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WHITE PAPER

FROM INEQUALITY TO RESILIENCE: THE LONG- TERM BENEFITS OF EXPANDING ACCESS TO INSULIN PUMPS

*«Insulin pumps are not
expenses, but protection against
catastrophic costs»*

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ABOUT DIARCOM

The Public Foundation «Diabetes Parents Committee» (DIARCOM) is Kazakhstan's leading NGO in the field of diabetes. We advocate for the rights of families with children living with type 1 diabetes and promote systemic changes in healthcare. The foundation combines expert knowledge, international connections, and the practical experience of parents, transforming them into successful projects — from educational camps and school programs to national-level advocacy campaigns. We are a reliable partner for government, business, and international organizations, capable of professionally implementing projects of any complexity and achieving real changes in the lives of patients.

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INSULIN PUMPS FOR ADULTS AND PREGNANT WOMEN: A STRATEGY FOR PREVENTING COMPLICATIONS AND ECONOMIC LOSSES

Executive Summary

Type 1 diabetes (T1D) in adults and pregnant women is a chronic, progressive disease that requires strict glucose control. Insulin pumps are globally recognized as an effective method of managing T1D, reducing complication rates, improving quality of life, and preventing disability. However, in Kazakhstan, the state funding program covers only children: after turning 18, patients with T1D are forced either to purchase expensive devices and consumables on their own or to return to the less effective therapy of multiple daily injections.

Analysis shows that lack of access to pumps for adults and pregnant women leads to worsening glycemic control, increased hospitalizations for diabetic ketoacidosis and hypoglycemia, higher costs of treating complications (nephropathy, retinopathy, diabetic foot), and increased disability rates. Each pregnancy with T1D without pump support carries high risks for both mother and child, while the economic costs (including loss of working capacity) amount to millions of tenge per patient annually.

International experience, including that of the USA, EU, Canada, Israel, and Russia, confirms that the introduction of insulin pump therapy not only reduces healthcare spending but also delivers long-term benefits to the state. This is achieved through improved patient health, higher labor productivity, and reduced disability burden. According to more than 50 % of economic models, insulin pumps are a cost-effective intervention. Cost-effectiveness is assessed using the ICER (incremental cost-effectiveness ratio). If the ICER is less than \$50,000 per additional quality-adjusted life year (QALY), the intervention is considered economically justified in terms of costs and benefits to society.

Our calculations show that covering 1,000 adults and pregnant women would require between 700 million and 1 billion tenge annually. However, these are investments that begin to pay off within 5–7 years due to avoided hospitalizations and complication treatments. Calculations presented in this paper also demonstrate that each prevented case of disability saves the healthcare system up to 2 million tenge per year.



This White Paper proposes a step-by-step strategy: regulatory changes, a pilot project, physician training, launch of a patient registry, interagency cooperation, and communication support. Introducing pump therapy for vulnerable groups is not merely a medical measure; it is a signal of a mature healthcare system oriented toward prevention, equity, and sustainability.

Abbreviations

Abbreviation	Full Form
T1D	Type 1 Diabetes Mellitus
GVFMC	Guaranteed Volume of Free Medical Care
MSHI	Mandatory Social Health Insurance
QALY	Quality-Adjusted Life Year
HbA _{1c}	Glycated Hemoglobin
MDI	Multiple Daily Injections
IDF	International Diabetes Federation
NICE	National Institute for Health and Care Excellence
NHS	National Health Service
WOH	World Health Organization
SK-Pharmacy	Unified distributor for procurement of medicines and medical devices in the Republic of Kazakhstan
MoH RK	Ministry of Health of the Republic of Kazakhstan
DKA	Diabetic Ketoacidosis
NGO	Non-Governmental Organization



Key Terms

Term	Definition
Insulin Pump	A medical device designed for continuous subcutaneous insulin infusion throughout the day. Helps maintain stable glucose levels in patients with T1D.
Type 1 Diabetes Mellitus (T1D)	A chronic autoimmune disease in which the pancreas stops producing insulin. Requires continuous insulin therapy.
Glycemic Control	Maintaining blood glucose levels within target ranges to prevent diabetes complications.
Hypoglycemia	A condition of low blood sugar (<3.9 mmol/L), potentially life-threatening.
Hyperglycemia	A condition of elevated blood sugar levels, associated with poor well-being and risk of complications.
HbA _{1c}	Glycated hemoglobin – an indicator of the average blood glucose concentration over the past 2–3 months. Used to assess the effectiveness of diabetes treatment.
QALY	Quality-Adjusted Life Year – used in pharmacoeconomics to evaluate the effectiveness of medical interventions.
Consumables	Components required for the functioning of an insulin pump: infusion sets, reservoirs, batteries, etc.
Clinical Protocol	An official document regulating approaches to diagnosis, treatment, and management of a specific disease.



Term	Definition
Outpatient Drug Provision	Distribution of medicines and medical devices to patients outside hospital settings under GOBMP and OSMS.
Pharmacoeconomics	A discipline studying the relationship between costs and effectiveness in the use of medical technologies.
Disability	Loss of work capacity and social activity due to illness and its complications.



DIABETES WITHOUT BORDERS, BUT SUPPORT WITH AN AGE LIMIT OF 18

Chapter 1. Introduction and Relevance of the Problem

Type 1 diabetes (T1D) is a chronic autoimmune disease that requires lifelong glycemic control and regular insulin administration. Modern treatment technologies, particularly insulin pumps, make it possible to achieve more stable glucose levels and reduce the risk of dangerous fluctuations in blood sugar¹. An insulin pump is a portable device for continuous subcutaneous insulin infusion that mimics the physiological secretion of the hormone and eliminates the need for multiple daily injections. Numerous studies have confirmed that insulin pump therapy improves glycemic control, reduces the frequency of hypoglycemia and diabetic complications, and enhances the quality of life of patients with T1D².

