

นิพนธ์ต้นฉบับ

ผลของโปรแกรมการจัดการความรู้ด้านพฤติกรรมการบริโภคอาหารและยาต่อการเปลี่ยนแปลงค่าการกรองของไต (Glomerular Filtration Rate) ในผู้ป่วยโรคไตเรื้อรังระยะ 3 และ 4 ในบริบทการดูแลสุขภาพระดับปฐมภูมิ

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บทคัดย่อ

ที่มา: โรคไตเรื้อรัง (chronic kidney disease; CKD) เป็นปัญหาสาธารณสุขที่เพิ่มขึ้นอย่างต่อเนื่องในประเทศไทย อันมีสาเหตุสำคัญจากโรคไม่ติดต่อเรื้อรังและการเข้าสู่สังคมผู้สูงอายุ พฤติกรรมการบริโภคอาหารและการใช้ยาที่ไม่เหมาะสมมีส่วนทำให้โรคดำเนินรุนแรงขึ้น อย่างไรก็ตามพบว่าทั้งในผู้ป่วยและผู้ดูแลยังมีช่องว่างด้านความรู้ ความเข้าใจเกี่ยวกับปัจจัยที่จำเพาะด้านพฤติกรรมการบริโภคอาหารและการใช้ยาที่ทำให้ไตวายเรื้อรังแย่ลง การศึกษานี้มีวัตถุประสงค์เพื่อประเมินประสิทธิผลของโปรแกรมการจัดการความรู้ด้านพฤติกรรมการบริโภคอาหารและการใช้ยา ต่อการพัฒนาการทำงานของไตในผู้ป่วยโรคไตเรื้อรังระยะที่ 3-4 ในบริบทของการดูแลสุขภาพปฐมภูมิ

วัสดุและวิธีการ: การศึกษาเชิงทดลองแบบกลุ่มเดี่ยวก่อนและหลังการศึกษา (one-group pre-post interventional study) ดำเนินการที่หน่วยบริการปฐมภูมิ โรงพยาบาลปทุมธานี ระหว่างเดือนธันวาคม พ.ศ. 2566 ถึงธันวาคม พ.ศ. 2567 ผู้ป่วยโรคไตเรื้อรังระยะที่ 3-4 จำนวน 322 ราย เข้าร่วมโปรแกรมการให้ความรู้เกี่ยวกับอาหารที่มีโซเดียมและน้ำตาลสูง การใช้ยาในกลุ่มต้านการอักเสบที่ไม่ใช่สเตียรอยด์ (NSAIDs) การใช้สมุนไพร และผลิตภัณฑ์เสริมอาหารที่ไม่ได้มาตรฐาน โปรแกรมนี้เน้นเนื้อหาความรู้ที่เข้าใจง่ายและจดจำได้สะดวก ประกอบด้วยการจัดกิจกรรมให้ความรู้โดยแพทย์และการตรวจค่าอัตราการกรองของไต (GFR) ทุก 3 เดือน ตัวชี้วัดหลักคือการเปลี่ยนแปลงของค่า eGFR ตลอดระยะเวลา 12 เดือน โดยใช้สถิติ paired t-test ในการวิเคราะห์

ผลการศึกษา: ผู้เข้าร่วมมีการพัฒนาของค่า eGFR ดีขึ้นอย่างมีนัยสำคัญทางสถิติ โดยค่าเฉลี่ยเพิ่มขึ้น $+2.154 \text{ mL/min/1.73m}^2$ ที่การติดตามครั้งสุดท้าย ($p = 0.004$) และ $+3.943 \text{ mL/min/1.73m}^2$ ที่ค่าการเปลี่ยนแปลงสูงสุด ($p < 0.001$) การวิเคราะห์ย่อย (subgroup analysis) ไม่พบความแตกต่างอย่างมีนัยสำคัญตามอายุ โรคร่วม หรือประเภทสิทธิการรักษา

