

FACTORS PREDICTING THE PROGRESSION OF CHRONIC KIDNEY DISEASE IN THE NORTHERN REGION OF THAILAND

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Abstract

The increasing incidence and prevalence of chronic kidney disease (CKD) is placing significant health burdens on patients and costs on the healthcare system. This cross-sectional study aimed to determine the factors predicting the progression of chronic kidney disease. The study's participants included three hundred and sixty patients with CKD stages III-V treated in the outpatient clinics of eight hospitals in the northern region of Thailand. The participants were age 18 years or older and were selected for participation in the study by simple random sampling. Data were collected by using four questionnaires including 1) CKD knowledge, 2) self-management ability, 3) perception of provider practice in self-management support and 4) the Charlson comorbidity index. A binary logistic regression analysis was used to determine the factors predicting the progression of chronic kidney disease. The results revealed that comorbidity, CKD knowledge, self-management ability and self-management supported by healthcare providers were factors predicting the delayed progression of CKD. Healthcare providers, including nurses, may delay a decline in kidney function by providing patients with information about CKD and promoting their self-management ability.

Keywords: Chronic kidney disease, self-management support, kidney disease progression, self-management ability

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Introduction

The population burden of chronic kidney disease (CKD) is high. It is reported that patients with CKD in developing countries include more than two billion people (Jha, 2009). In Thailand, the data from the Thai Screening and Early Evaluation of Kidney Disease (Thai SEEK) program indicated that CKD prevalence was at 17.5% in 2009 (Ingsathit *et al.*, 2010), with an increase to 18.6% in 2011 and 19.9% in 2012 (Nephrology of Thailand, 2015).

CKD affects both patients and healthcare services, decreasing patients' physical function and quality of life (Morishita *et al.*, 2017) with its impact on health service management in the form of rising healthcare costs. The estimated cost of care for stage IV-V CKD is more than two times that of stage III CKD (Songsermlosakul *et al.*, 2020).

Treatment of CKD is complex and depends upon the stage of the disease and CKD knowledge. The impact tends to be more severe as the disease progresses. The literature shows that many countries have attempted to delay the decline of kidney function because the progression of CKD can be delayed, but it requires the coordination of healthcare system components (Johnson *et al.*, 2016). These include health service management and human resources, such as collaboration among healthcare providers and nurse case managers (Wongkongkam, 2016). Therefore, policies for delaying the progression of CKD have been implemented worldwide (Bello *et al.*, 2015; Hasan *et al.*, 2018). It is suggested that the essential components for delaying the progression of CKD are service management and human resources. Service management includes a self-management education program (Vann *et al.*, 2015; Gantagad *et al.*, 2020). The requirement for human resources in delaying the progression of CKD includes multi-disciplinary healthcare providers, such as physicians or nurses who are certified to provide services for patients with CKD (Vann *et al.*, 2015).

Some developed countries, such as Australia, the United States of America, and

European countries, provide an effective service delivery model for patients with CKD (Wouters *et al.*, 2015). In Thailand, the Renal Service Plan policy was initially launched in 2013 (Thai Ministry of Public Health, 2013) and developed to determine strategic directions for providing renal services for patients with CKD at all stages. The purpose of this plan is to delay patients' declining kidney function. To achieve these goals, Thailand's Ministry of Public Health has provided directions for CKD clinics, including an education program for patients with CKD, to be administered by healthcare personnel, including physicians, nurses and dietitians. The patient education program incorporates education on medicine, diet and health behavior; while creating and maintaining a patient database (Thai Ministry of Public Health, 2013).

Previous international studies revealed that CKD patients who are older adults, males, and those with multiple comorbidities, greater severity of kidney disease, lower levels of CKD knowledge, long periods of time between receiving care, low levels of self-management support by healthcare providers and no presence of a nursing role in the care process are more likely to have worse decline in kidney function (McClure *et al.*, 2017; Tsai *et al.*, 2017; Donald *et al.*, 2018; Gheewala *et al.*, 2018; Kaewput *et al.*, 2020). However, there is still a dearth of information to show what factors contribute to the enhancement of the average annual change of glomerular filtration rate in previous Thai studies.