In Kazakhstan, access to insulin pumps through government programs is currently limited to children and adolescents under 18 years of age. However, upon reaching adulthood, patients are forced either to purchase devices and consumables on their own or to return to multiple daily injections. Adults with T1D, and especially pregnant women with this condition, are effectively left without state support in terms of pump therapy. This creates serious barriers to effective treatment: financial burden, unequal access to technology, deterioration in diabetes management, and increased risk of complications. Considering the rising incidence of diabetes and improved survival of children with T1D, ensuring access to insulin pumps for **adult patients** is becoming increasingly relevant and requires a systemic solution at the state level.

Epidemiology of Type 1 Diabetes in Adults and During Pregnancy

According to official data from the Ministry of Health, about **439,327** patients with all types of diabetes are registered in Kazakhstan, which corresponds to approximately 2.2 % of the population. By comparison, in developed countries this figure reaches 4–6 % of the population, and with the epidemic of obesity

1 Feig DS, Murphy HR, Donovan LE, Corcoy R, Barrett JFR, Sanchez JJ, Ruedy K, Kollman C, Tomlinson G; CONCEPTT Collaborative Group. *Pumps or Multiple Daily Injections in Pregnancy Involving Type 1 Diabetes: A Prespecified Analysis of the CONCEPTT Randomized Trial*. Diabetes Care. 2018 Dec;41(12):2471–2479. doi:10.2337/dc18-1437. PMID:30327362.

2 Gandhi K, Ebekozi O, Noor N, McDonough RJ, Hsieh S, Miyazaki B, Dei-Tutu S, Golden L, Desimone M, Hardison H, Rompicherla S, Akturk HK, Kamboj MK; T1D Exchange Quality Improvement Collaborative. *Insulin Pump Utilization in 2017–2021 for More Than 22,000 Children and Adults With Type 1 Diabetes: A Multicenter Observational Study*. Clinical Diabetes. 2024 Winter;42(1):56–64. doi:10.2337/cd23-0055. PMID: 38230341; PMCID: PMC10788665. Доступно на: <https://diabetesjournals.org/clinical/article/42/1/56/153723/Insulin-Pump-Utilization-in-2017-2021-for-More>.



and metabolic disorders, a further increase in diabetes prevalence is expected in Kazakhstan as well. Among the total number of people living with diabetes, only a small proportion are diagnosed with T1D—estimated at around **3–5 %** (no more than 15,000–20,000 individuals) suffer specifically from insulin-dependent diabetes³. This confirms that T1D is relatively rare compared to the predominant type 2 diabetes; however, patients with T1D require much more intensive therapy and medical attention due to the complete absence of endogenous insulin secretion. Their life expectancy largely depends on the quality of glycemic control.

A particularly high-risk group consists of **pregnant women** with pre-existing T1D. Every year, hundreds of pregnancies among women with T1D are recorded in Kazakhstan (according to internal estimates, about 100–200 cases annually). Pregnancy with T1D is associated with an increased likelihood of complications for both mother and fetus: the risk of diabetic fetopathy, congenital malformations, miscarriages, and stillbirths directly correlates with maternal glycemia during pregnancy⁴. Achieving normoglycemia significantly reduces these risks. International data indicate that the use of insulin pumps in pregnant women with T1D helps improve glucose control and reduce episodes of severe hypoglycemia, contributing to successful pregnancy outcomes and the birth of healthy children⁵. In Kazakhstan, the management of pregnancies in women with diabetes is particularly challenging, as the number of women of reproductive age with T1D is increasing, while neonatal outcomes depend heavily on the quality of diabetes care.

Thus, despite the relatively small absolute number of patients with T1D over 18 years of age and pregnant women with this condition, the social significance of the problem is extremely high. Each such patient is a person of working age whose health and quality of life are determined by the degree of diabetes compensation. Providing them with modern therapeutic tools—particularly insulin pumps—is relevant not only from a medical perspective but also from demographic and economic standpoints, as it directly affects family well-being, birth rates, and the long-term burden on the healthcare system.

3 Pease A, Zomer E, Liew D, Lo C, Earnest A, Zoungas S. *Cost-effectiveness of health technologies in adults with type 1 diabetes: a systematic review and narrative synthesis*. Syst Rev. 2020 Aug 3;9(1):171. doi:10.1186/s13643-020-01373-Y. PMID:32746937; PMCID:PMC7401226.

4 Сахарный диабет при беременности (гестационный диабет, прегестационный диабет) (www.msmanuals.com)

5 Feig DS, Murphy HR, Donovan LE, Corcoy R, Barrett JFR, Sanchez JJ, Ruedy K, Kollman C, Tomlinson G; CONCEPTT Collaborative Group. *Pumps or Multiple Daily Injections in Pregnancy Involving Type 1 Diabetes: A Prespecified Analysis of the CONCEPTT Randomized Trial*. Diabetes Care. 2018 Dec;41(12):2471–2479. doi:10.2337/dc18-1437. PMID:30327362



The Problem of Insufficient Provision and Its Consequences

Limited access to pump therapy for adults

At present, state funding for insulin pumps in Kazakhstan is provided only for children and adolescents with T1D. Upon reaching the age of 18, patients are excluded from the preferential supply program: they must either purchase the pump and consumables at their own expense or continue therapy through multiple daily insulin injections. The cost of an insulin pump and its accessories is extremely high for the average patient. Estimates suggest that the device itself costs between **1.5 and 2.5 million tenge**, while consumables (infusion sets, reservoirs) require approximately **50,000–60,000 tenge** per month (amounting to about **600,000–720,000 tenge annually** per patient). For comparison, the market price of an imported pump in neighboring Russia reaches 150,000–500,000 rubles, and consumables cost up to 6,000 rubles per month⁶, comparable to prices in Kazakhstan. Such a financial burden is unmanageable for most families, especially given that T1D often begins at a young age, when patients may not have sufficient income. As a result:

- **Low coverage of adults with pump therapy.** Only a handful of patients over 18 can afford to purchase and maintain a pump. Patient surveys show that the overwhelming majority continue intensified insulin therapy with pens due to the inaccessibility of pumps (financial or geographic). This means losing the glycemic control achievements they had in childhood on pump therapy, undermining the impact of pediatric programs.
- **Inequality and social injustice.** Children from wealthier families may continue pump therapy into adulthood, while those from low-income families are forced to abandon it. In addition, residents of rural areas and regions without supplier representatives face difficulties obtaining consumables. This situation contradicts the principles of equity in healthcare and worsens the condition of socially vulnerable groups.
- **Negative motivation among adolescents.** Knowing that they will lose benefits upon turning 18, adolescents with T1D and their families experience stress and uncertainty about the future. This can reduce treatment adherence during a critical transition period to adulthood and lead to diabetes decompensation (a condition caused by uncontrolled hyperglycemia).

