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TRENDS AND PATTERNS OF MALE REPRODUCTIVE SYSTEM DISEASES IN THE CONTEXT OF MEDICAL AND DEMOGRAPHIC INDICATORS. LITERATURE REVIEW

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Abstract

Introduction: Male infertility, affecting every sixth man worldwide [5], is a pressing and complex medical and social issue that influences national demographic indicators, the psycho-emotional well-being of individual families, and public health at large. In Kazakhstan, there is a rising incidence of congenital reproductive system pathologies in boys, declining spermogram parameters, and inadequate organization of specialized andrological care.

Objective: to analyze the scientific literature in order to identify the main trends and patterns of male reproductive system diseases in the context of medico-demographic indicators (male birth and fertility rates, reproductive health parameters, and socio-demographic consequences).

Search strategy: scientific publications from the past 10 years were reviewed through databases such as Scopus, PubMed, Web of Science, CyberLeninka, among others. Additionally, Legal information system of Regulatory Legal Acts of the Republic of Kazakhstan "Әділет" and statistical data from the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan were examined, including regional demographic indicators of the male population and the structure of andrological diseases.

Research results: key factors contributing to the rise of male infertility were identified, including a high prevalence of varicocele (up to 40% among infertile men), delayed marriage, increasing divorce rates, and limited access to andrological care. These trends are linked to changes in male lifestyles, comorbidities, and environmental deterioration. Until 2017, specialized andrological medical care in Kazakhstan was underdeveloped; since 2022, fragmented initiatives have been introduced, but coverage remains insufficient. The absence of a unified registry, comprehensive prevention programs, and coordination across healthcare system levels hampers effective solutions.

Conclusions: to date, male reproductive health remains one of the underexplored areas of medicine and healthcare. Literature analysis revealed the need to develop a national strategy and an organizational-functional model for the male reproductive health system, including the creation of a registry for men experiencing infertility, development of andrological services, expansion of preventive programs, and interdepartmental cooperation.

Key words: *men, male reproductive health, male infertility, demography, andrology, Kazakhstan, trends, patterns, prevention.*

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Резюме

ТЕНДЕНЦИИ И ЗАКОНОМЕРНОСТИ ЗАБОЛЕВАНИЙ РЕПРОДУКТИВНОЙ СИСТЕМЫ МУЖЧИН В КОНТЕКСТЕ МЕДИКО-ДЕМОГРАФИЧЕСКИХ ПОКАЗАТЕЛЕЙ. ОБЗОР ЛИТЕРАТУРЫ

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Введение: Проблема мужского бесплодия, затрагивающая каждого шестого человека в мире [5] является актуальной комплексной медико-социальной проблемой, оказывающей влияние на демографические показатели стран, психоэмоциональное состояние отдельной семьи и общественное здоровье в целом. В Казахстане отмечается увеличение числа случаев врожденной патологии репродуктивной системы среди мальчиков, снижение показателей спермограммы и недостаточная организация специализированной андрологической помощи.

Цель исследования: анализ литературы для выявления основных тенденций и закономерностей заболеваний репродуктивной системы мужчин в контексте медико-демографических показателей (уровень рождаемости и фертильности мужчин, показатели репродуктивного здоровья, социально-демографические последствия).

Стратегия поиска: поиск научной литературы в базах данных Scopus, PubMed, Web of Science, CyberLeninka и др., глубиной поиска в 10 лет. Также проведен анализ информационно-правовой базы нормативных правовых актов Республики Казахстан «Әділет» (далее – ИПС НПА «Әділет») и статистических данных Комитета по статистике Министерства национальной экономики РК (МНЭ РК), региональных демографических показателей мужской популяции, структуры андрологических заболеваний.

Результаты исследования: среди многочисленной информации были идентифицированы ключевые факторы, способствующие росту бесплодия среди мужчин, такие как: высокая распространенность варикоцеле (до 40% у бесплодных мужчин), позднее вступление в брак, рост числа разводов, ограниченные возможности получения андрологической помощи. Эти тенденции связаны с изменением образа жизни мужчин, наличием сопутствующих заболеваний и ухудшением экологии. До 2017 года в Казахстане специализированная медицинская помощь в области андрологии была развита слабо; с 2022 года внедряются фрагментарные инициативы, однако масштабы охвата остаются недостаточными. Отсутствие единого регистра, комплексных профилактических программ и координации между звеньями системы здравоохранения затрудняют решение проблемы.

Выводы: на сегодняшний день репродуктивное здоровье мужчин представляет собой одну из недостаточно изученных сфер медицины и системы здравоохранения. Анализ литературы выявил необходимость разработки национальной стратегии и организационно-функциональной модели системы охраны репродуктивного здоровья мужчин, включающей создание регистра мужчин, испытывающих трудности с зачатием, развитие андрологических служб, расширение спектра профилактических программ и межведомственное взаимодействие.

Ключевые слова: *мужчины, репродуктивное здоровье мужчин, мужское бесплодие, демография, андрология, Казахстан, тенденции, закономерности, профилактика.*

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Түйіндеме

МЕДИЦИНАЛЫҚ-ДЕМОГРАФИЯЛЫҚ КӨРСЕТКІШТЕР КОНТЕКСТІСІНДЕГІ ЕРЛЕРДІҢ РЕПРОДУКТИВТІК ЖҮЙЕСІ АУРУЛАРЫНЫҢ ҮРДІСТЕРІ МЕН ЗАҢДЫЛЫҚТАРЫ. ӘДЕБИЕТТІК ШОЛУ

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Кіріспе: Әлемдегі әрбір алтыншы ер адамға әсер ететін ерлер бедеулігі мәселесі [5] – бұл елдердің демографиялық көрсеткіштеріне, жекелеген отбасылардың психоэмоционалдық жағдайына және жалпы қоғамдық денсаулыққа ықпал ететін өзекті әрі күрделі медициналық-әлеуметтік мәселе болып табылады. Қазақстанда ер балалар арасында репродуктивтік жүйенің туа біткен патологияларының жиілегені, спермограмма көрсеткіштерінің төмендеуі және мамандандырылған андрологиялық көмектің жеткіліксіз ұйымдастырылғаны байқалады.

Зерттеудің мақсаты: ерлердің репродуктивтік жүйесі ауруларының негізгі үрдістері мен заңдылықтарын медицина-демографиялық көрсеткіштер (ерлердің туу және ұрпақ әкелу деңгейі, репродуктивтік денсаулық көрсеткіштері, әлеуметтік-демографиялық салдарлар) контекстінде анықтау үшін ғылыми әдебиеттерге шолу жүргізу.

Іздеу стратегиясы: соңғы 10 жыл ішінде жарық көрген ғылыми әдебиеттер Scopus, PubMed, Web of Science, CyberLeninka және басқа да мәліметтер базаларында ізделді. Сонымен қатар, Қазақстан Республикасы нормативтік

құқықтық актілерінің «Әділет» ақпараттық-құқықтық жүйесі (НҚА «Әділет» АҚЖ) мен ҚР Ұлттық экономика министрлігінің статистика Комитетінің, сондай-ақ аймақтық демографиялық мәліметтер мен андрологиялық аурулар құрылымының деректері талданды.

Зерттеу нәтижелері: Ерлер бедеулігінің артуына әсер ететін негізгі факторлар анықталды: варикоцеленің жоғары таралуы (бедеу ерлер арасында 40%-ға дейін), некеге кеш тұру, ажырасу деңгейінің өсуі, андрологиялық көмекті алудың шектеулі мүмкіндіктері. Бұл үрдістер ерлер өмір салтының өзгеруімен, қатар жүретін аурулардың болуымен және экологияның нашарлауымен байланысты. 2017 жылға дейін Қазақстанда андрология саласында мамандандырылған медициналық көмек жеткілікті дамымаған, 2022 жылдан бастап жекелеген бастамалар қолға алына бастағанымен, олардың ауқымы жеткіліксіз. Біртұтас тіркеу жүйесінің, кешенді алдын алу бағдарламалардың және денсаулық сақтау жүйесінің барлық буындары арасындағы үйлестіктің болмауы мәселенің шешілуін қиындатады.

Қорытынды: Қазіргі уақытта ерлердің репродуктивтік денсаулығы медицина мен денсаулық сақтау жүйесінде жеткіліксіз зерттелген сала болып табылады. Әдебиетке жүргізілген талдау ерлердің ұрықтандыруда қиындық көріп жүргенін тіркеуге алатын ұлттық регистрді құру, андрологиялық қызметті дамыту, алдын алу бағдарламалардың аясын кеңейту және буынаралық өзара іс-қимылды қамтитын ұлттық стратегия мен ұйымдастырушылық-функционалдық модельді әзірлеу қажеттігін көрсетеді.