Therefore, the purpose of this study was to determine the factors affecting the progression of CKD, which is determined as the average annual change of glomerular filtration rate in patients who receive care from health organizations under the government of the Northern Health Region (region No. 1) of Thailand. Northern Health Region has the highest number of patients in the last stage of CKD who need to dialysis, among the 12 health regions of Thailand (Nephrology Society of Thailand, 2015). In addition, the nurse to patient ratio in the

northern part of Thailand is the second lowest in Thailand, with only that in the northeast region being lower (Office of the National Economics and Social Development Council, 2018). It is expected that the results of this study will guide the further improvement of health service delivery, which may lead to an enhancement of delay in the progression of CKD.

Materials and Methods

Study Design and Sample

This study was a cross-sectional study. The minimum sample size was determined under the following parameters: desired power of the test 0.80, significance level 0.05, effect size 1.02, all of which were determined based on previous research by Chen *et al.* (2011). The researcher determined the sample size based on the method recommended by Polit and Beck (2008). Using the Thailand Nephrology Society's data (2017), the researcher used the proportional sampling technique to select a study area in northern Thailand with a large number of ESRD patients. Initially, the subjects were recruited from 8 out of 37 hospitals. Next, the researcher estimated the sample size in each hospital by the ratio of patients who received care at each hospital level. A total of 360 CKD patients were randomly selected for enrollment in the study, based on the following criteria: (a) patients with stages III-V CKD; (b) they were at least 18 years old; and (c) they had been treated at the outpatient clinics for at least six months. The exclusion criteria were those who: (a) were waiting for renal replacement therapy; (b) discontinued of care for at least one time after CKD had been diagnosed; (c) diagnosed with a mental disorder or an MMSE-Thai score (2002) of less than or equal to 17/30 (for those who had graduated from primary school) or less than or equal to 23/30 (for those who had graduated from a higher level than primary school); or (d) were unable to complete the questionnaires, even when the questionnaires were read to them.

Data Collection

The data collection was performed during routine visits at the outpatient department. The researcher contacted the nurses at the outpatient clinic to invite all potential participants for voluntary participation, then the researcher explained all of the information to the eligible patients and obtained their consents to participate in the study. The data collection methods included interviews that were conducted by use of a questionnaire and retrieval of patients' clinical profiles from medical records.

Research Instruments

The researcher collected data when the patients received care from the outpatient department via four questionnaires, including questionnaires on CKD knowledge, self-management ability and perception of provider practice in self-management support and the Charlson comorbidity index (CCI).

The CCI score developed by Charlson *et al.* (2008) was used to measure the patient's comorbidities. The instrument considers the presence of 21 diseases or factors and gives one, two or three points for each disease or factor. The total possible score ranged from 0 to 39 points. Higher scores indicate more severe comorbidities. The Cronbach's alpha value in the previous study was 0.92 (Benjonggeb *et al.*, 2016).

The 9-item self-management ability score was used to measure the patient's self-management ability. The instrument was modified from the "Partner in Health Scale" by Batterbys *et al.* (2003). The patients' self-management ability scores were rated on the 5 point-Likert scale (1 = strongly disagree, 5 = strongly agree). The total possible range of the total score was 9-45. Higher scores indicated better self-management ability. Cronbach's alpha in the present study was 0.80.

The 8-item perceived provider practice in self-management support score was used to measure the patient's perceived provider practice in self-management support. The instrument was modified from the "Brief 5A's Patients Surveys" by Glasgrow *et al.* (2003). The provider practice in self-management

support was rated on the 5 point -Likert scale (1 = strongly disagree, 5 = strongly agree). The total possible scoring range was 8-40 points. Higher scores indicate greater patient perception of provider practice in self-management support. The Cronbach's alpha value in the present study was 0.79.

