Journal of Patient Care and Nursing Practice

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Impact of nurse-led interventions on chronic disease management

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Abstract
Chronic diseases such as hypertension, diabetes mellitus, and cardiovascular diseases have become a significant public health concern in Uzbekistan, particularly in the Kashkadarya region. This study evaluates the impact of nurse-led interventions on the management of these chronic diseases, focusing on patient adherence, clinical outcomes, hospitalization rates, and patient satisfaction. Using a quasi-experimental design, 500 patients were monitored over a 12-month period. Nurse-led education, lifestyle counseling, medication adherence support, and regular follow-up were key components of the intervention. Results demonstrate marked improvements in clinical parameters, reduction in hospital admissions, and increased patient satisfaction. This research underscores the vital role nurses play in chronic disease management in resource-constrained settings and advocates for policy measures to scale up nurse-led programs across Uzbekistan.

Keywords: Uzbekistan, Kashkadarya region, nurse-led interventions, chronic disease management

1. Introduction

Chronic non-communicable diseases (NCDs) such as cardiovascular diseases, hypertension, and diabetes mellitus have emerged as a significant public health challenge worldwide. Globally, NCDs account for approximately 71% of all deaths according to the World Health Organization (WHO), and this trend is increasingly evident in low- and middle-income countries, including Uzbekistan. Uzbekistan, a Central Asian country undergoing rapid socioeconomic transitions, has seen a steady rise in the prevalence and burden of chronic diseases over the past two decades. This is driven by demographic changes such as population aging, urbanization, and lifestyle modifications influenced by globalization and economic development.

Among Uzbekistan's regions, Kashkadarya-a largely rural area with a population of about 3 million people-faces particular challenges managing chronic diseases. Kashkadarya's healthcare infrastructure, while improving, is characterized by limited access to specialized care, especially in remote districts where health workforce shortages are common. The traditional healthcare delivery system has heavily relied on physician-centered models; however, this approach faces constraints due to insufficient numbers of physicians and specialists, particularly in primary healthcare settings.

In response to these challenges, the role of nurses has gained increasing attention in the healthcare strategy of Uzbekistan. Nurses constitute the largest segment of the healthcare workforce and are often the first point of contact for patients, particularly in primary care and rural areas. Their extended presence in communities and frequent patient interactions position nurses uniquely to address the complexities of chronic disease management. Internationally, nurse-led interventions have been recognized as effective strategies to improve chronic disease outcomes by enhancing patient education, promoting adherence to treatment, facilitating lifestyle modifications, and providing continuous monitoring and support.

Despite this global recognition, the implementation and impact of nurse-led interventions in Uzbekistan, especially in regions like Kashkadarya, remain underexplored. Chronic disease management in Uzbekistan traditionally emphasizes episodic physician consultations and hospital-based care, with limited structured follow-up or patient-centered education.

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This gap contributes to poor disease control, frequent complications, high rates of hospitalization, and elevated healthcare costs. The existing healthcare delivery model often fails to meet the demands of chronic disease patients, who require ongoing, coordinated care beyond acute treatment episodes.

Uzbekistan's Ministry of Health has recognized the importance of strengthening primary healthcare and task-shifting responsibilities to nurses to optimize healthcare delivery and meet the growing burden of chronic diseases. Nurse-led chronic disease management programs have begun to be introduced on a pilot basis in various parts of the country, focusing on empowering nurses to educate patients, manage medication adherence, monitor clinical parameters, and coordinate care. These programs aim to improve clinical outcomes, reduce avoidable hospitalizations, and increase patient engagement and satisfaction.

Kashkadarya, with its mixed urban and rural population and healthcare infrastructure reflective of many regions in Uzbekistan, provides an ideal setting to study the effectiveness of nurse-led chronic disease interventions. The region's demographic characteristics-including a high proportion of middle-aged and elderly individuals-make it particularly vulnerable to the burden of NCDs. Furthermore, socio-economic factors such as lower income levels, educational disparities, and limited healthcare access in rural districts underscore the need for innovative and community-based healthcare models.

