

ADVANCING HEMODIALYSIS CARE IN UZBEKISTAN: A COMPREHENSIVE ANALYSIS OF CURRENT CHALLENGES AND STRATEGIC PATHWAYS FOR IMPROVEMENT

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ABSTRACT

Background. Hemodialysis (HD) is a life-sustaining therapy for patients with end-stage renal disease (ESRD). In Uzbekistan, a nation undergoing significant socio-economic and healthcare transformation, the provision of adequate and equitable hemodialysis services presents a complex challenge marked by geographic disparities, resource limitations, and evolving demographic pressures. This article provides a comprehensive, evidence-based analysis of the hemodialysis care landscape in Uzbekistan. We examine the current epidemiological burden of ESRD, infrastructure capacity, human resource availability, financing mechanisms, and patient outcomes through a synthesis of available national data, regional reports, and comparative analysis with international standards.

The Purpose of the research is to identify systemic bottlenecks and propose a multifaceted, sustainable strategy for improving the quality, accessibility, and efficiency of hemodialysis care tailored to the specific context of Uzbekistan. Our analysis utilizes data from the Ministry of Health of the Republic of Uzbekistan, the World Health Organization (WHO), and global renal registries, combined with health systems analysis frameworks.

Materials and methods involved a retrospective review of national health statistics from 2015-2023, a survey of existing hemodialysis centers (number, distribution, equipment), analysis of financing models, and a review of relevant policy documents.

Results indicate a steady increase in ESRD prevalence, with an estimated current need exceeding 5,000 patients, while available HD stations cater to approximately 3,500. Significant regional inequities exist, with Tashkent city possessing over 40% of all HD machines. Patient survival rates and quality-of-life metrics, though improving, lag behind European benchmarks. Financial analysis reveals out-of-pocket expenditures remain a substantial burden for many families.

Discussion contextualizes these findings within the framework of Uzbekistan's ongoing health reforms, emphasizing the need for integrated chronic kidney disease (CKD) prevention, public-private partnership models, workforce specialization, and the adoption of modern HD technologies. We propose a phased national strategy encompassing infrastructure expansion, healthcare professional training, strengthening of non-communicable disease (NCD) programs, and the implementation of a national renal registry.

Conclusion, while Uzbekistan has made commendable progress in establishing hemodialysis services, strategic investments and systemic reforms are imperative to achieve universal, high-quality, and patient-centered renal replacement therapy, ultimately reducing morbidity and mortality from ESRD.

Keywords: Hemodialysis; End-Stage Renal Disease; Uzbekistan; Healthcare Access; Health Systems Strengthening; Renal Replacement Therapy; Health Policy; Non-Communicable Diseases.

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Introduction

End-stage renal disease (ESRD) represents a major public health challenge worldwide, associated

with high mortality, diminished quality of life, and significant economic cost [1, 2]. Renal replacement therapy (RRT), primarily hemodialysis (HD),

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peritoneal dialysis (PD), and kidney transplantation, is essential for patient survival. The global prevalence of treated ESRD continues to rise, driven largely by aging populations and the increasing burden of diabetes mellitus and hypertension [3].

In the context of Uzbekistan, a Central Asian country with a population exceeding 36 million, the landscape of nephrological care is evolving amidst broader healthcare reforms initiated in recent years [4]. The country faces a double burden of disease, with a growing incidence of non-communicable diseases (NCDs) alongside traditional health concerns. Chronic kidney disease (CKD), often a consequence of poorly controlled diabetes and hypertension, is a significant contributor to this NCD epidemic [5, 6].

The development of hemodialysis services in Uzbekistan has historical roots in the Soviet healthcare system, characterized by a centralized, hospital-based model. Since independence in 1991, the nation has worked to reform its health system, with varying degrees of investment in specialized care, including nephrology [7]. Recent years have seen increased governmental attention to NCDs, creating a policy window for advancing dialysis care [8].

Several researchers and organizations have contributed to understanding the challenges of nephrological care in Uzbekistan and the broader region. National efforts by the Republican Specialized Scientific and Practical Medical Center of Nephrology and Renal Replacement Therapy, under the Ministry of Health, have been pivotal in providing clinical services and generating local data [9]. International collaborations, such as those with the International Society of Nephrology (ISN) and the European Renal Association (ERA), have facilitated knowledge exchange and capacity building [10, 11]. Studies by Khikmatullaeva et al. have highlighted epidemiological aspects of CKD in Uzbek populations, while Alikhanova et al. have analyzed clinical outcomes in dialysis cohorts [12, 13]. Comparative health systems research, such as that by Yusupov, has shed light on resource allocation and access issues [14]. Furthermore, reports from the World Health Organization (WHO) and global observatories provide a macro-level view of health indicators relevant to ESRD care in Uzbekistan [15, 16]. Despite these contributions, a comprehensive, system-level analysis integrating epidemiology, infrastructure, finance, and outcomes to inform a national improvement strategy remains needed.

