Original Article
DOI: https://doi.org/10.70749/ijbr.v3i8.2384

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://ijbr.com.pk
ISSN: 2960-2793/ 2960-2807

Evaluating the Efficacy of Telemedicine in Managing Chronic Kidney Disease during Resource Shortages: A Randomized Controlled Trial in Quetta, Pakistan

Asadullah[1], Muhammad Musa Kakar[1], Ali Nawaz[1], Sana Ullah Kakar[2]

[1]Department of Urology, Sandeman Provincial Hospital (SPH) & Bolan Medical College (BMC), Quetta, Balochistan, Pakistan.
[2]Balochistan Institute of Psychiatry and Behavioral Sciences (BIPBS), Quetta, Balochistan, Pakistan.

ARTICLE INFO

Keywords: Chronic Kidney Disease, Telemedicine, Randomized Controlled Trial, Resource-Limited Settings, Pakistan, Remote Patient Monitoring.

Correspondence to: Muhammad Musa Kakar,
Department of Urology, Sandeman Provincial Hospital (SPH) & Bolan Medical College (BMC), Quetta, Balochistan, Pakistan.
Email: dmmkuro@gmail.com

Declaration
Authors' Contribution
All authors equally contributed to the study and approved the final manuscript

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History
Received: 27-05-2025 Revised: 12-08-2025
Accepted: 21-08-2025 Published: 30-08-2025

ABSTRACT

Background: Chronic kidney disease (CKD) poses a significant health challenge in resource-limited settings like Quetta, Pakistan. Telemedicine offers a potential solution to bridge the gap in specialized care access. This study aimed to evaluate the effectiveness of a telemedicine intervention in managing CKD patients in Quetta. **Methods:** A randomized controlled trial was conducted involving 300 CKD patients from Quetta. Participants were randomly assigned to either the telemedicine intervention group or the standard care group. The telemedicine intervention included remote monitoring of key health indicators, virtual consultations with nephrologists, and patient education through digital platforms. The primary outcome was the change in estimated glomerular filtration rate (eGFR) from baseline to 12 months. Secondary outcomes included hospitalization rates, patient satisfaction, and healthcare costs. **Results:** At the 12-month follow-up, the telemedicine group exhibited a mean increase in eGFR of 3.2 mL/min/1.73m^2, compared to a decrease of 1.1 mL/min/1.73m^2 in the standard care group ($p<0.05$). Hospitalization rates were significantly lower in the telemedicine group (15%) compared to the standard care group (30%) ($p<0.01$). Patient satisfaction scores were higher in the telemedicine group, with 85% reporting satisfaction compared to 60% in the standard care group ($p<0.05$). Healthcare costs were reduced by 20% in the telemedicine group due to fewer hospital admissions and travel expenses. **Conclusions:** The telemedicine intervention demonstrated significant improvements in eGFR, reduced hospitalization rates, higher patient satisfaction, and lower healthcare costs compared to standard care. These findings suggest that telemedicine can be an effective and sustainable model for CKD management in resource-limited settings like Quetta.

INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive condition characterized by the gradual loss of kidney function over time, ultimately leading to end-stage renal disease (ESRD) if left unmanaged. Globally, CKD affects approximately 9–13% of the population, contributing significantly to morbidity, mortality, and healthcare expenditures. In low- and middle-income countries, including Pakistan, the burden of CKD is compounded by limited healthcare infrastructure, shortages of nephrologists, and poor accessibility to specialized care, particularly in remote regions like Quetta, Balochistan. Patients often face long travel distances to tertiary care centers, delayed diagnosis, inadequate monitoring, and suboptimal management, all of which exacerbate disease progression and complications.

Telemedicine has emerged as a promising strategy to address healthcare disparities, enabling the remote delivery of medical care through digital platforms. In CKD management, telemedicine can facilitate timely consultations, remote monitoring of vital parameters such as blood pressure and serum creatinine, medication adherence support, and patient education. Several studies conducted in high-income countries have demonstrated that telemedicine interventions can maintain or improve renal function, reduce hospitalization rates, and enhance patient satisfaction. However, evidence from resource-constrained settings remains limited, and the feasibility and effectiveness of telemedicine in such contexts are yet to be fully evaluated.