สรุป: การมีโปรแกรมการจัดการองค์ความรู้ที่มีประสิทธิภาพ มีความจำเพาะสำหรับผู้ป่วยและให้ความรู้อย่างสม่ำเสมอในหน่วยบริการปฐมภูมิ สามารถช่วยทำให้ผู้ป่วยโรคไตเรื้อรังระยะที่ 3 และระยะที่ 4 มีการทำงานของไตดีขึ้น ชะลอการเสื่อมของไตได้

คำสำคัญ: โรคไตเรื้อรัง โปรแกรมการจัดการความรู้ บริบทการดูแลสุขภาพระดับปฐมภูมิ

ORIGINAL ARTICLE

The Effect of Knowledge Management Program of Food and Drug Consumption Behavior in Change on Glomerular Filtration Rate for Patients with Chronic Kidney Disease Stage 3-4 in Primary Care Setting

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ABSTRACT

Background: Chronic kidney disease (CKD) is a growing public health problem in Thailand, largely driven by non-communicable diseases and aging populations. Poor dietary and medication behaviors contribute to disease progression, yet knowledge gaps persist among patients and caregivers. This study aims to evaluate the effectiveness of a knowledge management program on dietary and medication behaviors in improving kidney function among CKD stage 3-4 patients and their caregivers in a primary care setting.

Methods: This one-group pre-post interventional study was conducted at the Primary Care Cluster of Pathumthani Hospital from December 2023 to December 2024. A total of 322 patients with stage 3-4 CKD participated in educational interventions focused on high-sodium and high-sugar foods, non-steroidal anti-inflammatory drugs (NSAIDs), herbal medicines, and unregulated supplements. The program employed easy-to-remember, targeted knowledge and included educational sessions as well as quarterly glomerular filtration rate (GFR) assessments. The primary outcome was the change in estimated glomerular filtration rate (eGFR) over 12 months, which was analyzed using paired t-tests.

Results: Participants showed a statistically significant improvement in eGFR, with a mean increase of +2.154 ml/min/1.73m² at final follow-up ($p = 0.004$) and +3.943 ml/min/1.73m² at peak ($p < 0.001$). Subgroup analyses found no significant differences in outcomes based on age, comorbidities, or insurance type.

Conclusion: The knowledge management program demonstrated effectiveness in improving kidney function among patients with stage 3-4 CKD. These findings support the incorporation of regular, targeted educational interventions that feature concise, easily memorable content into primary care settings to facilitate the slowing of glomerular filtration rate.

Keywords: chronic kidney disease, knowledge management program, primary care setting

Intro

The increase in non-communicable chronic diseases including diabetes, hypertension, and obesity, along with the growing elderly population, has led to a corresponding increase in chronic kidney disease (CKD). Globally, deaths from CKD reached 1.4 million people in 2019, representing a 20.00% increase from 2010, making it one of the top 10 leading causes of death worldwide.¹ CKD is a major public health concern that leads to a large burden of illness and death in low-to-middle income countries. In developing countries, the severity of this problem is greater than in developed countries. A WHO study of 204 countries conducted between 1990-2019 found that across every age group, CKD ranked 29th in disability-adjusted life years (DALYs), representing approximately 0.80% of the total burden in 1990, and rose to rank 18th, representing approximately 1.60% in 2019. This represents a 93.00% increase in growth when considering the age group of 25 years and above.²

For Thailand, according to the National Health Security Office annual report for fiscal year 2022, it was found that chronic kidney disease patients requiring dialysis showed an increasing trend every year. From 2020-2022, the numbers were 64,575, 69,487, and 82,463 cases, respectively.³ And according to data from the Strategy and Planning Division, Office of the Permanent Secretary, Ministry of Public Health, it was found that [kidney disease] has been among the top 10 causes of death in Thailand since 2013.⁴ It was also found that Thai people continue to show an increasing trend in deaths from CKD, with the mortality rate per 100,000 population rising from 14.24 to 16.49 from 2016 to 2020. It is estimated that approximately 2 out of every 10,000 people die from chronic kidney disease annually, with more female deaths than male deaths. This is consistent with service reports from the Urban Community Health Center, Pathumthani Hospital, which found that chronic kidney disease patients in stages 3-4 seeking services showed a continuously increasing trend from 2020 with 58 cases, to 184 and 191 cases in 2021 and 2022, respectively. Dietary consumption is a major risk factor contributing to the increased occurrence of chronic kidney disease.

