Title: Remote symptom assessment and management via mobile app for adults with chronic kidney disease living in Vietnam

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This version of the study protocol has been reviewed by the Human Research Ethics Committee, ethics approval number 135/2025/CN/HDDD VMEC, dated 16/08/2025.

INTRODUCTION

Adults with chronic kidney disease (CKD) experience a wide range of symptoms that significantly impact their health-related quality of life (HRQoL) and place a huge burden on the healthcare system. Mobile health app-based interventions for symptom assessment and management have the potential to alleviate the burden of CKD and improve patient outcomes. This study aims to develop and evaluate the feasibility of a Symptom Assessment and Management (SAM-CKD) program embedded into a mobile app for adults with CKD living in Vietnam. This study involves the development of a mobile app focusing on CKD symptom assessment and management, followed by a feasibility randomised trial to evaluate the feasibility, usability, acceptability, and potential effectiveness on symptoms and health-related quality of life. This is the first symptom assessment and management program delivered via mobile app to adults with CKD in Vietnam. This study is expected to provide a supportive tool for those with CKD, enabling them to actively engage in their symptom management.

BACKGROUND

According to the Kidney Disease Improving Global Outcomes organisation (2024), CKD is characterised by abnormalities of kidney structure and function persisting for more than 3 months and is classified into 5 grades based on glomerular filtration rate (GFR). Risk factors for CKD include diabetes, hypertension, obesity, cardiovascular disease, toxins/drugs, and

some non-modifiable factors such as genetic factors, increasing age and family history of CKD (Chertow et al., 2024; Tsai et al., 2016; L. Wang et al., 2023). Additionally, CKD is associated with impaired HRQoL, increased risks of other diseases such as cardiovascular disease and diabetes, increased years of life lost and premature death, and a huge burden to healthcare systems (Francis et al., 2024; GBD Chronic Kidney Disease Collaboration., 2020a; Kula et al., 2023).

The prevalence of CKD has risen dramatically and is now among the top 10 most common chronic diseases worldwide (Hill et al., 2016; Jager et al., 2019). In 2017, an estimated 843.6 million individuals worldwide (11.1% of the population) had CKD, resulting in 1.2 million deaths (Bikbov et al., 2020; Jager et al., 2019). By 2040, CKD is predicted to become the fifth leading cause of mortality worldwide (Bikbov et al., 2020; Jager et al., 2019). In Vietnam, the estimated prevalence of CKD in 2020 was 12.8% of the population, approximately 8.74 million people (Thaminda et al., 2022); it was the eighth leading cause of death in the country (Bikbov et al., 2020).

Due to the gradual damage to the kidney's function, CKD often shows no obvious symptoms or only a few symptoms in its earlier grades (De Santo & Di Iorio, 2023). Symptoms often first manifest in CKD grade 4 or grade 5, by which time most of the kidney function has been lost (Cox et al., 2017). The most common symptoms experienced by adults with CKD are fatigue, pain, poor sleep, pruritus, restless leg syndrome, sexual dysfunction, anxiety and depression (Clark-Cutaia et al., 2022; Gregg et al., 2021; Huang et al., 2021; Huang et al., 2019; Jhamb et al., 2019). Symptom burden negatively impacts the HRQoL of adults with CKD (Speyer et al., 2024; van Oevelen et al., 2024). A higher symptom burden also predicts a higher risk of healthcare use (Zhang et al., 2020). Moreover, symptoms such as sleep disorders, chronic pain and fatigue are associated with a higher risk of mortality and adverse health outcomes (Yang et al., 2018). Among adults receiving kidney replacement therapy,

anxiety and depression have an association with haemodialysis (HD) withdrawal and a lower chance of eligibility for kidney transplantation (Chen et al., 2022; El-Magd et al., 2023).