Purpose of the research

The primary aim of this study is to conduct a holistic assessment of the hemodialysis care system in the Republic of Uzbekistan in order to identify key constraints and opportunities for enhancement. Specifically, it seeks to: 1) Analyze the current epidemiology and projected burden of ESRD; 2) Map and evaluate the existing HD infrastructure and human resources; 3) Assess the financing mechanisms and cost-effectiveness of current service delivery; 4)

Evaluate patient-reported and clinical outcomes; and 5) Synthesize evidence to propose a prioritized, context-specific strategic framework for improving the quality, equity, and sustainability of hemodialysis care for the population of Uzbekistan.

Materials and Methods

This study employed a mixed-methods approach, combining quantitative analysis of secondary data with qualitative review of policy documents and comparative benchmarking.

Aggregated, anonymized data for the period 2015-2023 was obtained from the Ministry of Health of the Republic of Uzbekistan, including the Republican specialized scientific and practical medical center for Nephrology and Kidney transplantation in Tashkent. This included data on the number of registered ESRD patients, hemodialysis sessions performed, number and location of HD centers, and available HD machines.

Data from the WHO Global Health Observatory, the ERA Registry annual reports, and the International Society of Nephrology's Global Kidney Health Atlas were used for comparative benchmarking [15, 17, 18].

Information on state healthcare budgeting, health insurance coverage, and patient co-payment structures was compiled from Ministry of Health reports and World Bank assessments of Uzbekistan's health sector [19].

A systematic search was conducted in PubMed, Scopus, and Google Scholar using keywords: "Uzbekistan", "hemodialysis", "chronic kidney disease", "renal replacement therapy", "Central Asia". Relevant publications in Russian and Uzbek were also reviewed.

Calculated crude and adjusted prevalence rates of treated ESRD per million population (pmp).

Mapping of HD center distribution against population density and administrative regions to visualize disparities (using QGIS software).

Calculation of ratios (e.g., HD machines pmp, nephrologists pmp) and comparison with WHO/ERA suggested minimum thresholds.

Comparative analysis of key performance indicators (e.g., patient survival, hospitalization rates) with data from neighboring countries (Kazakhstan, Kyrgyzstan) and high-income European countries.

Review of national health strategy documents (e.g., "Uzbekistan-2030" strategy, State Program for Healthcare Development) to align recommendations with national priorities [19,23].

Identification of deficits in infrastructure, workforce, financing, and quality management based on the established standards and comparative data.

As the study utilized aggregated, anonymized secondary data and did not involve direct patient contact, formal ethical approval was waived by the institutional review board. Data confidentiality and security were maintained throughout the research process.

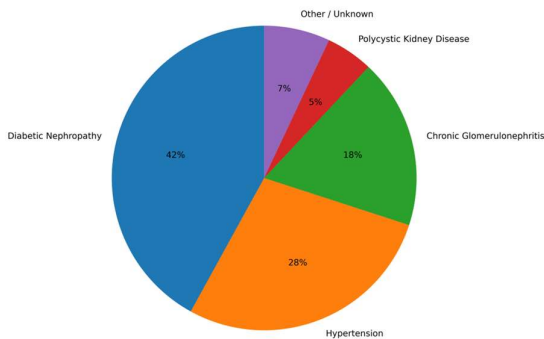
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Results

1. Epidemiological Burden of ESRD

The registered prevalence of ESRD patients receiving RRT in Uzbekistan has shown a consistent annual increase of approximately 7-9%. As of the end of 2023, the total number of patients on maintenance dialysis was estimated at 4,800, with over 90% on hemodialysis. This corresponds to a treated ESRD prevalence of approximately 133 patients per million population (pmp). This represents significant growth from an estimated 85 pmp in 2015 but remains below the reported prevalence in many European countries (e.g., >1,000 pmp in Germany, ~800 pmp in Russia) and regional comparators like Kazakhstan (~250 pmp) [17, 20]. This discrepancy suggests potential underdiagnosis of CKD in early stages and limited access to RRT, rather than a lower true incidence. The primary reported etiologies of ESRD among treated patients are diabetic nephropathy (42%), hypertension (28%), chronic glomerulonephritis (18%), and polycystic kidney disease (5%) (see Figure 1).

