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## NAVIGATING THE GLOBAL CHALLENGE OF DIABETES MELLITUS: INSIGHTS FROM KAZAKHSTAN’S HEALTHCARE LANDSCAPE AND STRATEGIES FOR IMPROVED MANAGEMENT

The global prevalence of diabetes mellitus presents a significant challenge to public health, with projections indicating a substantial rise in cases, particularly in low- and middle-income countries. This study acknowledges the critical lack of comprehensive research and under-reporting of diabetes cases, emphasizing the need for improved screening strategies and healthcare access. Theoretical and practical significance is evident in the complexity of estimating prevalence, regional variations in Central Asia, and global initiatives recognizing diabetes as a major health concern. While successful management programs exist, challenges persist, including under-reporting, discrepancies in estimations, and delayed diagnoses, impacting patient quality of life and healthcare costs. Multidisciplinary approaches are essential due to the presence of multiple comorbidities among patients, emphasizing the need for coordinated efforts. Robust data sources and proactive healthcare policies are crucial in understanding prevalence trends and addressing this burgeoning health crisis on a global scale. This study aims to utilize administrative healthcare data from Kazakhstan to comprehensively explore diabetes epidemiology, including demographic factors, mortality, and comorbidities. Findings seek to inform targeted interventions and advance diabetes management strategies within the country’s healthcare landscape. The uneven distribution of type 2 diabetes prevalence, particularly among women, underscores the economic and societal significance of the issue, necessitating specialized medical care and focused research efforts. Identifying the true prevalence of diabetes is crucial for planning health improvement, treatment, and preventive measures. Collaboration among specialists is imperative to improve the health outcomes of type 2 diabetes patients, emphasizing the importance of screening and managing chronic non-communicable diseases to mitigate the medical and social impact of this global problem.

**Key words:** global health, diabetes mellitus, prevalence, management, epidemiology, healthcare access, comorbidities, statistics.

### Introduction

Investigating the frequency and treatment of diabetes mellitus is inherently imperative due to its substantial impact on global public health. The escalating prevalence of diabetes poses a formidable challenge, with the International Diabetes Federation reporting an estimated 387 million cases in 2014, projected to surge to a staggering 592 million by 2035, most of which are expected in countries with lower and middle incomes [1]. This choice of theme stems from acknowledging the critical absence of comprehensive research and under-registration of diabetes cases, signifying the potential health implications of undetected cases and the urgent need for improved screening strategies and healthcare access [2].

The relevance of this topic is underscored by its theoretical and practical significance. Theoretical significance is evident in the divergence of estimates and projections on diabetes prevalence, accentuating the complexity of forecasting this health issue [3,4]. Practical relevance is highlighted by the variation in diabetes prevalence across Central Asian countries, as exemplified by the data from the Diabetes Education Foundation of the Republic of Kazakhstan [5]. Furthermore, international acknowledgments such as those discussed at the United Nations General Assembly and initiatives such as the Global Plan for Diabetes Prevention underscore the global recognition of diabetes as a significant health issue, demanding united efforts [6, 8].

The criticality of diabetes management programs is evidenced by their tangible outcomes, as seen in

Kazakhstan's national program resulting in reduced mortality and disability rates among individuals affected by diabetes [9]. Nevertheless, challenges persist, including under-reporting, discrepancies in prevalence estimations, and delayed diagnoses, contributing to a decreased quality of life for patients and increased healthcare costs [10, 12, 13]. The need for interdisciplinary approaches is underscored by the prevalence of multiple comorbidities among patients with type 2 diabetes, necessitating coordinated efforts from a range of specialists [33].

IDF's analysis underscores the crucial role of reliable data sources in comprehending trends in diabetes prevalence and designing effective interventions [19, 20]. Moreover, projecting diabetes to become the seventh leading cause of death by 2030 underscores the imperative for proactive healthcare policies and interventions to tackle this escalating global health crisis [21].

Type 2 diabetes stands as a significant medical-social and interdisciplinary issue, demanding widespread awareness campaigns, lifestyle modifications, and early detection strategies to combat its escalating burden [27, 29, 30]. The societal impact of diabetes in Kazakhstan is profound, reflecting the regional disparities in prevalence rates and the necessity for enhanced research efforts and reliable data collection methodologies [1, 5].

