*Original Article*

# The Impact of Self-Management and Case Management on Progression of Chronic Kidney Disease in Urban Communities of Khon Kaen

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***Objective:*** This randomized controlled trial was designed to compare the efficacy of self-management and case management compared with conventional care in CKD patients.

***Material and Methods:*** The study included 200 CKD patients with stages II-IV. They were randomly assigned into intervention and control groups. The intervention group received experience-sharing sessions based on case studies, behavior change, and home visits. The control group received only conventional care and they were followed-up for 12 months. The data clinical outcomes and self-management behavior were collected and analysed using descriptive statistics and independent t-test.

***Results:*** The mean age of participants was 69 years. The mean eGFR was revealed to be 45.90 ml/min/1.73 m$^2$ (stage 3) and the comorbidities were diabetes mellitus with hypertension. The absolute eGFR and self-management behavior mean scores at the end of the study was significantly higher than before intervention and in the control group (49.57 versus 46.23 ml/min/1.73 m$^2$; $p<0.05$). Furthermore, intervention group had statistically significant lower mean blood pressure compared to the control group (129.58/76.08 versus 135.79/83.59 mmHg). However, BMI, waist circumference and HbA1c were not significantly different between the two groups.

***Conclusion:*** Self-management and case management play a significant role in reducing CKD progression and improving self-management behavior in CKD patients.

***Keywords:*** Self-management, Case management, Chronic kidney disease

Chronic kidney disease (CKD) is a public health problem worldwide. The increasing incidence and prevalence of CKD is placing significant health burdens on patients and costs on our already stressed health-care system. The estimated prevalence of CKD worldwide is 8 to 16%[1]. An estimated 80% of this burden occurs in low- or middle-income countries, and 75% is in people older than 60 years[2]. It is estimated that the total number of CKD stage 3 to 4 patients in Thailand is 4.1 millions[3]. These patients have about an equal risk of progressing to end-stage renal disease (ESRD) or death due to cardiovascular events[4]. The cost of renal replacement therapy in Thailand has risen steadily, that is, US$ 53, 467, 900, 1,066, and 1,300 million in 2008, 2009, 2010, 2011, and 2012, respectively[4]. The impacts of CKD on clinical outcomes have received less concern given that globally more people are living with CKD than at any previous time[5]. The problem of chronic kidney disease progression is a panic, affecting both patients and multidisciplinary team. Therefore, it is necessary to take into account that holistic care is need for CKD.

Self-management is one method to slow progress of the disease[6,7]. Many studies have found that self-management behaviors such as exercising regularly, maintaining a low salt diet, controlling blood pressure, ceasing smoking, and reducing alcohol consumption and weight can delay the progression of CKD[8,9]. In fact, self-management behaviors contribute to lower serum creatinine levels[10], improve estimated glomerular filtration rates (eGFR)[11] and reduce weight and body mass index[12].

Case management is used to describe different approaches with the goal to improve the coordination and organization of services for patients with complex care needs[13]. Case management is a process, encompassing a culmination of consecutive collaborative phases that assist clients to access available and relevant resources necessary for the client to attain their identified goals[14] and widely used to provide high quality care with efficient utilization of medical resources. The system combines essences of patient-

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centered, multidisciplinary, and organizational care. It integrates health care services, improves completeness of treatment, coordinates resource referral, and is also cost-effective[15]. Therefore, case management has been considered an effective approach to slow progression of CKD. An earlier study[16,17] showed that case management in community aged care can improve clients psychological health or well-being and unmet service needs and the value of care coordination among nephrologists, providers, and health plan case managers in improving outcomes and reducing total medical costs among beneficiaries at risk for CKD progression from stage 4 to stage 5[18]. Case management refers to those facilities that health care services provide to enable patients to self-manage their health better. It includes the provision of health information, patient education and skills, self-management of complications and interacts with members and families. Very few studies have examined the implementation mechanisms and the involvement of primary care professionals in such case management programs. The goal is to improve the health and quality of life of CKD patients by providing personalized and ongoing support, based on the best evidence in the field. In Thailand, there is a study on the effectiveness of integrated care on delaying progression of stage 3 to 4 chronic kidney disease in rural communities with a mean follow-up duration of two years. It shows that integrated CKD care may slow the rate of eGFR decline significantly and seems to improve the number of composite clinical events[19], but there are no studies in urban settings. The context is different. As a result, this study aimed to compare the impact on delaying CKD progression between a conventional care and self-management and case management care in urban communities. This study was conducted using data from only one province located in the Northeastern Thailand, where the CKD prevalence is highest compared to other regions, except Bangkok[3].