In addition to financial barriers, there are **regulatory and organizational obstacles**. At present, insulin pumps for adults are not included in either the list

⁶ Толстоухова Н. Набор для введения инсулина включили в список льготных медизделий. Российская газета. 10.01.2019.



of guaranteed free medical care (GFMC) or the mandatory social health insurance (MSHI) system for outpatient drug provision. There are no separate service codes or reimbursement tariffs through which polyclinics could procure and supply pumps and consumables to adult patients. Nor is there a clear clinical protocol or standard regulating pump indications for adults—despite the fact that international guidelines recommend pump therapy when multiple daily injections fail to achieve target HbA_{1c} levels or in cases of frequent hypoglycemia⁷. As a result, even if there is political will, rapid expansion of the program is difficult without making amendments to regulatory acts (orders of the Ministry of Health, state programs, etc.).

Pregnant women with T1D face a dual challenge. On the one hand, when planning pregnancy and during gestation, it is vital for them to optimize glucose control (ideally maintaining HbA_{1c} <6.5 % even before conception and <6.0 % in the early stages) in order to reduce risks to the fetus. Pumps help achieve this by allowing flexible dose adjustments, temporary suspension of insulin delivery during hypoglycemia, and programming of different basal profiles for the first, second, and third trimesters. On the other hand, after childbirth, when the woman is no longer in a state of pregnancy, there are no official mechanisms for continuing pump therapy at state expense if she is over 18 years of age. Thus, pregnant women with T1D can in practice receive a pump only within the framework of obstetric care (if the regional hospital has this possibility) or at their own expense. The continuity of therapy is therefore disrupted, negating the benefits for both mother and child. Further medical consequences of insufficient pump provision for adults and pregnant women are considered below.

Medical and Social Consequences of Insufficient Glycemic Control

Type 1 diabetes requires maintaining blood glucose levels as close as possible to the normal range. With traditional methods (multiple daily injections), achieving this is significantly more difficult than with a pump that provides precise dosing. If the state does not ensure access to modern technologies, this leads to a number of negative consequences:

- **Deterioration of glycemic control.** According to surveys and observations, adult patients who switch from a pump to insulin pens experience an increase in average HbA_{1c} by **1–2 percentage points** compared to the level achieved on a pump during childhood (for example, from ~7 % to 8–9 %). International studies confirm that pump therapy provides lower HbA_{1c} and more stable glucose levels compared to injections. Worsening glycemic control is directly associated with accelerated development of diabetic complications.

⁷ Feig DS, Murphy HR, Donovan LE, Corcoy R, Barrett JFR, Sanchez JJ, Ruedy K, Kollman C, Tomlinson G; CONCEPT Collaborative Group. *Pumps or Multiple Daily Injections in Pregnancy Involving Type 1 Diabetes: A Prespecified Analysis of the CONCEPT Randomized Trial.* *Diabetes Care.* 2018 Dec;41(12):2471–2479. doi:10.2337/dc18-1437. PMID:30327362.



- **Increase in acute complications.** Insufficient control raises the risk of **diabetic ketoacidosis (DKA)** and severe hypoglycemia requiring hospitalization. Statistics show that among adult patients with T1D on multiple daily injections, the annual rate of DKA-related hospitalizations is significantly higher than among those using pumps⁸. In international cohorts, insulin pump users experienced **44 % fewer DKA hospitalizations** and fewer episodes of severe hypoglycemia compared to patients on injections⁹. In Kazakhstan, according to data from some hospitals, young adults with T1D account for a significant proportion of repeated ICU admissions due to ketoacidosis—cases that could be largely prevented with wider use of pumps.
- **Accelerated development of chronic complications.** Poor diabetes control leads to damage to the blood vessels of the eyes, kidneys, and nervous system. Diabetic retinopathy, nephropathy, and neuropathy develop much earlier in patients with T1D in the absence of optimal therapy. According to the landmark DCCT/EDIC study, the difference between groups with good and poor glycemic control is striking: over a 30-year period, intensive therapy (maintaining HbA_{1c} ~7 %) provided an additional **1.62 quality-adjusted life years (QALYs)** and prevented complications worth nearly **\$91,000** per person compared to suboptimal control¹⁰. In other words, systemic investments in improving T1D compensation pay off in saved life years and reduced treatment costs for complications. In the context of Kazakhstan, this translates into thousands of potentially productive life years saved and billions of tenge in savings on treatment for kidney failure, blindness, diabetic foot syndrome, and other complications (see the economic section below).
- **Increased disability and mortality.** T1D that is not properly controlled leads young people to disability during their most productive years. According to the Republican Center for e-Health, diabetes-related mortality in Kazakhstan increased fourfold for T1D between 2014 and 2019¹¹. Severe disability arises

8 Gandhi K, Ebekozien O, Noor N, McDonough RJ, Hsieh S, Miyazaki B, Dei-Tutu S, Golden L, Desimone M, Hardison H, Rompicherla S, Akturk HK, Kamboj MK; T1D Exchange Quality Improvement Collaborative. *Insulin Pump Utilization in 2017–2021 for More Than 22,000 Children and Adults With Type 1 Diabetes: A Multicenter Observational Study*. Clin Diabetes. 2024 Winter;42(1):56–64. doi:10.2337/cd23–0055. PMID:38230341; PMCID:PMC10788665.

9 Ilkowitz J, Choi S, Rinke ML, Vandervoot J, Heptulla R, et al. *Pediatric Type 1 Diabetes: Reducing Admission Rates for Diabetes Ketoacidosis*. Quality Management in Health Care. 2016 Oct–Dec;25(4):231–237. doi:10.1097/QMH.000000000000109. PMID:27749721; PMCID:PMC5054972.