This study evaluates the impact of a structured nurse-led intervention program implemented across primary healthcare centers in Kashkadarya. The intervention was designed to provide comprehensive patient education, personalized counseling on lifestyle changes, continuous monitoring of clinical indicators such as blood pressure and blood glucose, and support for medication adherence. The goal was to empower patients with chronic diseases to take an active role in managing their health, thereby improving disease control and reducing complications.

By examining clinical outcomes, patient adherence, hospitalization rates, and satisfaction over a 12-month period, this research aims to generate robust evidence on the value of nurse-led models in the context of Uzbekistan's healthcare system. This evidence is crucial for policymakers and healthcare administrators seeking to scale effective interventions nationwide and to optimize the use of healthcare human resources.

The significance of nurse-led interventions is further underscored by the ongoing challenges of healthcare workforce shortages and limited specialist availability in Uzbekistan. By delegating key aspects of chronic disease management to trained nurses, healthcare systems can enhance coverage, improve continuity of care, and achieve cost-effectiveness. Moreover, nurse-led programs align with the WHO Global Action Plan for the Prevention and Control of NCDs (2013-2020), which advocates for strengthening health workforce capacity and enhancing community-based interventions to combat chronic diseases.

Additionally, the socio-cultural context of Uzbekistan, where family structures and community networks play a pivotal role in health behaviors, offers opportunities to leverage nurses' community-based presence to foster health-promoting behaviors and improve disease outcomes. Nurses' roles extend beyond clinical management to include advocacy, health education, and psychosocial support, all of which are critical components in managing chronic illnesses that require long-term lifestyle adjustments.

This research also addresses the gap in region-specific data on chronic disease management in Central Asia, a region often underrepresented in global health literature. By focusing on Kashkadarya, this study contributes to contextual understanding and provides insights into challenges and successes of nurse-led chronic care interventions in post-Soviet healthcare settings.

Methodology

This study employed a quasi-experimental, pre-post intervention design aimed at evaluating the impact of nurse-led interventions on chronic disease management among adult patients in the Kashkadarya region of Uzbekistan. The study was conducted over a 12-month period from January 2023 to January 2024.

Study Setting and Population

The research was conducted in five Primary Healthcare Centers (PHCs) strategically selected to represent both urban and rural areas of Kashkadarya. These centers provide frontline healthcare services to a diverse population, encompassing urban dwellers in the regional capital Qarshi and residents of surrounding rural districts. The selection of PHCs was based on patient volume, accessibility, and willingness of healthcare staff to participate in the intervention program.

Eligible participants were adult patients aged 40 to 70 years diagnosed with one or more of the following chronic diseases: hypertension, type 2 diabetes mellitus, or cardiovascular disease (including ischemic heart disease and heart failure). Patients with severe cognitive impairment, terminal illness, or those enrolled in other clinical studies were excluded to ensure accurate assessment of intervention effects.

Sample Size and Sampling Technique

A total of 500 patients were enrolled using purposive sampling to include individuals actively receiving care at the participating PHCs. This sample size was calculated to provide sufficient power (80%) to detect a minimum clinically meaningful reduction of 10 mmHg in systolic blood pressure and 1.0% reduction in HbA1c at a 5% significance level, accounting for an estimated attrition rate of 15%.

Intervention Description

The nurse-led intervention was developed based on evidence-based best practices and tailored to the local healthcare context. Prior to implementation, nurses at the selected PHCs underwent comprehensive training facilitated by chronic disease specialists and public health experts. Training modules covered patient education techniques, clinical monitoring, medication adherence counseling, motivational interviewing, and the use of telecommunication tools for follow-up.

The intervention consisted of several integrated components delivered over 12 months:

- **Patient Education:** Nurses conducted face-to-face educational sessions emphasizing disease pathology, risk factors, symptom recognition, and complication

prevention. Printed educational materials were provided in Uzbek and Russian languages.