With the rapid advancement of technology, there has been an explosion of eHealth solutions within healthcare in recent years, and CKD is no exception (Okpechi et al., 2022). An increase in delivering kidney care through eHealth has been identified, even in lower-income countries, which offers an opportunity to enhance CKD management and improve health outcomes via digital health interventions (Jeddi et al., 2017; Marin et al., 2023; Okpechi et al., 2022). In Vietnam, existing self-management programs for adults with CKD mainly focus on providing knowledge about kidney disease and self-management behaviours (Nguyen et al., 2019). Support programs focusing on symptom assessment and management in adults with CKD are still limited. Research involving eHealth is just beginning with a few initiatives supporting CKD self-management (Lan et al., 2022). While symptom management via eHealth is emerging in other countries, it has not commenced in Vietnam.

Justification for the study

The prevalence of CKD is high in Vietnam; it is a significant health problem in the country. Adults with CKD have to deal with various physical, psychological and emotional symptoms which often interfere with usual activities, limit social interaction, and reduce capacity to undertake work (Fletcher et al., 2022; Gregg et al., 2021; Moore et al., 2022; Yapa et al., 2020). The vital role of symptom management in CKD is well acknowledged, but there is still a lack of supporting programs to help adults better manage their CKD symptoms (Shen et al., 2021). Along with global trends towards remote healthcare services delivered through digital health technology, symptom assessment and management interventions based on eHealth can be a possible solution (Okpechi et al., 2022). Using CKD symptom management strategies delivered through eHealth has the potential to minimise the burden and

consequence of CKD and improve outcomes and HRQoL among adults with CKD (Curtis et al., 2024; Ghozali et al., 2023). However, implementing eHealth solutions focusing on CKD symptom assessment and management requires further study.

RESEARCH QUESTIONS AND OBJECTIVES

Study objectives

To develop and evaluate the feasibility, usability, acceptability and potential effectiveness of a mobile app-based symptom assessment and management program for adults with CKD living in Vietnam.

Research questions

(1) Is a symptom assessment and management program delivered via a mobile app for adults with CKD living in Vietnam acceptable and feasible?

Are there any changes in CKD symptoms and health-related quality of life among adults with CKD following the symptom assessment and management program?

METHODS

Study design

A randomised feasibility trial is an appropriate approach to studying new interventions (Teresi et al., 2022). This study is necessary to determine important parameters such as the number of people eligible, the willingness of patients to be randomised, the follow-up rate, the response rates, and the adherence (Whitehead et al., 2014). This study can be used to estimate the sample size for future large-scale studies. The Consolidated Standards of Reporting Trials (CONSORT) statement extension for randomised pilot and feasibility trials

(Eldridge et al., 2016) guides this phase. The protocol of the feasibility trial will be registered with ClinicalTrial.gov.

Settings

This study will be conducted in the Department of Nephrology and Haemodialysis, and Outpatient Clinic, E Hospital, Hanoi, Vietnam.

Participants

Inclusion criteria

Individuals aged 18 years or above who are diagnosed with CKD grade 4 or grade 5 with or without haemodialysis, can speak and read Vietnamese, own a smartphone operating on Android with internet accessibility, and agree to participate in this study.

Exclusion criteria

Patients with a medical diagnosis of cognitive impairment or psychological problems or another terminal illness, such as cancer and advanced lung disease, who are acutely unwell or participating in another study during this trial will be excluded from this study.

Intervention

The SAM-CKD intervention will be developed and embedded into an existing Smart Kidney app, which currently provides CKD diet, exercise and disease management strategies (Hoang et al., 2022). The development of the Smart Kidney app in Vietnam involved a co-design process with adults with CKD, their family caregivers, healthcare experts in kidney disease, IT developers and researchers. The app is accessible on smartphones running on the Android operating system and available on Google Play at no cost.

The Smart Kidney app enables additional material to be added. As symptom assessment and management are absent in the existing app, embedding the SAM-CKD program into the app will fill this gap. This approach is also cost- and time-efficient in extending the existing digital intervention rather than building a new application. The design, interface and preexisting features of the Smart Kidney app will remain. The IT team in charge of Smart Kidney app development will continue to work on the current project.