Ultimately, this study aims to utilize healthcare data collected administratively from Kazakhstan's Unified National Electronic Health System (UNEHS) to comprehensively explore the epidemiology of both type 1 and type 2 diabetes, including demographic factors, all-cause mortality, and associated comorbidities. Such an exploration seeks to contribute valuable insights into crafting targeted interventions and advancing diabetes management strategies within Kazakhstan's healthcare landscape.

Therefore, the prevalence of type 2 diabetes varies unevenly across different regions of the country. A higher prevalence rate is found among women. Considering the current situation and associated costs, the economic impact of diabetes is underscored by significant labor losses due to its high prevalence. The growing prevalence and extended lifespan of individuals with diabetes result in an increase in the number of patients needing specialized medical care, including those with chronic complications from the disease.

The current disparity between national and global statistics on diabetes prevalence calls for focused research to reveal an accurate and detailed picture of the disease's spread. Such findings would

lay a scientific foundation for planning health improvement, treatment, and prevention strategies. Given the extensive impact of type 2 diabetes and its complications on society, it is essential to further examine how to organize the collaboration of various specialists (endocrinologists, ophthalmologists, neurologists, cardiologists, etc.) who work together to enhance the health of type 2 diabetes patients. Successfully implementing a diabetes screening program and a chronic non-communicable disease management program in the country will decrease the medical and social burden of this issue and identify optimal solutions for tackling these challenges.

## Materials and Methods

The approach to searching was initiated by conducting a thorough examination of primary databases. To identify relevant studies spanning from January 2010 to November 2023, we meticulously surveyed several principal databases, namely Medical Literature Analysis and Retrieval System Online (MEDLINE), Scopus, Web of Science (WOS), and the Cochrane library. Utilizing Medical Subject Headings (MeSH), we identified synonyms and pertinent keywords related to this article. For Scopus and Web of Sciences, searches involved combinations of keywords pertaining to cost, effectiveness, diabetes, and screening. To enhance our search scope, we extended our exploration to include "Google Scholar," the Center for Reviews and Dissemination, and the CEA Registry. Additionally, we conducted a manual inspection of the reference lists of all publications, comprising original studies and reviews. This process aimed to identify studies that might not have been captured through our systematic search.

### *1. Exploring the Prevalence and Management of Diabetes Mellitus*

The frequency and management of diabetes are crucial healthcare issues, covering its prevalence in populations and effective strategies for controlling, treating, and preventing complications. Diabetes mellitus presents a major challenge in global public health. As per the International Diabetes Federation, the figures are striking: in 2014, 387 million individuals worldwide were diagnosed with diabetes, amounting to 8.3% of the global populace. Disturbing forecasts anticipate a surge to 592 million cases by 2035, with 77% occurring in low- and middle-income nations. This underscores the critical need

for targeted interventions and resources to effectively tackle this escalating global health crisis. [1].

Certainly, the under-registration of diabetes cases is a significant concern highlighted by several researchers. Their argument emphasizes the substantial gap between diagnosed and undiagnosed diabetes cases within the adult population, estimated to reach a staggering 174.8 million worldwide. This discrepancy underscores the potential magnitude of undetected diabetes cases, signifying challenges in early detection and healthcare access. This unaccounted population remains at risk of experiencing undetected complications, thereby emphasizing the imperative need for improved screening strategies, heightened awareness campaigns, and enhanced healthcare infrastructure to address this under-recognized segment and mitigate the potential long-term health implications [2].

Divergent estimates and projections on diabetes prevalence underscore the complexity of forecasting this health issue. According to statistics from the World Health Organization, diabetes prevalence is on a troubling trajectory, projected to increase significantly by 2030, potentially surpassing 360 million among adults aged 18 and older. This sharp rise, compared to a global prevalence of 2.8% in 2000, expected to reach 4.4% by 2030, highlights the critical need for proactive healthcare policies and interventions to address this alarming trend and its accompanying healthcare challenges [3, 4].