Studies have found that the causes of chronic kidney disease stages 3-4 result from inappropri-

ate dietary and medication behaviors, as follows: 1) consumption of high-sodium foods 2) consumption of sweet foods 3) use of non-steroidal anti-inflammatory drugs (NSAIDs) 4) use of herbal medicines 5) consumption of dietary supplements. However, most patients still lack knowledge and awareness regarding these issues.⁵⁻⁸

Diet plays a crucial role in managing CKD, as it can affect disease progression, electrolyte balance, and overall health. Generally, patients with chronic kidney disease need to limit their intake of sodium, potassium, and phosphorus, while protein intake may need to be adjusted according to individual needs.⁹ As kidney function declines, the accumulation of metabolic waste products and excessive electrolytes can harm patients with CKD. Proper nutritional management for CKD patients can control uremic symptoms and positively affect declining kidney function. Therefore, the diet of CKD patients should be a significant consideration in their care.¹⁰ The incidence of new-onset hypertension or diabetes increases the risk of new-onset CKD. Hypertension and diabetes jointly influence the risk of new-onset CKD. Diabetes and hypertension accelerate CKD by damaging the filtering blood vessels and nephrons. High blood sugar levels injure the kidney's blood vessels, while high blood pressure increases stress on these vessels and nephrons, creating a vicious cycle of escalating damage and worsening kidney function. This leads to a reduced ability to filter waste, protein leaking into the urine, and a decline in kidney health.^{11,12} The use of NSAIDs is closely linked to acute kidney injury, particularly in patients who already have chronic kidney disease. The continuous decline of the glomerular filtration rate in CKD patients, electrolyte abnormalities, and hypervolemia, along with worsening heart failure and hypertension, contribute to the risk of nephrotoxicity. These risks may vary depending on co-existing risk factors, including the use of multiple medications. For CKD patients, the risk differs according to each individual's glomerular filtration rate.¹³

The process of patient care, which may receive supporting or resistant factors, depends on caregivers, especially regarding diet and medication adherence. Appropriate caregiver support can improve CKD outcomes.^{14,15} Prioritizing chronic kidney disease services in primary care units is crucial and has a significantly positive impact

on the care process for chronic kidney disease patients. Particularly important is providing appropriate knowledge in primary care settings, as this enables access to at-risk groups and undiagnosed patients on a large scale, leading to diagnosis and referral to kidney disease specialists for appropriate subsequent treatment.^{16,17}

Currently, the provision of specific knowledge regarding dietary and medication consumption in primary care units still has incomplete and limited service coverage. Therefore, a knowledge management program on dietary and medication consumption behaviors for patients and caregivers in the care of chronic kidney disease patients in stages 3 and 4 in primary care units has been developed

Materials and Methods

Study design

This study is an interventional study using a one-group pre-posttest design.

Population and sample

The study population consisted of individuals aged 18 years and above who were diagnosed with chronic kidney disease stages 3 and 4 (estimated glomerular filtration rate (eGFR) 15-59 ml/min/1.73m²) attending the CKD progression delay clinic, who received the knowledge man-

agement program on dietary and medication consumption behaviors for patients and caregivers, and who participated at least once throughout the study. with a 12-month study period at the Primary Care Cluster, Pathumthani Hospital, from December 2023 to December 2024.

Exclusion criteria included: continuous upward trend in serum creatinine levels, progression to stage 5 diagnosis, development of acute kidney injury, other health problems requiring additional care, and inability to comply with the research protocol. Due to all of these conditions associated risks and potential complications, referral to a nephrologist for specialized management and close follow-up is warranted (Figure 1)

Operation definition

CKD stage 3 and stage 4^{7,18}

CKD Stage 3 : the glomerular's filtration rate (GFR) is between 30 - 59 ml/min/1.73m²

CKD Stage 4 : the GFR is between 16-29 ml/min/1.73m²

Slowing the CKD Progression definition

Slowing CKD progression means slowing the rate at which the kidneys lose function, ideally by reducing the rate of decline in glomerular filtration rate (eGFR) to less than 5 ml/min/1.73m²/year.¹⁹⁻²¹