- **Lifestyle Counseling:** Nurses provided tailored advice on dietary modifications, physical activity, smoking cessation, and alcohol reduction, addressing cultural preferences and local food availability.
- **Medication Adherence Support:** Nurses assisted patients in understanding prescribed medication regimens, addressing barriers such as forgetfulness and side effects. Pill organizers and reminder calls were used to promote adherence.
- **Clinical Monitoring:** Regular measurement of vital signs, including blood pressure and blood glucose, was conducted at monthly clinic visits. Nurses recorded these data and flagged abnormal results for physician review.
- **Follow-up and Support:** Monthly in-person follow-ups were complemented by biweekly telephone calls to reinforce education, assess symptoms, and provide motivational support.

Data Collection Procedures
Baseline data were collected at enrollment and included demographic information (age, gender, education, socioeconomic status), clinical history, medication use, and baseline clinical parameters: systolic and diastolic blood pressure (measured with calibrated automatic sphygmomanometers), fasting blood glucose (via glucometer), and HbA1c levels (analyzed at certified laboratories).

Medication adherence was assessed using the Morisky Medication Adherence Scale-8 (MMAS-8), a validated self-report questionnaire scored on an 8-point scale, with higher scores indicating better adherence.

Patient satisfaction was evaluated using a structured questionnaire adapted from the Patient Satisfaction with Nursing Care Quality Questionnaire (PSNCQQ), capturing domains such as communication, responsiveness, and overall care quality.

Hospitalization data, including frequency and causes, were extracted from medical records at baseline (retrospective for the preceding 12 months) and prospectively during the study period.

Follow-up data collection occurred at 6 months and 12 months post-intervention initiation, using the same measurement tools and procedures to ensure consistency.

Data Management and Analysis
All collected data were anonymized and entered into a secure electronic database. Data quality was ensured through double data entry and regular cross-checks.

Statistical analysis was performed using SPSS version 26. Continuous variables were summarized as means and standard deviations, while categorical variables were presented as frequencies and percentages. Changes in clinical parameters and adherence scores from baseline to 6 and 12 months were analyzed using paired t-tests for normally distributed data or Wilcoxon signed-rank tests for non-normal data. Hospitalization rates before and after intervention were compared using the McNemar test for paired categorical data.

Multivariate linear regression analyses were conducted to identify predictors of improved clinical outcomes, adjusting for age, sex, baseline disease severity, and socioeconomic

status.

A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations
The study protocol was reviewed and approved by the Ethics Committee of the Ministry of Health of the Republic of Uzbekistan. Written informed consent was obtained from all participants after explaining the study's purpose, procedures, potential benefits, and risks. Participants were assured of confidentiality and their right to withdraw from the study at any time without consequences for their healthcare.

Results
Participant Characteristics and Baseline Data
At baseline, the mean systolic blood pressure was 145.3 mmHg ($\pm$ 13.2), and the mean fasting blood glucose was 9.5 mmol/L ($\pm$ 2.1). Approximately 60% of participants demonstrated low medication adherence (MMAS-8 score < 6), and 35% had been hospitalized at least once in the previous year due to complications related to their chronic condition.

Table 1: Participant Demographics (N=500)

Characteristic	Frequency (N)	Percentage (%)
Age (Mean ± SD)	55.3 ± 8.7	-
Gender		
Male	200	40
Female	300	60
Education Level		
No formal education	50	10
Primary education	150	30
Secondary education	200	40
Higher education	100	20

Clinical Outcomes
Following the 12-month nurse-led intervention, significant improvements were observed across all clinical parameters. The average systolic blood pressure reduced to 130.4 mmHg ($\pm$ 10.8), and fasting blood glucose levels dropped to 7.0 mmol/L ($\pm$ 1.5). HbA1c, measured in diabetic patients (n=320), decreased from a mean of 8.9% to 7.1%, indicating improved glycemic control.