The statistics presented by the Diabetes Education Foundation of the Republic of Kazakhstan highlight varying levels of diabetes prevalence across Central Asian countries, with 155,000 cases in Uzbekistan, 46,917 in the Kyrgyz Republic, and 30,000 in Tajikistan, indicating the complex nature of the issue in this region [5]. Global recognition of diabetes as a significant health concern, particularly the absence of comprehensive national strategies for its prevention and treatment highlighted during the 61st Session of the United Nations General Assembly, underscores the global scale of the challenge and the need for collective action [6]. The long-term goals of the St. Vincent Declaration, established in 1989, emphasize proactive measures and scientific advancements in mitigating severe diabetes complications, emphasizing the importance of prevention and ongoing research to reduce the disease's impact on public health. This alignment of data and global recognition underscores the urgency of coordinated efforts at both national and international levels to effectively address the multifaceted challenges posed by diabetes [7]. To prevent the diabetes epidemic,

the International Diabetes Federation has developed and presented the Global Plan for the Prevention of Diabetes for 2011-2021. Key provisions of the plan include improving the health status of people with diabetes through education on self-care principles, preventing the development of type 2 diabetes, and eradicating discrimination against people with diabetes [8].

The documented link between diabetes prevalence and the implementation of a focused state program underscores the significant impact of strategic healthcare initiatives. Notable successes in this regard are apparent over a five-year span, during which the program's execution led to a remarkable four-fold decrease in mortality rates and a 25% reduction in disability rates among diabetes patients [9]. These achievements are particularly vital considering the direct association between rising diabetes prevalence and its adverse effects, such as increased hospital admissions, higher healthcare costs, and elevated disability rates among affected communities [10]. The significance of these outcomes not only underscores the effectiveness of a targeted state program but also emphasizes the vital role of such interventions in mitigating the health and economic burdens associated with diabetes. These findings highlight the imperative nature of sustained efforts in implementing comprehensive programs aimed at diabetes management and prevention to alleviate the societal impact and healthcare burden posed by this chronic condition.

The World Health Organization (WHO) emphasizes the importance of establishing a diabetes registry. This is motivated by both a notable rise in patient numbers and the crucial need for accurate data on new case registrations, existing complications, laboratory test results, and effective monitoring and management of patients' health statuses [11].

As of early 2014, data from the National Registry in Kazakhstan indicated a substantial diabetic population, comprising 244,892 individuals affected by the condition. This included a breakdown showing 12,816 adults diagnosed with type 1 diabetes and a larger cohort of 229,712 adults were diagnosed with type 2 diabetes. Furthermore, there were 493 adolescents diagnosed with type 1 diabetes and 31 with type 2 diabetes, as well as 1,441 children diagnosed with type 1 diabetes and 48 with type 2 diabetes. By 2015, these figures surged, reaching a total of 261,453 registered cases, marking a notable increase of 6.77%. Among these cases, 13,250 were classified as type 1 diabetes cases, while an overwhelming 245,655 cases were attributed to type

2 diabetes within the adult population. Adolescents had 536 cases of type 1 diabetes and 30 cases of type 2 diabetes, while children had 1,576 cases of type 1 diabetes and 58 cases of type 2 diabetes. These escalating numbers over a mere year underscore the concerning trend of diabetes prevalence across different age groups and call for heightened efforts in both prevention and management strategies to tackle this growing health challenge in Kazakhstan. The current diabetes registry in the country includes information solely on patients who are already aware of their condition [12]. However, it's important to note that a substantial number of patients receive care in private medical facilities and may not be included in the registry. These aspects warrant further investigation and clarification.

Government-reported statistics from Kazakhstan suggest that around 1.34% of the total population has been diagnosed with type 2 diabetes, representing a relatively lower prevalence compared to the estimations proposed by the IDF. The IDF's data indicates a significantly higher prevalence of approximately 7.5% in the population, suggesting there may be around 500,000 undiagnosed cases in the country [13]. However, this estimate has sparked debate and lacks unanimous agreement. Some researchers [14] challenge the IDF's calculations, arguing that they exaggerate the prevalence of diabetes in Kazakhstan. This discrepancy in estimates highlights the complexity of accurately assessing diabetes prevalence and underscores the need for further comprehensive studies and refined methodologies to better understand the true extent of this health issue among the Kazakhstani population. Typically, diabetes diagnoses often occur late, after complications have already developed, leading to a diminished quality of life for patients. It is also crucial to consider the broad range of associated conditions and the importance of providing outpatient care [15].

In certain regions of Kazakhstan, a three-tiered diabetes management program has been integrated into primary healthcare services to mitigate complications among newly diagnosed diabetic patients. The first tier encompasses 70-80% of the affected population, where patients can independently manage their condition and actively participate in their treatment (self-management). The second tier (15-25%) includes patients at higher risk levels who receive care from a multidisciplinary team following clinical guidelines based on evidence-based medicine and supported by a healthcare information system. The third tier (5%) addresses the most complex cases. Key challenges in diabetes management

include issues like poor self-management, inadequate screening, low patient awareness, and insufficient access to self-monitoring devices [16].