10 Herman WH, Braffett BH, Kuo S, Lee JM, Brandle M, Jacobson AM, Prosser LA, Lachin JM; DCCT/EDIC Research Group. *The 30-Year Cost-Effectiveness of Alternative Strategies to Achieve Excellent Glycemic Control in Type 1 Diabetes: An Economic Simulation Informed by the Results of the DCCT/EDIC*. J Diabetes Complications. 2018 Oct;32(10):934–939. doi:10.1016/j.jdiacomp.2018.06.005. PMID:30064713; PMCID:PMC6481926.

11 Galiyeva D, Gusmanov A, Sakko Y, Issanov A, Atageldiyeva K, Kadyrzhanuly K, Nurpeissova A, Rakhimzhanova M, Durmanova A, Sarria-Santamera A, Gaipov A. *Epidemiology of type 1 and type 2 diabetes mellitus in Kazakhstan: data from unified National Electronic Health System 2014–2019*. BMC Endocr Disord. 2022 Nov 11;22(1):275. doi:10.1186/s12902–022–01200–6. PMID: 36368961; PMCID: PMC9650815.



from complications such as vision loss (diabetic retinopathy is a leading cause of blindness among working-age adults), limb amputations due to diabetic foot, and end-stage kidney disease requiring dialysis or kidney transplantation. For example, every patient with T1D who progresses to chronic kidney failure must undergo hemodialysis at state expense—a cost higher than providing the same patient with an insulin pump for life. Without measures to improve diabetes control, the country faces an «epidemic» of complications that will impose a heavy burden on social protection and healthcare systems.

Thus, the current incomplete coverage of T1D patients with modern therapy already leads, in the medium term, to negative systemic consequences: an increase in hospitalizations, higher costs for high-tech treatment of complications (retinal laser coagulation, vitrectomy, dialysis, vascular surgeries, etc.), loss of economic potential due to early disability among young people, and human losses. Every delay in addressing the problem results in new cases of preventable complications and deaths. Pregnant women are particularly vulnerable: insufficient diabetes control during gestation leads to severe neonatal outcomes (including perinatal mortality), and the health of the next generation directly depends on maternal diabetes management. The absence of a pump provision program for this category risks increased pregnancy and delivery complications, a higher number of children with disabilities (due to congenital defects resulting from poor maternal glycemic control), and further strain on the healthcare system.

Conclusion: The problem of insufficient provision of insulin pumps to adult and pregnant patients with T1D has multiple negative consequences—medical, social, and economic. This underscores the urgent need for immediate state action. Possible solutions, taking into account international experience and economic analysis, are discussed below.



21ST CENTURY STANDARDS: WHY DEVELOPED AND DEVELOPING COUNTRIES FUND PUMPS

Chapter 2: International Experience in Pump Provision

Many developed countries have long recognized the benefits of insulin pump therapy and have implemented mechanisms to finance insulin pumps for patients with type 1 diabetes of all ages. Let's look at a few examples:

- **USA:** The healthcare system in the USA is diverse, but in general, insulin pumps are covered by insurance if there are medical indications. The federal *Medicare* program provides pumps for people over 65 or with disabilities suffering from Type 1 Diabetes (T1D), if intensive insulin therapy is proven necessary. Private insurance companies also typically reimburse pumps and consumables for T1D patients, since it has been proven that this reduces the risks of acute complications and long-term costs¹². An estimated 30–40 % of Americans with T1D use pumps, and this share is growing. Pumps are especially widely used among children and young adults, which has led in some states to a decrease in diabetes-related hospitalizations.
- **European Union:** In EU countries, insulin pumps are generally included in reimbursable medical devices through national insurance systems. In **Germany**, T1D patients are entitled to a pump if intensive injection therapy does not ensure target control or if frequent severe hypoglycemia occurs. All expenses – about €4–5,000 for the device and ~€1,500 annually for consumables – are covered by mandatory health insurance¹³. In the **UK**, the National Health Service (NHS) funds pumps according to NICE criteria: if HbA1c > 8.5 % despite optimal injection therapy or in the presence of dangerous hypoglycemia. As a result, by 2020, more than 15–20 % of British T1D patients over 18 were receiving pumps free of charge, and among children this figure exceeded 30 %. **Scandinavian countries** achieved even broader coverage: for example, in Denmark and Sweden, almost **all children and a significant share of adults** with T1D are treated with pumps, with costs covered by the state. This has led to some of the lowest rates of diabetes complications and hospitalizations in Europe. In **France** and **Italy**, pumps and consumables are fully reimbursed by insurance; in France about 10 % of T1D patients use pumps, while Italy operates an annual quota for pump provision, which is gradually expanding.

12 Gandhi K, Ebekozi O, Noor N, McDonough RJ, Hsieh S, Miyazaki B, Dei-Tutu S, Golden L, Desimone M, Hardison H, Rompicherla S, Akturk HK, Kamboj MK; T1D Exchange Quality Improvement Collaborative. *Insulin Pump Utilization in 2017–2021 for More Than 22,000 Children and Adults With Type 1 Diabetes: A Multicenter Observational Study*. Clin Diabetes. 2024 Winter;42(1):56–64. doi:10.2337/cd23–0055. PMID: 38230341.

13 Foundation of European Nurses in Diabetes; International Diabetes Federation; Primary Care Diabetes in Europe. *Diabetes: The policy puzzle – Is Europe making progress?* 3rd ed. Luxembourg: DG Health & Consumers, European Commission; 2011. Available from health.ec.europa.eu/.../policy_puzzle_2011.pdf.