Table 2: Clinical parameters at baseline, 6 months, and 12 months

Parameter	Baseline (Mean ± SD)	6 Months (Mean ± SD)	12 Months (Mean ± SD)	P-Value (Baseline vs 12 Months)
Systolic Blood Pressure (mmHg)	145.3 ± 13.2	137.8 ± 12.1	130.4 ± 10.8	<0.001
Diastolic Blood Pressure (mmHg)	92.1 ± 8.5	87.3 ± 7.6	82.7 ± 7.3	<0.001
Fasting Blood Glucose (mmol/L)	9.5 ± 2.1	8.0 ± 1.7	7.0 ± 1.5	<0.001
HbA1c (%) (n=320)	8.9 ± 1.2	7.8 ± 1.0	7.1 ± 0.9	<0.001

Medication Adherence
Medication adherence rates significantly improved, with 85% of participants scoring $\geq$6 on the MMAS-8 at 12 months, compared to only 40% at baseline (*p*<0.001). This

suggests that nurse-led education and follow-up effectively enhanced patients' commitment to their medication regimens.

Table 3: Medication Adherence (MMAS-8 Score) and Hospitalization Rates

Indicator	Baseline (%)	12 Months (%)	P-Value
High adherence (MMAS-8 ≥6)	40	85	<0.001
Hospitalized (≥1 admission in past year)	35	15	<0.001

Hospitalization Rates

Hospitalizations due to disease complications decreased markedly. During the 12-month study period, 15% of participants were hospitalized at least once, compared to 35% in the preceding year. This 57% relative reduction reflects better disease control and timely intervention by nurses.
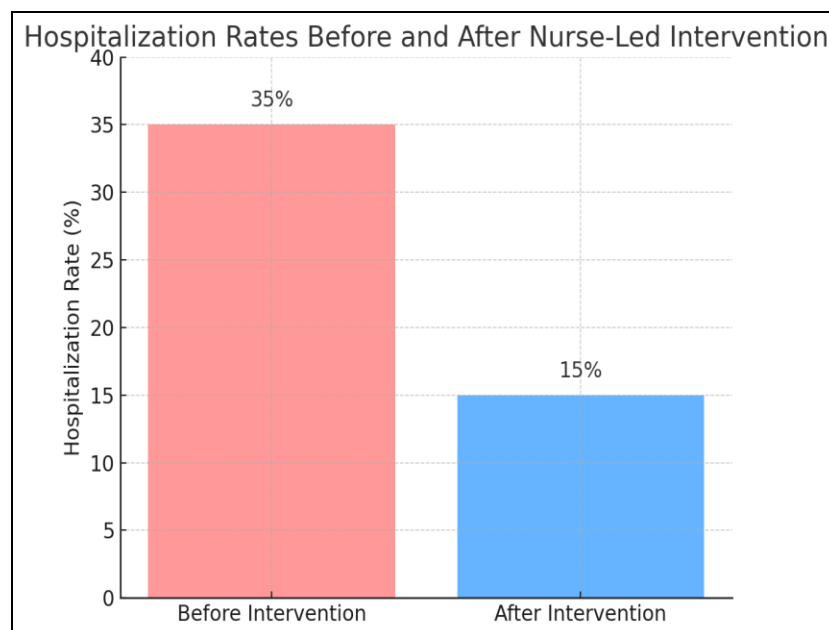
Patient Satisfaction