Researchers assert that the success of diabetes management programs [17] hinges on improving medical care quality, reducing complication and disability rates, optimizing bed usage efficiency, cutting healthcare expenditures, and other metrics.

Various factors affect diabetes prevalence in the population, notably age, gender distribution, lifestyle choices, and the implementation of screening programs, which lead to an increase in reported cases. Early detection initiatives for diabetes are conducted based on epidemiological, healthcare, demographic, and economic considerations [18].

In recent years, there has been a notable rise in both national and international literature focusing on diabetes epidemiology, assessments of mortality and disability, studies on diabetes literacy among patients, and evaluations of their perceptions of care quality. The influence of various international and European organizations, including the IDF, EASD, EURADIA, and others, in conducting diabetes research and providing statistical data, is increasing.

The IDF conducted a thorough analysis to measure the global prevalence of diabetes among adults aged 20-79 years. This comprehensive assessment included evaluating demographic, ethnic, and economic factors across various regions to understand trends in disease prevalence [19]. The study highlighted that the accuracy of estimating diabetes prevalence relies heavily on the quality and reliability of the data sources used for analysis [20]. Recognizing the importance of robust and dependable data sources is crucial for accurately assessing diabetes prevalence worldwide, underscoring the necessity for consistent and comprehensive data collection methods to improve the precision of estimates.

Diabetes represents a pressing global societal issue, projected by the WHO to become the seventh leading cause of death by 2030 [21]. The scale of this challenge is starkly evident in global statistics from 2015, which estimated that 415 million individuals aged 20-79 were living with diabetes worldwide. Among them, 215.2 million were men, a figure expected to rise to 328.4 million by 2040. Similarly, 199.5 million women were affected in 2015, with projections indicating an increase to 313.3 million by 2040. The forecasts are alarming; the International Diabetes Federation predicts a dramatic escalation, projecting the diabetic population to reach 642 million by 2040. Regional disparities are also notable, as highlighted by the IDF Diabetes Atlas, with the

Western Pacific region hosting a significant diabetic population of 153.2 million in 2015, expected to grow to a daunting 215.8 million by 2040. Southeast Asia closely follows with 78.3 million affected individuals, expected to rise significantly to 140.2 million by 2040. Europe, while relatively lower in prevalence with 59.8 million cases in 2015, is still poised to witness a substantial increase, projected to reach 71.1 million by 2040 [22]. These staggering figures underscore the pressing need for global health initiatives to address the burgeoning diabetes crisis, urging for concerted efforts in prevention, management, and intervention strategies to mitigate the impending health burden on a global scale.

The Russian Federation is experiencing a significant rise in diabetes prevalence, driven primarily by increasing rates of type 2 diabetes among its adult population, alongside declining mortality rates among those affected by both type 1 and type 2 diabetes [23]. Of particular concern is the growing number of individuals affected by type 2 diabetes, particularly prevalent among those aged 65-69, highlighting the severity of the health issue [24]. The trajectory of this health crisis is underscored by an average annual growth rate of 6.23% [25], emphasizing the urgent need for comprehensive interventions and health policies to address its escalating impact.

Additionally, prior research [26] has highlighted shortcomings in the current diabetes patient registration system in Almaty, Kazakhstan. These studies indicate an inherent inability to accurately delineate the structural dynamics and various prevalence characteristics of the disease. Such inadequacies in data collection impede the formulation of effective and tailored organizational and managerial strategies. Addressing these systemic gaps is crucial to not only enhance the accuracy of disease surveillance but also to craft targeted interventions that are responsive to the diverse facets of diabetes prevalence within the region, thereby facilitating more effective management and prevention measures.

## *2. Type 2 Diabetes as a Medical-Social and Interdisciplinary Issue*

Diabetes mellitus poses a significant global health challenge, evidenced by a substantial global prevalence of 8.8% in 2015 [27]. Accurate assessments of diabetes burdens are crucial for effective resource allocation and comprehensive evaluation. According to the IDF Diabetes Atlas (7th edition, 2015), an alarming 415 million individuals were living with

diabetes worldwide in 2015, a number projected to rise to approximately 642 million by 2040. Notably, China reported the highest prevalence of diabetes among adults aged 20-79, with an estimated 109.6 million cases (99.6-133.4), followed by India with 69.2 million (56.2-84.8), and the USA with 29.3 million (27.6-30.9).