- **Other countries:** In **Canada**, provincial insurance programs cover pumps for children and often for young adults up to age 25, and in some provinces without age limits if indicated. **Israel** includes pumps in its healthcare basket: ~85 % of the pump and accessory costs are state-funded. **Australia** subsidizes pumps for children and youth through national funds. In developed Asian countries (Japan, South Korea), insurance systems also partially or fully cover pump therapy, especially for children.
- **CIS and Russia:** In the Russian Federation until recently, pumps were centrally provided mainly to children (similar to Kazakhstan). However, since 2019 insulin pumps have been included in the federal list of technical rehabilitation aids for people with diabetes disability, and in 2023 the Ministry of Health issued clarification on preferential provision of pump consumables¹⁴. Thus, pumps can now be provided free to *certain patient categories*: children with disabilities, pregnant women, and people with severe diabetes. In some regions (e.g., Tyumen region, St. Petersburg), pilot programs have been adopted under which **adults** with T1D began receiving pumps covered by compulsory medical insurance (OMS) or the regional budget¹⁵. Although coverage remains limited, the trend is clear – Russia is moving toward expanding pump therapy in its benefits system. For Kazakhstan, it is important to consider this experience in order not to fall behind in diabetes care standards. Also noteworthy is the experience of neighboring Central Asian countries: for example, **Uzbekistan** has announced plans to launch a state program to provide pumps to children, while in **Kyrgyzstan** and **Belarus** pumps are still procured only through humanitarian projects or at patients' expense, similar to the current situation in Kazakhstan.

Conclusion on international experience: In countries with comparable levels of economic development (Eastern Europe, Russia), the need to provide insulin pumps not only for children but also for high-risk adults is gradually being recognized and codified. In developed countries, pumps have long been the standard of care for T1D and are covered by insurance, since their **medical and economic effectiveness** is proven: reducing complications justifies the cost of the technology¹⁶. These examples show that including pumps in the guaranteed list is not a luxury but a reasonable investment in citizens' health. Kazakhstan can build on the best global practices, adapting patient selection criteria and financing models to its own healthcare system.

14 Ministry of Health of the Russian Federation. 2023. *Minzdrav Rossii razyasnil poryadok lgotnogo obespecheniya raskhodnymi materialami k insulinovoy pompe*. September 11, 2023. Accessed June 19, 2025. <https://www.mco-panacea.ru/news/minzdrav-rossii-raz-yasnil-poryadok-lgotnogo-obespecheniya-rashodnymi-materialami-k-insulinovoy-pompe>

15 DiaMarka. Бесплатные помпы для детей и взрослых! [Электронный ресурс]. – Режим доступа: https://diamarka.com/sales/besplatnye_pompy_dlya_detey_i_vzroslykh/ (дата обращения: 19.06.2025).

16 Pease A, Zomer E, Liew D, Lo C, Earnest A, Zoungas S. *Cost-effectiveness of health technologies in adults with type 1 diabetes: a systematic review and narrative synthesis*. Syst Rev. 2020 Aug 3;9(1):171. doi:10.1186/s13643-020-01373-Y. PMID:32746937; PMCID:PMC7401226.



ECONOMIC FEASIBILITY AND RETURN ON INVESTMENT: WHY INSULIN PUMPS ARE A RATIONAL EXPENSE

Chapter 3 – Economic Justification and Comparative Cost Analysis

Increase in life expectancy and quality of life (QALY)

One of the key indicators of medical technology effectiveness is **QALY (quality-adjusted life year)** – the number of years of life adjusted for quality (utility). Insulin pump therapy demonstrates improvement in this indicator for patients with Type 1 Diabetes (T1D) compared with multiple daily injections (MDI). Thanks to better glycemic control, pumps slow the development of complications, thereby **prolonging life** and improving its quality. Modeling results show that for an average adult with T1D, the **lifetime gain** from using a pump is about **+0.5–1.0 QALY** compared to traditional therapy. This means that each patient switched to a pump lives on average several months longer in full health than they would without a pump. At the population level (several thousand potential pump users among adult diabetics in Kazakhstan), the cumulative gain is measured in **thousands of QALYs**, achieved through prevented complications. For example, reduced risk of end-stage renal disease adds years of active life; avoiding blindness preserves vision and quality of life; preventing amputations maintains work ability, etc. In addition, patients themselves report **better well-being and psychosocial condition with pumps**, which is also important for quality of life. Studies show increased treatment satisfaction and reduced diabetes-related distress after switching to a pump¹⁷. Thus, from the QALY perspective, pumps are unambiguously beneficial: *they not only extend life but make it more fulfilling*.

It should be emphasized that **pregnant women with type 1 diabetes** are a special category, where the gains in life years and quality of life benefit not only the mother but also the child. Every successful, fully-term pregnancy, with good monitoring, is the birth of a healthy child. If pump therapy reduces the incidence of perinatal mortality and severe neonatal complications (for example, hypoxia requiring neonatal intensive care), it will indirectly improve the total QALYs of the next generation. Such effects are difficult to quantify, but they are significant for society. In economic calculations, improved pregnancy outcomes can also be considered an **additional benefit** of the pump program.

¹⁷ Feig DS, Corcoy R, Donovan LE, Murphy KE, Barrett JFR, Sanchez JJ, Wysocki T, Ruedy K, Kollman C, Tomlinson G, Murphy HR; CONCEPTT Collaborative Group. *Pumps or Multiple Daily Injections in Pregnancy Involving Type 1 Diabetes: A Prespecified Analysis of the CONCEPTT Randomized Trial*. Diabetes Care. 2018 Dec;41(12):2471–2479. doi:10.2337/dc18–1437. PMID:30327362.



Comparative Costs: Pump vs. Multiple Daily Injections

Let's consider the direct medical costs of using an insulin pump compared to traditional therapy (MDI – multiple daily injections). Costs include the cost of equipment (the pump itself, which lasts approximately 5 years), consumables (infusion sets, reservoirs, batteries—usually replaced every 2–3 days for infusion sets and every ~1 week for batteries), as well as the cost of insulin and self-monitoring devices (glucometers or sensors). For multiple injections, costs include insulin, syringe pens (replaced every few years), needles, and self-monitoring devices. Pumps typically use only ultra-short-acting **insulin**, and the daily dose can be reduced by ~10–20 % due to the lack of excess stock. However, medication costs for both treatment methods are comparable.

