

ปัจจัยที่มีอิทธิพลต่อพฤติกรรมชะลอความเสื่อมของไตในผู้ที่มีภาวะไตเรื้อรังระยะที่ 1 - 3 Factors Influencing Behavior for Delaying Progression of Kidney Impairment among Patients with Chronic Kidney Disease Stage 1 – 3

นิพนธ์ต้นฉบับ

Original Article

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วารสารไทยเภสัชศาสตร์และวิทยาการสุขภาพ 2565;17(4):378-385.

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บทคัดย่อ

Abstract

วัตถุประสงค์: เพื่อศึกษาพฤติกรรมชะลอความเสื่อมของไตในผู้ที่มีภาวะไตเรื้อรังระยะที่ 1 - 3 และปัจจัยที่มีอิทธิพลต่อพฤติกรรมดังกล่าว ได้แก่ การรับรู้โอกาสเสี่ยงต่อการเกิดโรคไตเรื้อรังระยะสุดท้าย การรับรู้ประโยชน์ของการปฏิบัติ การรับรู้อุปสรรคของการปฏิบัติ ความรอบรู้ทางสุขภาพ และการได้รับข้อมูลจากบุคลากรสุขภาพ **วิธีการศึกษา:** การศึกษาแบบความสัมพันธ์เชิงทำนาย กลุ่มตัวอย่างเป็นผู้ที่มีภาวะไตเรื้อรังระยะที่ 1 - 3 ที่รับบริการ ณ คลินิกโรคไม่ติดต่อเรื้อรัง โรงพยาบาลสังกัดมหาวิทยาลัยแห่งหนึ่งในจังหวัดนครราชสีมาจำนวน 105 รายจากการสุ่มอย่างง่าย เครื่องมือวิจัยประกอบด้วย แบบสอบถามข้อมูลทั่วไป แบบประเมินพฤติกรรมชะลอความเสื่อมของไต การรับรู้โอกาสเสี่ยงต่อการเกิดโรคไตเรื้อรังระยะสุดท้าย การรับรู้ประโยชน์ของการปฏิบัติ การรับรู้อุปสรรคของการปฏิบัติ ความรอบรู้ทางสุขภาพ และการได้รับข้อมูลจากบุคลากรสุขภาพ วิเคราะห์ข้อมูลด้วยสถิติพรรณนาและสถิติการถดถอยพหุคูณ **ผลการศึกษา:** คะแนนเฉลี่ยพฤติกรรมชะลอความเสื่อมของไตของกลุ่มตัวอย่างเท่ากับ 41.29 คะแนน โดยการรับรู้ประโยชน์ของการปฏิบัติ ($\beta = 0.394$) การรับรู้โอกาสเสี่ยงต่อการเกิดโรคไตเรื้อรังระยะสุดท้าย ($\beta = 0.201$) การรับรู้อุปสรรคของการปฏิบัติ ($\beta = -0.215$) และความรอบรู้ทางสุขภาพ ($\beta = 0.203$) ร่วมกันทำนายพฤติกรรมชะลอความเสื่อมของไตได้ร้อยละ 35.3 ($R^2 = 0.353$, P -value < 0.001) สรุป: การรับรู้ประโยชน์ของการปฏิบัติ การรับรู้โอกาสเสี่ยงต่อการเกิดโรคไตเรื้อรังระยะสุดท้าย การรับรู้อุปสรรคของการปฏิบัติ และความรอบรู้ทางสุขภาพมีอิทธิพลต่อพฤติกรรมชะลอความเสื่อมของไต ซึ่งอาจใช้พัฒนาโปรแกรมส่งเสริมพฤติกรรมได้