Түйінді сөздер: *ерлер, ерлердің репродуктивтік денсаулығы, ерлер бедеулігі, демография, андрология, Қазақстан, үрдістер, заңдылықтар, алдын алу.*

Дәйексөз үшін:

Оразаева Б.Б., Искакова Н.С., Серикова-Есенгельдин Д.С., Уразалина Н.М., Атабаева А.К., Хисметова З.А. Медициналық-демографиялық көрсеткіштер контекстісіндегі ерлердің репродуктивтік жүйесі ауруларының үрдістері мен заңдылықтары. Әдебиеттік шолу // Ғылым және Денсаулық. 2025. Т.27 (3), Б. 175–188. doi: 10.34689/SH.2025.27.3.020

Introduction. One of the priority areas of the modern healthcare system is the protection of the population's reproductive health, as reproductive health is a key indicator of a country's demographic potential, and directly affects socio-economic development and geopolitical security [33].

The demographic processes in our country have specific features that require detailed study and an accurate understanding of the structure of family life and the formation of a healthy younger generation to ensure full and quality generational renewal. The main goal of demographic policy is to ensure sustainable population growth, promote the stabilization of family relationships as the "basic unit" of society, and foster harmonious family values. According to the National Strategy of the Republic of Kazakhstan for 2021–2025, the main threats to national security include the deterioration of the demographic situation, such as a decline in birth rates and an increase in mortality, as well as a decrease in the level and quality of the healthcare system [24].

The challenges of the modern healthcare system emphasize the need to protect men's reproductive health, as long-standing neglect of this field of medicine has led to underestimating the male factor in demographic policy. The health status of the male reproductive system directly influences population trends, demographic stability, and the overall social well-being of society.

Currently, there is a dynamic increase in the number of men with reproductive health problems [25], as well as a rise in the number of infertile marriages. This is due to both medical and socio-economic determinants. The decline in male fertility, the increasing prevalence of male reproductive system diseases, and lifestyle changes necessitate a comprehensive approach to studying and addressing this issue.

Aim: to analyze the scientific literature in order to identify the main trends and patterns of male reproductive system diseases in the context of medico-demographic indicators (male birth and fertility rates, reproductive health parameters, and socio-demographic consequences).

Search Strategy: the literature search was conducted using the following databases: Scopus, PubMed, Web of Science, Google Scholar, Cochrane Library, Oxford University Press, eLibrary, and CyberLeninka. To obtain comprehensive information, the analysis included Legal information system of Regulatory Legal Acts of the Republic of Kazakhstan "Әділет" (hereinafter referred to as LIS RLA "Әділет"). The search covered a 10-year period (from 2015 to 2025).

An analysis was conducted of documentation from the regional branch of the Abay Republican State Enterprise on the Right of Economic Management "Salidat Kairbekova National Scientific Center for Health Development" of the Ministry of Health of the Republic of Kazakhstan (hereinafter – the branch) regarding the number of men experiencing difficulties with conception (Outgoing letter № 06-01, 06-01-10/1191 dated 24.12.2024). In addition, documents from the Regional Branch of the NCJSC "State Corporation Government for Citizens" for the Abay Region were reviewed concerning the number of marriages and divorces (Outgoing letter № 169-_И dated 17.02.2025).

Inclusion Criteria: studies that match the stated research topic; publications meeting the criteria for depth and completeness of the search; research published in English and Russian; dissertations; articles with evidence-based findings; full-text scientific publications in open access. To ensure a comprehensive retrospective analysis, educational and methodological sources published before 2015 and thematically relevant were included in the review. Additionally, the study utilized regulatory legal acts (in particular, ministerial

orders), as well as information obtained from official sources in response to submitted information requests.

Exclusion Criteria: studies not corresponding to the stated topic; sources published before 2015; articles published in other languages; articles behind paywalls; dissertation abstracts; short communications, promotional and newspaper publications; conference abstracts and non-peer-reviewed analytical reports.

The literature search used the following key words and phrases: "health AND reproductive system", with a focus on the male rather than female reproductive domain (using clarifying terms such as "male reproductive health", "men's health OR male health", "men's reproduction OR male reproduction", "male infertility", "male infertility NOT female infertility", etc.), diseases of the genitourinary system AND men, public health, medical and demographic indicators, trends AND patterns.

As a result of the search, 513 sources were identified, of which 82 were selected for further analysis.

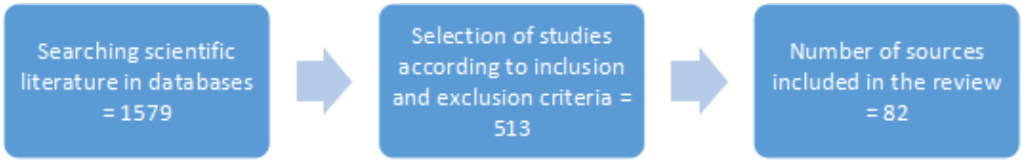

Figure 1. Search Strategy

Research Results.

According to estimates by the United Nations (UN), the current global population exceeds more than three times the population of the mid-20th century. In 1950, the world population was 2.5 billion, whereas by the end of 2022, this figure had reached 8 billion [70]. As of May 2025, the world population counter shows approximately 8.2 billion people [14]. Experts predict that within the next 30 years, the global population will increase by another 2 billion, and by the year 2080, it may reach a peak of 10.4 billion [70].

This rapid growth is explained by the increasing number of people surviving to reproductive age, as well as related factors such as increased life expectancy, intensive urban development, and expanding migration flows.

The gender composition of the global population is as follows: 50.5% of the total population are men, and 49.5% are women [14]. Globally, the sex ratio at birth is approximately 1.05 boys for every 1 girl. Overall, as of 2024, there are about 101 men for every 100 women. It is worth noting that these indicators can vary significantly depending on territorial and other factors, including political instability, population aging, and differences in life expectancy between sexes [74]. With regard to the Republic of Kazakhstan, according to the data from the Bureau of National Statistics, the population of Kazakhstan was approximately 20.3 million as of April 2025, placing it 62nd in the global ranking. Of this total, men account for 48.86%, and women account for 51.14%, respectively.

Key Medical and Demographic Trends in Men's Health. Based on historical demographic data repositories and population census records, the World Fertility Data database was developed, presenting information on global fertility [79].

According to World Fertility Data, the data for Kazakhstan can be interpreted as follows: from 2000 to 2018, there was a steady and progressive increase in the Total fertility rate (TFR), rising from 1.85 to 2.85. This phenomenon indicates a renewal of the population's reproductive capacity and reflects the positive influence of demographic, social, and economic factors. However, a clear trend toward delayed motherhood is observed. For example, the Mean age at childbearing (MAC) was 26.73 years in 2000, increasing to 28.51 years by 2018. This is most likely due to higher educational attainment among women, a stronger focus on professional careers, and a reassessment of life priorities.

Positive developments were also noted among adolescents aged 15 to 19. A decline in the Age-specific fertility rate (ASFR) for this group was recorded – from 33 to 24 births per 1,000 women. This is likely linked to health system reforms, including strengthened health education on reproductive health and broader access to contraceptive methods. During this period, an increase in fertility was observed among women aged 25 to 34 (from 105 in 2000 to 165 in 2018), indicating a shift in reproductive activity toward older age cohorts. Additionally, in the age groups 35–39 and 40–44, the ASFR increased by nearly 2.5 times, reflecting improvements in the quality of medical care and advances in assisted reproductive technologies (Table 1. Fertility data in Kazakhstan for the period from 2000 to 2018).

Table 1.

Fertility data in Kazakhstan for the period from 2000 to 2018.

Age groups (years)	Indicator	Serial date in years				
		2000.5	2005.5	2010.5	2015.5	2018.5
15-19	ASFR1519	33.00	26.00	28.00	31.00	24.00
20-24	ASFR2024	133.00	140.00	147.00	161.00	165.00
25-29	ASFR2529	105.00	133.00	156.00	159.00	165.00
30-34	ASFR3034	64.00	87.00	111.00	116.00	123.00
35-39	ASFR3539	28.00	46.00	63.00	67.00	72.00
40-44	ASFR4044	6.00	11.00	16.00	16.00	19.00
45-49	ASFR4549	1.00	1.00	1.00	1.00	1.00
Total	MAC	26.73	27.77	28.32	28.22	28.51
Total	TFR	1.85	2.22	2.61	2.76	2.85

**Note – Indicator names: ASFR – Age-specific fertility rates, TFR – Total fertility rate, MAC – Mean age at childbearing.*

Statistical reports indicate that the average life expectancy of men worldwide is lower than that of women. This phenomenon became particularly evident in the 21st century as mortality from infectious diseases declined and cardiovascular diseases became the leading cause of death [30], [37], [82]. For example, according to a report by the Organization for Economic Co-operation and Development (OECD), in 2021 the life expectancy of women in OECD countries was 83.0 years, while for men it was 77.6 years – a gap of approximately 5.4 years on average [66]. The lowest male life expectancy is observed in Central and Eastern European countries, where the gender gap exceeds 8 years. In particular, in Latvia, men live less than 75 years, and their life expectancy at age 65 is only 12.7 years. Minor gender differences of less than three years are observed in Iceland and Norway.