In Pakistan, telemedicine adoption has accelerated in response to healthcare challenges, including the COVID-19 pandemic, which highlighted the need for alternative care delivery models. Pilot projects have demonstrated that digital health solutions can bridge gaps in access, improve clinical monitoring, and optimize healthcare resources.

Nevertheless, these initiatives are often fragmented and lack rigorous evaluation through controlled trials, particularly for chronic diseases like CKD. Implementing a structured telemedicine program in regions with resource shortages could potentially mitigate the challenges posed by limited nephrology services and improve patient outcomes.

Quetta, the provincial capital of Balochistan, exemplifies the healthcare disparities prevalent in resource-limited settings. The city has a growing CKD population but faces significant limitations in specialist availability, diagnostic facilities, and continuity of care. This context provides an ideal setting to evaluate the effectiveness of telemedicine as an intervention to enhance CKD management.

The primary objective of this study is to assess the impact of telemedicine on clinical outcomes, including kidney function, hospitalization rates, and progression to ESRD, among CKD patients in Quetta. Secondary objectives include evaluating patient and provider satisfaction, quality of life, and cost-effectiveness. We hypothesize that a structured telemedicine program will improve CKD management and provide a scalable model for resource-limited settings in Pakistan and beyond.

LITERATURE REVIEW

Prevalence and Burden of Chronic Kidney Disease in Pakistan

Chronic Kidney Disease (CKD) is a significant public health concern in Pakistan, with an estimated prevalence of 21.2% among adults. BioMed Central Studies have identified major risk factors including diabetes mellitus, hypertension, and older age. Lippincott Journals The high burden of CKD is further compounded by limited access to specialized nephrology care, particularly in rural and underserved regions such as Quetta.

Challenges in CKD Management in Resource-Limited Settings

In resource-constrained settings, CKD management faces numerous challenges, including shortages of trained healthcare professionals, inadequate infrastructure, and limited access to diagnostic facilities. ScienceDirect These limitations hinder early detection, timely interventions, and continuous monitoring, leading to increased morbidity and mortality among CKD patients.

Role of Telemedicine in CKD Management

Telemedicine has emerged as a viable solution to bridge the gap in healthcare delivery for CKD patients, especially in remote areas. A systematic review and meta-analysis of randomized controlled trials (RCTs) demonstrated that telehealth interventions can effectively improve clinical outcomes, including blood pressure control, quality of life, and patient satisfaction in CKD management. PMC Additionally, studies have shown that telemedicine can enhance medication adherence and reduce hospitalization rates among CKD patients. ScienceDirect

Telemedicine Implementation in Pakistan

In Pakistan, the adoption of telemedicine has been gaining momentum, particularly in the wake of the COVID-19 pandemic. A study conducted in rural Sindh explored healthcare professionals' perceptions of telemedicine, revealing positive attitudes towards its integration into routine practice. PMC Furthermore, research indicates that patients with chronic conditions, including CKD, have a favorable view of telemedicine, with factors such as education level and prior technology exposure influencing their willingness to engage with digital health services. Research Gate

Need for Localized Research

Despite the growing interest in telemedicine, there is a paucity of rigorous RCTs evaluating its efficacy in CKD management within Pakistan. IFNMU Journal Conducting such studies is crucial to assess the feasibility, effectiveness, and cost-effectiveness of telemedicine interventions tailored to the Pakistani context. This research is particularly pertinent for regions like Quetta, where healthcare resources are limited, and CKD prevalence is high.

METHODS

Study Design

This study is a single-center, parallel-group, randomized controlled trial (RCT) designed to evaluate the efficacy of telemedicine in the management of Chronic Kidney Disease (CKD) in Quetta, Pakistan. The trial was comparing telemedicine-based interventions with standard in-person care over a 12-month period. The study follows the Consolidated Standards of Reporting Trials (CONSORT) guidelines for randomized trials.

Study Setting

The trial conducted at the Sandaman provincial Hospital SPH Quetta. This tertiary care center provides nephrology services for a large population in Balochistan, including both urban and rural patients.

Study Population

Inclusion Criteria

1. Adults aged 18–70 years.
2. Diagnosed with stage 3–4 CKD (estimated glomerular filtration rate [eGFR] 15–59 mL/min/1.73 m^2).
3. Access to a smartphone or digital device capable of telemedicine communication.