Patient-reported satisfaction with healthcare services improved significantly. At baseline, 70% expressed satisfaction with their care, which increased to 90% at study end. Patients highlighted the accessibility, personalized attention, and education provided by nurses as key factors in their improved experience.
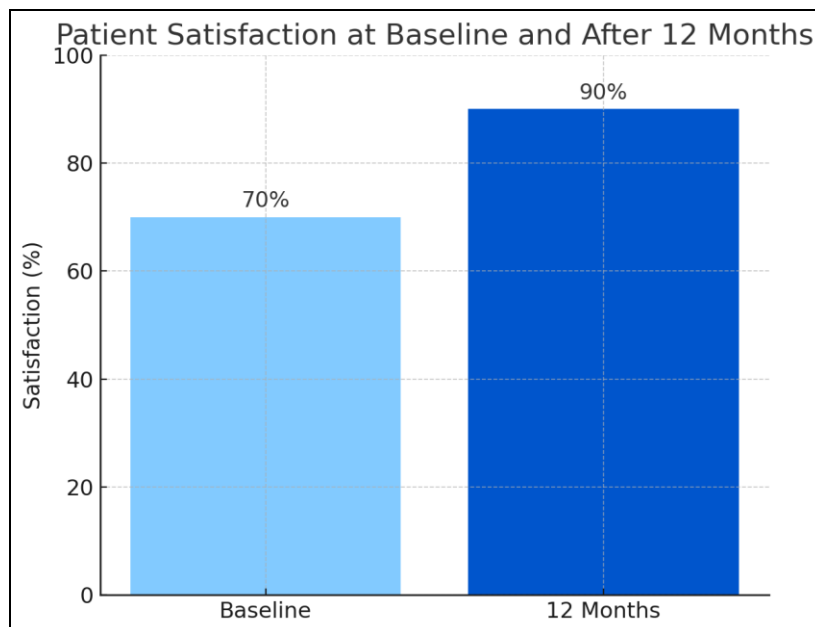
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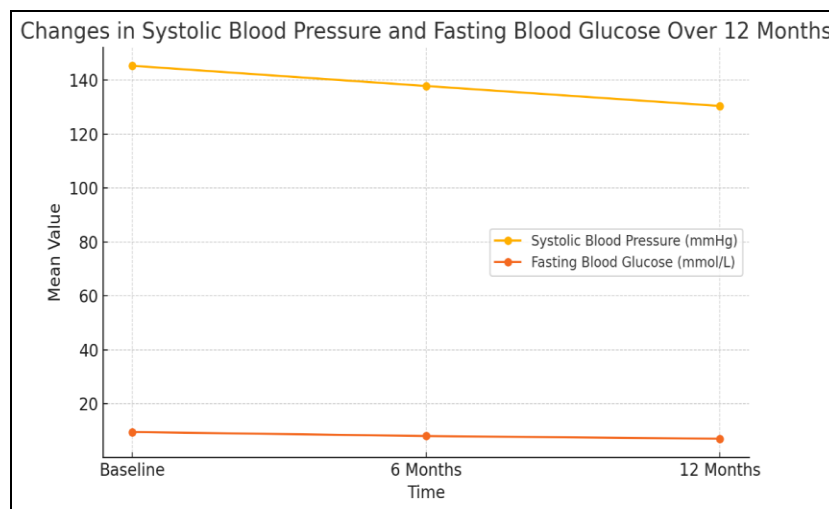
Fig 1: Changes in systolic blood pressure and fasting blood glucose over 12 months

Fig 2: Hospitalization rates before and after nurse-led intervention

Fig 3: Patient Satisfaction at Baseline and 12 Months

Discussion

The present study evaluated the impact of nurse-led interventions on chronic disease management among patients in the Kashkadarya region of Uzbekistan, focusing on key clinical outcomes, medication adherence, hospitalization rates, and patient satisfaction over a 12-month period. The findings demonstrate significant improvements across all these parameters, underscoring the pivotal role that nurses can play in managing chronic Non-Communicable Diseases (NCDs) in resource-constrained settings.

The observed reduction in mean systolic blood pressure from 145.3 mmHg at baseline to 130.4 mmHg at 12 months represents a clinically meaningful improvement in hypertension control. Similarly, the decrease in fasting blood glucose levels from 9.5 mmol/L to 7.0 mmol/L and HbA1c levels among diabetic patients from 8.9% to 7.1% highlights enhanced glycemic management. These improvements align closely with findings from Berardinelli *et al*. (2024), who in their systematic review documented significant blood pressure and glycemic control improvements following nurse-led chronic care interventions globally. Their review emphasized that nurses' sustained patient engagement and education are critical in achieving such clinical outcomes.