## Materials and Methods

The authors conducted a randomized controlled trial in five urban medical centers in the Khon Kaen province of Northeastern, Thailand. Eligible patients were 40 to 75 years old and had documented CKD with an estimated glomerular filtration rate (eGFR) between 15 and 89 ml/min per 1.73 m$^2$ (CKD stage 2 to 4). The sample size was calculated by using power = 0.80, medium effect size, alpha = 0.05[20]. It was estimated that 80 patients with stage 2 to 4 CKD were needed to be enrolled in each group. Taking into account that 20% of patients might be lost during follow-up because of non-end point death or other reasons. Approximately, 100 patients for each group were required. The inclusion criteria to participate in the present study, were patients ability to provide consent, comply with study procedures, visits, and assessments. Whereas, patients were excluded when they denied consent to participate; malnutrition; likely to die within 12 months; recently having unstable/advanced cardiovascular disease; receiving current treatment for malignancy; receiving immunotherapy for kidney disease and on dialysis or with an organ transplant.

Written consent was received from each participants after explaining the study protocol. The present study has been approved by the Khon Kean University ethics committee for Human Research based on the Declaration of Helsinki and the ICH Good Clinical Practice Guidelines (HE601166).

### Outcome measures

The outcomes of this study were the differences of mean eGFR, HbA1c, body mass index (BMI), waist circumference, blood pressure (systolic and diastolic) and self-management behavior between the two groups.

### Laboratory analysis

All patients were scheduled to follow-up clinical and laboratory parameters at their respective medical centers. Serum were sent to a central laboratory in Khon Kaen Hospital for measurement of creatinine and measured by creatinine-based CKD-EPI equation[21]. All biochemistry analyses were validated according to the standard protocol of Department of Medical Sciences, Ministry of Public Health, Thailand. Laboratory data were collected at the beginning and end of the study.

### Control and intervention prompts

To reduce the risk of contamination between physicians co-managing patients with CKD, randomization occurred at the level of the group practice using a computer-generated randomization sequence and concealment. Participants were stage 2 to 4 CKD patients, 40 to 75 years of age. The participants were divided into two randomized districts in urban communities of Khon Kaen province. In addition, 200 participants were randomly selected to the study. The participants of each group were further subdivided into 12 patients subgroup according to their sub districts, resulting in 25 to 30 CKD patients per subgroup.

### Study visits and measurements

After randomization, intervention-group, a nurse case manager was assigned apart from a team of doctor, dietician and other to conduct an evidence-based assessment, provided education about CKD and kidney failure treatment options, coordinated care with family and engaged multidisciplinary teams and other providers such as care giver, community all working together to provide effective care to patients with chronic kidney disease:

Family doctor evaluated etiology of CKD, determined the care plan and medication therapy.

Dietitian provided dietary counseling and fluid management.

Pharmacist reviewed medications, dosing, adherence, educated patients about the use of over the counter medications and herbal preparations.

Physical therapist determined how the exercise program should be designed to be able to affect physical fitness and functioning.

Village health volunteer visited home with case

manager and coordinated with the multidisciplinary team.

Social worker assisted patients to obtain needed resources.

Care giver discussed the care plan and needs with the family doctor and the case manager.

Community care network provided resources for patient care.

Patients had self-management change behavior to slow progression CKD.

The case manager visits were individualized to meet patients' need because not all patients required all services offered within the team at each visit. In addition, continuous monitoring at home to power individual solutions and planning solutions to common problems was continued until the end.