The Theory of Symptom Management underpins the SAM-CKD program (Humphreys et al., 2008). The SAM-CKD program has three components - introduction, symptom tracker and symptom management. A short introduction video explaining the symptoms and how to use the SAM-CKD app will be provided in the Introduction. A symptom tracker to enable self-assessment and monitor symptoms will be offered. A list of 17 common symptoms will be assessed according to the IPOS-Renal instrument. Patients can self-assess symptoms and rate these according to the severity level (overwhelmingly, severely, moderately, slightly, and not at all). The SAM-CKD program will provide symptom management recommendations which will be adapted from the Conservative Kidney Management and Kidney Supportive Care programs (Conservative Kidney Management., 2024). After embedding the SAM program into the existing app, it will be tested to identify design problems prior to use in the feasibility trial.

Sample size

Due to the nature of the feasibility trial, setting the sample size using a power-based calculation is unnecessary and there is no consensus concerning the minimum sample size (Whitehead et al., 2016). This study's sample size is 50, and to allow for drop-out based on other CKD feasibility trials (Dingwall et al., 2021; Jakubowski et al., 2020), the sample size has been increased by 20%. In total, 60 participants will be recruited.

Research outcomes and measurements

Primary outcomes are feasibility, usability and acceptability of the intervention. Secondary outcomes are changes in CKD symptoms and HRQoL following the intervention. Table 1 illustrates the timeline for outcome assessment in this study.

Table 1. Timeframe for outcome assessment and intervention

Timepoint (week)	W0	W1	W2	W3	W4	W5	W6
Enrolment							
Eligibility	√						
Informed consent	√						
Recruitment	√						
Measures							
Demographic information	√						
Clinical information	√						
List of current medications	√						
Haemodialysis information	√						
Digital health literacy	√						
Attrition							√
Retention							√
Protocol adherence							√
Missing data	√			√			√
Ease of use							√
Satisfaction							√
Usefulness							√
CKD symptoms	√			√			√
Health-related quality of life	√			√			√
Intervention							
Intervention (SAM-CKD)	←	—	—	—	—	—	→
Control: Usual care	←	—	—	—	—	—	→

The sociodemographic information of participants will be collected through a structured questionnaire in electronic form. Details of demographic information include age, gender, ethnicity, marital status, religion, education level, employment, and income status. In addition, information about medical history, family history, haemodialysis-related information, a list of current medications, previous health education about symptom management, and digital health literacy will be assessed.

Primary outcomes

Feasibility will be measured by eligibility, recruitment, retention, attrition, protocol adherence, and missing data. The eligibility rate will be calculated by dividing the number of eligible participants by the number of screened participants. An eligibility rate of 70% or higher based on previous studies (Chan et al., 2016; Dingwall et al., 2021; Gabbard et al., 2021; Jakubowski et al., 2020) will be set. The recruitment rate will be calculated by dividing the number of recruited participants by the number of eligible participants. A recruitment rate equal to or greater than 25% of eligible participants will be considered successful. The intervention will be considered to have low attrition if less than 20% of participants are lost to follow-up or withdraw consent, while >80% completion will be considered a high retention rate. Protocol adherence is the percentage of participants in the allocated group who receive the assigned intervention. The protocol adherence rate is set at over 80% of participants in the allocated group receiving the allocated intervention.

The usability and acceptability will be assessed after participants complete 6 weeks of intervention using the Vietnamese version of the Mobile App Usability Questionnaire. The app's usability is determined by the total and average of all statements; the higher the overall average, the better the app's usability. The instrument to measure app usability will be completed in week 6.

Secondary outcomes

Participants will be asked to assess their symptoms and HRQoL three times during the study: week 0, week 3 and week 6. The Vietnamese version of IPOS-Renal will be used to assess symptoms. HRQoL will be assessed using a self-reported EQ-5D-5L Vietnamese version (Mai et al., 2020).

Recruitment

Participants will be recruited face-to-face at the point of care during their HD sessions or CKD outpatient clinic appointments. Participant information sheet describing the study will be distributed in the outpatient department, inpatient wards and the haemodialysis unit of E Hospital. Nephrologists and nurses in the Department of Nephrology and Dialysis will assist in referring patients who meet the inclusion criteria to the study by distributing the flyers to potential participants. The investigator will approach patients in person to invite them to participate in the study. If a patient shows interest in participating in the study, the researcher will schedule a meeting to screen potential participants using selection criteria. At the meeting, the investigator will confirm their interest, determine if the patient is eligible for the study, explain the study in detail and provide enough time for the patient to ask questions about the research. If potential participants agree to participate, they will be requested to provide their consent in written form. If participants have any further questions, they can contact the investigator using the contact details in the information sheet.