Such gender differences in life expectancy are to some extent associated with the fact that men are more exposed to risk factors, including the determinant influence of unhealthy lifestyles. When discussing mortality and gender differences in disease prevalence, it is important to emphasize that men have a higher incidence of fatal outcomes than women (while women more often suffer from chronic but non-lethal diseases) [42]. Among external causes of death, the most prominent are violent deaths, suicides, and road traffic accidents. Studies by researchers from Australia and the United Kingdom indicate that the difference in life expectancy between men and women is linked to a complex interplay of biological, social, and cultural determinants [39]. The Disability-Adjusted Life Year (DALY) indicator in Kazakhstan, as well as globally, is nearly three times higher among young men than among young women due to injuries and violence [11].

Moreover, the COVID-19 pandemic significantly affected male mortality: between 2019 and 2021, life expectancy in OECD countries decreased by an average of 0.7 years. The highest reductions were recorded in Central and Eastern Europe and the United States. In the first two years of the pandemic, countries such as the Czech Republic, Hungary, Latvia, Poland, Greece, the Slovak Republic, and the United States lost as many – or even more – years of life expectancy as had been gained over the previous decade [65].

The article by *Saloni Dattani and Lucas Rodés-Guirao* presents a list of countries with both the largest and smallest gender gaps in life expectancy. As of 2021, countries with the highest gaps (over 10 years) included Russia (11.3 years), Ukraine (10.9 years), and Belarus (10.2 years). On the other hand, countries with the smallest differences (1–2 years) included Nigeria (1.3 years), Togo (1.4 years), and Bangladesh (1.7 years) [43].

As for the situation in Kazakhstan, according to data from the Ministry of Health of the Republic of Kazakhstan, in 2022 the average life expectancy of men was 9 years shorter than that of women, and men's utilization of medical services was half that of women's (according to the "Men's Health" project by the National Association of Primary Health Care) [28].

There are several reasons for this: men are more frequently exposed to harmful, hazardous, and strenuous working conditions; they have higher rates of harmful habits; they suffer from low awareness and stigmatization (cultural and social barriers); they have limited access to specialized services (e.g., andrologists, sexologists); financial barriers; a lack of systematic screening and early diagnosis; and insufficient emphasis on prevention (preventive programs are often focused on women's health, while men's health – especially reproductive health – remains on the periphery) [38], [77].

In terms of morbidity structure among men, cardiovascular diseases and heart conditions have consistently ranked first over the past 10–30 years (1990–2019) [72]. It is known that a normal level of testosterone is beneficial for men's cardiovascular health; however, its level declines with age, which may consequently contribute to deterioration of cardiovascular function. Recent studies suggest that testosterone may potentially be used in the future to treat heart failure, angina pectoris, and myocardial ischemia [63]. However, such statements require in-depth research and comprehensive analysis.

The Problem of Population Growth. In 2021, researchers *Christian Dudel and Sebastian Klüsener* published the results of their analysis of differentiation trends in the volume and pace of male and female fertility across 17 highly developed countries. The results demonstrated that men, in most cases, become fathers at a later age compared to women (the median age of fatherhood is 2–5 years higher). In some countries (Germany, Sweden, Japan), total male fertility exceeds female fertility by 10–50%. This phenomenon is explained by the fact that men retain reproductive potential into older age (notably, according to the WHO, reproductive age for women is defined as 15 to 49 years [6], while no specific age range is defined for men). Furthermore, it was found that male fertility is more influenced by migration processes, as men are more frequently involved in international and age-asymmetric marriages. One noteworthy feature is that male fertility is largely underestimated in most countries, as data on fathers particularly in cases of non-marital births – are often not recorded [45]. This fact complicates research, reduces the analytical reliability of data, and hinders the identification of trends and regularities.

The issue of weak population growth is not a recent development. As early as 1981, *D. Valentei and A. Kvasha* noted that 80% of families in the country had few children. Accordingly, the number of childless families has been rising: approximately one in six marriages is infertile (N.M.Pobedinsky, 1981). According to World Health Organization (WHO) estimates, around 17.5% of the population – equivalent to one in six adults – experience infertility [5]. The consequences of this are often devastating. First and foremost, infertility presents a significant sociocultural and interpersonal challenge for society [10]. The stereotype that women are always to blame in childless marriages is increasingly outdated. Modern diagnostic approaches show that infertility is attributable to the female partner in only about 50% of cases (provisionally), whereas in 45.0–52.0% of cases, infertility is associated with disorders of the male reproductive system [41], [46], [51].

The organization of proper prevention, diagnosis, and treatment of infertility is a priority and urgent task of national importance, as population reproduction directly impacts a country's national security. Male infertility should not be

viewed solely as a modern problem of medicine emerging in the late 19th century. Historical and medical records indicate that this phenomenon has always existed, although it had not previously been publicly addressed in speeches, scientific publications, or clinical reports. The absence of systematic diagnosis and monitoring of male infertility can be attributed to both limited medical capabilities in the past and the dominant sociocultural stereotype that associates reproductive dysfunction primarily with the female partner.

In the past decade, this issue has attracted increased attention from both domestic and international scientific communities. According to materials presented by the Scientific Center of Urology named after B.U.Dzharbusynov (2019), male reproductive capacity is declining, while the number of infertile couples shows a steady upward trend [13]. WHO data based on birth rate analysis suggest that in nearly every country, "about 10% of couples are unable to conceive" (WHO Chronicle, 1970). At the same time, there is a consistent downward trend in total fertility rate (TFR). Data Commons reports that in 1970, the TFR was 4.84 births per woman, whereas by 2022, it had dropped to 2.27 [7].

In Kazakhstan, according to research findings, the infertility rate is higher than in European countries, reaching up to 15% (ranging between 12.0% and 15.5%), making it a major issue for both families and society at large [34], [67]. Causes of infertility include both environmental and medical factors, such as disorders of the reproductive system and hormonal imbalances.

According to Stephen W. Leslie et al. and Calvin C. Zhao et al., the causes of male infertility can be classified by basic etiology as follows: endocrine disorders (hypogonadism in 2–5% of cases, gonadotropin deficiency); obstructive pathologies (vasectomy, cysts of the vas deferens); genetic abnormalities (Klinefelter syndrome, CFTR gene mutations, Y chromosome microdeletions); environmental and lifestyle factors (pesticide exposure, smoking, alcoholism); and idiopathic cases (approximately 10–20% of cases without an identifiable cause) [68], [81].

Undoubtedly, the role of men in infertility, sexual health, and the relationship between overall health and reproductive function is critical. According to statistical data from the Abay Region branch for 2023, 260 women were registered with conception difficulties. Of these, 149 cases were due to tubal infertility; 66 due to male-factor infertility; 11 due to anovulation; 2 due to unspecified female infertility; and 32 due to other forms of female infertility. In 2024 reports, the total number of registered women was 212, including 127 cases of tubal infertility; 44 related to male factors; 16 due to anovulation; and 25 due to other forms of female infertility.

These data reveal that infertility is still predominantly perceived as a female issue, primarily because it is the woman who typically seeks medical help first when conception difficulties arise. This is due to both the physiological characteristics of the female body and persistent social stereotypes that place the responsibility for reproduction mainly on women. Men rarely seek help from specialists regarding fertility problems, which significantly delays diagnosis and complicates the treatment of infertility in couples.

Prevalence of Key Diseases of the Male Reproductive System. The decline in male reproductive potential may be attributed to various factors, with the following prevalence rates (expressed in %): idiopathic infertility (30.0%) [22], varicocele (14.8%), hypogonadism (10.1%), cryptorchidism (8.4%), malignant neoplasms (7.8%), presence of antisperm antibodies (3.9%), erectile and/or ejaculatory dysfunction (2.4%), systemic diseases (2.2%), obstructive factors (2.2%), testicular tumors (1.2%), Y-chromosome deletion (0.3%) [13]. Prevalence may vary depending on the data source.

Congenital malformations of the reproductive organs are considered among the major causes of male infertility. Over the past decade, the incidence of andrological diseases among children and adolescents has increased 1.5-fold. Annually in the Russian Federation, around 500 boys are born with Klinefelter syndrome and approximately 5,000 with hypospadias. The prevalence of cryptorchidism is 30% among preterm and 4% among full-term boys, while varicocele affects 15–19.4% of adolescents aged 14–15 years [31].

Varicocele – dilation of the spermatic cord veins – is a common condition among young men and the most frequent modifiable cause of male infertility [32]. It is diagnosed in 15–40% of men with abnormal semen parameters, 32–44% of men with primary infertility, and 28–81% of men with secondary infertility [3], [49].

Official data suggest that approximately 60% of diseases affecting reproductive function develop during childhood and adolescence [59]. Domestic studies show that compared to global statistics, Kazakhstan faces significant reproductive health risks among its youth, posing a threat to public health systems [11].

In 2021, among adolescents aged 15–17 years, diseases of the genitourinary system accounted for 4% of primary morbidity, behind respiratory diseases (49%), digestive diseases (11%), injuries and poisonings (8%), skin diseases (7%), and nervous system disorders (5%). Notable sexually transmitted infections (STI) included syphilis (0.4 cases per 100,000), gonorrhea (1.6 per 100,000), trichomoniasis (3 per 100,000), and chlamydia infections (1.4 per 100,000). While STI incidence decreased 2–2.5-fold from 2016–2019, this decline slowed from 2019–2021 [11].

