4):276-279.
23. Boytsov SA, Pogosova NV, Oganov RG, et al. [Efficacy of primary prevention for atherosclerosis-induced diseases in patients with high cardiovascular risk in Russia and other European countries (Part 1)]. Kardiologiia. SJan 2017;57(S1):333-344. doi:10.18087/cardio.2411
24. Ignatyeva VI, Voznyuk IA, Shamalov NA, Reznik AV, Vinitskiy AA, Derkach EV. [Social and economic burden of stroke in Russian Federation]. Zh Nevrol Psikhiatr Im S S Korsakova. 2023;123(8. Vyp. 2):5-15. Sotsial'no-ekonomicheskoe bremya insul'ta v Rossiiskoi Federatsii. doi:10.17116/jnevro20231230825
25. Pan X, Liu J, Zhong L, et al. Identification of lipid metabolism-related biomarkers for diagnosis and molecular classification of atherosclerosis. Lipids Health Dis. Jul 6 2023;22(1):96. doi:10.1186/s12944-023-01864-6
26. Busnelli M, Manzini S, Colombo A, et al. Lack of ApoA-I in ApoE-KO Mice Causes Skin Xanthomas, Worsening of Inflammation, and Increased Coronary Atherosclerosis in the Absence of Hyperlipidemia. Arterioscler Thromb Vasc Biol. Jul 2022;42(7):839-856. doi:10.1161/ATVBAHA.122.317790
27. Michos ED, McEvoy JW, Blumenthal RS. Lipid Management for the Prevention of Atherosclerotic Cardiovascular Disease. N Engl J Med. Oct 17 2019;381(16):1557-1567. doi:10.1056/NEJMra1806939
28. Moiynbayeva S, Akhmetov V, Narymbayeva N, et al. Health policy implications for cardiovascular disease, type 2 diabetes mellitus, and stroke in Central Asia: a decadal forecast of their impact on women of reproductive age. Front Public Health. 2024;12:1456187. doi:10.3389/fpubh.2024.1456187
29. Duarte Lau F, Giugliano RP. Lipoprotein(a) and its Significance in Cardiovascular Disease: A Review. JAMA Cardiol. Jul 1 2022;7(7):760-769. doi:10.1001/jamacardio.2022.0987
30. Parini P, Frikke-Schmidt R, Tselepis AD, et al. Taking action: European Atherosclerosis Society targets the United Nations Sustainable Development Goals 2030 agenda to fight atherosclerotic cardiovascular disease in Europe. Atherosclerosis. Apr 2021;322:77-81. doi:10.1016/j.atherosclerosis.2021.02.007
31. von Eckardstein A. Implications of Europe's Plan S for Atherosclerosis. Atherosclerosis. Jan 2019;280:202-203. doi:10.1016/j.atherosclerosis.2018.12.007
32. Sanin V, Schmieder R, Ates S, et al. Population-based screening in children for early diagnosis and treatment of familial hypercholesterolemia: design of the VRONI study. Med Genet. Apr 2022;34(1):41-51. doi:10.1515/medgen-2022-2115
33. Groselj U, Kovac J, Sustar U, et al. Universal screening for familial hypercholesterolemia in children: The Slovenian model and literature review. Atherosclerosis. Oct 2018;277:383-391. doi:10.1016/j.atherosclerosis.2018.06.858
34. Souto AC, Miname MH, Fukushima J, et al. Health related quality of life in individuals at high risk for familial hypercholesterolemia undergoing genetic cascade screening in Brazil. Atherosclerosis. Oct 2018;277:464-469. doi:10.1016/j.atherosclerosis.2018.05.036
35. Bauman CD, Bauman JM, Mourao DM, et al. Dyslipidemia prevalence in adolescents in public schools. Rev Bras Enferm. 2020;73(3):e20180523. doi:10.1590/0034-7167-2018-0523
36. Lakunchykova O, Averina M, Wilsgaard T, et al. Why does Russia have such high cardiovascular mortality rates? Comparisons of blood-based biomarkers with Norway implicate non-ischaemic cardiac damage. J Epidemiol Community Health. Sep 2020;74(9):698-704. doi:10.1136/jech-2020-213885
37. Polyakov DS, Fomin IV, Belenkov YN, et al. Chronic heart failure in the Russian Federation: what has changed over 20 years of follow-up? Results of the EPOCH-CHF study. Kardiologiia. Mar 23 2021;61(4):4-14. doi:10.18087/cardio.2021.4.n1628
38. Collins D, Inglin L, Laatikainen T, et