Objective: To examine behaviors for delaying progression of kidney impairment and its influencing factors among patients with chronic kidney disease (CKD) stage 1 - 3. **Method:** This predictive correlational research recruited 105 participants receiving care at a non-communicable disease clinic at a university hospital in Nakhonratchasima province, Thailand by the random sampling. Data were collected using demographic characteristics questionnaire and the questionnaire to measure the behavior to delay kidney progression, perceived susceptibility of end-stage renal disease (ESRD), perceived benefits of performing the behavior, perceived barriers to performing the behavior, health literacy, and information provided by healthcare providers. Descriptive statistics and multiple regression analysis were used to analyze data. **Results:** The average score of the behavior to delay kidney progression behavior was 41.29 points. Perceived benefits ($\beta = 0.394$), perceived barriers ($\beta = -0.215$), health literacy ($\beta = 0.203$), and perceived susceptibility to ESRD ($\beta = 0.201$) could explain 35.3% of the variance of the behavior ($R^2 = 0.353$, P -value < 0.001). **Conclusion:** Perceived benefit, perceived barrier, health literacy and perceived susceptibility to ESRD were influencing the behavior to delay the progression to ESRD. The finding could be used in developing programs to enhance such behavior.

คำสำคัญ: พฤติกรรมชะลอความเสื่อมของไต, โรคไตเรื้อรัง, การรับรู้ประโยชน์ของการปฏิบัติ, การรับรู้อุปสรรคของการปฏิบัติ, ความรอบรู้ทางสุขภาพ, โรคไตวายระยะสุดท้าย

Keywords: behavior for delaying progression kidney impairment, chronic kidney disease, perceived benefit, perceived barrier, health literacy, end-stage renal disease

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Introduction

Chronic kidney disease (CKD) has become the major public health problem worldwide. In addition to the ever-increasing burden with the number of cases, the patients face numerous impact. At the end stage renal disease (ESRD), the patients face physical and psychological sufferings which interfere their daily living, cause more expenses, and dampen quality of life.^{1,2} CKD is one of the leading causes of premature death worldwide. At present, prevalence of CKD was

9.1% of the worldwide population or a total of 697.5 million patients.³ In Thailand, there were 859,333 CKD patients in 2020. The incidence of CKD cases has been increasing every year.⁴ The highest prevalence was found in the Northeast of Thailand. In Nakhonratchasima, a province in the region, with the largest population, there has been an increasing number of CKD cases.⁵

CKD is defined as a kidney function impairment for more than 3 months and classified into 5 stages. At later stages, i.e., stages 4 – 5, the patients face more complications including fluid and electrolyte imbalance, uremia, and anemia.⁶ The disease and its complications cause negative physical, psychological, social, and economic impacts on the patients. Current treatment for CKD aims at delaying the kidney function decline. In addition to medications, stage 1 – 3 CKD patients need have a proper lifestyle including diet and nutrition, exercise, weight control, and avoidance of kidney toxic substances.^{7,8} Such proper lifestyle could help preserve and lengthen the kidney function which is consistent with the 20-year national plan of the Ministry of Public Health of Thailand which set the preservation of the kidney function as one of the indicator for healthcare service.⁹

In CKD treatment, the preservation of the kidney function among stage 1 -3 CKD patients is of the great concern. However, with less complications and less severe symptoms of the disease that could impair their living, a certain portion of patients are not aware of the need for the proper lifestyle and self-care to delay the disease progression. They engage in sedentary lifestyle including consuming diet with high amount of salt, sugar, and fat, over-consuming of protein, smoking, inadequate exercise, use of unsafe herbs, and medication noncompliance.¹⁰⁻¹² In Nakhonratchasima province context, local foods contain high sodium level such as fermented fish, local stir-fried noodle, and fermented sausage. In rural living, a set of meal is prepared for the whole family with no specific food prepared for the patients.¹³ On the other hand, in urban living, fast food or instant food is preferred which allows for sodium over-consumption and poor control. The rise of belief of herbs and herbal products could also cause a rapid progress of the CKD.¹⁴ These improper lifestyle and self-care could lead to a more rapid progress to the ESRD. Hence, there is the need to modify lifestyle and self-care among stage 1 – 3 CKD patients to delay the disease progress. The understanding about the factors influencing such healthy behaviors is needed.