The 11-item CKD knowledge questionnaire was developed by the researcher based on a literature review of research about the knowledge of patients with CKD in the pre-dialysis stage. The patients with CKD should be provided information about following: 1) pathology and disease progression, including renal health, progression and symptoms; 2) behavior management, including diet management, smoking cessation, and medication nephrotoxic avoidance; and 3) medical management, including pharmacological regimens, such as cardioprotective medication, and types of renal replacement therapy (Oluyombo *et al.*, 2016; Gheewala *et al.*, 2018). The patients selected one response for each item as true or false. The total possible scoring range was 0-11 points. Higher scores indicated patients that had CKD knowledge at a high level. Based on KR-21, the reliability of the instrument in present study was 0.85.

The Charlson comorbidity index (CCI score) the 9-item self-management ability score and the 8-item perceived provider practice in self-management support were used with permission from the authors. All of the instruments were originally written in English. Therefore, the back-translation process was followed, except for the CCI, for which the questionnaires were translated from English to Thai by the researcher. Then, the Thai version was back-translated to English by two bilingual experts. Finally, the researcher modified some of the itemized statements of the 9-item self-management ability questionnaire and the 8-item perceived provider practice in self-management support questionnaire to improve their suitability and assume a closer cultural context for Thais with CKD.

In reference of instruments' validity, except for the CCI, all of the instruments were approved by five expert panelists. The panel consisted of two nurse instructors who had

expertise in the concept of self-management, two nurses who had expertise in the care of patients with CKD at the pre-dialysis stage, and one nephrologist. The content validity index for the instruments was analyzed with the proportional agreement, and the researcher modified certain items following the experts' suggestions. The face validity index was approved by two experts who had experience in consulting about behavioral modification for patients with CKD. CVI = 1.

For the health outcome in this study, a decline in the estimated glomerular filtration rate (eGFR) was used to measure health outcome in patients with CKD (KDOQI, 2000) eGFR greater than 4 ml/min/1.73 m² per year indicated that a patient has faster kidney function decline.

Ethical Consideration

The research protocol was reviewed and approved by the Research Ethical Committee of the Faculty of Nursing, Mahidol University, Thailand (COA No. IRB-NS 2015/43.0607) as well as by the local boards of the hospitals involved in this study.

Data Analysis

Descriptive statistics were used for the service characteristics and patients' demographic data. A binary logistic regression analysis was used to determine the factors predicting the progression of chronic kidney disease. A logistic regression coefficient, Wald statistics, and odds ratios were used to analyze the predictors of faster CKD progression.

Results

Patient Characteristics

Data was collected from 360 participants. Of these, 54.2% were females, 90% were 60 years old and up (Mean = 63.5 years, S.D. = 14.6), 59.4% were diagnosed with stage III CKD, and 77.8% had an eGFR decline equal to 4 ml/min/1.73 m² or less per year, 63.9% had 0-1 comorbidities, 70.8% had moderate to high CKD knowledge scores, 72.2% had moderate to high self-management ability

Table 1. Patient's characteristics and outcomes of CKD progression (n = 360)

Patients' characteristics	n (%)
Sex	
Male	165 (45.8)
Female	195 (54.2)
Age	
< 60 y	36 (10)
≥ 60 y	324 (90)
Severity of CKD at the time of diagnosis	
CKD stage III	214 (59.4)
CKD stage IV	130 (36.1)
CKD stage V	16 (4.5)
eGFR decline per year	
≤ 4 ml/min/1.73m ²	280 (77.8)
> 4 ml/min/1.73m ²	80 (22.2)
Role of CKD nurse	
Nonspecific role	166 (46.1)
Information/Counselling	194 (53.9)
CCI score	
0-1	230 (63.9)
≥ 2	130 (36.1)
CKD knowledge	
Low to Moderate	105 (29.2)
Moderate to High	225 (70.8)
Self-management ability	
Low to Moderate	100 (27.8)
Moderate to High	260 (72.2)
Perceived of provider practice in self-management support	
Low to Moderate	126 (35)
Moderate to High	234 (65)

CKD: chronic kidney disease; eGFR: estimated glomerular filtration rate

scores, and 65% perceived provider practice in self-management support (Table 1).