For the control group, all of the participants received whatever usual care that their health care providers felt indicated. Usual care meant care delivered by a family doctor providing assessments and treatments for their patients as they saw fit. The family doctors could consult specialists or involve allied health personnel if necessary. Stage 2 to 3 CKD patients were followed-up every 6 months and stage 4 CKD patients were followed-up every 3 months. NCDs nurse provided education about CKD and home visit when patients had problem. The visits were only assessed for clinical outcomes and self-management behavior. At visit, any adverse clinical outcomes were noted. Current drugs and all health care resources used since the prior visit were recorded. Measurements consisted of the following.

1) The sociodemographic characteristics were age, sex, education, socioeconomic status, marital status, medical history and caregiver.

2) Clinical outcomes assessments were renal function (eGFR), HbA1c, BMI, waist circumference, systolic and diastolic blood pressure.

3) Self-management behavior to slow progression of CKD questionnaire consisted of 30 items, including: 1) food consumption 10 items, 2) exercise 10 items, and 3) rational drug use 10 items. Content validity index 0.86 and Cronbach's alpha coefficient was 0.85.

*Study intervention*

In the pre-study period, a 3-day nurse case manager attended the training-course before commencement of the intervention program. The key process is the cooperation between case manager and multidisciplinary team. The management and education were dependent upon the different stages of CKD and, according to the NKF K/DOQI guidelines[22]. On the basis of the individual treatment plan, assessment, and findings, case managers provided the intervention which consisted of following components in 12 months:

1) An assessment of medical history such as hypertension and diabetes, the kidney disease stage and current plan of care, self-management behaviors and quality of life to identify the individual.

2) An assessment of risk factors and gaps in the

plan of care; functional deficits, pain assessment, sick-day plan, treatment plan, and care plan goals.

3) Assessment of body mass index (BMI), waist circumference, handgrip strength, Nutritional Subjective Global Assessment (N-SGA), and a diet history that includes usual food intake, food habits.

4) Education and skills to care for patients and their relatives in line with risky behavior;

a) Pre-dialysis education for patients with CKD[23] content: It was about the overview of normal kidney function and CKD, appropriate candidates for dialysis, renal transplant patients shared their experiences with dialysis to discuss what patients can expect from dialysis as well as option to withdraw from dialysis if the feel they do not have reasonable quality of life.

b) Nutritional: The main steps are screening, assessment, nutritional planning, and monitoring such as understanding why changes in lifestyle and diet are required. What they cannot eat or what they can eat i.e. appropriate substitutions in their diet, avoiding foods high in sodium, potassium, and phosphorus. Learning about calories, fats, proteins, and fluids is important for a person with advanced CKD. Protein foods such as meat and dairy products break down into waste products that healthy kidneys remove from the blood. Dietary intake for patients with CKD is based on the stage of kidney disease and calculated from standard food[24]. Patients should be closely monitored to assess dietary compliance, to ensure nutritional adequacy and identify patients who are nutritionally at risk. Providing safe care for patients requires an awareness and perception of the signs that indicate changes in a patient's condition. Nurses case manager play an essential role in preventing the deterioration of malnutrition and in improving patient outcomes. Monitor the effectiveness of any malnutrition prevent strategies, and reassess the patient if malnutrition occurs.

c) Medication: Adverse effects of medication have either a renal cause or a renal effect. Certain drugs are particularly useful[25]. The use of NSAIDs can lead to further, permanent renal damage.

d) Exercise: Effect of obesity on CKD. The exercise program was determined how it should be designed (e.g. type, duration, intensity, frequency of exercise) to be able to affect physical fitness and functioning.

5) Management of complications of CKD: This included blood pressure control, blood sugar, cardiovascular risk, anemia, calcium, phosphate and PTH.

6) Requested clinical information, included treatment plan, laboratory values, and medications.

7) Coordinating partners in the coordinating partners; Interacts with members and families, offering a complete support network extensive patient education and support program helped members achieve and maintain a healthier lifestyle, thereby reducing future medical costs.

8) Continuous monitoring at home to power individual solutions and planning solutions to common problems was continued until the end.