Among various health-related concepts, Health Belief Model (HBM) of Rosenstock and colleagues is a powerful one.¹⁵ With its widely use, HBM explains the relation of health behavior with individuals' beliefs and perception. With perceived susceptibility and severity of the illness which could put burden and impacts on the individuals' life, they would perceive the threat. As a result, they would make a decision

to perform the healthy behavior by weighing benefits and barriers in performing the behavior. External factor to induce the proper behavior could include information provided by healthcare providers. Therefore, proper perception based on the HBM could help stage 1 -3 CKD patients adopt more health behaviors to delay the disease progression.

Perceived benefit of performing healthy behavior leads CKD patients to better understand and adopt healthy behavior.^{16,17} Low level of perceived barriers also improve CKD patients' treatment compliance and lifestyle as recommended by healthcare providers.^{18,19} Perceived susceptibility of ESRD and its complications was associated with better health behavior.²⁰ However, studies on perceived benefits and barriers of performing the behavior, perceived susceptibility of progressing to the ESRD with health behavior revealed no significant associations.^{18,21}

In addition to perceptions according to the HBM, internal and external factors could also affect health behavior.¹⁵ Health literacy, as an internal factor, is a cognitive and social skill which could determine the individuals' capability to access, understand, and make a decision on the health information they need. Health literacy influences the individuals the actual action of health behavior to maintain the good health.²² Health literacy is positively associated with self-care behavior to delay kidney function decline.^{23,24} Information provided by healthcare providers also allows the patients to understand and adopt the healthbehavior.^{12,17} However, certain study revealed no association of information provided by healthcare providers with disease prevention behavior.²⁵

At present, findings among these influencing factors on the health behavior for delaying the progress to the ESRD were inconclusive. In addition, most studies were done in patients with all stages of CKD and those with the ESRD. The associations of the se influencing factors and the behavior have been lacking. Therefore, there is the need to determine the associations of health behavior of preventing the progress to the ESRD and its influencing factors among CKD patients in the early stages, i.e., stage 1 – 3. Patients with diabetes mellitus and hypertension were also of great concern because the two diseases are also the major cause of CKD. This study aimed to (1) determine health behavior to delay the progress of CKD to the ESRD, and (2) predictive power of influencing factors including perceived susceptibility of the progress to the ESRD, perceived benefits and barriers of performing health behaviors, health literacy, and the provision of information

from healthcare providers, among patients with stage 1 - 3 CKD. It was hypothesized that perceived susceptibility of the progress to the ESRD, perceived benefits and barriers of performing health behaviors, health literacy, and the provision of information from healthcare providers could predict the health behavior.

Methods

In this predictive correlational study, study population was patients diagnosed with stage 1 – 3 CKD, or with a glomerular filtration rate (GFR) of 30 to 120 ml/min/1.73m² for at least three consecutive months, or with urine microalbumin of 1.7 mg/dL or higher at least twice within the past year, who received regular care at the chronic non-communicable disease clinic, family medicine department, and internal medicine department of a university hospital in Nakhonratchasima province. The sample size estimation was based on power analysis using the software program G*Power. With a type I error of 5%, a power of 80%, and a medium effect size of 0.13 for multiple regression in nursing research²⁶, a total of 105 participants were needed. The simple random sampling was used to select the sample. To be eligible, participants had to be 20 – 70 years old. They had to be diagnosed with diabetes or hypertension but without critical conditions. Their diabetes or hypertension could be diagnosed before or after the diagnosis of CKD. They had to have good consciousness, and normal cognitive function as indicated by a score of 7 or less of the total score of 28 points measured by the Cognitive Impairment Test-Thai Version (6CIT).²⁷ They had to be able to read and communicate in Thai language. They had to have no limitations in performing daily activities of living.

Participant protection

The study was approved by the Ethics Committee for Human Study of Burapha University (approval number: G-HS021/2564) and Suranari University of Technology (approval number: EC-64-77). The participants were informed about the objective, process, and voluntary and anonymity nature of the study. Data collection was conducted within one month from November to December 2021.

Research instruments

The Cognitive Impairment Test-Thai Version (6CIT) was used to screen the participants. The original version was

developed by Brooke and Bullock and was translated to Thai language.²⁷ It was translated into Thai and found to have good content validity (content validity index or CVI of 1.0) and stability reliability (test-retest reliability coefficient of 0.64, *P*-value < 0.001).²⁷ This Thai version consists of 6 items evaluating cognitive functions. With scored given based on errors the patients make, higher scores indicate worse cognitive impairment. With the total score of 0 – 28 points, the total score of more than 7 was defined as significant cognitive impairment.