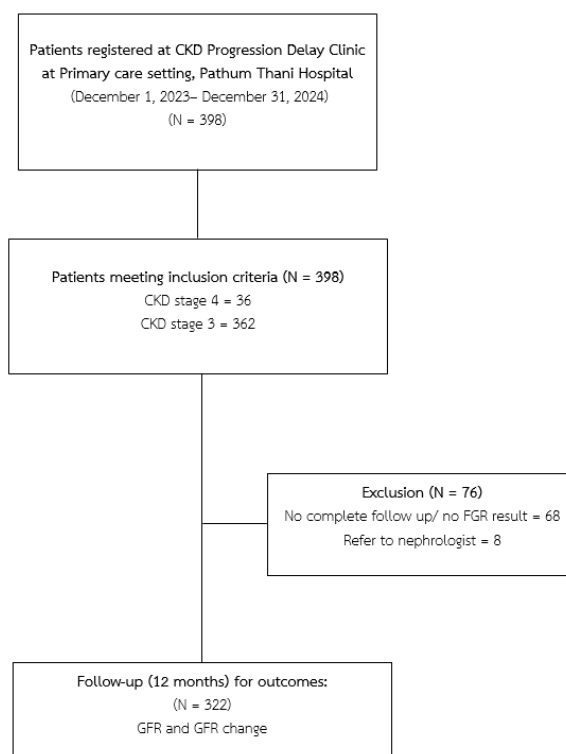


Figure 1. Flow diagram

eGFR²²

Use the CKD EPI formular for eGFR in adults

$$eGFR = 175 \times \text{standardized } S_{cr}^{-1.154} \times \text{age}^{-0.203} \times 1.212 \text{ [if black]} \times 0.742 \text{ [if female]}$$

the variables

- eGFR: The estimated GFR in mL/min/1.73m².
- S_{cr}: Standardized serum creatinine in mg/dL.

Intervention

The program provided knowledge about foods and medications found to affect the kidneys and that were commonly consumed by clients at the CKD progression delay clinic. It consisted of educational lectures (high-sodium foods, high-sugar foods, use of NSAIDs, use of herbal medicines and consumption of uncertified dietary supplements or those with unknown ingredients) and cooking demonstrations of low-sodium foods by nutritionists.

This knowledge management program we developed base on understand level on bloom's taxonomy this program developed from Banmai Health Promoting model.²³ In detail we explain what and how food and drug effect on kidney and we develop easy-to-remember phrase

The clients at the CKD progression delay clinic will receive education sessions every 3 months, approximately 20 minutes each by family physician, before seeing the doctor. In addition to standard knowledge, we also provide easy-to-remember knowledge that can be applied in practice such as "Any medicine that is harmful to the stomach is also harmful to the kidneys.", "High blood pressure is like a high-pressure water gun.", "Consuming too much of any substance can also be dangerous.", "Soup, curry, noodle soup are more dangerous than you think", "There are three types of salt: sweet salt, unsalted salt, and salty salt." And it ends with a question-and-answer session.

The clients at the CKD progression delay clinic undergo blood testing for GFR and targeted educational interventions that feature concise, easily memorable content every 3 months, in accordance with the standard management protocol for chronic kidney disease in primary care settings. We conducted a 12-month follow-up to compare with the patients' baseline blood results before participate to CKD progression delay clinic. All patients were managed in accordance with the patient care guidelines applicable to primary care settings in Mueang District, Pathum Thani Prov-

ince. (Banmai Health Promoting model).²³

Data analysis

1. For the characteristics of the patient group receiving services, descriptive statistics were used for description. The primary outcome measured was the change in eGFR over 1 year before and after program participation, using paired t-test statistics since the variables were normally distributed as confirmed by the Shapiro-Wilk normality test.

2. Secondary outcomes included

a. Subgroup analysis associations between GFR changes and age, diabetes mellitus, hypertension by Mann-Whitney U test and healthcare scheme by Kruskal-Wallis test

b. Correlation between age and change in GFR confirmed by Pearson correlation

Statistical analysis was performed using statistical modules in Python library.