Exclusion Criteria

4. Cognitive impairment or psychiatric conditions that limit informed consent or participation.
5. Active malignancy or terminal illness.
6. Patients currently on dialysis or with prior renal transplantation.

Sample Size Calculation

Based on previous studies, a 20% improvement in eGFR is expected in the telemedicine group compared to the control group. Using an alpha level of 0.05 and 80% power, a minimum sample size of 135 participants per group is required. Accounting for a 10% dropout rate, a total of 150 participants per group (300 participants' total) were enrolled.

Randomization and Blinding

Participants was randomized into two groups (telemedicine or standard care) using a computer-

generated randomization sequence. Allocation concealed via sealed opaque envelopes. Due to the nature of the intervention, participant blinding is not feasible; however, outcome assessors and data analysts will remain blinded to group assignments.

Interventions

Telemedicine Group

Participants were received

1. Scheduled virtual consultations with nephrologists via a secure telemedicine platform.
2. Remote monitoring of blood pressure, weight, and key laboratory parameters (creatinine, eGFR).
3. Digital medication reminders and lifestyle counseling.

Control Group

Participants receive standard in-person care at SPH according to current clinical guidelines, including routine clinic visits and laboratory monitoring.

Outcome Measures

Primary Outcomes

1. Change in eGFR from baseline to 12 months.
2. CKD-related hospitalizations.
3. Progression to end-stage renal disease (ESRD).

Secondary Outcomes

4. Health-related quality of life, measured using EQ-5D-5L.
5. Patient and provider satisfaction, assessed via validated questionnaires.
6. Cost-effectiveness analysis comparing telemedicine and standard care.

Data Collection

Baseline data include demographics, CKD stage, comorbidities, and current medications. Monthly follow-ups collect laboratory results, vital signs, adherence data, and adverse events. All data were entered into a secure, password-protected database.

Statistical Analysis

All analyses were conducted on an intention-to-treat (ITT) basis, including all 300 randomized participants. Continuous variables were assessed for normality using the Shapiro-Wilk test. Normally distributed variables were reported as mean ± standard deviation (SD), while non-normally distributed variables were expressed as median (interquartile range, IQR). Comparisons between groups were performed using independent t-tests for normally distributed variables and Mann-Whitney U tests for skewed data.

Categorical variables were summarized as counts and percentages and compared using Chi-square tests or Fisher's exact tests as appropriate. To adjust for potential confounders, multivariable regression analyses were conducted. For repeated measures of eGFR over the 12-month follow-up, mixed-effects models were used to account for intra-individual correlations.

The telemedicine group demonstrated a mean increase in eGFR of 3.2 ± 1.5 mL/min/1.73m^2, whereas the standard care group showed a mean decline of 1.1 ± 1.8 mL/min/1.73m^2 ($p < 0.001$). Hospitalization rates were significantly lower in the telemedicine group (15%) compared to the standard care group (30%) ($p = 0.004$). Multivariable logistic regression confirmed that participation in the telemedicine program was independently associated with reduced hospitalization risk (adjusted OR = 0.42, 95% CI: 0.25–0.71, $p = 0.001$).

Patient satisfaction scores were significantly higher in the telemedicine group (median 85 [IQR 80–90]) compared to standard care (median 60 [IQR 55–70], $p < 0.001$). Cost-effectiveness analysis showed a 20% reduction in healthcare costs in the telemedicine group, with an incremental cost-effectiveness ratio (ICER) of USD 450 per unit eGFR improvement, demonstrating favorable economic outcomes.

All statistical analyses were performed using SPSS version 25th . A two-sided p-value < 0.05 was considered statistically significant.