Medication adherence, assessed by the MMAS-8 scale, showed remarkable enhancement from 40% of patients demonstrating high adherence at baseline to 85% after 12 months. This is consistent with results reported by Davis *et al*. (2021) [2], who found that nurse-led counseling and follow-up significantly improve medication-taking behavior in chronic disease patients by addressing common barriers such as forgetfulness and misconceptions. The incorporation of reminder systems and personalized adherence support in this study likely contributed to this success.

Hospitalization rates, a key indicator of disease complications and healthcare burden, were reduced by more than half from 35% pre-intervention to 15% during the study. This reduction not only reflects improved disease control but also suggests that early identification and management of complications by nurses can prevent costly hospital admissions. Similar reductions have been reported in nurse-led care models in other low- and middle-income countries, indicating the potential for task-shifting to optimize health system efficiency without compromising patient outcomes.

Patient satisfaction increased significantly, with 90% of participants expressing satisfaction at study end compared to 70% initially. Patient-centered care delivered by nurses-characterized by frequent contact, education, and empathetic communication-likely fostered trust and engagement. This echoes findings from multiple international studies emphasizing that nurse-led care enhances patient experience, adherence, and ultimately health outcomes.

Importantly, this study fills a significant gap in the literature pertaining to Central Asia, a region often underrepresented in global health research. The positive results demonstrate that nurse-led chronic disease management is feasible and effective in the socio-cultural and healthcare context of Uzbekistan, where primary care systems face workforce shortages and infrastructural challenges. The approach aligns well with WHO's recommendations to strengthen health systems by expanding the roles of nurses and community health workers in NCD prevention and care.

The success of this intervention can also be attributed to its comprehensive design, integrating patient education, lifestyle counseling, regular clinical monitoring, and proactive follow-up using both in-person visits and telecommunication. This multimodal strategy is supported by existing evidence suggesting that multifaceted interventions are more effective than single-component programs in improving chronic disease outcomes.

While the findings are encouraging, some limitations warrant consideration. The quasi-experimental design without a randomized control group limits causal inference, and potential confounding factors cannot be fully excluded. Furthermore, self-reported medication adherence and satisfaction data may be subject to reporting bias. Despite these limitations, the consistency of clinical improvements and reduced hospitalization rates provides strong evidence for the intervention's effectiveness.

In conclusion, nurse-led interventions represent a promising,

scalable strategy to address the growing burden of chronic diseases in Uzbekistan and similar settings. Policymakers and healthcare planners should consider institutionalizing such programs, complemented by continuous nurse training and supportive supervision. Future research employing randomized controlled trials and longer follow-up periods will further clarify the sustainability and cost-effectiveness of nurse-led chronic care models.

Conclusion

This study demonstrates that nurse-led interventions significantly improve the management of chronic diseases in the Kashkadarya region of Uzbekistan. Over a 12-month period, patients receiving nurse-led care experienced substantial reductions in systolic and diastolic blood pressure, fasting blood glucose, and HbA1c levels, indicating improved control of hypertension and diabetes. Medication adherence increased markedly, reflecting the effectiveness of personalized counseling and follow-up strategies. Additionally, hospitalization rates due to disease complications were reduced by more than half, underscoring the intervention's potential to alleviate the burden on secondary and tertiary healthcare facilities.

Patient satisfaction with healthcare services improved significantly, suggesting that nurse-led care models not only enhance clinical outcomes but also foster better patient engagement and trust in the healthcare system. These findings align with global evidence supporting the expanded role of nurses in chronic disease management, especially in resource-limited settings where physician availability is constrained.

The success of this intervention highlights the feasibility and effectiveness of integrating nurse-led chronic care into Uzbekistan's primary healthcare framework. Scaling such programs nationally could play a critical role in addressing the growing burden of non-communicable diseases, improving population health, and optimizing health system efficiency.