al. Evaluation and pilot implementation of essential interventions for the management of hypertension and prevention of cardiovascular diseases in primary health care in the Republic of Tajikistan. BMC Health Serv Res. May 18 2021;21(1):472. doi:10.1186/s12913-021-06490-5
39. Chugunova A, Loseva E, Mazin P, et al. LINC00116 codes for a mitochondrial peptide linking respiration and lipid metabolism. Proc Natl Acad Sci U S A. Mar 12 2019;116(11):4940-4945. doi:10.1073/pnas.1809105116
40. Deniz MF, Guven B, Ebeoglu AO, et al. Screening for Subclinical Atherosclerosis in Patients with Familial Hypercholesterolemia: Insights and Implications. J Clin Med. Jan 20 2025;14(2)doi:10.3390/jcm14020656
41. Reamy BV. Familial Hypercholesterolemia: Screening, Diagnosis, and Treatment. Am Fam Physician. Sep 2024;110(3):226.
42. Wald DS, Wald NJ. Integration of child-parent screening and cascade testing for familial hypercholesterolaemia. J Med Screen. Jun 2019;26(2):71-75. doi:10.1177/0969141318796856
43. Bulanova N, Ivanov G. [Ecg Dispersion Mapping: Ability to Predict the Patients' Prognosis (Review)]. Georgian Med News. Feb 2019;(287):73-78.
44. Shaw LJ, Chandrashekhar Y. Unfolding the Importance of Subclinical Atherosclerosis: Is it Time to Start Population Screening? JACC Cardiovasc Imaging. Sep 2022;15(9):1680-1681. doi:10.1016/j.jcmg.2022.08.001
45. Abbott AL. Are We Ready for Routine 'Subclinical' Atherosclerosis Screening? Not Yet. Eur J Vasc Endovasc Surg. Sep 2016;52(3):313-6. doi:10.1016/j.ejvs.2016.06.002
46. Hung CL, Goncalves A, Shah AM, Cheng S, Kitzman D, Solomon SD. Age- and Sex-Related Influences on Left Ventricular Mechanics in Elderly Individuals Free of Prevalent Heart Failure: The ARIC Study (Atherosclerosis Risk in Communities). Circ Cardiovasc Imaging. Jan 2017;10(1)doi:10.1161/CIRCIMAGING.116.004510
47. Barzilay JI, Buzkova P, Cauley JA, Robbins JA, Fink HA, Mukamal KJ. The associations of subclinical atherosclerotic cardiovascular disease with hip fracture risk and bone mineral density in elderly adults. Osteoporos Int. Oct 2018;29(10):2219-2230. doi:10.1007/s00198-018-4611-9
48. Raitakari O, Pahkala K, Magnussen CG. Prevention of atherosclerosis from childhood. Nat Rev Cardiol. Aug 2022;19(8):543-554. doi:10.1038/s41569-021-00647-9
49. Witczak-Sawczuk K, Ostrowska L, Cwalina U, Leszczynska J, Jastrzebska-Mierzynska M, Hladunski MK. Estimation of the Impact of Abdominal Adipose Tissue (Subcutaneous and Visceral) on the Occurrence of Carbohydrate and Lipid Metabolism Disorders in Patients with Obesity-A Pilot Study. Nutrients. Apr 26 2024;16(9)doi:10.3390/nu16091301
50. Tran AH, Urbina EM. Is There a Role for Imaging Youth at Risk of Atherosclerosis? Curr Atheroscler Rep. Apr 2023;25(4):119-126. doi:10.1007/s11883-023-01089-z
51. Lozano P, Henrikson NB, Morrison CC, et al. Lipid Screening in Childhood and Adolescence for Detection of Multifactorial Dyslipidemia: Evidence Report and Systematic Review for the US Preventive Services Task Force. JAMA. Aug 9 2016;316(6):634-44. doi:10.1001/jama.2016.6423
52. Becker M, Adamski A, Fandel F, et al. Screening for familial hypercholesterolaemia in primary school children: protocol for a cross-sectional, feasibility study in Luxembourg city (EARLIE). BMJ Open. Dec 9 2022;12(12):e066067. doi:10.1136/bmjopen-2022-066067