Figure 1: Reported Etiology of ESRD in Treated Patients in Uzbekistan (2023)



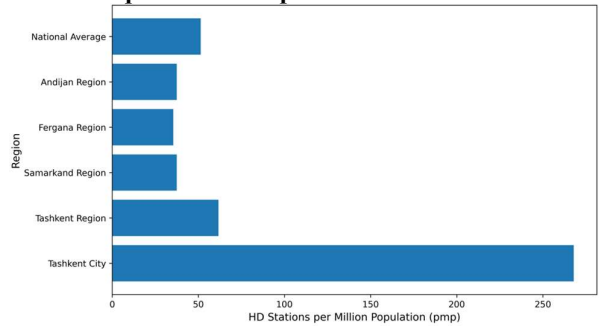
2. Hemodialysis Infrastructure and Distribution

As of December 2023, Uzbekistan had 87 hemodialysis centers operating across its 14 regions and the Republic of Karakalpakstan. These centers housed a total of 1,850 functional hemodialysis stations. The distribution, however, is highly inequitable. Tashkent City, the capital, with about 8% of the national population, hosts 22 centers with 750 stations (40.5% of the national total). In contrast, several remote rural regions (e.g., Surkhandarya, Jizzakh, Navoi) have fewer than 50 stations each, serving populations of 2-3 million. The national average is ~51 HD stations pmp, but this ranges from over 200 pmp in Tashkent City to below 25 pmp in the least-served regions (see Table 1 and Figure 2).

Table 1: Distribution of Hemodialysis Centers and Stations by Region (2023)

Region	Population (approx. million)	Number of HD Centers	Number of HD Stations	HD Stations pmp
Tashkent City	2.8	22	750	267.9
Tashkent Region	3.0	10	185	61.7
Samar kand Region	4.0	8	150	37.5
Fergan a Region	3.8	7	135	35.5
Andija n Region	3.2	6	120	37.5
National Total/Average	36.0	87	1850	51.4

Figure 2: Geographic Distribution of HD Stations per Million Population in Uzbekistan.



3. Human Resources for Hemodialysis Care

The nephrology workforce is critically limited. There are an estimated 180 certified nephrologists in Uzbekistan (5 pmp) and approximately 450 dialysis nurses (12.5 pmp). The recommended ratio for optimal care in resource-limited settings is often cited at >15 nephrologists pmp and >30 dialysis nurses pmp [18]. Furthermore,

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specialization is concentrated in major cities. There is no formal, standardized national training and certification program for dialysis nurses or technicians; most training is conducted on-the-job at major centers. The shortage of trained personnel is cited as a primary constraint on expanding service hours (most centers operate 2-3 shifts, 6 days a week) and establishing new satellite units.

4. Financing and Economic Aspects

Hemodialysis is included in the state-guaranteed package of free medical services for citizens. However, the state reimbursement rate per HD session, estimated at approximately 150,000 Uzbek soums (\approx \$12 USD as of 2023), is reported by center directors to cover only 60-70% of the actual direct costs (consumables, water treatment, electricity, basic salaries). This creates a funding gap that centers often fill by requesting informal or formal co-payments from patients for "additional" services or higher-quality consumables (e.g., specific dialyzers, erythropoiesis-stimulating agents (ESAs) beyond a basic quota). Our survey suggests that out-of-pocket expenditures for a patient on HD can range from 30% to 50% of the total treatment cost, imposing a severe financial burden on families. Transplantation activity remains very low (less than 50 kidney transplants pmp annually), which perpetuates reliance on the more expensive long-term dialysis modality.

5. Clinical and Patient-Reported Outcomes

Data on standardized patient outcomes is fragmented. Available data from the two largest centers in Tashkent indicate a one-year patient survival rate on HD of approximately 85%, and a five-year survival of 45-50%. These figures are lower than the averages reported by the ERA Registry (one-year survival \sim 87%, five-year survival \sim 55%) [17]. Key quality indicators show variability: the percentage of patients with a $Kt/V \geq 1.2$ (a measure of dialysis adequacy) averages 78%; the rate of patients with hemoglobin >110 g/L is 65%; and the proportion with controlled serum phosphorus is 58%. Patient-reported outcomes, assessed through a small-scale survey ($n=120$) using a translated KDQOL-SF™ (Kidney Disease Quality of Life) instrument, revealed significant burdens in the domains of "burden of kidney disease," "work status," and "physical functioning."