9) Approach gave the patient opportunity to learn
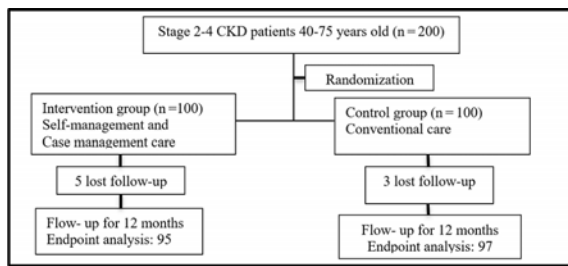
**Figure 1.** Flow diagram of the design of the study.

more about disease and be pro active in planning for the future; consultation with a social worker may help the patient maintain or obtain medical insurance even if not able to work.

### Data collection

Data were collected from May 2017 to April 2018. A pretested structured questionnaire was used as the data collection tool. The questionnaire was formed after thorough literature and research were reviewed by the authors. It was administered in Thai language. The questionnaire was consisting of two sections. The first section included demographic details of the participants such as; age, gender, educational status, occupation, income, current caregiver, disease combinations and clinical outcome including eGFR, HbA1c, BMI, waist circumference and blood pressure were recorded twice with a sphygmomanometer with 15-minute rest between the measurements. Section two comprised of the self-management behavior questionnaire.

### Statistical analyses

The Kolmogorov Smirnov test showed all variables to be normally distributed. All the tested variables in different groups were assumed as normal distribution. The data were presented with mean and standard deviation (SD) for continuous variables and number (%) for categorical variables. Baseline characteristics of the two groups were compared using the student t-test for continuous variables and the Chi-square test for nominal variables. Statistical comparisons were sub-grouped using student's t-test. All statistical tests will be two-tailed tests. The $p$-value of less than 0.05 would be considered statistically significant.

### Results
### Population

A total of 200 participants were enrolled and 100 patients were randomized into each group. Out of 200 patients 8 withdrew during the study. Intervention group consisted of 95 participants and 97 participants were in the control group. Demographic characteristics at the baseline for both study groups were similar. The mean age was 69 years, and 54.67% were female. The mean eGFR was 45.90 ml/min/1.73 m² (stage 3) and the comorbidities were diabetic with hypertension as shown in Table 1.

### Baseline clinical outcomes

Based on the parameters, the difference between the intervention and control groups, there were no significant differences in the clinical outcomes of BMI, waist circumference, renal function (eGFR) with stage, HbA1c, and blood pressure. as shown in Table 2.

### Clinical outcomes after intervention

The absolute eGFR at the end of the study was significantly higher than before intervention (49.57±13.14 versus 46.23±13.33 ml/min/1.73 m²; $p<0.05$) and in the control group. The mean blood pressure (systolic and diastolic) in the intervention group was different with statistical significance from the control group at $p<0.05$. However, there were no significant differences in the clinical outcomes of HbA1c, body mass index, waist circumference, and stage of CKD as shown in Table 3.

### Self-management behavior to slow progression of CKD after intervention

The mean scores on self-management behaviors in the intervention group were significantly higher than the control group at $p<0.05$ as shown in Table 4.

### Discussion

The results of this randomized controlled study suggest that standardized case management intervention effectively slows renal progression. The study included 200 participants. The mean age was 69 years, and 54.67% were female. The mean eGFR 45.90 ml/min/1.73 m² (stage 3), and the comorbidities were diabetic with hypertension. Currently, Thailand has a population of approximately 66 million, and CKD prevalence in the Thai population is much higher than previously known and published (17.5% versus 4.6 to 13.8%). There was a trend toward prevalence with increasing age. Early stages of CKD seem to be as common as later stages[3]. In terms of the primary care of Thailand, the number of specialized personnel is limited and work burden is overwhelming, good clinical care and equal accessibility to the care may be too difficult to achieve. Recent study in Thailand has indicated that integrated CKD care can delay CKD progression in resource-limited settings[19]. Therefore, we trained the nurse case managers and endorsed them to work as the escorts to protect CKD patients. The important roles of case managers are monitoring compliance to medication, diet control, blood pressure, and exercise behavior during a series of home visits for 4 weeks and instantly feedback to the patients. The authors also saw the benefits of detailed discussion about some clinical outcomes among the patients. However, compliance with the medication regimen and the sacrifice of personal independence are difficult for many CKD patients because of the long-lasting nature of the disease and its multiple comorbidities. Multidisciplinary care is effective in halting the progression of CKD[26]. The case manager supported the patients in several ways, which eventually improved the patient's self-management and can enhance the acquisition of knowledge about CKD. It may be