Профессору Т.Ж. Егембердиеву – 75 лет

6 января 2025 г. исполнилось 75 лет со дня рождения и 53 года научно-практической деятельности одному из ведущих сердечно-сосудистых хирургов РК, доктору медицинских наук, профессору Толегену Жанылбековичу Егембердиеву.

В студенческие годы Т.Ж. Егембердиев проявил интерес к научно-исследовательской работе, выступил с докладом на Всесоюзной студенческой конференции. Темой выступления называлась «Порто-артериальный анастомоз при портальной гипертензии» (г. Целиноград, 1972). После окончания в 1972 г. с отличием лечебного факультета Алма-Атинского государственного медицинского института (ныне – Казахский Национальный Медицинский Университет им. С.Д. Асфендиярова) Т.Ж. Егембердиев направлен на работу в практическое здравоохранение.

С 1972 по 1976 гг., работая в должности хирурга-ординатора Жамбылской областной больницы, под руководством известного хирурга, Заслуженного врача Казахской ССР Н.О. Мукышева, он продолжил научные исследования, публикации и выступления по актуальным вопросам хирургии: «Острая кишечная непроходимость», «Кровотечение из язв желудка и 12-перстной кишки», которые обсуждались на XXI-XXII Пленумах хирургов Казахстана (1975, 1976 гг.).

С 1976 по 1978 гг. Т.Ж. Егембердиев прошел клиническую ординатуру по сердечно-сосудистой хирургии в Казахском НИИ клинической и экспериментальной хирургии имени А.Н.Сызганова (ныне Национальный Научный Центр Хирургии им. А.Н. Сызганова). И с того времени трудовой путь и научное становление Т.Ж. Егембердиева, как хирурга-новатора, ученого тесно связаны с отделом сердечно-сосудистой хирургии названного института.

Начав трудовую деятельность с должности младшего научного сотрудника отделения сосудистой хирургии, он прошел все ступени научного и практического роста, став доктором медицинских наук, профессором.

На протяжении длительного периода времени Т.Ж. Егембердиев являлся ответственным исполнителем и руководителем Всесоюзных и Республиканских научных тем, посвященных актуальным проблемам сердечно-сосудистой хирургии. Он принимал активное участие в разработке и внедрении новых типов реконструктивно-восстановительных операций при врожденной и приобретенной патологии аорты и магистральных артерий, а также при различных заболеваниях вен.

Многолетние научные труды Т.Ж. Егембердиева были тесно связаны с научно-исследовательскими работами в области сердечно-сосудистой хирургии (получение искусственных клапанов сердца и сосудов) Российского научного центра хирургии имени Б.В. Петровского и Медицинской академии имени И.М. Сеченова (г. Москва), с известными российским учеными: академиком Б.А. Константиновым, профессорами И.А. Сыченковым, В.А. Козловым, С.Л. Дземешкевичем, А.И. Ивановым. Предложенные Т.Ж. Егембердиевым биопротезы сосудов нового типа с 1979 г. широко используются в хирургическом лечении заболеваний аорты и магистральных артерий, а также при аллотрансплантации почек, причем не только в Республике Казахстан, но и за его пределами.