Consumables are the main difference: with MDIs, these are inexpensive needles, while with pumps, these are expensive kits. If a needle needs to be changed ~1–2 times per day (360–700 needles/year, equivalent to several thousand tenge), then an infusion set and pump reservoir equate to ~120–180 sets per year. According to government procurement prices, one set costs about 4,500–5,000 tenge, and a reservoir ~1,200–1,300 tenge. [48†] In total, one patient requires consumables worth approximately **700,000 tenge per year**. Plus pump depreciation: if the price is, say, 2 million and the service life is 5 years, that's another ~400,000 tenge per year. A total of **~1.1 million tenge/year** – direct costs for pump therapy per adult (possibly less with savings on consumables). By comparison, the costs of multiple injections are incomparably lower: needles, syringe pens, glucometers, and test strips are estimated at ~50,000–100,000 tenge per year per patient (the strips are the most expensive component). It would seem that a pump is more expensive. But let's look at the **indirect and deferred costs**.

Without a pump, the risk of complications increases, and their treatment is expensive. For example:

- **Treatment of diabetic nephropathy:** one patient with type 1 diabetes who develops end-stage renal failure at age ~40–50 years will require dialysis for the rest of their life. A year of hemodialysis costs approximately **5–6 million tenge** (including consumables, equipment, and staff costs). A kidney transplant is even more expensive, plus lifelong immunosuppression. Preventing even a few cases of nephropathy already saves tens of millions of tenge.
- **Ophthalmological surgeries:** Diabetic proliferative retinopathy requires courses of retinal laser photocoagulation (from 50,000 tenge per session) and often surgical intervention – vitrectomy. **Vitreoretinal surgery** is a high-tech procedure; the cost of one operation ranges **from 500,000 to 1 million tenge**



(including consumables such as silicone oil and disposable instruments). If pump therapy delays the need for vitrectomy in at least ten patients, this already represents a savings of ~5–10 million tenge.

- **Amputations and foot treatment:** According to specialized hospitals, the average cost per patient with diabetic foot syndrome (conservative treatment, surgery, prosthetics) exceeds **1 million tenge** per year of treatment, not including disability payments.
- **Hospitalizations for DKA and hypoglycemia:** one case of severe ketoacidosis requires intensive care, IVs, and tests, costing approximately 200,000–300,000 tenge per hospitalization. Severe hypoglycemia can lead to an accident, injury, or even the need for an ambulance—also an expense. If using a pump reduces the incidence of DKA and hospitalizations by even 30–40%¹⁸, the savings over several years will more than cover the cost of the pump.

Therefore, **long-term costs with traditional therapy are higher** when considering the costs of complications. A high-quality study conducted as part of the DCCT showed that over 30 years, the total medical costs of patients with poor injection control exceed those of the well-controlled group by **\$90,000** (at US prices)¹⁹. And good control is typically achieved through intensive therapy (of which the pump serves as a prototype today). In other words, **every tenge invested in improved control yields a return of several tenge in complication prevention**. From an economic perspective, pumps are a **cost-effective technology**. Various studies of the cost per QALY gained for pump therapy yield a ratio of approximately \$50,000–\$80,000 per QALY, which is within the generally accepted threshold for an effective intervention (in developed countries, \$100,000/QALY). When calculated for our economy, investments in pumps meet the criterion of «less than 3 times GDP per capita per QALY,» meaning they are justified from a pharmacoeconomic perspective. Moreover, when taking into account all indirect effects (preserved work capacity, the birth of healthy children, etc.), **pumps can also lead to direct savings** for the healthcare system in the long term²⁰.

18 Ilkowitz JT, Choi S, Rinke ML, Vandervoot K, Heptulla RA. *Pediatric Type 1 Diabetes: Reducing Admission Rates for Diabetes Ketoacidosis*. Qual Manag Health Care. 2016 Oct–Dec;25(4):231–237. doi:10.1097/QMH.0000000000000109.

19 Herman WH, Braffett BH, Kuo S, Lee JM, Brandle M, Jacobson AM, Prosser LA, Lachin JM; DCCT/EDIC Research Group. *The 30-Year Cost-Effectiveness of Alternative Strategies to Achieve Excellent Glycemic Control in Type 1 Diabetes: An Economic Simulation Informed by the Results of the Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (DCCT/EDIC)*. J Diabetes Complications. 2018 Oct;32(10):934–939. doi:10.1016/j.jdiacomp.2018.06.005. PMID: 30064713; PMCID: PMC6481926.

20 Pease A, Zomer E, Liew D, Lo C, Earnest A, Zoungas S. *Cost-effectiveness of health technologies in adults with type 1 diabetes: a systematic review and narrative synthesis*. Syst Rev. 2020 Aug 3;9(1):171. doi:10.1186/s13643-020-01373-y. PMID: 32746937; PMCID: PMC7401226.



Socioeconomic effects should also be considered. Patients with type 1 diabetes who use pumps experience fewer complications from illnesses, take fewer sick days, and are able to work more productively. According to international studies, switching to pumps reduced the number of missed work days due to illness and hypoglycemia by **20–30 %**. This is especially true for people with unpredictable hypoglycemia episodes: pumps and monitoring systems allow them to perform their work more safely (for example, driving, working at heights), whereas without a pump, they are more likely to be forced into disability or change professions. All this means that investing in pumps is **an investment in human capital**. The state benefits by receiving more years of work from patients with diabetes and a higher return, while reducing disability payments.

A clear example is the calculation of the projected program costs in Kazakhstan and the potential savings:

Forecast of the necessary budget expenditures for the phased expansion of the insulin pump therapy program for adults and pregnant women (in 2025 prices). The initial investment is approximately 245 million tenge in the first year (for approximately 300 adult and 50 pregnant patients), gradually increasing to 890 million tenge annually, covering approximately 1,100 new adults and 170 pregnant women per year. The average cost per patient is approximately 700,000 tenge per year (pump and consumables). At the same time, prevented complications and hospitalizations will bring significant savings to the healthcare system.

As can be seen from internal calculations, **the scale of the program is quite modest** in terms of costs for the national healthcare budget. Even when reaching full coverage (approximately 1,000–1,500 new patients per year), the annual costs (<1 billion tenge) are comparable to, for example, the cost of providing several courses of chemotherapy or building a single small outpatient clinic. However, the effect is systemic and long-term. The program will begin to pay for itself in 5–10 years by reducing the need for expensive treatment of complications.