**Table 1.** Baseline characteristics of the participants

| Variables | Intervention group (n = 95) Number (%) | Control group (n = 97) Number (%) | p-value |
|---|---|---|---|
| Gender | | | |
| Male | 45 (47.37) | 42 (43.30) | 0.647 |
| Female | 50 (59.63) | 55 (56.70) | |
| Marital status | | | 0.155 |
| Single | 7 (7.37) | 4 (4.42) | |
| Married | 57 (60.00) | 71 (73.20) | |
| Divorced | 31 (32.63) | 22 (22.68) | |
| Educational | | | 0.233 |
| Elementary school or lower | 58 (61.05) | 67 (69.07) | |
| High school | 24 (25.26) | 23 (23.71) | |
| Diploma | 5 (5.26) | 5 (5.16) | |
| Bachelor | 6 (6.32) | 2 (2.06) | |
| Occupation | | | |
| Agriculture | 10 (10.53) | 4 (4.12 | 0.338 |
| Industry | 13 (13.68) | 15 (15.47) | |
| Services | 17 (17.89) | 25 (25.77) | |
| Not working | 55 (57.89) | 53 (54.64) | |
| Current caregiver | | | 0.746 |
| Self- care | 30 (31.60) | 40 (41.20) | |
| Family | 46 (48.00) | 46 (47.40) | |
| Caregiver | 19 (20.00) | 11 (11.40) | |
| Co-orbidities | | | 0.242 |
| DM | 8 (8.42) | 13 (13.40) | |
| H T | 26 (27.37) | 25 (25.77) | |
| DM with HT | 42 (44.21) | 38 (39.18) | |
| Other | 11 (11.58) | 15 (15.46 | |
| Non co-orbidities | 8 (8.42) | 6 (6.19) | |
| Age (years)* | M = 69.71, SD = 8.81 | M = 69.69, SD = 8.05 | 0.984 |
| Average monthly income* | M = 6,588.42, SD = 5,299.71 | M = 6,448.75, SD = 4,113.64 | 0.838 |

* Independent t-test

**Table 2.** Baseline clinical findings

| Variables | Intervention group (n = 95) | | Control group (n = 97) | | p-value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Body mass index (kg/m$^2$) | 25.19 | 3.77 | 25.48 | 4.07 | 0.617 |
| Waist circumference (cm) | 89.74 | 10.83 | 90.78 | 10.75 | 0.505 |
| eGFR (ml/min/1.73m$^2$) | 46.23 | 13.33 | 45.56 | 12.76 | 0.723 |
| Stage of CKD | Number | % | Number | % | 0.693 |
| II | 13 | 13.68 | 15 | 15.46 | |
| III | 71 | 74.74 | 74 | 76.29 | |
| IV | 11 | 11.58 | 8 | 8.25 | |
| Blood pressure | | | | | |
| Systolic BP (mmHg) | 136.95 | 16.31 | 134.78 | 16.72 | 0.363 |
| Diastolic BP (mmHg) | 83.64 | 10.67 | 83.69 | 11.05 | 0.975 |
| HbA1c | 8.40 | 2.05 | 8.27 | 1.56 | 0.735 |

a key factor in slowing its progression. This important information will be used to modify lifestyle of CKD patients and may improve compliance to the treatments. The case manager can encourage the patients to play an active and collaborative role in disease management, reinforce systems for individualized psychological support and improve adherence to medication regimens and dietary control. The process of dietary counselling often starts with a simple educational session highlighting the need to alter diet in the context of CKD, the function of different nutrients in the