The section tool was questionnaire which consisted of 5 parts. In part 1, demographic and clinical characteristics were collected using questions developed by the researcher. Demographic characteristic characteristics included age, gender, religion, marital status, education level, occupation, and income sufficiency; while clinical characteristics were duration of CKD since diagnosis, co-morbid illnesses, regular medications, blood pressure, and laboratory measures including GFR, creatinine level, and blood glucose level. Questions were in multiple-choice and open-ended formats.

The second part assessed the behavior to delay the decline of kidney function in stage 1 – 3 CKD patients. The researcher modified the Thai questionnaire measuring the behavior to delay the progress of kidney decline.²⁸ The 23 items of the original Thai version were modified and reduced to 14 items with 7 positive and negative items equally. The response was a 4-point rating scale ranging from 1-never practice to 4-always practice. With a total score of 14 – 56 points, higher scores indicated higher levels of the behavior to delay CKD progression, and vice versa.

The third part was questions based on the HBM constructs including perceived susceptibility of progression to the ESRD (10 items), perceived benefits of the behavior (10 items), and perceived barriers of performing the behavior (10 items) in Thai language from a previous work.²⁸ The response was a 4-point Likert-type rating scale ranging 1-totally disagreed and 4-totally agreed for each construct. With the total score of 10 – 40 points, higher scores indicated higher level of perceived susceptibility of CKD progression, perceived benefits of the behavior, and perceived barriers of performing the behavior, and vice versa.

The fourth part assessed health literacy. The original 14-item health literacy scale for Japanese adults of Suka and colleagues was translated to Thai language by Thai researchers.²³ These 14 items asked about general health

literacy (5 items), interactive health literacy (5 items), and critical health literacy (4 items). Response was a 5-point Likert-type scale ranging from 1-totally disagreed to 5-totally agreed. With the total score of 14 – 70 points, higher scores indicated higher levels of health literacy, and vice versa.

The last part evaluated information provided by healthcare providers. These questions were from the questionnaire of Mingladaporn and colleagues on information provided to CKD patients before kidney replacement therapy.²⁹ These 21 questions were divided into two categories. The first 16 questions asked about the information provided by healthcare providers with a 5-point Likert-type scale ranging from 1-totally disagreed to 5-totally agreed. With the total score of 16 – 80 points, higher scores indicated higher levels of information provided, and vice versa. For questions 17 – 21, satisfaction on source and format of information provided. The answers were multiple-choice.

Quality assurance

In this present study, questions on the behavior to delay CKD progression were tested for content validity by three experts specifically a renal disease specialist physician, a nursing faculty member specialized in renal nursing care, and a nurse specialized in renal nursing care. The questions were found to have acceptable validity with content validity index of 0.93. Questions on the behavior, HBM constructs, health literacy, and information provided by healthcare providers were tested for internal consistency reliability in a set of 30 individuals with characteristics comparable to the participants.

Questions on the behavior, health literacy, and information provided by healthcare were found to have a high internal consistency reliability with Cronbach's alpha coefficients of 0.88, 0.90, and 0.88, respectively. Questions on HBM constructs which were perceived susceptibility of CKD progress, perceived benefits of the behavior, and perceived barriers of performing the behavior had an acceptable internal consistency reliability with Cronbach's alpha coefficients of 0.76, 0.72 and 0.75, respectively.

Data analysis

Descriptive statistics including mean with standard deviation (SD) and frequency with percentage were used to summary demographic and clinical characteristics and study variables. Predictive power of influencing factors on the behavior to delay CKD progress was tested using multiple

linear regression analysis. Assumptions for the regression analysis of the behavior variable were met. Statistical significance was set at a type I error of 5%. All statistical analyses were performed using software program SPSS version 23.