To summarize the economic analysis: **including insulin pumps in adult subsidized care is financially justified**. In the short term, it will require an increase in the budget for diabetes programs, but these investments have a high return. The pumps meet the criteria for cost-effectiveness, especially for patients with a high risk of complications (poor control or frequent hypoglycemia). Ultimately, the state will realize long-term savings and, most importantly, **will preserve lives and health**.

Benefits of implementing a pump therapy program

Implementing the initiative to provide insulin pumps to adult and pregnant patients under the guaranteed volume of medical care and the mandatory health insurance program will have a number of positive effects:



- **Reducing morbidity and mortality from diabetes complications.** Improved control of type 1 diabetes automatically leads to a reduction in the incidence of micro- and macrovascular complications. A reduction in new cases of retinopathy, nephropathy, neuropathy, and cardiovascular disease is expected among patients switched to pumps. This will impact overall healthcare indicators over the next 5–10 years, reducing the rates of blindness, end-stage renal failure, disability, and premature mortality associated with diabetes. **Life expectancy** for this category of citizens will increase. It is estimated that the program's implementation could reduce mortality in working-age patients with type 1 diabetes by **15–20 %** over 10 years (by preventing acute conditions and delaying complications).
- **Improving the quality of life for patients and their families.** An insulin pump gives patients more freedom and flexibility in their daily lives: they don't need multiple injections, and they can more freely plan their meals and physical activity. Painful procedures are reduced, and the fear of public injections disappears. Parents of children with type 1 diabetes report improved sleep and reduced anxiety when their child is on a pump—the same benefits extend to adult patients and their loved ones. Better-controlled diabetes means fewer mood swings, a more stable state of health, and more energy for work and creativity. Families where the expectant mother with type 1 diabetes received pump support during pregnancy are less prone to stress associated with risks to the child. All this leads to improved **social well-being**.
- **Maintaining work potential and reducing lost work time.** Patients on a pump take fewer sick days due to unstable blood sugar or treatment for complications. A reduction in temporary disability among employed patients with type 1 diabetes is expected (reportedly, ~20 % fewer sick days). Moreover, the pump allows many patients to remain in their jobs longer, avoiding early disability retirement. This means more active participants in the economy and a reduced dependency burden. The number of women with type 1 diabetes who can safely plan pregnancies and then return to work will increase, which is also important in the context of gender balance in the workforce.
- **Social support for vulnerable groups and equity.** Including pumps in the list of benefits eliminates the glaring inequality that, after turning 18, effectively lost access to life-saving technology. This demonstrates the state's concern for young people with chronic illnesses and increases public trust in the healthcare system. The right to medical care is not interrupted upon reaching adulthood—continuity between pediatric and adult services is restored. Families raising children with diabetes will gain confidence that their child will not be left without support even in adulthood. This will strengthen the image of a state that **invests in the health of the younger generation** and protects the rights of patients with this disabling disease.



- **Demographic effects.** Support for pregnant women with type 1 diabetes will reduce pregnancy and childbirth complications and increase the likelihood of having healthy children. This will have a positive impact on demographic indicators, as every pregnancy that is continued contributes to the birth rate. Furthermore, improving the prognosis for women with diabetes will allow them to plan more children (currently, many limit themselves to one child due to the severity of their first pregnancy). Thus, the program also has **strategic benefits** in terms of national health.
- **Innovative healthcare development.** Pump therapy is only part of the modern approach to diabetes treatment. Its expansion will require infrastructure development: training endocrinologists in pump operation, implementing continuous glucose monitoring systems (ideally in conjunction with a pump), and creating patient education schools. This will stimulate an overall improvement in the quality of endocrinology services and the introduction of new technologies. Kazakhstan's healthcare system will approach global standards of diabetes care, strengthening its image and credibility. Furthermore, the accumulated experience (e.g., data on improved outcomes) can form the basis for scientific publications, the development of telemedicine for managing pump patients, etc. This is an investment in the **human capital of healthcare professionals** and the digitalization of healthcare.

Given all the listed benefits, it is safe to say that **the impact of including insulin pumps in the guaranteed volume of medical care is multifaceted and affects not only individual patients but also society as a whole, the economy, and the future health of the nation.** The next section presents specific recommendations for implementing this initiative.



A FAIRNESS SCENARIO: HOW TO IMPLEMENT PUMP THERAPY FOR ADULTS

Chapter 4. Implementation Recommendations and Necessary Measures

To successfully implement the program to provide insulin pumps to adults and pregnant patients with type 1 diabetes, the following action plan is proposed:

- 1. Amend regulations.** The Ministry of Health should initiate the addition of the item «Insulin pump and consumables for patients with type 1 diabetes over 18 years of age and pregnant women» to the list of medical products issued under the State Funded Benefits of Medical Care/Compulsory Health Insurance (GFMCHI). Orders and regulations governing outpatient drug provision should be updated to include criteria for pump provision. At the same time, the clinical protocol for the management of type 1 diabetes in adults should be revised to include indications for pump use (e.g., high HbA_{1c} levels > 8% with injections; frequent severe hypoglycemia; pronounced «dawn phenomena»; pregnancy with type 1 diabetes, etc.). This creates a regulatory framework for financing.
- 2. Identify a responsible financing mechanism.** Funding through the compulsory medical insurance system appears optimal, since the pump is a device for outpatient use. Centralized procurement of pumps and consumables through SK-Pharmacia or allocation of funds through transfers to regional healthcare budgets are possible. It is important to budget for sufficient funding based on the planned phased coverage (e.g., 300 new adults and 50 pregnant women in 2025, 500 adults and 100 pregnant women in 2026, etc.). According to preliminary estimates, approximately **245 million tenge** is needed for the first year and up to **890 million tenge** for the full-scale ramp-up phase. These amounts should be reflected in the budget forecast. Possible sources include funds from the compulsory medical insurance system, the national budget (diabetes program), and grants from international organizations (in the initial period).
- 3. Phased launch of the program.** It is recommended to begin with a **pilot phase**—for example, in 2025, providing pumps to a limited group of adults (say, 200–300 people) and all pregnant women registered with T1D. This will allow for the development of distribution, training, and monitoring procedures. By 2026–2027, the program will be scaled up nationwide, increasing quotas. Over the next five years, coverage will be systematically



increased to reach **100 % of those in need** (all current T1D patients seeking a pump, and all new 18-year-olds and pregnant women annually). This gradual expansion will take into account budget and system capacity. Priority in patient selection in the first phase should be given to those most in need: patients with vision or kidney impairments, those with frequent hypoglycemia, and pregnant women.