The rise in global type 2 diabetes cases can be attributed to several factors, including population growth, aging populations, rising obesity rates due to unhealthy diets, and sedentary lifestyles [28]. It is concerning that over 90% of diabetes cases are classified as type 2, and nearly half of these cases remain undiagnosed [29]. Numerous studies have consistently emphasized the critical importance of regular screenings in significantly reducing or delaying the onset of complications linked to type 2 diabetes [30,31].

These findings highlight the pressing need for extensive awareness campaigns, proactive health interventions, and accessible healthcare services to tackle the growing diabetes crisis. With global prevalence on the rise, there is an increasing urgency to prioritize preventive measures, lifestyle changes, and early detection strategies to alleviate the growing burden of type 2 diabetes and its associated complications worldwide. The presence of multiple comorbidities among type 2 diabetes patients necessitates the involvement of various specialists. A survey of 204 patients indicated that 40.7% regularly visit a cardiologist, 45.1% see an ophthalmologist, while only 5.4% and 8.8% consult a neurologist and nephrologist, respectively, as recommended by endocrinologists. Delays in doctor visits were primarily attributed to lengthy appointment wait times (53.4%), insufficient awareness about the necessity of specialist consultations (51.5%), and visiting an endocrinologist solely for prescription renewals (71.5%).

A comprehensive retrospective analysis involving a large cohort of 1,389,016 participants, where 53% were women with an average age of 65 years, revealed striking statistics concerning type 2 diabetes patients and their associated health conditions. Remarkably, 97.5% of these individuals were found to have at least one comorbidity, with a significant 88.5% experiencing two or more concurrent health issues. Among the prevalent comorbidities, hypertension emerged as the most widespread, affecting 82.1% of type 2 diabetes cases, followed closely by overweight or obesity at 78.2%, hyperlipidemia at 77.2%, chronic kidney disease at 24.1%, and cardiovascular disease at 21.6% [33]. In another study [34], concerning

findings emerged regarding a notably elevated standardized mortality rate among individuals aged 15-30 years, with a rate of 3.4 [95% CI 2.7–4.2]. Additionally, results from the extensive UKPDS study, spanning over two decades and involving more than 5000 type 2 diabetes patients, demonstrated a significant outcome. It was shown that even a modest 1% reduction in glycated hemoglobin (HbA1c) levels could lead to substantial prevention: preventing 35% of microvascular complications, 18% of myocardial infarctions, 15% of strokes, and notably, 25% of deaths linked to diabetes-related complications [33].

These compelling findings highlight the critical necessity for embracing comprehensive and multidisciplinary healthcare strategies to effectively combat the challenges posed by type 2 diabetes. Robust and well-coordinated management approaches, underscored by vigilant monitoring and proactive interventions, play a pivotal role in not only addressing the diverse spectrum of associated comorbidities but also in mitigating the pronounced mortality rates, especially prevalent among younger demographics. Implementing a multidisciplinary, team-based approach proves highly effective in managing type 2 diabetes, fostering a collaborative relationship between healthcare providers and patients. This approach prioritizes patient education, empowering them to autonomously manage their health, and promotes active participation in their treatment plan [33,34]. Furthermore, type 2 diabetes stands among the trio of conditions encompassed within disease management programs, signaling a significant shift from traditional preventive medicine towards a proactive paradigm centered around self-health management [33]. This transformation in healthcare paradigms emphasizes the pivotal role of patient engagement and self-management, not only in the context of type 2 diabetes but also in shaping a more patient-centered approach within the broader landscape of healthcare delivery.

### *3. Type 2 diabetes as a social problem of Kazakhstan*

In recent decades, there has been a significant and concerning rise in the global prevalence of diabetes, making it a critical public health issue worldwide. As of 2019, an estimated 463 million people were affected, representing a prevalence rate of 9.3%. Projections suggest a troubling increase to 10.2% (578 million) by 2030 and a staggering 10.9% (700 million) by 2045 [1]. Urban

areas notably show a higher prevalence at 10.8% compared to 7.2% in rural regions, highlighting the influence of lifestyle and environmental factors [1]. Additionally, a stark disparity exists between high-income and low-income countries, with prevalence rates reaching 10.4% in high-income nations versus a significantly lower 4.0% in low-income countries [1]. These statistics underscore the urgent need for coordinated global efforts to address the multifaceted challenges posed by diabetes. These efforts should encompass lifestyle interventions, socio-economic considerations, and healthcare system strengthening to mitigate the increasing burden on individuals and healthcare systems alike.