STIs are among the primary disruptors of reproductive health [69]. In inflammatory reproductive conditions associated with STIs or opportunistic flora, ejaculates show elevated leukocyte counts; local antibodies are produced, triggering autoimmune responses that can lead to immunologic infertility. Additionally, leukocytes release superoxide radicals that may damage spermatozoa, weakening and reducing their motility so they cannot penetrate the oocyte's zona pellucida, resulting in failed conception [27].

Male fertility depends on numerous factors, which are classified into two main categories: genetic (hereditary, e.g., Klinefelter syndrome) and acquired (lifestyle-related factors such as harmful habits, deviant behaviors, poor nutrition, stress, etc.) [31], [47].

For instance, Klinefelter syndrome (KS) is the most common chromosomal anomaly in the general male population and one of the most prevalent genetic causes of non-obstructive azoospermia (14% of men with non-obstructive azoospermia have KS [62]) and severe

oligospermia [50]. It is characterized by an additional X chromosome (47, XXY). KS occurs in approximately 1 in 500–1,000 newborn boys, making it one of the most common chromosomal deviations in men [54]. Notably, around 65% of KS cases remain undiagnosed, especially when symptoms are mild or nonspecific [61].

According to GBD 2020 Alcohol Collaborators, youth alcohol use is rising in Kazakhstan (from 34.5% to 55.6%) and globally (from 20.3% to 59.1%) [40]. Alcohol abuse causes Leydig cell atrophy and reduced numbers of mature spermatozoa, leading to conception problems and infertility in 80–85% of cases [29]. A systematic review and meta-analysis found that alcohol abuse negatively affects semen quality, particularly ejaculate volume (a reduction of 0.25 mL, 95% CI 0.07–0.42 mL) and sperm morphology (normal forms reduced by 1.87%, 95% CI 0.86–2.88%) [71].

Tobacco use (including e-cigarettes) in Kazakhstan exceeds global averages (3.3% of girls and 18.7% of boys, compared to global rates of 2.8% and 11.3%, respectively). Tobacco use among Kazakhstani boys is 1.6 times higher than the global average. E-cigarette and vaping use among youth remains at 1.0–1.4% [52]. Tobacco's harmful impact on male fertility is well documented – it is cytotoxic to spermatogenesis, suppresses testosterone production, and disrupts microcirculation, all of which are risk factors for erectile dysfunction and infertility.

A systematic review, The global prevalence of erectile dysfunction: a review, shows that cardiovascular disease (CVD) – stemming from unhealthy lifestyles – is linked to erectile dysfunction (ED). Men with ED have higher risks of overall mortality (OR = 1.26, 95% CI 1.01–1.57) and CVD mortality (OR = 1.43, 95% CI 1.00–2.05). ED prevalence ranges from 3% to 76.5%, depending on age groups and assessment methods, and is notably more common in older men due to natural aging [60].

Reproductive health issues are more common in individuals with comorbid conditions that weaken immunity (65%), as well as in men leading sedentary lifestyles and with excess body weight [26]. Numerous studies link obesity to suppressed testosterone synthesis and hypogonadism, which in turn leads to fertility problems [21], [58]. Elevated body mass index (BMI) is associated with poorer semen quality, affecting sperm volume, concentration, and motility [48].

Obesity and insulin resistance cause systemic oxidative stress that impairs sperm quality by reducing motility and increasing DNA damage. Metabolic disorders – particularly overweight and insulin resistance – are significant risk factors for male infertility [21], [57].

The scientific community increasingly calls for global sperm parameter research due to widespread declines in sperm count and/or quality, especially in Western countries [44]. Clinicians worldwide increasingly encounter patients with abnormal semen parameters [76]. According to World Population Review, as of 2025, the top 5 countries with the highest male testosterone levels are Uzbekistan (773 ng/dL), Croatia (752 ng/dL), Cameroon (731 ng/dL), Azerbaijan (694 ng/dL), and Mongolia (693 ng/dL), while Kazakhstan's level is 356 ng/dL [78].

A 2023 meta-analysis on sperm concentration (SC) and total sperm count (TSC) in males worldwide between 1973 and 2018 highlights a global decline in sperm counts affecting men across all continents. The average sperm concentration dropped by 51.6%, and since 2000 the annual decline rate doubled from 1.16% to 2.64% per year [64]. Literature reviews indicate that sperm quality decline is especially evident in the Middle East and North African regions. However, due to data heterogeneity, further research is needed [36].

The Role of Reproductive Failure in Marital Stability. Childless marriages represent a significant social and psychological challenge, becoming a source of chronic stress that can degrade quality of life [56] and negatively affect both the emotional state of the couple and their physiological health. Prolonged psycho-emotional tension contributes to disharmony in family-sexual relationships, sexual dysfunctions, as well as neurotic and somatic disorders, including reproductive organ dysfunction. It has been established that after a diagnosis of "infertility", partners often develop pronounced psychological issues, which under certain circumstances may lead to divorce [4]. Statistics show that for 1 in 5 Kazakhstani couples (20%), the main cause of divorce was the inability to reproduce [12].

According to data from the United Nations Statistics Division, the average age at first marriage among Kazakhstani men and women is rising. In 1979, the average age for men entering marriage was 24.1 years and for women 21.7; in 1989 it was 24.6 and 22.4; in 1999 it increased to 26.1 and 23.4; by 2009 it reached 27.6 years for men and 24.7 years for women [80].

The degradation of the family institution and crisis of family values exert destructive effects on state development. As of March 2024, Kazakhstan ranks second in the world for divorce rates, behind only the Maldives [8]. On average, over 40,000 marriages are dissolved annually in the country [1], [8].

From January to December 2023, Kazakhstan's marriage rate declined from 6.46 to 6.07 per 1,000 population. The highest rate was in the capital at 7.46 per 1,000. Among regions, Ulytau (6.76) and Almaty (6.64) had the highest, while Turkestan was lowest at 5.55. In Abay Region it stood at 5.67 per 1,000. The divorce rate in Kazakhstan was 0.84 per 1,000, down from 0.89 the previous year. The highest divorce rates were in East Kazakhstan (1.36), Karaganda (1.34), and Pavlodar (1.29) regions, while Turkestan had the lowest at 0.30. In Abay Region, it was 0.83 per 1,000 [9].

According to data from the Regional Branch of the NCJSC "State Corporation Government for Citizens" for the Abay Region, the number of marriages recorded over the last three years is rising. From July 8, 2022: 1,910 marriages; 2023: 3,220; 2024: 3,308; and by February 18, 2025: 297 marriages. Divorces have also increased: 245 (from July 8, 2022), 281 (2023), 568 (2024); and 60 divorces by February 18, 2025. Not all marriages are registered with the State Corporation (divorces are registered only by mutual consent without minor children; others go through courts and may remain unofficial), so actual divorce numbers may be higher.

From these data, we can conclude that despite the positive trend in recorded marriages, divorces are also rising. However, detailed analysis of divorce causes in Abay Region is lacking, making it difficult to identify key social, economic, and psychological factors affecting marital

stability. It is possible that infertility, affecting both women and men, is one of the drivers of divorce.

Organization and Accessibility of Specialized Care for Men. Male infertility is a complex problem with significant social implications. In fertility clinics, care primarily goes to women. Organizational measures to combat male infertility are insufficiently detailed. Marcia C. Inhorn and Pasquale Patrizio highlighted three key trajectories for research and intervention: controlling known causes of infertility, providing support to those experiencing conception difficulties, and promoting innovations of LCIVF (Laboratory of Clinical and Experimental In Vitro Fertilization) to improve access – including financial accessibility – and acceptability of assisted reproductive technologies (ART) [55].

There are grounds to believe that while women benefit from fairly well-developed medical support, a comparable system for men's reproductive health is effectively absent, confirming that male reproductive health remains off the medical community's radar. Research into female reproductive health is 2–3 times more prevalent than male-focused studies. The systematic review by Robab Latifnejad Roudsari, Farangis Sharifi, and Fatemeh Goudarzi (2023) describes barriers limiting men's participation in reproductive health programs, including limited access to comprehensive and quality medical services, financial constraints, personal attitudes and priorities of couples, as well as societal perceptions and cultural stereotypes. The authors emphasize the need to actively involve men in reproductive health initiatives [73].

Discussion

One of the key aspects of Kazakhstan's national interests, according to the National Security Strategy, is achieving and maintaining a level and quality of healthcare and social support systems that meet the needs of improving citizens' and society's well-being. Public safety aims to support natural population growth and to ensure the implementation of urgent measures aimed at countering critical demographic processes [23]. The role of men in ensuring the country's demographic sustainability is immense.

In our country, population reproduction and generational health have long been addressed mainly from the perspective of "maternal and child health protection". Men are generally left outside the scope of attention from medical professionals and health system managers. Meanwhile, this fully-fledged participant in the reproductive process exhibits – compared to women – a higher morbidity rate (including reproductive system diseases that can lead to childless marriages) and a lower average life expectancy.

At the same time, medical care in the field of male reproductive health is not separated from urological services, and the attention of urologists to these issues remains limited.