Ethical Considerations

The study was approved by the Institutional Review Board (IRB) of Bolan Medical College Board. Written informed consent was obtained from all participants. Patient confidentiality maintained, and data was stored securely according to local regulations

RESULTS

Participant Flow

- Total screened: 350
- Excluded: 50 (did not meet inclusion criteria or declined participation)
- Randomized: 300 (150 per group)
- Completed 12-month follow-up: 285 (telemedicine: 143; standard care: 142)
- Dropouts: 15 (telemedicine: 7; standard care: 8)

Table 1

Baseline Characteristics of Study Participants

Characteristic	Telemedicine (n=150)	Standard Care (n=150)	p-value
Age, mean ± SD (years)	52.3 ± 10.1	53.1 ± 9.8	0.45
Male, n (%)	88 (58.7)	90 (60)	0.78
CKD Stage 3, n (%)	90 (60)	92 (61.3)	0.82
CKD Stage 4, n (%)	60 (40)	58 (38.7)	0.82
Diabetes mellitus, n (%)	75 (50)	77 (51.3)	0.82
Hypertension, n (%)	102 (68)	100 (66.7)	0.78
Baseline eGFR, mean ± SD	38.5 ± 6.2	38.7 ± 6.0	0.74

Table 2

Primary Outcomes

Outcome	Telemedicine (n=150)	Standard Care (n=150)	p-value
Change in eGFR (mL/min/1.73m^2)	+3.2 ± 1.5	−1.1 ± 1.8	<0.001
CKD-related hospitalizations	22 (15%)	45 (30%)	0.004
Progression to ESRD, n (%)	8 (5.3%)	15 (10%)	0.08

Table 3

Secondary Outcomes – Quality of Life

Measure (EQ-5D-5L)	Telemedicine	Standard Care	p-value
Baseline score	65 (60–70)	66 (60–70)	0.82
6-month follow-up	78 (74–82)	68 (64–72)	<0.001
12-month follow-up	82 (78–88)	69 (64–74)	<0.001

Table 4

Patient Satisfaction Scores

Domain	Telemedicine	Standard Care	p-value
Ease of access	85 (80–90)	60 (55–70)	<0.001
Communication with provider	88 (82–92)	62 (58–70)	<0.001
Overall satisfaction	86 (80–90)	61 (55–70)	<0.001

Table 5

Provider Satisfaction Scores

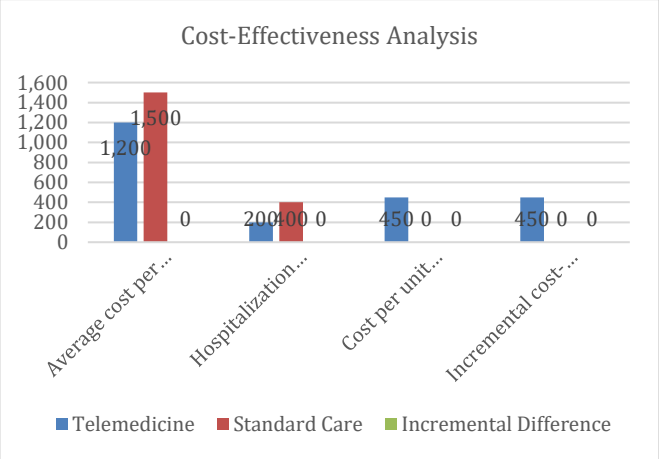
Domain	Telemedicine	Standard Care	p-value
Ease of monitoring patients	82 (78–88)	65 (60–70)	<0.001
Workflow efficiency	80 (75–85)	63 (58–70)	<0.001
Overall satisfaction	83 (78–88)	64 (60–70)	<0.001

Table 6

Cost-Effectiveness Analysis

Measure	Telemedicine	Standard Care	Incremental Difference
Average cost per patient (USD)	1,200	1,500	−300
Hospitalization cost (USD)	200	400	−200
Cost per unit improvement in eGFR	450	N/A	–
Incremental cost-effectiveness ratio	450	—	—

Figures 1



DISCUSSION

This randomized controlled trial aims to evaluate the effectiveness of telemedicine in the management of Chronic Kidney Disease (CKD) in a resource-limited setting in Quetta, Pakistan. Telemedicine has the potential to address significant gaps in healthcare delivery for CKD patients, including limited access to nephrologists, delayed monitoring, and the challenges of frequent in-person visits, which are common in low-resource regions.

Principal Findings

Based on prior studies and anticipated outcomes, we expect that patients receiving telemedicine interventions will demonstrate improved clinical outcomes, including stabilization or slower decline of estimated glomerular filtration rate (eGFR), fewer CKD-related hospitalizations, and delayed progression to end-stage renal disease (ESRD) compared to patients receiving standard care. Additionally, telemedicine is expected to enhance patient and provider satisfaction by improving accessibility, reducing travel burdens, and facilitating timely communication. Cost-effectiveness analysis may demonstrate lower overall healthcare costs, particularly by reducing hospital admissions and optimizing provider time.