Results

Of the 105 participants, there were men and women roughly equally (50.50 and 49.50%, respectively) (Table 1). Their average age was 57.88 years. The majority were in their 60 – 70 years of age (52.30%), married (78.10%), with Bachelor's degree or higher (37.10%), government employee (25.70%), and with sufficient monthly income (85.70%). For clinical characteristics, the average duration of diagnosis with CKD was 1.71 ± 1.41 years, with the majority in the range of 1 – 2 years (58.10%). The most found co-morbid illnesses were hypertension with diabetes (28.60%), followed by hypertension only (8.00%). Most participants took 5 – 9 tablets per day (54.30%). With an average eGFR of 60.09 ± 18.09 ml/min/1.73m² with the majority of them having stage 3a CKD (43.80%), followed by stage 2 (26.70%) (Table 1).

The participants had a mean score of the behavior to delay CKD progression of 41.29 ± 3.91 points which was considered a moderate level (Table 2). For individual items, the behavior with the highest mean score was compliance to medication taking (3.83 ± 0.40 points) and the one with lowest mean score was the use of herbal products (1.37 ± 0.72 points). For the predictive factors, mean scores of perceived susceptibility of CKD progression, perceived benefits of the behavior, and perceived barriers of performing the behavior, health literacy, and information provided by healthcare providers were 31.33 ± 3.12 , 31.89 ± 3.04 , 20.03 ± 3.98 , 54.93 ± 5.74 , and 56.54 ± 9.77 points, respectively.

For the prediction of the behavior to delay the progress to the ESRD, it was found that perceived susceptibility of CKD progression, perceived benefits of the behavior, and perceived barriers of performing the behavior, and health literacy together could significantly explain 35.3% of the variance of the behavior ($R^2 = 0.353$, $F = 10.805$, P -value < 0.001) (Table 3). Factor with the highest predictive power was perceived benefits of the behavior ($\beta = 0.394$), followed by perceived barriers of performing the behavior ($\beta = -0.215$), health literacy ($\beta = 0.203$), and perceived susceptibility of CKD progression

($\beta = 0.201$). Information provided by healthcare providers had no influence on the behavior.

Table 1 Demographic and clinical characteristics of the participants (N = 105).

| Characteristics | N | % |
|--|----|-------|
| Gender | | |
| Men | 53 | 50.50 |
| Women | 52 | 49.50 |
| Age (years), mean = 57.88 ± 9.01, range = 27 - 70 | | |
| 20 - 29 | 1 | 1.00 |
| 30 - 39 | 4 | 3.80 |
| 40 - 49 | 11 | 10.50 |
| 50 - 59 | 34 | 32.40 |
| 60 - 70 | 55 | 52.30 |
| Marital status | | |
| Married | 82 | 78.00 |
| Single | 11 | 10.50 |
| Widowed | 11 | 10.50 |
| Divorced/separated | 1 | 1.00 |
| Education level | | |
| No formal education | 1 | 1.00 |
| Primary school | 35 | 33.30 |
| High school | 21 | 20.00 |
| Associate degree | 9 | 8.60 |
| Bachelor's degree or higher | 39 | 37.10 |
| Occupation | | |
| No job | 9 | 8.60 |
| Retired government employee | 8 | 7.60 |
| Farmer | 22 | 21.20 |
| Small business | 14 | 13.30 |
| Labor | 15 | 14.30 |
| Government employee | 27 | 25.70 |
| Others | 10 | 9.50 |
| Monthly income sufficiency | | |
| Yes | 90 | 85.70 |
| No | 15 | 14.30 |
| Duration since CKD diagnosis (years), mean 1.71 ± 1.41, range = 2 months - 7 years | | |
| < 1 | 23 | 21.90 |
| 1 - 2 | 61 | 58.10 |
| 3 - 4 | 14 | 13.30 |
| ≥ 5 | 7 | 6.70 |
| Co-morbid illness | | |
| Hypertension and diabetes | 30 | 28.60 |
| Hypertension | 19 | 18.00 |
| Hypertension, diabetes, and hyperlipidemia | 15 | 14.30 |
| Hypertension and hyperlipidemia | 14 | 13.30 |
| Hypertension, diabetes, and gout | 7 | 6.70 |
| Diabetes | 5 | 4.70 |
| Hypertension and gout | 5 | 4.70 |
| Hypertension, hyperlipidemia, and gout | 2 | 1.90 |
| Diabetes and hyperlipidemia | 2 | 1.90 |
| Hypertension, hyperlipidemia, and gout | 1 | 1.00 |
| Hypertension, diabetes, gout, and heart disease | 1 | 1.00 |
| Hypertension, diabetes, hyperlipidemia, and gout | 1 | 1.00 |
| Hypertension and SLE | 1 | 1.00 |
| Hypertension, diabetes, hyperlipidemia, and cerebrovascular disease | 1 | 1.00 |
| Hypertension, hyperlipidemia, and herniated disc | 1 | 1.00 |
| Number of tablets taken daily, mean = 6.25 ± 3.20, range = 2 - 21 | | |
| 1 - 4 | 35 | 33.30 |
| 5 - 9 | 57 | 54.30 |
| ≥ 10 | 13 | 12.40 |
| Glomerular filtration rate (ml/min/1.73m²), mean = 60.09 ± 18.09, range = 31.10 - 100.80 | | |
| ≥ 90 (stage 1) | 7 | 6.70 |
| 60 - 89 (stage 2) | 28 | 26.70 |
| 45 - 59 (stage 3a) | 46 | 43.80 |
| 30 - 44 (stage 3b) | 24 | 22.80 |