Male health clinics were first established at "Marriage and Family" consultation centers in Almaty, Karaganda, and Tselinograd on the initiative of the Kazakhstani scientist, Doctor of Medical Sciences, Professor B.U.Dzharbusynov. Also, at his initiative and under his leadership, in 1990 the first Research Institute of Urology under the Ministry of Health of the Kazakh SSR was founded on the basis of the Republican Center of Urology and Operative Nephrology under the name "The Institute of One Doctor" (Resolution of the Council of Ministers of the Kazakh SSR dated December 14, 1990, № 484) [2]. On November 11, 1996, by Resolution of the Government of the Republic of Kazakhstan № 1367, the institute was transformed into the B.U.Dzharbusynov Scientific Center of Urology under the Ministry of Health, which continues to operate to this day [13].

In 1991, the first Congress of Urologists of Kazakhstan took place, and in 1992 Kazakhstani urologists joined the European Association of Urology. The annual congresses of the European Association of Urology allocate dedicated sessions to discuss fertility issues, and all adopted updates are included in the core guidelines, which are revised every ten years.

The next step was the establishment of male infertility clinics at regional consultative polyclinics in all regional centers of the country, where registration, follow-up, diagnosis, and treatment of couples seeking medical help were carried out. These clinics provided assistance with conditions affecting family and marital relationships.

In 2008, a professional organization of sexual medicine doctors was created, which in 2011 was re-registered as the Republican Public Association (RPA) "Men's Health."

In 2013, "Centers for Men's Health and Family Longevity" (CMHFL) began operating across the country, examining more than 6,000 men. By 2014, the number of patients examined and treated exceeded 26,000 nationwide. In January 2014, the Minister of Health approved the "Regulation on the Urological Service," according to which CMHFLs were integrated into the staffing structure of primary healthcare (PHC). According to the 2016 report on the work of the "Centers for Men's Health and Family Longevity," within the framework of the "Men's Health" program, the initiatives "Men's Health Days" and "Men's Health Schools" were implemented. During the "Men's Health Days" events, 4,021 men were examined across 16 cities in Kazakhstan. However, the city of Semey remained outside the scope of attention of researchers and specialists.

Today, medical services in the field of male reproductive health are provided at the following levels: 1) Primary level – PHC specialists conduct initial diagnostics and refer the patient to a narrow specialist; 2) Secondary and tertiary levels – urologists and andrologists in specialized medical institutions conduct detailed diagnostics and targeted treatment using high-tech medical services.

Kazakhstan has a number of legislative acts regulating issues related to male reproductive health and marital-family relations [15], [16], [17], [18], [19], [20], [22]. The country also applies national standards and clinical protocols for diagnosing and treating male reproductive disorders, such as the Clinical Protocol on Male Infertility, the Standard for the Organization of Urological and Andrological Care, and the Rules for the Use of Assisted Reproductive Technologies (ART), etc.

However, despite this, there is currently no monitoring or analysis system for male reproductive health data in Kazakhstan. There is no registry system for men with fertility problems, nor any formal national databases recording male infertility cases (as in most countries, due to ethically justified approaches). Scientific foundations for organizing medical care for infertile men have not yet been developed. Nevertheless, proposals exist to create a unified

confidential registry for couples experiencing conception difficulties, which would include both men and women seeking assistance from reproductive health professionals.

By developing and implementing an electronic information platform focused on male reproductive health, men would have the opportunity to seek anonymous consultations from specialists, receive a preliminary health assessment, and obtain necessary information from official sources. This approach could significantly reduce psychological barriers and social stigma, laying the groundwork for increased trust in the healthcare system and, consequently, more frequent access by men to specialized care. This is especially important for men who are struggling with infertility but refrain from seeking medical assistance due to psychological discomfort or a lack of accessible, reliable information. Additionally, such measures could positively impact the monitoring and planning of government support programs, including in vitro fertilization (IVF) and other ART.

Typically, demographic studies focus on female fertility, but in light of today's challenges, for a more comprehensive understanding of demographic processes, it is necessary to consider male fertility as well [45]. Addressing these issues requires a comprehensive approach – taking into account genetic, environmental, social, and economic factors – including improved education and awareness among men [75], expanding access to specialized and high-tech medical services, and enhancing the quality of care provided.

Conclusion

The literature analysis has demonstrated the need for a comprehensive approach to the problem of male infertility. This includes organizational and functional interventions, improving the quality of diagnostics, etiopathogenetic treatment, and advancements in reconstructive and plastic surgical techniques, which could potentially lead to positive outcomes.

The World Health Organization emphasizes the critical need for scientific research in the field of reproductive health, including male reproductive health, since infertility can result in violence, divorce, social stigma, emotional stress, depression, anxiety, and low self-esteem.

The data presented above indicate significant changes in the reproductive indicators of the population, which necessitates in-depth study and the development of comprehensive measures to support reproductive health.

Typically, studies on male reproductive health are narrowly focused and examine the impact of specific pathologies. There is a noted lack of research on risk factors for male reproductive disorders, as well as on the monitoring and analysis of data related to the male reproductive system and the organization of its protection.

One of the targets of the Sustainable Development Goal "Ensure healthy lives and promote well-being for all at all ages" is to guarantee, by 2030, universal access to sexual and reproductive health services. This includes access to family planning, education, and the integration of reproductive health into national strategies and programs [35].

For effective diagnosis and treatment of reproductive disorders, standardized assessment methods should be applied. Both physical and psychological aspects must be taken into account. The development and implementation of individualized treatment plans in fertility medicine, based on a comprehensive evaluation of the patient's health status, can improve patients' sexual well-being [53].

Conclusion: Thus, in Kazakhstan, as in other countries, it is important to continue research in the field of male reproductive health, to develop measures aimed at supporting and protecting public health, and to enhance awareness and educational programs on reproductive health issues [44], which will ultimately contribute to improving the country's demographic situation.

The lack of effective state programs for the protection of male reproductive health and the absence of a structured mechanism for providing andrological care underscore the relevance of further research in this area.

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References:

1. АНК: Казахстан на втором месте по числу разводов в мире [Электронный ресурс]. URL:https://24.kz/ru/news/social/675291-ank-kazakhstan-na-vtorom-meste-po-chislu-razvodov-v-mire (дата обращения: 19.03.2025).

2. Биография Б.У. Джарбусынова. Научный Центр Урологии [Электронный ресурс]. URL: https://ncu.kz/biografija-b-u-dzharbusynova/ (дата обращения: 03.04.2025).

3. *Божедомов В.А. [и др.].* Варикоцеле и репродуктивная функция: эпидемиология и риск развития бесплодия (данные обследования 3908 мужчин) // Урология. 2021. № 3. С. 122–128.

4. *Бородачева И.В.* Особенности этиологии и патогенеза невротических расстройств при мужском бесплодии 2008. С. 210.

5. ВОЗ: бесплодием страдает каждый шестой человек в мире [Электронный ресурс]. URL:https://www.who.int/ru/news/item/04-04-2023-1-in-6-people-globally-affected-by-infertility (дата обращения: 10.02.2025).

6. Женщины и здоровье [Электронный ресурс]. URL: https://www.who.int/ru/news-room/fact-sheets/detail/women-s-health (дата обращения: 16.03.2025).

7. Инициатива Мир - Демография - Data Commons [Электронный ресурс]. URL: https://datacommons.org/place/Earth?category=Demographics (дата обращения: 18.03.2025).

8. Казахстан – на втором месте в мире по разводам. Forbes.kz [Электронный ресурс]. URL: https://forbes.kz/articles/kazahstan_-_na_vtorom_meste_v_mire_po_razvodam (дата обращения: 24.03.2025).

9. Казахстан по частоте разводов уступает только Мальдивам - Ranking.kz [Электронный ресурс]. URL: https://ranking.kz/reviews/regions/kazahstan-po-chastote-razvodov-ustupaet-tolko-maldivam.html (дата обращения: 13.03.2025).

10. *Кулбаева С.Н. [и др.].* Современный взгляд на проблему бесплодного брака: обзор литературы. Репродуктивная медицина (Центральная Азия). 2024. № 1. С. 147–157.

11. *Курманова А.М. [и др.].* Показатели бремени болезней и риски для репродуктивного здоровья молодежи. Репродуктивная медицина (Центральная Азия). 2024. № 1. С. 138–146.

12. Названы основные причины разводов в казахстанских семьях. Казинформ. URL: https://www.inform.kz/ru/nazvani-osnovnie-prichini-razvodov-v-kazahstane-d0cbee (дата обращения: 06.02.2025).

13. Научный центр Урологии имени Б.У. Джарбусынова. URL: https://ncu.kz/ (дата обращения: 27.02.2025).

14. Население земли - счетчик населения мира. URL: https://countrymeters.info/ru/World (дата обращения: 03.03.2025).

15. О браке (супружестве) и семье - ИПС «Әділет». URL: https://adilet.zan.kz/rus/docs/K1100000518 (дата обращения: 02.01.2025).

16. Об утверждении правил и условий проведения вспомогательных репродуктивных методов и технологий - ИПС «Әділет». URL: https://adilet.zan.kz/rus/docs/V2000021816 (дата обращения: 13.01.2025).