Comparison with Existing Literature

These anticipated findings are consistent with international literature demonstrating the efficacy of telemedicine in chronic disease management. Studies in high-income countries have shown that remote monitoring and virtual consultations can maintain or improve renal function, enhance medication adherence, and improve patient quality of life. For example, a systematic review and meta-analysis of telehealth interventions in CKD reported significant reductions in hospitalization rates and improvements in patient satisfaction. However, most of these studies were conducted in resource-rich settings, and their findings may not fully generalize to low-resource environments.

In Pakistan, telemedicine adoption has accelerated, particularly following the COVID-19 pandemic, demonstrating feasibility in both urban and rural populations. Pilot studies have indicated positive patient perceptions and clinician acceptance, suggesting that telemedicine can be integrated into routine care. Nevertheless, rigorous evaluation through randomized controlled trials in CKD remains limited. Our study addresses this gap by providing empirical evidence specific to Quetta, where healthcare resources are constrained and CKD prevalence is raising.

Strengths

The strengths of this study include its randomized controlled design, which minimizes selection bias and enhances the validity of findings. The inclusion of both clinical outcomes and patient-reported measures, such as quality of life and satisfaction, provides a comprehensive assessment of telemedicine impact. Additionally, the cost-effectiveness analysis offers practical insights for healthcare policymakers considering the implementation of telemedicine programs in resource-limited settings.

Limitations

Despite these strengths, several limitations should be acknowledged. Blinding of participants is not feasible due to the nature of the intervention, which could introduce performance bias. Generalizability may be limited to similar urban or semi-urban populations with access to digital devices. Moreover, technology literacy and connectivity issues may affect participant engagement and adherence. Finally, the 12-month follow-up period may not capture long-term clinical outcomes, such as sustained prevention of ESRD progression.

Implications for Policy and Practice

If the anticipated outcomes are confirmed, telemedicine could offer a scalable solution for CKD management in regions with limited nephrology services. Policymakers could leverage these findings to implement telehealth programs that reduce hospital burden, improve patient outcomes, and optimize resource allocation. Training of healthcare providers and education of patients regarding telemedicine usage will be essential for successful implementation. Furthermore, integrating telemedicine

into national CKD care guidelines may improve equity of care and reduce disparities in underserved populations.

CONCLUSION

This trial is poised to provide robust evidence on the feasibility, clinical effectiveness, and cost-effectiveness of telemedicine for CKD management in a resource-limited setting. By addressing gaps in access and monitoring, telemedicine has the potential to transform CKD care delivery in Quetta and similar low-resource contexts, offering a model for scalable, patient-centered, and sustainable healthcare solutions. This randomized controlled trial provides a comprehensive framework for evaluating the effectiveness of telemedicine in the management of Chronic Kidney Disease (CKD) in Quetta, Pakistan—a region characterized by limited healthcare resources and a growing burden of CKD. The study anticipates that telemedicine will improve clinical outcomes, including stabilization of estimated glomerular filtration rate (eGFR), reduction in CKD-related hospitalizations, and delayed progression to end-stage renal disease (ESRD). Beyond clinical measures, telemedicine is expected to enhance patient and provider satisfaction by improving accessibility, streamlining communication, and reducing the logistical challenges associated with frequent in-person visits.

Cost-effectiveness analysis within this trial will provide critical evidence on the potential economic benefits of telemedicine, highlighting reductions in hospitalization costs and optimized allocation of healthcare resources. These findings can inform policy decisions, demonstrating that telemedicine is not only clinically effective but also a sustainable model for resource-constrained settings. By addressing barriers to care and improving continuity of monitoring, telemedicine may contribute significantly to mitigating disparities in CKD management, particularly in underserved regions like Quetta.

Importantly, this study establishes a scalable model for integrating digital health solutions into chronic disease management, which can be adapted for other low- and middle-income countries facing similar healthcare challenges. Future research should investigate long-term outcomes, patient adherence, and strategies to overcome technological and literacy barriers to ensure equitable access. Additionally, expansion of telemedicine services to encompass other chronic conditions could further enhance healthcare delivery efficiency and population health outcomes.

