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Protocol — The effectiveness of telehealth interventions on chronic kidney disease management: A systematic review and meta-analysis

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ADMINISTRATIVE INFORMATION

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Conflicts of interest - No conflicts of interest have been declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 22 October 2024 and was last updated on 22 October 2024.

INTRODUCTION

Review question / Objective The aim of this systematic review is to evaluate the effectiveness of telehealth interventions on various health outcomes in adults with CKD. Specifically, the review will assess the impact of telehealth interventions on renal function indicators, such as eGFR and serum creatinine, and investigate the role of telehealth in controlling blood pressure, including systolic (SBP) and diastolic (DBP) measurements. It will also evaluate improvements in quality of life, using measures such as HRQOL and KDQOL-SF, and examine changes in dietary habits through the Healthy Eating Index (HEI) and the Alternative Healthy Eating Index (AHEI). Additionally, the review will explore how Registered Dietitian Nutritionists (RDNs) and other healthcare providers contribute to enhancing patient outcomes through telehealth interventions.

Rationale Chronic kidney disease (CKD) is a growing global health concern, affecting over 800 million people and contributing to a substantial increase in mortality. Telehealth interventions, which leverage technology to deliver healthcare remotely, offer promising solutions for improving CKD management, particularly for patients who may have limited access to in-person care. This systematic review aims to assess the effectiveness of telehealth interventions on key CKD outcomes such as dietary habits, blood pressure management, renal function, and quality of life. As telehealth becomes increasingly integrated into healthcare systems, particularly post-COVID-19, understanding its impact on CKD patients will help optimize patient care and healthcare delivery.

Condition being studied This review focuses on chronic kidney disease (CKD), a condition characterized by the gradual loss of kidney function over time. CKD affects millions worldwide, with its progression often leading to complications

such as hypertension, cardiovascular disease, and end-stage renal disease. The condition requires careful management of various health factors, including blood pressure, diet, and biochemical markers, to delay its progression. Telehealth interventions are explored as a means to provide more accessible and efficient care to individuals managing CKD at various stages (1–4), before the onset of dialysis or kidney transplantation.

METHODS

Search strategy The search strategy for this systematic review will follow the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. A comprehensive literature search will be conducted across four online databases: PubMed/MEDLINE, Scopus, Embase, and ScienceDirect. The search will focus on identifying relevant studies using the following keywords: ("telehealth" OR "ehealth" OR "mhealth" OR "telenutrition" OR "telemedicine" OR "telenutrition") AND ("chronic kidney disease" OR "renal disease").

Participant or population Adults (≥18 years) patients with CKD stages 1-4. Excluded patients are those undergoing dialysis or diagnosed with ESRD.

Intervention Telehealth interventions using mobile apps, video consultations, phone counseling, and wearable devices for self-monitoring. Interventions will include collaborations with healthcare professionals like Registered Dietitian Nutritionists (RDNs).

Comparator Usual care, which does not involve telehealth, will be used as the comparator for this study. For single-arm trials, there will be no comparator.

Study designs to be included Randomized controlled trials (RCTs) and single-arm studies published between 2012 and 2024.

Eligibility criteria Studies will be included if they meet the following criteria: (1) randomized controlled trial (RCT) or single-arm study, as RCTs provide high-quality evidence of causality, while single-arm studies offer insight when control groups are not feasible; (2) a sample of adult individuals (≥18 years old), ensuring homogeneity in physiology and treatment protocols, as CKD management differs between children and adults; (3) diagnosis of chronic kidney disease stage 1 to 4 (glomerular filtration rate [GFR]: >90 to <15 mg/mmol, respectively), focusing on telehealth's potential to manage complications and delay progression before dialysis or kidney transplant; (4) use of telehealth communications; and (5) assessment of the effect of telehealth on dietary habits, quality of life, blood pressure, or renal function via GFR, as these outcomes are critical for monitoring CKD progression and management.

The exclusion criteria will be: (1) adults on hemodialysis or dialysis, as these patients have different healthcare needs that could obscure the specific benefits of telehealth for earlier CKD stages; (2) end-stage renal disease (ESRD), which introduces confounding variables from dialysis or transplant interventions; and (3) reviews, as they do not contribute original data for analysis.

Information sources The literature search will follow PRISMA guidelines and will include searches in the following databases: PubMed, Scopus, Embase, and ScienceDirect. Keywords used will include terms such as "telehealth," "chronic kidney disease," "telenutrition," "eHealth," and other related terms.

Main outcome(s) This systematic review will assess several outcomes related to chronic kidney disease management. Kidney function will be evaluated using estimated glomerular filtration rate (eGFR) and serum creatinine levels. Blood pressure measurements will include systolic (SBP) and diastolic (DBP) blood pressure. Dietary habits will be assessed using the Healthy Eating Index (HEI) and the Alternative Healthy Eating Index (AHEI). Quality of life outcomes will be measured through the Health-Related Quality of Life (HRQOL) and Kidney Disease Quality of Life Short Form (KDQOL-SF) scales. Clinical markers such as serum potassium, sodium, albumin, and phosphorus levels will be examined, along with 24-hour sodium excretion, which serves as a key indicator of dietary sodium intake.

Data management Data will be extracted from studies that meet predefined eligibility criteria, focusing on the impact of telehealth interventions on chronic kidney disease (CKD) management. All records will be collected and organized using reference management software such as EndNote and Zotero. Duplicate studies and ineligible records will be filtered and removed using Zotero. Data from the included studies, such as study design, interventions, and outcome measures, will be documented in a structured format. Any discrepancies in data extraction will be resolved by reviewers to ensure accuracy.

Quality assessment / Risk of bias analysis The methodological quality of the included studies will be assessed using a modified version of the Downs and Black checklist. This checklist allows for the evaluation of both randomized and non-randomized studies, with a maximum score of 28 and 25 points, respectively. For uncontrolled studies, the maximum score will be 20, as certain items are not relevant. Studies will be classified based on their total score as excellent (26-28), good (20-25), fair (15-19), or poor (≤14) quality. Two independent reviewers will critically appraise each study, and any disagreements will be resolved through discussion.

Strategy of data synthesis The data synthesis will employ a narrative approach, providing a qualitative summary of the findings from the included studies. The synthesis will describe the key outcomes related to telehealth interventions for chronic kidney disease (CKD), such as quality of life, dietary habits, and renal function. The studies will be grouped based on intervention types (e.g., mobile apps, phone calls, text messaging), and results will be compared and contextualized based on common themes and patterns. This approach will allow for the integration of findings from both randomized controlled trials and single-arm studies, focusing on descriptive outcomes to identify trends and gaps in the literature.

Subgroup analysis The subgroup analysis in this review aims to explore variations in outcomes across different populations and interventions. The analysis will consider factors such as chronic kidney disease (CKD) stages, age groups, and intervention types (e.g., telehealth method or frequency of contact). The goal is to determine whether certain subpopulations, such as older adults or those in early versus late CKD stages, benefit more significantly from specific telehealth interventions. This approach will help clarify which telehealth strategies are most effective for diverse CKD populations, enhancing personalized care in future clinical applications.

Sensitivity analysis None.

Language restriction English.

Country(ies) involved United States.

Keywords Telehealth, mHealth, chronic kidney diseases, dietitian, quality of life.

Dissemination plans The results of this systematic review on the effectiveness of telehealth interventions for chronic kidney disease management will be submitted for publication in *Mayo Clinic Proceedings: Digital Health*. Upon acceptance, the findings will be made accessible to healthcare professionals, researchers, and policy-makers.

Contributions of each author

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