17. Об утверждении правил, объема и периодичности проведения профилактических медицинских осмотров целевых групп населения, включая детей дошкольного, школьного возрастов, а также учащихся организаций технического и профессионального, послесреднего и высшего образования - ИПС «Әділет». URL: https://adilet.zan.kz/rus/docs/V2000021820 (дата обращения: 20.02.2025).

18. Об утверждении правил организации медицинской помощи по охране репродуктивного и психического здоровья несовершеннолетних в возрасте от десяти до восемнадцати лет и молодежи - ИПС «Әділет». URL: https://adilet.zan.kz/rus/docs/V2000021846 (дата обращения: 11.02.2025).

19. Об утверждении Правил проведения военно-врачебной экспертизы и Положения о комиссиях военно-врачебной экспертизы в Вооруженных Силах Республики Казахстан - ИПС «Әділет». URL: https://adilet.zan.kz/rus/docs/V2000021869/history (дата обращения: 15.01.2025).

20. Об утверждении стандарта организации оказания урологической и андрологической помощи в Республике Казахстан - ИПС «Әділет». URL: https://adilet.zan.kz/rus/docs/V2300032541 (дата обращения: 06.02.2025).

21. Ожирение, инсулинорезистентность и репродуктивное здоровье мужчины: патогенетические взаимодействия и современная патогенетическая фармакотерапия uMEDp. URL: https://umedp.ru/articles/ozhirenie_insulinorezistentnost_i_reproduktivnoe_zdorove_muzhchiny_patogeneticheskie_vzaimodeystviya.html (дата обращения: 25.01.2025).

22. О здоровье народа и системе здравоохранения - ИПС «Әділет». URL: https://adilet.zan.kz/rus/docs/K2000000360 (дата обращения: 02.02.2025.

23. О национальной безопасности Республики Казахстан - ИПС «Әділет». URL: https://adilet.zan.kz/rus/docs/Z1200000527 (дата обращения: 18.01.2025).

24. О проекте Указа Президента Республики Казахстан «Об утверждении основных направлений государственной политики Республики Казахстан в сфере официальной помощи развитию на 2021 – 2025 годы» - ИПС «Әділет». URL: https://adilet.zan.kz/rus/docs/P2100000344 (дата обращения: 25.11.2024).

25. Оценка репродуктивного потенциала мужского населения. URL:https://cyberleninka.ru/article/n/otsenka-reproduktivnogo-potentsiala-muzhskogo-naseleniya/viewer (дата обращения: 11.01.2025).

26. Просмотр «Этиологические факторы нарушения репродуктивной функции у мужчин (по данным клиники «Мать и дитя». URL: https://repromed.kz/index.php/journal/article/view/5/2 (дата обращения: 23.03.2025).

27. *Расимович А.А.* Роль инфекций, передаваемых половым путем, в формировании демографического состояния Республики Татарстан и пути его улучшения 2022. С. 321.

28. Сегодня мужским здоровьем в Казахстане никто не занимается – эксперт. Казинформ. URL: https://www.inform.kz/ru/segodnya-muzhskim-zdorov-em-v-kazahstane-nikto-ne-zanimaetsya-ekspert_a3947337 (дата обращения: 04.12.2024).

29. Сергеевич Б.Ю. Социально-гигиенические и медико-организационные аспекты совершенствования санаторно-курортного лечения пациентов с болезнями мужских половых органов 2019. С. 124.

30. Сердечно-сосудистые заболевания. URL: https://www.who.int/ru/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds) (дата обращения: 11.11.2024).

31. Современная демографическая ситуация и проблемы улучшения репродуктивного здоровья населения России. URL: https://cyberleninka.ru/article/n/sovremennaya-demograficheskaya-situatsiya-i-problemy-uluchsheniya-reproduktivnogo-zdorovya-naseleniya-rossii/viewer (дата обращения: 25.01.2025).

32. *Угли Ш.А.* Клинико-лабораторные предикторы эффективности варикоцелэктомии у мужчин с нарушением репродуктивной функции 2023. С. 131.

33. Угрозы и риски демографической безопасностИ Российской Федерации. URL: https://cyberleninka.ru/article/n/ugrozy-i-riski-demograficheskoy-bezopasnosti-rossiyskoy-federatsii/viewer (дата обращения: 06.03.2025).

34. Уровень бесплодия в Казахстане выше, чем в европейских странах. Forbes.kz. URL:

https://forbes.kz/news/newsid_296601 (дата обращения: 19.02.2025).

35. Цель 3: Обеспечение здорового образа жизни и содействие благополучию для всех в любом возрасте. Устойчивое развитие. URL: https://www.un.org/sustainabledevelopment/ru/health/ (дата обращения: 24.02.2025).

36. *Alqurna N.M., Al-Alami Z.M.* Worldwide sperm quality variations between 2000 and 2020: a scoping review. Middle East Fertility Society Journal. 2023. № 1 (28). С. 32.

37. Amini M., Zayeri F., Salehi M. Trend analysis of cardiovascular disease mortality, incidence, and mortality-to-incidence ratio: results from global burden of disease study 2017. BMC Public Health. 2021. № 1 (21). С. 401.

38. Barriers to the participation of men in reproductive health care: a systematic review and meta-synthesis | BMC Public Health | Full Text. URL: https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-023-15692-x (дата обращения: 11.06.2025).

39. *Baum F. [и др.].* New Perspective on Why Women Live Longer Than Men: An Exploration of Power, Gender, Social Determinants, and Capitals. International Journal of Environmental Research and Public Health. 2021. № 2 (18). С. 661.

40. B*ryazka D. [и др.].* Population-level risks of alcohol consumption by amount, geography, age, sex, and year: a systematic analysis for the Global Burden of Disease Study 2020. The Lancet. 2022. № 10347 (400). С. 185–235.

41. *Chalyi M.E.C., Akhvlediani N.D.A., Kharchilava R.R.K.* Male infertility. Urologiia. 2017. (2-supplement_2017). С. 4–19.

42. *Crimmins E.M. [и др.].* Differences between Men and Women in Mortality and the Health Dimensions of the Morbidity Process. Clinical Chemistry. 2019. № 1 (65). С. 135–145.

43*. Dattani S., Rodés-Guirao L. Why do women live longer than men? Our World in Data. 2023.*

44. *De Jonge C.J. [и др.].* Current global status of male reproductive health. Human Reproduction Open. 2024. № 2 (2024). С. hoae017.

45. *Dudel C., Klüsener S.* Male–Female Fertility Differentials Across 17 High-Income Countries: Insights From A New Data Resource. European Journal of Population. 2021. № 2 (37). С. 417–441.

46. *Eisenberg M.L. [и др.].* Male infertility. Nature Reviews. Disease Primers. 2023. № 1 (9). С. 1-22, 49.

47. Elamin I.E., Elrasheed F.E., Alameddine S.M. et al. Male infertility: a review of medical and surgical approaches. JPTCP. *2024.*

48. *Engin-Ustun Y. [и др.].* Body Mass Index Effects Kruger's Criteria in Infertile Men. International Journal of Fertility and Sterility. 2018. № 4 (11).

49. Extended indications for varicocelectomy - PMC. URL: https://pmc.ncbi.nlm.nih.gov/articles/PMC6733372/ (дата обращения: 26.05.2025).

50. *Fainberg J., Hayden R.P., Schlegel P.N.* Fertility management of Klinefelter syndrome. Expert Review of Endocrinology & Metabolism. 2019. № 6 (14). С. 369–380.

51. *Fainberg J., Kashanian J.A.* Recent advances in understanding and managing male infertility. F1000Research. 2019. (8). С. F1000 Faculty Rev-670.

52. *Glushkova N. [и др.].* Prevalence of Smoking Various Tobacco Types in the Kazakhstani Adult Population in 2021: A Cross-Sectional Study. International Journal of Environmental Research and Public Health. 2023. № 2 (20). С. 1509.

53. *Hatzichristou D. [и др.].* Recommendations for the clinical evaluation of men and women with sexual dysfunction. The Journal of Sexual Medicine. 2010. № 1 Pt 2 (7). С. 337–348.

54. How many people are affected by or at risk for Klinefelter syndrome (KS)? | NICHD - Eunice Kennedy Shriver National Institute of Child Health and Human Development. URL: https://www.nichd.nih.gov/health/topics/klinefelter/conditioninfo/risk?utm_source (дата обращения: 11.06.2025).

55. *Inhorn M.C., Patrizio P.* Infertility around the globe: new thinking on gender, reproductive technologies and global movements in the 21st century. Human Reproduction Update. 2015. № 4 (21). С. 411–426.

56. *Jacob J.A. [и др.].* Common mental disorders, quality of life and explanatory models in men undergoing infertility treatment in a tertiary care hospital: A cross-sectional study. Journal of Psychosomatic Research. 2021. (147). С. 110536.

57. J*azayeri M. [и др.].* Underestimated Aspects in Male Infertility: Epigenetics is a New Approach in Men with Obesity or Diabetes. International Journal of Fertility and Sterility. 2021. № Online First.