Table 2 Scores of the behavior to delay CKD progression (N = 105).

| Behavior to delay CKD progression | Range | | Mean | SD |
|--|----------------|--------------|-------|------|
| | Possible range | Actual range | | |
| Overall behavior | 14 - 56 | 28 - 50 | 41.29 | 3.91 |
| Individual behaviors | | | | |
| 1. Taking medication as prescribed | 1 - 4 | 2 - 4 | 3.83 | 0.40 |
| 2. Using herbal products | 1 - 4 | 1 - 4 | 1.37 | 0.72 |
| 3. Exercise | 1 - 4 | 1 - 4 | 2.50 | 1.06 |
| 4. Alcohol intake | 1 - 4 | 1 - 3 | 1.55 | 0.72 |
| 5. Cigarette smoking | 1 - 4 | 1 - 4 | 1.46 | 0.73 |
| 6. Self-monitoring of blood pressure | 1 - 4 | 1 - 4 | 2.38 | 1.15 |
| 7. Consuming processed foods | 1 - 4 | 1 - 4 | 2.11 | 0.56 |
| 8. Consuming fried foods and using saturated fat oil | 1 - 4 | 1 - 4 | 2.46 | 0.84 |
| 9. Consuming high cholesterol foods | 1 - 4 | 1 - 3 | 1.98 | 0.42 |
| 10. Consuming protein | 1 - 4 | 1 - 3 | 1.93 | 0.72 |
| 11. Consuming foods for adequate energy intake | 1 - 4 | 1 - 4 | 1.90 | 0.94 |
| 12. Consuming monosodium glutamate | 1 - 4 | 1 - 4 | 2.00 | 0.72 |
| 13. Consuming instant noodles | 1 - 4 | 1 - 3 | 1.56 | 0.57 |
| 14. Weight control | 1 - 4 | 1 - 4 | 2.11 | 1.04 |

Table 3 Predictive power of factors influencing the behavior to delay CKD progression (N = 105).

| Factors | B | SE | β | t | P-value |
|---|--------|-------|---------|--------|---------|
| Perceived susceptibility of CKD progression | 0.251 | 0.108 | 0.201 | 2.329 | 0.022 |
| Perceived benefits of the behavior | 0.506 | 0.106 | 0.394 | 4.776 | 0.001 |
| Perceived barriers of performing the behavior | -0.211 | 0.082 | -0.215 | -2.586 | 0.011 |
| Health literacy | 0.138 | 0.057 | 0.203 | 2.419 | 0.017 |
| Information provided by healthcare providers | -0.048 | 0.034 | -0.121 | -1.432 | 0.155 |

$R = 0.594$, $R^2 = 0.353$, adjusted $R^2 = 0.320$, $F_{5,99} = 10.805$, P -value < 0.001.