Predictors of CKD Progression

Data analysis showed that four out of six independent variables including, comorbidities, self-management support, CKD knowledge, and self-management ability were significant predictors of the progression of CKD (p 0.000). The odds ratio for the comorbidity score was 0.166 (95% confidence interval [CI]: 0.080-0.348); indicating that a higher comorbidity score was associated with a reduced risk of accelerated CKD progression. The odds ratio for self-management support was 0.122 (95% CI: 0.059-0.253), indicating that a higher patient self-management support score was associated with a reduced risk of accelerated

CKD progression. The odds ratio for CKD knowledge was 0.556 (95% CI: 0.433-0.715), showing that a higher CKD knowledge score was associated with a reduced risk of CKD progression. In addition, the odds ratio for self-management ability was 0.791 (95% CI: 0.710-0.882), illustrating that a higher patients' self-management ability score was associated with a reduced risk of accelerated CKD (Table 2).

Discussion

In present study, the researcher studied the effectiveness of the Thailand Renal Service Plan policy and factors affecting delays in the progression of CKD. During the course of the

Table 2. Logistic regression analysis of factors predicting the progression of CKD (n = 360)

Variables	B	SE	W	Sig	Exp (B)	95% CI	
						Lower	Upper
CCI	-1.793	0.376	22.765	0.000***	0.166	0.080	0.348
Severity of CKD at the time of diagnosis	-0.015	0.017	0.803	0.370	0.985	0.954	1.018
SMS	-2.101	0.370	32.222	0.000***	0.122	0.059	0.253
CKD knowledge	-0.586	0.128	21.020	0.000***	0.556	0.433	0.715
Self-management ability	-0.234	0.055	18.059	0.000***	0.791	0.710	0.882
Role of the CKD nurse	0.478	0.697	0.470	0.493	1.613	0.411	6.325
Constant	13.365	1.496	39.009	.000	.002		

*** p < 0.001

CKD: chronic kidney disease; CI: confidence interval; CCI: Chalson comorbidity index; SMS: self-management support

study, the researcher discovered the following interesting points:

Effectiveness of the Renal Service Plan Policy Implementation in the Northern Region of Thailand

The results of this study showed that the number of CKD patients with a rapid kidney disease progression was 22.2% less than the previous study in one hospital in the southern region of Thailand conducted by Sukmark *et al.* (2014). Sukmark and colleagues (2014) reported that 26.6% of the patients with CKD developed faster kidney disease progression, which might be explained by the fact that 72.4% of the participants in Sukmark's study had diabetes mellitus, while only 59.5% of the participants suffered from diabetes in the present study. It is consistently reported that diabetes in CKD patients seems to have a significant influence on faster kidney function decline (Watanabe *et al.*, 2018).

Furthermore, the results of this study showed a slower rate 77.8% of kidney progression than reported in other countries (Vigil *et al.*, 2015; Kuo *et al.*, 2017). As an example of a study in a developed country, Vigil *et al.* (2015) conducted a retrospective, longitudinal, observational, prospective cohort study in Spain between 2005 and 2013 with 306 patients who visited primary care facilities. 23.3% of the sample developed faster kidney disease progression. As an example of another study conducted in an Asian populations, Kuo

et al. (2017) studied 343 Chinese patients with CKD and showed that 38% of the sample developed faster kidney disease, which, again, is a higher percentage than in the present study.

Factors Predicting the Progression of CKD

The findings of the present study showed that among the factors predicting the progression of CKD, most of the CKD patients in this study had a moderate to high level of CKD knowledge regarding medicine, diet and health behavior. A moderate to high level of CKD knowledge predicts a delay in the progression of CKD. The findings of this study are consistent with those of a study by Gheewala *et al.* (2018). These researchers found that patients who had higher CKD knowledge scores were able to modify health behavior related to their health status more than those who had lower CKD knowledge score. They concluded that the progression of CKD was more likely to be delayed in these patients than in those who had lower CKD knowledge scores (Gheewala *et al.*, 2018). The results are also consistent with the results of a study by Enworom *et al.* (2015), which was a two-part non-experimental study. They found that patients who received an education program had slower progression of CKD than those who did not receive the education program (Enworom *et al.*, 2015).