58. K*ahn L.G. [и др.].* The Relation of Birth Weight and Adiposity Across the Life Course to Semen Quality in Middle Age. Epidemiology (Cambridge, Mass.). 2019. № Suppl 2 (30). С. S17–S27.

59. K*azemeini S.K. [и др.].* Causes of infertility in view of Iranian traditional medicine: A review. International Journal of Reproductive Biomedicine. 2017. № 4 (15). С. 187–194.

60. *Kessler A. [и др.].* The global prevalence of erectile dysfunction: a review. BJU International. 2019. № 4 (124). С. 587–599.

61. Klinefelter syndrome: MedlinePlus Genetics. URL: https://medlineplus.gov/genetics/condition/klinefelter-syndrome/ (дата обращения: 02.06.2025).

62. Klinefelter Syndrome. The Oncofertility Consortium. URL: https://oncofertility.msu.edu/non-malignant-conditions/klinefelter-syndrome/ (дата обращения: 02.06.2025).

63. *Kloner R.A. [и др.].* Testosterone and Cardiovascular Disease. Journal of the American College of Cardiology. 2016. № 5 (67). С. 545–557.

64. *Levine H. [и др.].* Temporal trends in sperm count: a systematic review and meta-regression analysis of samples collected globally in the 20th and 21st centuries. Human Reproduction Update. 2023. № 2 (29). С. 157–176.

65. Life expectancy at birth by sex, in years, 2023. https://datawrapper.dwcdn.net/iGZgr/4/ (дата обращения: 11.06.2025).

66. Life expectancy. OECD: https://www.oecd.org/en/publications/society-at-a-glance-2024_918d8db3-en/full-report/life-expectancy_37a61588.html (дата обращения: 19.05.2025).

67. *Lokshin V., Omar M., Karibaeva S.* Assisted

Reproductive Technologies in the Republic of Kazakhstan: A 6-Year Trend Analysis from Efficacy to Availability. Journal of Reproduction & Infertility. 2022. № 1 (23). С. 61–66.

68. Male Infertility - Male Infertility Authors Stephen W. Leslie 1 ; Taylor L. Soon-Sutton 2 ; Moien AB - Studocu [Электронный ресурс]. URL: https://www.studocu.com/row/document/kathmandu-university-school-of-medical-sciences/medicine/male-infertility/91855141 (дата обращения: 26.05.2025).

69. *Mankelkl G. [u др.].* Individual and community level factors associated with sexually transmitted infections among men in Tanzania: insights from the Tanzania demographic and health survey of 2022. BMC infectious diseases. 2024. № 1 (24). С. 580.

70. *Nations U.* Народонаселение | Организация Объединенных Наций. United Nations. URL: https://www.un.org/ru/global-issues/population (дата обращения: 18.05.2025).

71. *Ricci E. [u др.].* Semen quality and alcohol intake: a systematic review and meta-analysis. Reproductive Biomedicine Online. 2017. № 1 (34). С. 38–47.

72. *Roth G.A. [u др.].* Global Burden of Cardiovascular Diseases and Risk Factors, 1990-2019: Update From the GBD 2019 Study. Journal of the American College of Cardiology. 2020. № 25 (76). С. 2982–3021.

73. *Roudsari R.L., sharifi F., Goudarzi F.* Barriers to the participation of men in reproductive health care: a systematic review and meta-synthesis. BMC Public Health. 2023. № 1 (23). С. 818.

74. Sex ratio at birth. Our World in Data [Электронный ресурс]. URL: https://ourworldindata.org/grapher/sex-ratio-at-birth?utm_source (дата обращения: 11.06.2025).

75. *Skakkebaek N. E. [u др.].* Populations, decreasing fertility, and reproductive health. Lancet (London, England). 2019. № 10180 (393). С. 1500–1501.

76. Temporal trends in sperm count: a systematic review and meta-regression analysis | Human Reproduction Update | Oxford Academic]. URL: https://academic.oup.com/humupd/article/23/6/646/4035689 (дата обращения: 26.05.2025).

77. T*eo C.H. [u др.].* Barriers and facilitators to health screening in men: A systematic review. Social Science & Medicine (1982). 2016. (165). С. 168–176.

78. Testosterone Levels by Country 2024. URL: https://worldpopulationreview.com/country-rankings/testosterone-levels-by-country (дата обращения: 06.02.2025).

79. World Fertility Data | Population Division. URL: https://www.un.org/development/desa/pd/node/3282 (дата обращения: 18.05.2025).

80. World Marriage Data | Population Division. URL: https://www.un.org/development/desa/pd/data/world-marriage-data (дата обращения: 18.05.2025).

81. *Zhao C.C., Scott M., Eisenberg M.L.* Male Fertility as a Proxy for Health. Journal of Clinical Medicine. 2024. № 18 (13). С. 5559.

82. *Zhao E., Crimmins E.M.* Mortality and morbidity in ageing men: Biology, Lifestyle and Environment. Reviews in Endocrine & Metabolic Disorders. 2022. № 6 (23). С. 1285–1304.

References: [1-35]

1. ANK: Kazakhstan na vtorom meste po chislu razvodov v mire [Kazakhstan ranks second in the world in terms of the number of divorces] [Elektronnyi resurs]. URL:https://24.kz/ru/news/social/675291-ank-kazakhstan-na-vtorom-meste-po-chislu-razvodov-v-mire (accessed: 19.03.2025). [in Russian - in Kazakh]

2. Biografiya B.U. Dzharbusynova. Nauchnyi Tsentr Urologii [Biography of B. U. Dzharbusynov. Scientific Center of Urology] [Elektronnyi resurs]. URL: https://ncu.kz/biografija-b-u-dzharbusynova/ (accessed: 03.04.2025). [in Russian - in Kazakh]

3. Bozhedomov V.A. [i dr.]. Varikotsele i reproduktivnaya funktsiya: epidemiologiya i risk razvitiya besplodiya (dannye obsledovaniya 3908 muzhchin) [Varicocele and reproductive function: epidemiology and risk of infertility (data from the examination of 3908 men)]. *Urologiya* [Urology]. 2021. № 3. pp. 122–128. [in Russian]

4. Borodacheva I. V. *Osobennosti etiologii i patogeneza nevroticheskikh rasstroistv pri muzhskom besplodii* [Features of the etiology and pathogenesis of neurotic disorders in male infertility] 2008. С. 210. [in Russian]

5. *VOZ: besplodiem stradaet kazhdyi shestoi chelovek v mire* [WHO: Every sixth person in the world suffers from infertility] [Elektronnyi resurs]. URL:https://www.who.int/ru/news/item/04-04-2023-1-in-6-people-globally-affected-by-infertility (accessed: 10.02.2025). [in Russian]

6. *Zhenshchiny i zdorov'e* [Women and health] [Elektronnyi resurs]. URL: https://www.who.int/ru/news-room/fact-sheets/detail/women-s-health (accessed: 16.03.2025). [in Russian]

7. *Initsiativa Mir - Demografiya* - Data Commons [Initiative World – Demography] [Elektronnyi resurs]. URL: https://datacommons.org/place/Earth?category=Demographics (accessed: 18.03.2025). [in Russian]

8. *Kazakhstan – na vtorom meste v mire po razvodam* [Kazakhstan ranks second in the world in divorce rates]. Forbes.kz [Elektronnyi resurs]. URL: https://forbes.kz/articles/kazahstan_-_na_vtorom_meste_v_mire_po_razvodam (accessed: 24.03.2025). [in Russian - in Kazakh]

9. *Kazakhstan po chastote razvodov ustupaet tol'ko Mal'divam* [Kazakhstan ranks second after the Maldives in divorce rate] - Ranking.kz [Elektronnyi resurs]. URL: https://ranking.kz/reviews/regions/kazahstan-po-chastote-razvodov-ustupaet-tolko-maldivam.html (accessed: 13.03.2025). [in Russian - in Kazakh]

10. Kulbaeva S.N. [i dr.]. Sovremennyi vzglyad na problemu besplodnogo braka: obzor literatury [A modern view on the problem of infertility: literature review]. *Reproduktivnaya meditsina* (Tsentral'naya Aziya). 2024. № 1. С. 147–157. [in Russian]

11. Kurmanova A. M. [i dr.]. Pokazateli bremeni boleznei i riski dlya reproduktivnogo zdorov'ya molodezhi [Burden of disease indicators and risks to youth reproductive health]. *Reproduktivnaya meditsina* (Tsentral'naya Aziya). 2024. № 1. pp. 138–146. [in Russian]

12. Nazvany osnovnye prichiny razvodov v kazakhstanskikh sem'yakh [Main causes of divorce in Kazakhstani families]. *Kazinform* [Elektronnyi resurs]. URL: https://www.inform.kz/ru/nazvani-osnovnie-prichini-

razvodov-v-kazahstane-d0cbee (accessed: 06.02.2025). [in Russian - in Kazakh]

13. *Nauchnyi tsentr urologii imeni B.U. Dzharbusynova* [Scientific Center of Urology named after B. U. Dzharbusynov] [Elektronnyi resurs]. URL: https://ncu.kz/ (accessed: 27.02.2025). [in Russian - in Kazakh]