Ethics Approval

Ethical approval was obtained from the Human Research Ethics Committee of Pathumthani Hospital. Certificate Number, EC-PTH A040-66

Results

This interventional study enrolled 322 patients with chronic kidney disease stages 3-4 attending the CKD progression delay clinic. The cohort demonstrated typical characteristics of an aging population, with nearly three-quarters of participants (73.60%) aged 65 years or older and a mean age of 70.27 years with a standard deviation of 9.48 years. There was a predominance of female participants, comprising 62.42% of the study population compared to 37.57% males.

The insurance coverage patterns reflected Thailand's healthcare system structure, with the vast majority of patients (87.26%) covered under the Universal Coverage Scheme, while smaller proportions utilized direct payment (7.76%) or social security benefits (4.96%).

Comorbidity analysis revealed the expected burden of cardiovascular risk factors commonly associated with chronic kidney disease. Hypertension was nearly universal, affecting 96.27% of participants (310 patients). Diabetes mellitus was present in 43.16% of patients (139 individuals). Dyslipidemia was documented in only 9.00% of participants (29 patients). The baseline kidney function assessment showed a mean estimated glomerular filtration rate (eGFR) of 48.32 ml/min/1.73m² with a standard deviation of 14.47. (Table 1)

The primary outcome analysis demonstrated statistically significant improvements in kidney function following the knowledge management program implementation. When comparing final follow-up eGFR measurements to baseline values using paired t-test analysis, the results showed a mean improvement of 2.154 ml/min/1.73m² (p-value = 0.004, 95%CI: 0.7-3.61). While the Cohen's d effect size of 0.151 indicated a small effect magnitude. More remarkably, when examining the best eGFR achieved during the fol-

low-up period compared to baseline, participants demonstrated a mean improvement of 3.943 ml/min/1.73m² (p < 0.001, 95% CI: 2.51-5.38), with a Cohen's d effect size of 0.285 representing a small-to-medium effect. (Table 2)

Secondary analyses explored potential associations between patient characteristics and treatment response. At the last follow-up, the median (IQR) GFR was slightly higher in patients aged < 65 years compared with those aged ≥ 65 years (51.7 [45.4-59.4] vs. 50.8 [40.3-58.5] mL/min/1.73m²), although the difference was not statistically significant (p = 0.082). Similarly, patients without diabetes mellitus (DM) had a higher median GFR than those with DM (52.8 [42.5-60.0] vs. 49.7 [40.8-55.25] mL/min/1.73m², p = 0.185). When comparing patients with and without hypertension (HT), the non-HT group had a higher GFR (55.85 [45.25-60.95] vs. 50.8 [40.8-58.72] mL/min/1.73m²), but the difference was not statistically significant (p = 0.126). Analysis by healthcare scheme showed a trend toward differences in GFR (p = 0.065), with patients under the universal coverage (UC) scheme presenting higher values (51.6 [42.3-59.2] mL/min/1.73m²) compared with those under the Civil Servant scheme (45.0 [37.2-52.3]) and the Social Security Office (SSO) scheme (50.6 [48.9-55.9]). (table 3) Correlation analysis showed no significant relationship between age and change in GFR (r = 0.005, p = 0.924). (Table 4)

Discussion

This study demonstrates that a structured knowledge management program focusing on dietary and medication behaviors can produce statistically significant improvements in kidney function among patients with chronic kidney disease stages 3-4. The observed increases in eGFR of 2.154 ml/min/1.73m² at final follow-up and 3.943 ml/min/1.73m² at peak measurement rep-

Table 1. Baseline Characteristics of participants (n=322)

Baseline characteristics	Number (%)
Sex	
Male	121(37.58)
Female	201 (62.42)
Age (year, mean±S.D.)	70.27±9.48
Age ≥ 65 years	237 (73.60)
Age < 65 years	85 (26.40)
Universal Health Coverage	281(87.27)
Direct payment	25 (7.76)
Social security	16 (4.97)
Type II Diabetes mellitus	139 (43.16)
Hypertension	310 (96.27)
Dyslipidemia	29 (9.00)
Baseline GFR (ml/min/1.73m ² , mean±S.D.)	48.32±14.47