Most of the CKD patients in present study had a moderate to high level of self-management ability. A moderate to high self-

management score predicts a delay in the progression of CKD. The results of this study are also consistent with those of a study by Schrauben *et al.* (2018), who reported that self-management behavior was strongly associated with CKD progression. This indicates that self-management in this population will provide insights into potential interventions to help individuals optimally manage CKD.

Concerning provider practice in self-management support, a moderate to high level of self-management support can delay the progression of CKD due to knowledge that is specific to the pathology of CKD. The results of this study are consistent with a previous study by Gheewala *et al.* (2018). Gheewala *et al.* (2018) found that the progression of CKD would be delayed if the provider actively discussed lifestyle modifications and various medications with the patient, provided care according to guidelines, and followed up with the patient regarding their lifestyle, especially health behaviors.

The association of a higher comorbidity score with reduced risk of CKD progression was unexpected. Comorbidities were prevalent in the patient with CKD. In the present study, most of the subjects had CCI scores of 1-2 points, which was consistent with a study by Huang *et al.* (2014). Furthermore, even though higher CCI is associated with a higher risk for death in patients with stage III CKD, CCI scores of 1-2 points are not associated with a risk for death.

A recent study showed that the severity of kidney disease at diagnosis and the present role of CKD nurses are not significant predictors of the progression of CKD, possibly because the majority of the subjects in this study were patients with stage III CKD who had an annual eGFR decline that was less than more advanced stages (Chiu *et al.*, 2008).

Implications

Implications for Health Care Services

Healthcare providers should promote action to improve self-management to delay the progression of kidney disease in patients

with CKD by providing CKD education and self-management support. In addition, healthcare providers should consider the diversities of patients' comorbidities when planning to delay the progression of declining kidney function.

Implication for Nursing Practice and Health Policy

To ensure the effectiveness of the health service system, policymakers should ensure that nurses working to slow progression of declining kidney function in patients with CKD pass a formal training course enabling them to provide specialized knowledge and skills, such as brief counseling for patients. Meanwhile, policymakers should promote access to essential information regarding self-management ability skills for delay of kidney disease progression to patients with CKD.

Implications for Future Research

Future research should be conducted to determine the effectiveness of the health service system for patients with CKD by evaluating health literacy, which may affect self-management skill and other health outcomes such as quality of life.

Study Limitations

This study had some limitations. First, most of the patients enrolled in this study received care from CKD clinics. Therefore, the results of the study cannot be generalized to the other patients with CKD who have not received care from CKD clinics. Second, the participants of this study were patients with CKD who resided in the northern region of Thailand, where access to healthcare resources might differ from other regions. Therefore, generalizability is limited.

Conclusions

After Thailand's launching of the Renal Service Plan policy, this study offer a view of the effectiveness of the policy among patients with CKD in the northern region of Thailand. Data collection methods included interview

and data gathering from medical profile. The results revealed that comorbidity, CKD knowledge, self-management ability and self-management supported by healthcare providers were factors predicting the delayed progression of CKD. The study's results imply that the Renal Service Plan Policy may promote provider practice in self-management support and also self-management ability to delay the progression on declining in kidney function. In addition, the study illustrated that Thailand Renal Service Plan Policy will be useful in delaying the progression of declining kidney function in patients with CKD in the pre-dialysis stage. Nurses working in CKD clinics should have participated in training related to specialized knowledge and skills, such as brief counseling for patients, because the patients should receive specific knowledge related to their declining kidney function and practice based on that knowledge. For example, a short course for hemodialysis and peritoneal dialysis nurses and nurse case managers in diabetes mellitus and hypertension patients, which includes training in specific knowledge and brief counseling skills.

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Conflicts of Interest

No conflicts of interest have been declared by the author (s).

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