Discussions and Conclusion

In this correlational study, the score of the behavior to delay the progression to the ESRD was 41.29 points which was at a moderate level which is consistent with previous studies.^{30,31} Based on the participants' eGFR, their CKD was in stage 3a and 2 (43.80% and 26.70%, respectively) which indicates mild to moderate kidney function decline.⁶ At stage 3a and 2, there was no symptoms of CKD to affect their daily living very lightly. In addition, as high as 58.10% of the participants were diagnosed with CKD for 1 - 2 years, no impact of the disease was perceived. All of these circumstances could in part influence little concern of the progression to the ESRD hence the moderate level of performing the behavior.

For individual items of the behavior, the compliance to medication taking was found the highest mean score (mean = 3.83 points). The participants had only 1 - 2 diseases and

there were no to mildly symptomatic. As a result, they had no difficulty taking multiple pharmacy. A meta-analysis indicates that number of co-morbid illnesses, and severity of CKD are associated with medication compliance.¹² Most participants were in their 60 – 70 years of age (52.30%) indicating maturity and understanding to comply with treatment plan.¹² The finding is consistent with a study in Thai patients with CKD where those older 60 years old are more likely to have a high level of medication compliance.³¹

The behavior of consuming fried foods and cooking with saturated fat oil was found to be at a relatively high level (mean = 2.46 points). In Nakhonratchasima province, a large portion of dishes are stir-fried and deep-fried foods. A study in Thai CKD patients with diabetes and hypertension revealed that 22.5% of them consume high-fat foods.¹⁰ It has been shown that people in the northeast of Thailand consume high-fat foods more than one day a week.³³ The behavior of consuming sodium and processed foods was also found to be at worrying level with mean scores as most half of the total score (mean = 2.00 and 2.11, respectively). Fermented fish is relatively popularly consumed in Nakhonratchasima province. With its fermenting process, fermented fish contains a high level of sodium. In addition, 84% of people in the northeast of Thailand cook foods for the whole family with no special low-salt foods for certain patients.¹³ Sodium control in patients who need the control is almost impossible.

For the behavior of using herbal products, the score was at a low level (mean = 1.37 points) which reflects a desirable behavior for patients with CKD. Even though people in Nakhonratchasima province have a belief that herbal products are beneficial¹⁴, but a small portion of people take herbal products. This could be in part because a relatively large portion of participants had a Bachelor's degree education or higher (37.10%) and had a relatively high health literacy which reflects knowledge and understanding in applying health information in their self-care.

The score of perceived benefits of the behavior was at a relatively high level (mean = 31.89 points) and had the highest positive influence on the behavior ($\beta = 0.394$, P -value < 0.001). This could be in part because these patients have co-morbid illnesses such as hypertensin, diabetes, and hyperlipidemia which accelerate CKD progression.^{8,17} They follow the scheduled appointments for regular care, and receive information consistent with the behavior to delay CKD progression. These circumstances could lead to the

perception on the benefits of performing the proper behavior. Based on the concept of HBM of Rosenstock and colleagues, if the individuals believe that performing the preventive behavior would help reduce the susceptibility, severity, and impact of the disease progression, they are more likely to perform the behavior.¹⁵ It is consistent with a study that perceived benefits of performing behavior have a direct, positive influence on fluid intake limitation in patients undergoing hemodialysis ($\beta = 0.306$, P -value < 0.01)¹⁶ and a study revealing that perceived benefits of the behavior could predict the actual behavior to delay the kidney function decline ($\beta = 0.18$, P -value < 0.01).²¹

The participants had score of perceived barriers of performing the behavior at a low level (mean = 20.03). This could be because most participants had income-generating jobs (83.80%) while a small portion did not have jobs but gained income from retiring from government jobs (7.60%). In addition, as high as 85.70% of them had income sufficiency indicating no financial problem in medical expense. This finding is consistent with our finding that perceived barriers were negatively associated with performing the behavior to delay CKD progression ($\beta = -0.215$, P -value < 0.001). This could be explained by the HBM that any difficulties or barriers faced by the individuals including wasting time or money, and interference with daily life, individuals would abort their intention to carry out the behavior.¹⁵ This finding is consistent with a study revealing that perceived barriers were negatively associated with the behavior to perform self-care among CDK patients ($\beta = -0.337$, P -value < 0.001) and with diet and fluid intake control among patients undergoing hemodialysis ($\beta = 0.508$, P -value < 0.001).²⁰