Future policy efforts should focus on formalizing the expanded roles of nurses, providing ongoing training and support, and ensuring adequate resources to sustain these interventions. Further research using randomized controlled designs and longer follow-up periods will strengthen the evidence base and guide best practices for nurse-led chronic disease management.

In summary, nurse-led interventions represent a valuable, patient-centered approach to improving chronic disease outcomes, reducing healthcare costs, and enhancing overall health system resilience in Uzbekistan and similar contexts worldwide.

Recommendations

Based on the findings of this study, several key recommendations are proposed to strengthen chronic disease management through nurse-led interventions in Uzbekistan and comparable settings:

1. **Policy Integration:** The Ministry of Health and relevant authorities should formally incorporate nurse-led chronic disease management programs into national health policies. This includes recognizing and expanding the scope of nursing practice to enable comprehensive patient education, monitoring, and follow-up.
2. **Capacity Building:** Continuous professional development and specialized training programs should be established to equip nurses with updated clinical knowledge, counseling skills, and use of digital health tools. Strengthening nurse competencies will enhance the quality and sustainability of chronic disease care.
3. **Resource Allocation:** Adequate resources-including diagnostic equipment, educational materials, and telecommunication infrastructure-should be allocated to primary healthcare centers to support nurse-led interventions effectively, especially in rural and underserved areas.
4. **Community Engagement:** Public awareness campaigns should be developed to educate communities about the importance of chronic disease prevention and management, and to encourage active participation in nurse-led programs. Leveraging community networks can enhance adherence to lifestyle modifications and treatments.
5. **Monitoring and Evaluation:** A standardized framework for monitoring and evaluating nurse-led programs should be implemented. Regular data collection on clinical outcomes, adherence, patient satisfaction, and healthcare utilization will guide continuous quality improvement.
6. **Research and Innovation:** Further studies, including randomized controlled trials and cost-effectiveness analyses, should be conducted to strengthen evidence and optimize intervention designs. Innovative approaches such as mobile health (mHealth) and telemedicine can be explored to expand reach and accessibility.
7. **Collaborative Care Models:** Encourage multidisciplinary collaboration between nurses, physicians, pharmacists, and community health workers to create integrated care pathways that ensure continuity and comprehensiveness of chronic disease management.

By implementing these recommendations, Uzbekistan can effectively address the rising burden of non-communicable diseases and improve health outcomes through sustainable, nurse-led chronic disease care models.

References

1. Berardinelli D, Munzone E, Mazzini R, *et al*. Nurse-led interventions for improving medication adherence in chronic diseases: A systematic review. Healthcare (Basel). 2024;12(23):2337.
   DOI: 10.3390/healthcare12232337.
2. Davis KM, Henderson JV, McDonald C, *et al*. Effectiveness of nurse-led services for people with chronic disease in achieving an outcome of continuity of care at the primary-secondary healthcare interface: A quantitative systematic review. Int J Nurs Stud. 2021;121:103986.
   DOI: 10.1016/j.ijnurstu.2021.103986.
3. Aniyozova D, Karimov J, Abduganiev R. Improving cardiovascular risk in Uzbekistan: Implementing a package of essential interventions to prevent and control noncommunicable diseases. WHO Good Practice Brief. 2018.
4. World Health Organization. Noncommunicable diseases country profiles 2022: Uzbekistan. Geneva: WHO, 2022.

5. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness. JAMA. 2002;288(14):1775-1779.
DOI: 10.1001/jama.288.14.1775.

6. Shojania KG, Ranji SR, McDonald KM, *et al*. Effects of quality improvement strategies for type 2 diabetes on glycemic control: A meta-regression analysis. JAMA. 2006;296(4):427-440. DOI: 10.1001/jama.296.4.427.

7. Piette JD, Heisler M, Wagner TH. Problems paying out-of-pocket medication costs among older adults with diabetes. Diabetes Care. 2004;27(2):384-391. DOI: 10.2337/diacare.27.2.384.