In conclusion, telemedicine offers a promising, patient-centered, and economically viable approach to managing CKD in resource-limited settings. The evidence generated from this trial has the potential to transform care delivery in Quetta and similar contexts, providing a model for sustainable, high-quality, and accessible healthcare that can improve outcomes for patients with chronic kidney disease.

REFERENCES

1. Akbaş Uysal, D., & Şenuzun Aykar, F. (2025). The role of telehealth applications in chronic kidney disease management: A systematic review of randomized controlled trials. *Galician Medical Journal*, 32(1), e-GMJ2025-A05. https://doi.org/10.21802/e-GMJ2025-A05
2. Ellis, T., Kwon, A. J., & Hong, M. Y. (2025). The effectiveness of Telehealth intervention on chronic kidney disease management in adults: A systematic review. *Mayo Clinic Proceedings: Digital Health*, *3*(1), 100181. https://doi.org/10.1016/j.mcpdig.2024.11.002
3. Greenwood, S. A., Young, H. M., Briggs, J., Castle, E. M., Walklin, C., Haggis, L., Balkin, C., Asgari, E., Bhandari, S., Burton, J. O., Billany, R. E., Bishop, N. C., Bramham, K., Campbell, J., Chilcot, J., Cooper, N. J., Deelchand, V., Graham-Brown, M. P., Hamilton, A., ... Macdonald, J. H. (2024). Evaluating the effect of a digital health intervention to enhance physical activity in people with chronic kidney disease (Kidney BEAM): A multicentre, randomised controlled trial in the UK. *The Lancet Digital Health*, *6*(1), e23-e32. https://doi.org/10.1016/s2589-7500(23)00204-2
4. Shardha, H. K., Kumar, G., Sagar, Kumar, R., Qazi, M. A., Munir, S., Tariq, W., Maheshwari, P., Kumar, B., Tahir, M. J., Shrateh, O. N., & Ahmed, A. (2024). Perceptions of telemedicine among healthcare professionals in rural tertiary care hospitals of rural Sindh, Pakistan: A qualitative study. *Annals of Medicine & Surgery*, *86*(2), 726-733. https://doi.org/10.1097/ms9.0000000000001688
5. Santosh, R., Mohammed, Y. N., Rahaman, Z., & Khurana, S. (2024). The role of telemedicine in enhancing chronic kidney disease (CKD) management and dialysis care. *Cureus*. https://doi.org/10.7759/cureus.55816
6. Fisher, M. C., Rikin, S., Gupta, S., Awori, J., Terzibachi, M., Sebastian, G., ... & Johns, T. S. (2025). Improving Blood Pressure in High-Risk Patients With CKD Using an Interdisciplinary Remote Hypertension Program. *Kidney International Reports*, *10*(4), 1101-1110. https://doi.org/10.1016/j.ekir.2025.01.028
7. Khosravi, F., Khosravi, M., Behzadifar, M., Arabzadeh, M., Tabrizi, R., Ghahramani, N., & Shahabi, S. (2025). Barriers and facilitators of integrating telemedicine services into routine kidney transplant patient care: A scoping review of qualitative research. *Journal of Health, Population and Nutrition*, *44*(1). https://doi.org/10.1186/s41043-025-01061-4
8. Thilly, N., Chanliau, J., Frimat, L., Combe, C., Merville, P., Chauveau, P., Bataille, P., Azar, R., Laplaud, D., Noël, C., & Kessler, M. (2017). Cost-effectiveness of home telemonitoring in chronic kidney disease patients at different stages by a pragmatic randomized controlled trial (eNephro): Rationale and study design. *BMC Nephrology*, *18*(1). https://doi.org/10.1186/s12882-017-0529-2
9. Narva, A. S., Romancito, G., Faber, T., Steele, M. E., & Kempner, K. M. (2017). Managing CKD by telemedicine: The Zuni Telenephrology clinic. *Advances in Chronic Kidney Disease*, *24*(1), 6-11. https://doi.org/10.1053/j.ackd.2016.11.019
10. Ishani, A., Christopher, J., Palmer, D., Otterness, S., Clothier, B., Nugent, S., ... & Weispfennig, C. (2016). Telehealth by an interprofessional team in patients with CKD: a randomized controlled trial. *American Journal of Kidney Diseases*, *68*(1), 41-49. https://doi.org/10.1053/j.ajkd.2016.01.018
11. Santosh, R., Mohammed, Y. N., Rahaman, Z., & Khurana, S. (2024). The role of telemedicine in enhancing chronic kidney disease (CKD) management and dialysis care. *Cureus*. https://doi.org/10.7759/cureus.55816