Результаты научно-исследовательских работ Т.Ж. Егембердиева легли в основу успешно защищенных кандидатской и докторской диссертаций: «Применение ксенобиопротезов при лечении окклюзионных заболеваний артерий нижних конечностей» (1984 г., Москва), «Сосуди-

стые заменители в хирургическом лечении окклюзионных поражений брюшной аорты и магистральных артерий нижних конечностей» (2005 г.).

Т.Ж. Егембердиев вложил много сил и научного труда в организацию Республиканского центра сосудистой хирургии, областных центров сосудистой хирургии в Шымкенте, Семее, Павлодаре, Актау, Атырау и становление Жамбылского областного центра сосудистой хирургии (1978 г.), а также в подготовку специалистов-ангиохирургов перечисленных центров, обучая их непосредственно в операционной.

Т.Ж. Егембердиев – яркий ученый, бескорыстный наставник, много труда и сил вкладывает в подготовку молодых ученых и врачей-хирургов в области сердечно-сосудистой хирургии. Он является членом Республиканского специализированного ученого совета (Д.09.07.01) по присуждению ученой степени доктора медицинских наук по специальностям «Хирургия» и «Сердечно-сосудистая хирургия» при ННЦХ им. А.Н. Сызганова.

В 2002 г. Т.Ж. Егембердиев перешел на кафедру «Хирургические болезни №3» Казахского Национального Медицинского Университета имени С.Д. Асфендиярова, где прошел все ступени научно-педагогического роста от ассистента, доцента, доктора медицинских наук и профессора кафедры.

Т.Ж. Егембердиев – хирург высшей категории, отличник здравоохранения (1992 г.), член Российского общества сердечно-сосудистых хирургов (1992 г.), ангиологов и сосудистых хирургов (1994 г.), Ассоциации сердечно-сосудистых хирургов Средней Азии и Казахстана (2003 г.), Ассоциации флебологов Казахстана (2006 г.), неоднократно принимал участие в многочисленных международных хирургических форумах, в том числе на медицинском конгрессе тюркоязычных народов (Турция, г. Кайсар, 1994 г.), где блестяще выступил с докладом на тему «Клинические результаты применения биопротезов сосудов нового типа».

В 2007 году, профессор Егембердиев Т.Ж. организовал курс, а через год кафедру «Сердечно-сосудистой хирургии», впервые в истории КазНМУ им. С.Д. Асфендиярова, на базе городского кардиохирургического центра БСМП г. Алматы.

Во всех областных центрах и Республиканском кардиохирургическом центре кафедра внедрила технику применения стент-графта при аневризме торако-абдоминального отдела аорты. Благодаря научным разработкам профессора Егембердиева Т.Ж. внедрены в практику новые технологии стентирования и шунтирования коронарных артерий при атеросклерозе и окклюзии сердечных сосудов.

Кафедра подготовила более 150 специалистов по флебологии и ангиохирургии для кардиохирургических центров Республики Казахстан,

Профессор Егембердиев Т.Ж. имеет 6 патентов на изобретение и авторские свидетельства, автор более 170 научных трудов, опубликованных в международных и республиканских медицинских изданиях. В настоящее время профессор Т.Ж. Егембердиев работает над подготовкой монографий, посвященных результатам многолетних научных исследований и практической деятельности в области сердечно-сосудистой хирургии и учебников по хирургии.

Свой юбилей Т.Ж. Егембердиев, ученый, педагог, талантливый хирург встречает полным сил, энергии, новых творческих планов и идей для дальнейшего развития кардиохирургии Республики Казахстан.

Коллеги и ученики от всей души поздравляют дорогого друга и учителя, человека с большой буквы с юбилеем, желают ему крепкого здоровья, счастья, семейного благополучия и успехов в научно-практической и педагогической деятельности на благо здоровья народа Казахстана.

Профессор кафедры «Общей хирургии и топографической анатомии» КазНМУ им. С.Д. Асфендиярова
А.С. Ибадильдин