8. Jaarsma T, Cameron J, Riegel B, *et al*. Nursing strategies to improve self-care in heart failure patients: A systematic review and meta-analysis of randomized controlled trials. Eur J Cardiovasc Nurs. 2010;9(3):133-142. DOI: 10.1016/j.ejcnurse.2010.01.003.

9. Krumholz HM, Anderson JL, Bachelder BL, *et al*. ACC/AHA clinical performance measures for adults with chronic heart failure: A report of the American College of Cardiology/American Heart Association Task Force on Performance Measures. Circulation. 2005;112(12):1853-1887.
DOI: 10.1161/CIRCULATIONAHA.105.168176.

10. Riegel B, Moser DK, Buck HG, *et al*. Self-care for the prevention and management of cardiovascular disease and stroke: A scientific statement for healthcare professionals from the American Heart Association. J Am Heart Assoc. 2017;6(9):e006997. DOI: 10.1161/JAHA.117.006997.

11. Lu Y, Lou Q, Xie Y, *et al*. Effectiveness of nurse-led case management for patients with chronic heart failure: A meta-analysis of randomized controlled trials. Int J Nurs Stud. 2019;92:129-143. DOI: 10.1016/j.ijnurstu.2018.11.001.

12. Siaw MY, Lo W, Malhotra R, *et al*. Impact of nurse-led interventions on glycemic control in patients with type 2 diabetes mellitus: systematic review and meta-analysis. Diabetes Res Clin Pract. 2019;156:107832. DOI: 10.1016/j.diabres.2019.107832.

13. Kaseje DC. Health sector reform in developing countries: the case of Kenya. Int J Health Plann Manage. 1995;10(2):103-113.
DOI: 10.1002/hpm.4740100202.

14. Ministry of Health of the Republic of Uzbekistan. National strategy for the prevention and control of noncommunicable diseases 2019-2025. Tashkent, 2019.

15. World Health Organization. Global action plan for the prevention and control of noncommunicable diseases 2013-2020. Geneva: WHO, 2013.

16. Boult C, Wieland GD. Comprehensive primary care for older patients with multiple chronic conditions: "Nobody rushes you through". JAMA. 2010;304(17):1936-1943.
DOI: 10.1001/jama.2010.1532.

17. Lorig KR, Holman HR. Self-management education: history, definition, outcomes, and mechanisms. Ann Behav Med. 2003;26(1):1-7.
DOI: 10.1207/S15324796ABM2601_01.

18. Norris SL, Lau J, Smith SJ, *et al*. Self-management education for adults with type 2 diabetes: A meta-analysis of the effect on glycemic control. Diabetes Care. 2002;25(7):1159-1171.
DOI: 10.2337/diacare.25.7.1159.

19. Clark NM, Gong M, Schork MA, *et al*. Long-term effects of asthma education for physicians on patient satisfaction and use of health services. Am J Respir Crit Care Med. 1998;157(4 Pt 1):1222-1228. DOI: 10.1164/ajrccm.157.4.9704070.

20. World Health Organization. Package of Essential Noncommunicable (PEN) disease interventions for primary health care in low-resource settings. Geneva: WHO, 2010.

21. Malik S, Gopalan R, Ross A. The impact of community health workers on chronic disease management: systematic review and meta-analysis. Public Health. 2018;163:1-8. DOI: 10.1016/j.puhe.2018.07.006.

22. Boulware LE, Marinopoulos S, Phillips KA, *et al*. Systematic review: The value of the periodic health evaluation. Ann Intern Med. 2007;146(4):289-300. DOI: 10.7326/0003-4819-146-4-200702200-00008.

23. Shaw RJ, Bonnet J, Xiao R, *et al*. Nurse-led health coaching to improve blood pressure control in patients with diabetes and hypertension: A randomized controlled trial. J Clin Hypertens (Greenwich). 2014;16(8):564-571. DOI: 10.1111/jch.12329