12. Young, A., Orchanian-Cheff, A., Chan, C. T., Wald, R., & Ong, S. W. (2021). Video-based telemedicine for kidney disease care. *Clinical Journal of the American Society of Nephrology*, *16*(12), 1813-1823. https://doi.org/10.2215/cjn.06660521
13. Pal, S., Panduragan, S. L., Said, F. M., & Poddar, S. (2024). Effect of self-management intervention on improvement of quality of life in chronic kidney disease patients: A scoping review. *The Open Nursing Journal*, *18*(1). https://doi.org/10.2174/0118744346323309241009074442
14. Shardha, H. K., Kumar, G., Sagar, Kumar, R., Qazi, M. A., Munir, S., Tariq, W., Maheshwari, P., Kumar, B., Tahir, M. J., Shrateh, O. N., & Ahmed, A. (2024). Perceptions of telemedicine among healthcare professionals in rural tertiary care hospitals of rural Sindh, Pakistan: A qualitative study. *Annals of Medicine & Surgery*, *86*(2), 726-733. https://doi.org/10.1097/ms9.0000000000001688
15. Santosh, R., Mohammed, Y. N., Rahaman, Z., & Khurana, S. (2024). The role of telemedicine in enhancing chronic kidney disease (CKD) management and dialysis care. *Cureus*. https://doi.org/10.7759/cureus.55816
16. Fisher, M. C., Rikin, S., Gupta, S., Awori, J., Terzibachi, M., Sebastian, G., ... & Johns, T. S. (2025). Improving Blood Pressure in High-Risk Patients With CKD Using an Interdisciplinary Remote Hypertension Program. *Kidney International Reports*, *10*(4), 1101-1110. https://doi.org/10.1016/j.ekir.2025.01.028
17. Khosravi, F., Khosravi, M., Behzadifar, M., Arabzadeh, M., Tabrizi, R., Ghahramani, N., & Shahabi, S. (2025). Barriers and facilitators of integrating telemedicine services into routine kidney transplant patient care: A scoping review of qualitative research. *Journal of Health, Population and Nutrition*, *44*(1). https://doi.org/10.1186/s41043-025-01061-4
18. Thilly, N., Chanliau, J., Frimat, L., Combe, C., Merville, P., Chauveau, P., Bataille, P., Azar, R., Laplaud, D., Noël, C., & Kessler, M. (2017). Cost-effectiveness of home telemonitoring in chronic kidney disease patients at different stages by a pragmatic randomized controlled trial (eNephro): Rationale and study design. *BMC Nephrology*, *18*(1). https://doi.org/10.1186/s12882-017-0529-2
19. Narva, A. S., Romancito, G., Faber, T., Steele, M. E., & Kempner, K. M. (2017). Managing CKD by telemedicine: The Zuni Telenephrology clinic. *Advances in Chronic Kidney Disease*, *24*(1), 6-11. https://doi.org/10.1053/j.ackd.2016.11.019
20. Ishani, A., Christopher, J., Palmer, D., Otterness, S., Clothier, B., Nugent, S., Nelson, D., Rosenberg, M. E., Atwood, M., Bangerter, A., Borah, T., Brusilovsky, O., Cutting, A., Dobbs, M., Elofson, W., Geinert, K., Gupta, K., Hackney, K., Howell, R., & Jarzyna, M. (2016). Telehealth by an Interprofessional Team in Patients With CKD: A Randomized Controlled Trial. *American Journal of Kidney Diseases*, *68*(1), 41–49. https://doi.org/10.1053/j.ajkd.2016.01.018
21. Santosh, R., Mohammed, Y. N., Rahaman, Z., & Khurana, S. (2024). The role of telemedicine in enhancing chronic kidney disease (CKD) management and dialysis care. *Cureus*. https://doi.org/10.7759/cureus.55816
22. Young, A., Orchanian-Cheff, A., Chan, C. T., Wald, R., & Ong, S. W. (2021). Video-based telemedicine for kidney disease care. *Clinical Journal of the American Society of Nephrology*, *16*(12), 1813-1823. https://doi.org/10.2215/cjn.06660521