14. *Naselenie zemli - schetchik naseleniya mira* [World population counter] [Elektronnyi resurs]. URL: https://countrymeters.info/ru/World (accessed: 03.03.2025). [in Russian]

15. *O brake (supruzhestve) i sem'e* [On marriage and family] - IPS «Ədilet» [Elektronnyi resurs]. URL: https://adilet.zan.kz/rus/docs/K1100000518 (accessed: 02.01.2025). [in Russian - in Kazakh]

16. *Ob utverzhdenii pravil i uslovii provedeniya vspomogatel'nykh reproduktivnykh metodov i tekhnologii* [On approval of the rules and conditions for assisted reproductive methods and technologies] - IPS «Ədilet» [Elektronnyi resurs]. URL: https://adilet.zan.kz/rus/docs/V2000021816 (accessed: 13.01.2025). [in Russian - in Kazakh]

17. *Ob utverzhdenii pravil, ob"ema i periodichnosti provedeniya profilakticheskikh meditsinskikh osmotrov tselevykh grupp naseleniya, vklyuchaya detei doshkol'nogo, shkol'nogo vozrastov, a takzhe uchashchikhsya organizatsii tekhnicheskogo i professional'nogo, poslesrednego i vysshego obrazovaniya* [On the approval of the rules, scope, and frequency of preventive medical examinations for target population groups, including preschool and school-aged children, as well as students of technical and vocational, post-secondary, and higher education institutions] - IPS «Ədilet» [Elektronnyi resurs]. URL: https://adilet.zan.kz/rus/docs/V2000021820 (accessed: 20.02.2025). [in Russian - in Kazakh]

18. *Ob utverzhdenii pravil organizatsii meditsinskoi pomoshchi po okhrane reproduktivnogo i psikhicheskogo zdorov'ya nesovershennoletnikh v vozraste ot desyati do vosemnadtsati let i molodezhi* [On the approval of the rules for organizing medical care for the protection of reproductive and mental health of minors aged ten to eighteen and youth] - IPS «Ədilet» [Elektronnyi resurs]. URL: https://adilet.zan.kz/rus/docs/V2000021846 (accessed: 11.02.2025). [in Russian - in Kazakh]

19. *Ob utverzhdenii Pravil provedeniya voenno-vrachebnoi ekspertizy i Polozheniya o komissiyakh voenno-vrachebnoi ekspertizy v Vooruzhennykh Silakh Respubliki Kazakhstan* [On the approval of the Rules for conducting military medical examinations and the Regulation on military medical examination commissions in the Armed Forces of the Republic of Kazakhstan] - IPS «Ədilet» [Elektronnyi resurs]. URL: https://adilet.zan.kz/rus/docs/V2000021869/history (accessed: 15.01.2025). [in Russian - in Kazakh]

20. *Ob utverzhdenii standarta organizatsii okazaniya urologicheskoi i andrologicheskoi pomoshchi v Respublike Kazakhstan* [On the approval of the standard for the organization of urological and andrological care in the Republic of Kazakhstan] - IPS «Ədilet» [Elektronnyi resurs]. URL: https://adilet.zan.kz/rus/docs/V2300032541 (accessed: 06.02.2025). [in Russian - in Kazakh]

21. *Ozhirenie, insulinorezistentnost' i reproduktivnoe zdorov'e muzhchiny: patogeneticheskie vzaimodeistviya i sovremennaya patogeneticheskaya farmakoterapiya* [Obesity, insulin resistance, and male reproductive health: pathogenetic interactions and modern pathogenetic pharmacotherapy] uMEDp [Elektronnyi resurs]. URL: https://umedp.ru/articles/ozhirenie_insulinorezistentnost_i_reproduktivnoe_zdorove_muzhchiny_patogeneticheskie_vzaimodeystviya.html (accessed: 25.01.2025). [in Russian]

22. *O zdorov"e naroda i sisteme zdravookhraneniya* [On Public Health and the Healthcare System] - IPS «Ədilet» [Elektronnyi resurs]. URL: https://adilet.zan.kz/rus/docs/K2000000360 (accessed: 02.02.2025. [in Russian - in Kazakh]

23. *O natsional'noi bezopasnosti Respubliki Kazakhstan* [On the National Security of the Republic of Kazakhstan] - IPS «Ədilet» [Elektronnyi resurs]. URL: https://adilet.zan.kz/rus/docs/Z1200000527 (accessed: 18.01.2025). [in Russian - in Kazakh]

24. *O proekte Ukaza Prezidenta Respubliki Kazakhstan «Ob utverzhdenii osnovnykh napravlenii gosudarstvennoi politiki Respubliki Kazakhstan v sfere ofitsial'noi pomoshchi razvitiyu na 2021 – 2025 gody»* [On the Draft Decree of the President of the Republic of Kazakhstan «On the approval of the main directions of the state policy of the Republic of Kazakhstan in the field of official development assistance for 2021–2025»] - IPS «Ədilet» [Elektronnyi resurs]. URL: https://adilet.zan.kz/rus/docs/P2100000344 (accessed: 25.11.2024). [in Russian - in Kazakh]

25. *Otsenka reproduktivnogo potentsiala muzhskogo naseleniya* [Assessment of the reproductive potential of the male population] [Elektronnyi resurs]. URL:https://cyberleninka.ru/article/n/otsenka-reproduktivnogo-potentsiala-muzhskogo-naseleniya/viewer (accessed: 11.01.2025). [in Russian]

26. *Prosmotr «Etiologicheskie faktory narusheniya reproduktivnoi funktsii u muzhchin (po dannym kliniki „Mat' i ditya“)»* [Viewing «Etiological factors of impaired reproductive function in men (based on data from the Mother and Child clinic)»] [Elektronnyi resurs]. URL: https://repromed.kz/index.php/journal/article/view/5/2 (accessed: 23.03.2025). [in Russian]

27. Rasimovich A. A. *Rol' infektsii, peredavaemykh polovym putem, v formirovanii demograficheskogo sostoyaniya Respubliki Tatarstan i puti ego uluchsheniya* [The role of sexually transmitted infections in shaping the demographic situation of the Republic of Tatarstan and ways to improve it] 2022. C. 321. [in Russian]

28. Segodnya muzhskim zdorov'em v Kazakhstane nikto ne zanimaetsya – ekspert. *Kazinform* [Currently, no one is addressing men's health in Kazakhstan – expert] [Elektronnyi resurs]. URL: https://www.inform.kz/ru/segodnya-muzhskim-zdorov-em-v-kazahstane-nikto-ne-zanimaetsya-ekspert_a3947337 (accessed: 04.12.2024). [in Russian - in Kazakh]

29. Sergeevich B.Yu. *Sotsial'no-gigienicheskie i mediko-organizatsionnye aspekty sovershenstvovaniya sanatorno-kurortnogo lecheniya patsientov s boleznyami muzhskikh polovykh organov* [Socio-hygienic and medical-organizational aspects of improving sanatorium-resort treatment of patients with diseases of the male reproductive organs] 2019. C. 124. [in Russian]

30. *Serdechno-sosudistye zabolevaniya* [Cardiovascular diseases] [Elektronnyi resurs]. URL:

https://www.who.int/ru/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds) (accessed: 11.11.2024). [in Russian]

31. *Sovremennaya demograficheskaya situatsiya i problemy uluchsheniya reproduktivnogo zdorov'ya naseleniya Rossii* [The current demographic situation and challenges in improving the reproductive health of the population in Russia] [Elektronnyi resurs]. URL: https://cyberleninka.ru/article/n/sovremennaya-demograficheskaya-situatsiya-i-problemy-uluchsheniya-reproduktivnogo-zdorovya-naseleniya-rossii/viewer (accessed: 25.01.2025). [in Russian]

32. Ugli Sh. A. B. *Kliniko-laboratornye prediktory effektivnosti varikotselektomii u muzhchin s narusheniem reproduktivnoi funktsii* [Clinical and laboratory predictors of the effectiveness of varicocelectomy in men with impaired reproductive function] 2023. C. 131. [in Russian]

33. Ugrozy i riski demograficheskoi bezopasnosti Rossiiskoi Federatsii [Threats and risks to the demographic security of the Russian Federation] [Elektronnyi resurs]. URL: https://cyberleninka.ru/article/n/ugrozy-i-riski-demograficheskoy-bezopasnosti-rossiyskoy-federatsii/viewer (accessed: 06.03.2025). [in Russian]

34. *Uroven' besplodiya v Kazakhstane vyshe, chem v evropeiskikh stranakh* [The infertility rate in Kazakhstan is higher than in European countries] // Forbes.kz [Elektronnyi resurs]. URL: https://forbes.kz/news/newsid_296601 (accessed: 19.02.2025). [in Russian - in Kazakh]

35. *Tsel' 3: Obespechenie zdorovogo obraza zhizni i sodeistvie blagopoluchiyu dlya vsekh v lyubom vozraste* [Goal 3: Ensure healthy lives and promote well-being for all at all ages] // Ustoichivoe razvitie [Elektronnyi resurs]. URL: https://www.un.org/sustainabledevelopment/ru/health/ (accessed: 24.02.2025). [in Russian]

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