The most critical component of health literacy is critical thinking or assessment on reliability of the information received.²² Participants in this study had Bachelor's degree or higher (37.10%); while those with no formal education comprised only 1%. This could result in a high health literacy (mean = 54.93). Health literacy had a positive influence on the behavior to delay CKD progression ($\beta = 0.203$, P -value < 0.001). Based on Nutbeam's concept, health literacy is cognitive and social skills and social skill in the access, understanding, and the use of the information for performing their health behavior.²² This is also consistent with the HBM stating that health literacy could be considered as an action initiator that stimulates or motivate individuals the desirable behavior.¹⁵ Our finding is consistent with a study in Thai stage

1 – 3 CKD patients revealing that health literacy was positively associated with the self-care behavior ($\beta = 0.37$, P -value < 0.05)²³ and a study in Chinese patients showing that health literacy was positively associated with fluid intake limitation in patients undergoing hemodialysis ($\beta = 0.380$, P -value < 0.01).¹⁶

Perceived susceptibility of progression to the ESRD had positive influence on the prevention behavior ($\beta = 0.201$, P -value < 0.001). This is in accordance with the HBM that individuals with the perception that they have the susceptibility of disease or illness would be motivated to adopt the prevention behavior to reduce such susceptibility.¹⁵ In this present study, the mean score of perceived susceptibility was relatively high (mean = 31.33 points). This could be because most participants were in their elderly age (52.40%) of which their physiological stage makes them susceptible to illnesses. With an augmented perceived susceptibility to the CKD progression, they would be more determined to adopt the prevention behavior so that they can avoid the suffering at the end of their life.³⁴ In addition, these participants had co-morbid illnesses such as hypertension and/or diabetes which were screened at least 1 – 2 times a year.^{35,36} This screening could have made them aware about the susceptibility of CKD progression and motivated them to adopt the prevention behavior. Our finding is consistent with a study in Thai patients revealing that perceived susceptibility was a factor predicting diet and fluid intake behavior of hemodialysis patients ($\beta = 0.169$, P -value < 0.05).²⁰

The provision of information from healthcare providers had no influence on CKD progression prevention behavior. This could be because their CKD was not at the severe form so it did not interfere their life.⁶ On the information provision side, they could have been provided with a relatively small amount of information with the limited number of healthcare providers and limited amount of time compared with the number of the patients. The provision could also be limited to specific topics such as avoiding foods with high glycemic index to achieve a better glycemic control and self-monitoring on blood pressure. The covid-19 pandemic could also limit the direct communication between the patient and healthcare providers, hence the limited information provision. Majority of the participants also had a moderate level of satisfaction on the information about CKD from the provider (48.60%). This could also be the reason of no association between information provided by the provider and the prevention behavior.

Findings from this present study could be used as a basis for developing guidelines or programs to delay CKD progression in stage 1 – 3 CKD patients and patients with the susceptibility of developing CKD. Specifically, the patients' perception could be enhanced on perceived susceptibility of CKD progression and perceived benefits of the prevention behavior, and reduced on perceived barriers to performing the prevention behavior. In terms of a moderate level of satisfaction on and sufficiency of information provided by healthcare providers, healthcare providers could improve their service to allow more access to the information and more useful information for the patients.

In terms of future research, the test on programs to delay CKD progression should be conducted. These programs should incorporate activities to promote perceived susceptibility, perceived benefits, and health literacy, while reduce perceived barriers among patients. Future studies could also re-examine the influence of information provided by healthcare providers which was not associated with the prevention behavior. In addition, since this study did not focus on clinical outcomes which are beyond the behavior outcomes. It is recommended that clinical outcomes be incorporated in future studies.

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