4. **Training of medical personnel.** The success of pump therapy depends on competent management. It is necessary to conduct training for endocrinologists in outpatient and hospital settings on installing and configuring insulin pumps, and to teach patients how to use them. Pediatric specialists (who already have experience) and coordinators from manufacturing companies could be involved. Also, publish guidelines or a manual in the Kazakh and Russian languages for physicians. Establish reference centers in large cities (Almaty, Astana) – consultative departments where complex patients on pumps can be referred for therapy adjustments.
5. **Patient education and adherence support.** Organize «**Pump Therapy Schools**» at endocrinology clinics, where adult patients (and especially pregnant women) will undergo training before receiving a pump. Provide handouts, such as leaflets, self-monitoring diaries, and hotline contact information. Consider creating a call center or chat with consultants (experienced endocrinologists or diabetes nurses) where patients can quickly contact with questions about their pumps. Such support is especially important at first to minimize errors and prevent pump removal due to incompetence.
6. **Monitor effectiveness and safety.** Implement a system for recording issued pumps: a registration log or an electronic registry of patients who have received the device. Track effectiveness indicators—HbA_{1c} dynamics, hospitalizations, and complications—compared to the pre-pump period. This will allow for the presentation of interim program results to the Ministry and funding bodies within 1–2 years. Also, collect data on device malfunctions and episodes of ketoacidosis on the pump (to allow timely adjustments to training). Adjust management protocols as necessary.
7. **Information campaign and stakeholder engagement.** It's important to secure community support. The program's goals and benefits should be communicated to a broad audience (through media and social media) **to raise awareness of the benefits of pumps**. This will mitigate resistance from potential opponents who might view the program as a «luxury.» When developing the project, it's worth relying on patient



organizations (for example, the Diabetes Association of the Republic of Kazakhstan)—their voice in appeals to the government and parliament will strengthen the argument with real-life examples. Also, engage renowned endocrinologists, neonatologists, and ophthalmologists—specialists who have practical experience with the differences in outcomes between good and poor diabetes control. Their expert opinions (in the form of letters of support and presentations at roundtables) will help convince decision-makers. Potential opponents—primarily financiers focused on costs—can be neutralized by presenting detailed cost-benefit calculations (as in this document). It would be helpful to initiate a discussion in the Majilis and Senate, involving members of parliament responsible for social policy and healthcare, so that they can become **advocates** for this issue. International organizations (WHO, UNICEF, IDF) could also support the initiative with expert opinions on its importance for achieving the Sustainable Development Goals (health goals).

8. **Evaluation and replication of experience.** After 2–3 years of the program’s launch, conduct a comprehensive analysis of the results: how many patients were covered, how their health indicators changed, how much money was actually spent and how much was saved (through prevented complications). Publishing a report with these data will be a strong argument for continuing and expanding funding. If the results are positive, further steps can be considered—for example, including continuous glucose monitoring systems in the subsidized provision along with pumps, which would yield even greater results. A successfully implemented pump project could also serve as a model for improving care for other chronic diseases. If successful, Kazakhstan could share its experience with Central Asian countries, becoming a regional leader in diabetes innovation.

Implementing these recommendations will require the coordinated efforts of various stakeholders – the Ministry of Health, the Social Health Insurance Fund, pharmaceutical companies, the medical community, patient NGOs, and others. However, **the rewards for these efforts will be high:** saved lives, improved public health, upheld citizen rights, and innovative progress in the healthcare system.



CONCLUSION: AN URGENT STRATEGIC CHOICE

Chapter 5 Conclusion

The arguments presented in this White Paper convincingly demonstrate that **the inclusion of insulin pumps and consumables for patients over 18 and pregnant women in the State Funded Medical Care/Compulsory Health Insurance (GVMCHI) is a timely and strategically important step for Kazakhstan.** We analyzed epidemiological data, the medical and social consequences of the problem, international experience, and the economic implications of the issue. All arguments boil down to one thing: the benefits of implementing this measure significantly outweigh the costs. Insulin pump therapy has proven to be an effective way to improve the control of type 1 diabetes, prolong the lives of patients, and save money by preventing severe complications.

For our country, this initiative means:

- **Thousands of patients with type 1 diabetes will have the chance to live a healthier and longer life**, realizing their potential in society and their families, instead of becoming prematurely disabled.
- **The healthcare system will avoid a significant share of the costs** associated with treating diabetes complications by redirecting resources to more productive goals.
- **Society as a whole**, will benefit from increased productivity, birth rates, and trust in healthcare institutions. Kazakhstan will strengthen its reputation as a country where citizen health is a priority and where modern technologies are implemented for the well-being of its people.

Failure to take these steps, on the contrary, risks further increasing complications, costs, and social tensions associated with inequalities in healthcare. The systemic consequences of inaction will become apparent within a few years: increased disability, demographic losses, and the economic burden of chronic diseases. This cannot be allowed to happen when there is a proven, accessible tool for improving the situation.

In summary, the state is faced with an opportunity to make a decision that will save lives and money for decades to come. Providing insulin pumps to adults and pregnant women is not a narrow departmental issue, but an investment in the country's future. Based on the above, we strongly recommend that the Ministry of Health of the Republic of Kazakhstan initiate the inclusion of insulin pumps



and consumables in the list of guaranteed free medical care and/or in the compulsory health insurance system for patients with type 1 diabetes over 18 years of age and pregnant women. This step will be a logical continuation of previously implemented programs for children, will address current gaps in care, and will elevate Kazakhstan's diabetes services to a new level, in line with best international practices. Ultimately, success will be measured by the lives saved and the health of our citizens—an invaluable indicator that merits immediate action.



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