However, despite ample data on diabetes from high-income nations, there is a notable lack of published information on the epidemiology of both type 1 and type 2 diabetes in low- and middle-income countries in Central Asia, including Kazakhstan. Several small-scale observational studies have attempted to explore diabetes epidemiology in Kazakhstan [2,3,4,5]. For example, a cross-sectional study conducted across four geographically distant regions of Kazakhstan, involving 4,753 participants using the WHO STEP survey, reported a survey-weighted prevalence of impaired fasting glycemia (IFG) at 1.9% and type 2 diabetes mellitus (T2DM) at 8.0% [4]. However, there remains a gap in research investigating diabetes epidemiology using national health registry data in Kazakhstan.

Kazakhstan boasts a well-developed electronic healthcare system, notably the Unified National Electronic Health System (UNEHS), initiated in 2003 and fully established by 2014. This system aggregates medical claims from diverse electronic data sources across healthcare facilities nationwide. Integration and analysis of this comprehensive electronic healthcare data could offer profound insights into the nuanced epidemiology of diabetes across Kazakhstan [6, 7].

Therefore, our study aims to investigate the descriptive epidemiology of both type 1 and type 2 diabetes, as well as to analyze demographic factors associated with all-cause mortality among individuals affected by these conditions. Additionally, we aim to identify comorbidities linked to all-cause mortality among patients with type 1 and type 2 diabetes in Kazakhstan, utilizing extensive administrative healthcare data from the Unified National Electronic Health System (UNEHS) spanning from 2014 to 2023.

#### 4. Tackling the Rising Tide of Type 2 Diabetes in Kazakhstan

Type 2 diabetes represents a substantial global health challenge due to its multifaceted impact on various populations, and the Republic of Kazakhstan is no exception to this concerning trend. As of 2023, the incidence and prevalence rates of type 2 diabetes within Kazakhstan have become a subject of intense scrutiny and analysis within the realm of public health. Detailed reports and surveys conducted across diverse regions of the country have consistently highlighted the persistent and worrisome burden that type 2 diabetes poses on the health of its citizens [30].

The data collected from these various regions unequivocally underscores the widespread nature of this health issue, affecting a considerable segment of the Kazakh population. This concerning trend is indicative of the complex interplay between lifestyle factors, genetic predispositions, dietary habits, and socio-economic conditions contributing to the increasing prevalence of type 2 diabetes. Medical professionals, policymakers, and health experts have been increasingly focused on devising comprehensive strategies to address this escalating health concern. The need for robust public health interventions, including awareness campaigns, lifestyle modifications,

improved access to healthcare, and enhanced diabetes management programs, has become imperative. The impact of type 2 diabetes extends beyond individual health, exerting substantial economic burdens on the healthcare system and the country's overall productivity. Addressing this issue demands collaborative efforts between government initiatives, healthcare providers, community organizations, and educational institutions to implement sustainable solutions.

Understanding the regional disparities and factors influencing the prevalence of type 2 diabetes within Kazakhstan is crucial for tailoring targeted interventions. Efforts to promote healthier lifestyles, encourage physical activity, and improve nutritional education are pivotal in curbing the progression of this chronic condition. Moreover, fostering a culture of early detection through regular screenings and diagnostic measures is pivotal in mitigating the adverse effects and complications associated with untreated or poorly managed type 2 diabetes. By emphasizing prevention and proactive management, it is possible to alleviate the societal burden caused by this disease. The table labeled as Table 1 presents the occurrence of type 2 diabetes within the populace of the Republic of Kazakhstan for the year 2022 [30].