6. Analysis of the Service Delivery Model

The current model is almost exclusively in-center, thrice-weekly HD. Home-based therapies (peritoneal dialysis, home HD) are virtually non-existent ($<0.5\%$ of RRT patients). There is a lack of integrated CKD management programs for early detection and slowing progression. The referral pathway from primary care to nephrology is often delayed. Water quality for dialysis, while generally acceptable in large centers, is a concern in some regions with older infrastructure.

Discussion

The findings of this study paint a picture of a hemodialysis system in Uzbekistan that has achieved foundational coverage but is strained by rapid demand growth and characterized by significant structural weaknesses. The increasing prevalence of treated ESRD is a predictable consequence of demographic and epidemiological transition, yet the current infrastructure and financing models are not fully prepared for this sustained growth.

The most glaring issue is geographic inequity. The hyper-concentration of HD resources in Tashkent City creates a two-tier system where urban residents have relatively good access, while rural patients face immense hardships, including long-distance travel, accommodation costs, and family disruption. This violates the principle of equity, a cornerstone of the national health strategy [8]. Decentralization of services through the establishment of smaller satellite units in district hospitals, supported by telemedicine consultations from hub centers, is a critical imperative.

The human resource crisis is a fundamental bottleneck. The low density of nephrologists and dialysis nurses limits not only expansion but also the quality of care. International experience shows that outcomes are closely linked to nursing expertise [21,22]. Uzbekistan urgently needs to establish accredited post-graduate nursing and technician specialization programs in dialysis care, potentially in partnership with international professional societies like the ISN and ERA.

The financing model is unsustainable and promotes catastrophic health expenditure. The gap between state reimbursement and real costs incentivizes informal payments, eroding trust and creating financial toxicity for patients. A comprehensive revision of the reimbursement tariff, informed by accurate cost studies, is required. Simultaneously, exploring Public-Private Partnerships (PPPs) for building and managing dialysis centers in underserved regions could accelerate infrastructure development while the state retains regulatory and quality oversight. Increasing investment in kidney transplantation is the most cost-effective long-term solution for suitable patients, reducing lifelong dialysis dependence and improving quality of life.

Quality management requires systemic strengthening. The establishment of a mandatory National Renal Registry, modeled on successful examples like the Russian or Kazakh registries, is non-negotiable for monitoring epidemiology, benchmarking outcomes, and guiding resource allocation [20]. This should be linked to the development of national clinical guidelines for CKD and HD, adapted to local resources.

Finally, an exclusive focus on dialysis is a treatment-centric approach. A sustainable strategy must prioritize CKD prevention and early detection within primary care and NCD programs. Screening for albuminuria and managing diabetes and hypertension

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aggressively are the most powerful tools to curb the future growth of the ESRD population.

Our proposed strategic framework involves a phased, five-year plan:

- Phase 1 (Years 1-2): Strengthen governance (establish a national nephrology development task force), launch the National Renal Registry, revise HD reimbursement tariffs, and initiate a pilot PPP for 2-3 regional centers.
- Phase 2 (Years 3-4): Scale up infrastructure in 5-6 priority underserved regions, launch the national dialysis nurse certification program, and implement a national CKD early detection pilot.
- Phase 3 (Year 5): Evaluate and consolidate gains, expand transplantation services, and integrate telemedicine for nephrology support nationwide.

Conclusion

The improvement of hemodialysis care in Uzbekistan is a complex but achievable goal that aligns with the nation's broader aspirations for modernized, equitable healthcare. While challenges in infrastructure, workforce, financing, and quality assurance are substantial, they are not insurmountable. The path forward requires a paradigm shift from a reactive, treatment-focused model to a proactive, integrated, and patient-centered system. This necessitates strong political commitment, strategic investment, multisectoral collaboration, and a relentless focus on data-driven decision-making. By implementing a balanced strategy that simultaneously expands and decentralizes dialysis access, builds human capacity, reforms financing, strengthens prevention, and fosters transplantation, Uzbekistan can ensure that all its citizens with kidney failure have the opportunity to receive dignified, effective, and affordable life-sustaining care.