Data collection

A research assistant will assist in collecting outcome data. A training manual will be developed, and in-person training will be provided. The research assistant will be trained to collect outcome data. During the data collection, the researchers will monitor the process to ensure the research assistant adheres to the manual.

Information will be collected via self-report at three different time points: baseline at week 0 (T1), week 3 (T2) and after 6 weeks (T3). Data will be collected using patient-reported outcome measures by validated instruments, including IPOS-Renal, EQ-5D-5L, and Mobile App Usability Questionnaire, through an electronic form. Participants will be compensated $15AUD for their time upon completing the study.

Allocation

The recruitment and randomisation of this study will be ongoing processes where each new participant will be assigned a group when they join. After enrollment and completion of baseline assessments, participants will be randomised with a 2:1 allocation ratio, using a randomly permuted block randomisation (Matts & Lachin, 1988). The random sizes block of 3 and 6 will be used. An online software named Sealed Envelope will be used to create the blocked randomisation list (Sealed Envelope Ltd., 2024).

Blinding

Due to the nature of the study intervention, neither the patients nor the researchers can be blinded. The research assistant who collects study outcome data will be blinded to the group assignment.

Data analysis

RStudio version 4.4.1 software will be used to analyse data for this study. Intention-to-treat analysis will be applied in this study (McCoy, 2017). Descriptive statistics will be applied to analyse demographic characteristics. Means and medians will describe continuous variables and percentages and frequencies will describe categorical variables, where appropriate. The feasibility of the trial will be measured by recruitment, retention and completion rates, which will be calculated and reported as percentages. Usability scores of the SAM-CKD program will be measured by central tendency and spread and reported depending on distribution. The

secondary outcomes will determine whether there are any changes in symptoms and HRQoL following the intervention. The homogeneity of participants in the intervention and control group will be tested using Chi-square, Fisher's exact test, and independent t-test depending on the data categories. Depending on the distribution of data, independent t-tests or the Mann-Whitney U test will be used to determine the differences between the intervention and control groups. Paired t-tests, Wilcoxon Matched Pairs tests, repeated measures ANOVA or Friedman tests will be used to determine differences within each group at three assessment time points. Bonferroni correction will be used as a post hoc test to counteract the multiple comparisons after repeated measured ANOVA and Friedman tests. The significance level will be set at $\alpha = 0.05$.

Data management

All data will be managed using the secure web application REDCap. Information collected from this study that can identify study participants will be treated as confidential and securely stored. The digital data will be stored in Griffith University Research Space with a password and can only be accessed by the researchers. The data stored on the server can only be accessed by the research team with the principal investigator's approval. Hard copy materials will be securely stored in a locked filing cabinet and can only be accessed by the research team. Any identifiable information will not be disclosed in any research publication. All materials related to this research will be kept confidential for at least 15 years from the publication of the results, as per national requirements, and then disposed of by secure destruction methods.

Ethics considerations

There are no foreseeable risks or harm that may occur with participation in this study. If any of the questions cause distress, study participants can choose not to answer those questions.

To minimise any burden or inconvenience on those involved in this study, for example, the time they will need to spend to participate in the study, participants will be encouraged to use the app intervention as they want, without compulsory time allocation. Participants will be informed that their participation is voluntary and they can withdraw anytime without any reason or disadvantages.

The Human Research Ethics Committee at Vin University (Vietnam) and Griffith University (Australia) provided ethical approval for this study. Participants are provided with written information about voluntary participation, the right to withdraw at any time, the objectives of this study, the amount of time required when deciding to participate in this study, and what they would need to do during the study period. The participants will be invited to provide written consent before participating in the study.

DECLARATION OF INTEREST

The research team members declare that we have no conflict of interest in this study.

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