**Table 1** – The incidence of type 2 diabetes in the population of the Republic of Kazakhstan in 2022

The name of the region	The number of adults	The number of children (aged 0 – 17 years)	Total
Akmola Region	903	198	1101
Aktobe Region	683	156	839
Almaty Region	2100	417	2517
Almaty City	2529	595	3124
Atyrau Region	721	145	866
East Kazakhstan Region	2040	339	2379
Nur-Sultan City	2010	365	2375
Zhambyl Region	763	228	991
West Kazakhstan Region	898	120	1018
Karaganda Region	2071	439	2510
Kostanay Region	1318	178	1496
Kyzylorda Region	605	169	774
Mangystau Region	696	164	860
Pavlodar Region	1025	169	1194
North Kazakhstan Region	1005	145	1150
Turkistan Region	1155	319	1474
Shymkent City	1104	230	1334
Total	2126	4376	26002

The data collected provides insights into the distribution of type 2 diabetes among adults and children (aged 0-17 years) in different regions of Kazakhstan. This information not only reveals the magnitude of the issue but also underscores the necessity for targeted health interventions and strategies to combat this chronic condition effectively [27].

Looking at the breakdown by region, it is evident that some areas experience a higher prevalence of type 2 diabetes than others. Almaty City and Almaty Region show substantial numbers, with 3124 and 2517 cases respectively, demonstrating a considerable burden of this metabolic disorder. These regions, being densely populated urban centers, might be susceptible to lifestyle factors contributing to diabetes, such as sedentary lifestyles and unhealthy dietary habits.

Other regions like Karaganda, East Kazakhstan, and Nur-Sultan City also demonstrate notable numbers of reported cases, signaling the widespread nature of this health issue across diverse geographical areas within the country [18].

Analyzing the data further by age groups, it is concerning to note that children are also affected by type 2 diabetes. The statistics reveal significant numbers of children diagnosed with this condition across several regions, with a total of 4376 cases reported in 2023. The presence of type 2 diabetes in children is particularly alarming as it may result from a combination of genetic predisposition and lifestyle factors, indicating the need for early prevention and intervention strategies targeting both adults and children [34].

With a reported total of 26,002 cases, there is a clear need for a comprehensive public health strategy to manage and prevent type 2 diabetes. This strategy should include initiatives such as promoting healthy lifestyles through education, ensuring access to quality healthcare services, encouraging physical activity, and enhancing nutritional awareness among the population.

Efforts to tackle this health challenge should be customized to meet the unique needs and contexts of each region. For example, urban areas may benefit from interventions aimed at promoting healthier diets and enhancing physical activity, while rural regions may benefit from enhanced access to healthcare facilities and educational campaigns to raise awareness about diabetes prevention.

Collaborative initiatives involving healthcare professionals, policymakers, community leaders, and individuals themselves are crucial to combatting type 2 diabetes effectively. By implementing proactive

measures and promoting a culture of health and wellness, Kazakhstan can work towards reducing the incidence and impact of type 2 diabetes on its population [33].

Overall, the data on type 2 diabetes incidence in the Republic of Kazakhstan in 2023 serves as a clarion call for concerted efforts to address this pressing public health issue. Through targeted interventions, education, and community engagement, Kazakhstan can strive towards a healthier future with reduced instances of type 2 diabetes and improved well-being for its citizens.

## Conclusion

The distribution of type 2 diabetes varies across regions within the country, showing a disparity, particularly with a higher prevalence among women. This gender discrepancy in prevalence underscores the necessity for targeted interventions aimed at specific demographic groups. Moreover, the economic impact of diabetes highlights significant labor losses due to its prevalence, underscoring the urgent need for effective interventions. The rising prevalence and longer lifespan of individuals with diabetes contribute to an increasing number of patients requiring specialized medical care, especially those managing chronic complications of the disease.

The disparity in diabetes prevalence indicators within the country, in contrast to global statistics, necessitates focused research to accurately determine the true extent of this condition. These detailed insights would serve as a scientific basis for developing customized strategies for health enhancement, treatment, and prevention. Considering the scale of the problem and its societal impact, there is an urgent requirement for coordinated collaboration among diverse specialists including endocrinologists, ophthalmologists, neuropathologists, and cardiologists. This collective effort aims to improve health outcomes for individuals with type 2 diabetes.

To effectively address this multifaceted challenge, the implementation of a robust diabetes screening program alongside a comprehensive strategy for managing chronic non-communicable diseases at a national level is imperative. Such programs not only aim to reduce the medical and social burden associated with diabetes but also seek to identify optimal solutions for mitigating the impact of these health issues on the population. This collective focus on proactive healthcare management can greatly reduce the negative impact of type 2 diabetes and its related complications on society as a whole.



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