**Table 3.** Clinical outcomes compared between intervention and control groups

| Variables | Intervention group (n = 95) | | Control group (n = 97) | | Independent-t | *p*-value |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| Body mass index (kg/m²) | 25.13 | 3.62 | 25.55 | 4.06 | -0.741 | 0.460 |
| Waist circumference (cm) | 89.80 | 11.32 | 91.19 | 10.55 | -0.881 | 0.380 |
| eGFR (ml/min/1.73 m²) | 49.57 | 13.14 | 46.23 | 13.74 | 2.145 | 0.033* |
| Stage of CKD | Number | % | Number | % | | 0.043 |
| I | 3 | 3.16 | 0 | 0 | | |
| II | 14 | 14.74 | 16 | 16.50 | | |
| III | 69 | 72.63 | 70 | 72.16 | | |
| IV | 9 | 9.47 | 11 | 11.34 | | |
| Blood pressure | | | | | | |
| Systolic BP (mmHg) | 129.58 | 12.74 | 135.79 | 12.73 | -6.10 | 0.41* |
| Diastolic BP (mmHg) | 76.08 | 11.96 | 83.59 | 10.81 | -7.61 | 0.23* |
| HbA1c | 8.09 | 2.02 | 8.45 | 1.52 | -0.89 | 0.380 |

**Table 4.** Self-management behavior score compared between intervention and control groups

| Self-management behavior | Intervention group (n = 95) | | Control group (n = 97) | | Independent-t | *p*-value |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | | |
| Food consumption | 34.31 | 2.58 | 26.61 | 2.55 | 21.26 | 0.000* |
| Exercise | 27.99 | 8.33 | 24.93 | 6.52 | 3.02 | 0.003* |
| Rational drug use | 35.37 | 2.82 | 30.47 | 2.93 | 11.08 | 0.000* |
| Total | 97.67 | 9.14 | 82.02 | 7.01 | 14.38 | 0.000* |

body, the dangers of excesses or deficiencies of certain nutrients. Moreover, case manager may help to improve the relationship between patients and clinicians, leading to patients embracing CKD treatment and maximizing positive clinical outcomes. Furthermore, the case manager scheduled multidisciplinary meetings and coordinated and connected primary and secondary care. Recent studies have indicated that appropriate multidisciplinary management of CKD not only reduces the overall mortality but also delays the initiation of dialysis therapy[27,28].

After the intervention, the mean scores on self-management behaviors in the intervention group were significantly higher than those of the control group at p<0.05. The self-management interventions aim to facilitate an individual's ability to make lifestyle changes and manage symptoms, treatment and the physical and psychosocial consequences inherent in living with CKD and associated comorbidities[29]. The present study highlights the need to involve patients to evaluate a self-management intervention based on clinical evidence. Because of self-management behaviors contribute to lower serum creatinine levels[10], improve estimated glomerular filtration rates (eGFR)[11] and reduce weight and body mass index[12]. Therefore, the patients will be monitored throughout the treatment for evaluating the results and plans to modify the individual health behavior as well as encouraging them to continually adjust their behavior. Including encouraging patients to continually adjust their behavior. Engaging patients by having them co-design self-management interventions will ensure that patient preferences based on their values, culture and psychosocial needs will be addressed in the self-management intervention[30-32]. Recent studies show that case management in community aged care can improve client psychological health or well-being and unmet service needs[17]. The increasing number of patients with CKD in Thailand has created a demand for comparison, monitoring, and evaluation of outcomes across different treatment methods. The authors expect that the results of the present study will set forth a new standard of primary CKD care for Thailand and other resource-limited countries.

In conclusion, the results of this randomized control study suggest that case management can slow the progression of CKD and improve quality of life. The application of standardized case management intervention for the daily care of CKD patients should be a part of integrated CKD care and other disease and promote the quality of clinical care. The health professionals responsible for the care provided to this population should ideally be familiar with which may be valuable in the global assistance of these patients, even in the earlier stages of diseases, and allow timely health care interventions in the course of the disease.

### What is already know on this topic?

Progression of late-stage CKD is associated with high morbidity and increased mortality. Multidisciplinary intervention helps to improve outcomes for CKD patients.

### What this study adds?

Our randomized study suggests that self-management and case management play a significant role in reducing CKD progression and improving self-management behavior in CKD patients.

### Potential conflicts of interest

The authors declare no conflict of interest.

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