Conflict of Interest

The authors declare no conflicts of interest relevant to this manuscript. The research was conducted independently, and no funding was received from commercial entities involved in the dialysis industry.

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References

1. Jager KJ, Kovesdy C, Langham R, Rosenberg M, Jha V, Zoccali C. A single number for advocacy and communication—worldwide

more than 850 million individuals have kidney diseases. *Kidney Int.* 2019;96(5):1048-1050.

2. Liyanage T, Ninomiya T, Jha V, et al. Worldwide access to treatment for end-stage kidney disease: a systematic review. *Lancet.* 2015;385(9981):1975-1982.
3. Bikbov B, Purcell CA, Levey AS, et al. Global, regional, and national burden of chronic kidney disease, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet.* 2020;395(10225):709-733.
4. Rechel B, Ahmedov M, Akkazieva B, Katsaga A, Khodjamurodov G, McKee M. Lessons from two decades of health reform in Central Asia. *Health Policy Plan.* 2012;27(4):281-287.
5. World Health Organization. Noncommunicable diseases country profiles 2018. Geneva: World Health Organization; 2018.
6. Khikmatullaeva AA, Maksudova FK, Abdullaev AT. Features of chronic kidney disease in patients with type 2 diabetes mellitus in Uzbekistan. *Terapevticheskii arkhiv.* 2020;92(5):54-58. (In Russian).
7. Falkingham J. Health financing in Uzbekistan. In: *Health Systems in Transition: Uzbekistan.* European Observatory on Health Systems and Policies; 2010.
8. Government of Uzbekistan. "Uzbekistan-2030" Strategy*. Presidential Decree No. UP-60, 2023.
9. Ministry of Health of the Republic of Uzbekistan. Annual Report on the Activities of the Republican Specialized Scientific and Practical Medical Center of Nephrology and Renal Replacement Therapy. Tashkent; 2023.
10. International Society of Nephrology. ISN-Global Kidney Health Atlas. 2023 Edition. Available from: <https://www.theisn.org/initiatives/global-kidney-health-atlas/>
11. Bello AK, Okpechi IG, Osman MA, et al. Epidemiology of haemodialysis outcomes. *Nat Rev Nephrol.* 2022;18(6):378-395.
12. Alikhanova NA, Ismailov SI, Khamidullaeva GA. Survival analysis of patients on program hemodialysis in Uzbekistan. *Nephrology and Dialysis.* 2021;23(S1):S45-S46.
13. Khikmatullaeva AA. Chronic kidney disease as a medical and social problem in Uzbekistan. *Problems of Biology and Medicine.* 2019;4(109):241-244.
14. Yusupov M. Access to specialized medical care in the regions of Uzbekistan: problems and solutions. *Central Asian Journal of Medical Sciences.* 2021;7(2):15-24.

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15. World Health Organization. Global Health Observatory Data Repository. Available from: <https://www.who.int/data/gho>
16. World Bank. Uzbekistan Health Sector Review. World Bank Report No: 163794-UZ. Washington, DC; 2020.
17. ERA Registry. ERA Registry Annual Report 2021. Amsterdam, the Netherlands: Amsterdam UMC, location AMC; 2023.
18. Harris DCH, Davies SJ, Finkelstein FO, et al. Increasing access to integrated ESKD care as part of universal health coverage. *Kidney Int.* 2019;95(4S):S1-S33.
19. World Bank. Public Expenditure Review of the Health Sector in Uzbekistan. Washington, DC; 2022.
20. Tomilina NA, Bikbov BT, Andrushev AM, et al. The Russian Renal Replacement Therapy Registry: a status report. *Clin Nephrol.* 2016;86(13):24-30.
21. Brunier G, McArthur E, Jassal SV. The relationship between nurse staffing and patient outcomes in chronic hemodialysis units. *CANNT J.* 2015;25(4):24-30.
22. Javokhir Khalmukhamedov , Gulchekhra Djalilova, Ravshan Asadov // Improving hemodialysis care for the population in Uzbekistan, 62 ERA Congress abstracts, 2025 y, 4-7 June, Vienna, p:1300 (<https://doi.org/10.1093/ndt/gfaf116.1599>)
23. Gulchekhra Djalilova, Ravshan Asadov, Dinora Shakirova, Jamila Achilova //Improvement of hemodialysis care in the republic of Uzbekistan, BIO Web of Conferences 65, 05043 (2023), (<https://doi.org/10.1051/bioconf/20236505043>)