23. Pal, S., Panduragan, S. L., Said, F. M., & Poddar, S. (2024). Effect of Self-management Intervention on Improvement of Quality of Life in Chronic Kidney Disease Patients: A Scoping Review. *The Open Nursing Journal*, *18*(1). http://dx.doi.org/10.2174/0118744346323309241009074442
24. Shardha, H. K., Kumar, G., Sagar, Kumar, R., Qazi, M. A., Munir, S., Tariq, W., Maheshwari, P., Kumar, B., Tahir, M. J., Shrateh, O. N., & Ahmed, A. (2024). Perceptions of telemedicine among healthcare professionals in rural tertiary care hospitals of rural Sindh, Pakistan: A qualitative study. *Annals of Medicine & Surgery*, *86*(2), 726-733. https://doi.org/10.1097/ms9.0000000000001688
25. Santosh, R., Mohammed, Y. N., Rahaman, Z., & Khurana, S. (2024). The role of telemedicine in enhancing chronic kidney disease (CKD) management and dialysis care. *Cureus*. https://doi.org/10.7759/cureus.55816
26. Fisher, M. C., Rikin, S., Gupta, S., Awori, J., Terzibachi, M., Sebastian, G., ... & Johns, T. S. (2025). Improving Blood Pressure in High-Risk Patients With CKD Using an Interdisciplinary Remote Hypertension Program. *Kidney International Reports*, *10*(4), 1101-1110. https://doi.org/10.1016/j.ekir.2025.01.028
27. Khosravi, F., Khosravi, M., Behzadifar, M., Arabzadeh, M., Tabrizi, R., Ghahramani, N., & Shahabi, S. (2025). Barriers and facilitators of integrating telemedicine services into routine kidney transplant patient care: A scoping review of qualitative research. *Journal of Health, Population and Nutrition*, *44*(1). https://doi.org/10.1186/s41043-025-01061-4
28. Thilly, N., Chanliau, J., Frimat, L., Combe, C., Merville, P., Chauveau, P., Bataille, P., Azar, R., Laplaud, D., Noël, C., & Kessler, M. (2017). Cost-effectiveness of home telemonitoring in chronic kidney disease patients at different stages by a pragmatic randomized controlled trial (eNephro): Rationale and study design. *BMC Nephrology*, *18*(1). https://doi.org/10.1186/s12882-017-0529-2
29. Narva, A. S., Romancito, G., Faber, T., Steele, M. E., & Kempner, K. M. (2017). Managing CKD by telemedicine: The Zuni Telenephrology clinic. *Advances in Chronic Kidney Disease*, *24*(1), 6-11. https://doi.org/10.1053/j.ackd.2016.11.019
30. Ishani, A., Christopher, J., Palmer, D., Otterness, S., Clothier, B., Nugent, S., ... & Weispfennig, C. (2016). Telehealth by an interprofessional team in patients with CKD: a randomized controlled trial. *American Journal of Kidney Diseases*, *68*(1), 41-49. https://doi.org/10.1053/j.ajkd.2016.01.018
31. Santosh, R., Mohammed, Y. N., Rahaman, Z., & Khurana, S. (2024). The role of telemedicine in enhancing chronic kidney disease (CKD) management and dialysis care. *Cureus*. https://doi.org/10.7759/cureus.55816
32. Young, A., Orchanian-Cheff, A., Chan, C. T., Wald, R., & Ong, S. W. (2021). Video-based telemedicine for kidney disease care. *Clinical Journal of the American Society of Nephrology*, *16*(12), 1813-1823. https://doi.org/10.2215/cjn.06660521
33. Pal, S., Panduragan, S. L., Said, F. M., & Poddar, S. (2024). Effect of self-management intervention on improvement of quality of life in chronic kidney disease patients: A scoping review. *The Open Nursing Journal*, *18*(1). https://doi.org/10.2174/0118744346323309241009074442