Table 2. Primary outcome: change in GFR

Outcome	Group/variables	Baseline GFR Mean±SD)	Follow-up GFR (Mean±SD)	Mean difference (95%CI)	P-value
Primary					
Change in GFR from baseline to last follow-up	All	48.32±14.47	50.48±14.02	+2.154 (0.70, 3.61)	0.004
Change in GFR from baseline to best GFR within 1 year	All	48.32±14.47	52.27±13.08	+3.943 (2.51, 5.38)	< 0.001*

*Paired t-test, GFR; glomerular's filtration rate

Table 3. Secondary outcome (subgroup analysis)

Outcome	Last follow -up GFR, Median (IQR)	P-value
Secondary		
GFR change: Age \geq 65 vs < 65		
\geq 65	50.8 (40.3-58.5)	0.082*
< 65	51.7 (45.4-59.4)	
GFR change: DM vs non-DM		
DM	49.7 (40.8-55.25)	0.185*
Non-DM	52.8 (42.5-60.0)	
GFR change: HT vs non-HT		
HT	50.8 (40.8-58.72)	0.126*
Non-HT	55.85 (45.25-60.95)	
GFR change by healthcare scheme		
UC	51.6 (42.3-59.2)	0.065**
Civil Servant	45.0 (37.2-52.3)	
SSO	50.6 (48.9-55.9)	

*Mann–Whitney U test, **Kruskal–Wallis test, GFR; glomerular’s filtration rate, DM; diabetes mellitus, HT, hypertension; UC, universal coverage, SSO, Social Security Office

Table 4. Correlation statistic: age and change in GFR

Outcome	Group/variables	r	P-value
Correlation between age and change in GFR	Age vs GFR	0.005	0.924*

*Pearson correlation, GFR; glomerular’s filtration rate

resent meaningful clinical outcomes, particularly considering the natural history of CKD typically involves progressive functional decline.^{24,25} 24 25

The improvement in peak eGFR (3.943 ml/min/1.73m²) being greater than final eGFR improvement (2.154 ml/min/1.73m²) suggests that some patients experienced temporary kidney function recovery that subsequently stabilized at levels still above baseline. This pattern may reflect the resolution of reversible factors such as volume overload from excessive sodium intake 26 or acute nephrotoxicity from inappropriate medication use , while the sustained improvement at final follow-up indicates lasting benefits from continued behavioral modifications.

The demographic characteristics of our cohort align with established epidemiological patterns of CKD, with advanced age (mean 70.27 years), the high prevalence of hypertension (96.27%), and the substantial burden of diabetes (43.16%). The universal healthcare coverage pattern, with 87.26% of participants enrolled in Thailand’s Universal Coverage Scheme, suggests our findings are applicable to the broader population receiving care in public health systems.

The consistency of treatment benefits across diverse patient subgroups supports the generalizability of the knowledge management program’s effectiveness. The absence of age-related differences in treatment response is particularly encouraging, given concerns about older patients’ ability to implement behavioral changes. Similarly, the lack of differential effects based on comorbidity status suggests that the educational intervention’s core components—addressing high-sodium foods, high-sugar foods, NSAID use, herbal medicines, and unregulated dietary supplements—are universally relevant for CKD patients regardless of their specific risk factor profiles.

Conclusions

This study demonstrates that a structured knowledge management program, including easy-to-remember knowledge, focusing on dietary and medication behaviors can produce measurable improvements in kidney function among patients with CKD stages 3-4. The significant increases in both final and peak eGFR measurements, coupled with the consistent benefits observed across patient subgroups, support the

clinical value of implementing such educational interventions in primary care settings for chronic kidney disease management.

Limitations

Several limitations should be acknowledged. The one-group pre-post design lacks a control group, limiting our ability to definitively attribute eGFR improvements to the intervention rather than natural variation or regression to the mean. The 12-month follow-up period, while adequate for assessing short-term outcomes, may not capture long-term sustainability of behavioral changes or kidney function benefits. Additionally, the study was conducted at a single center with a specific population demographic, potentially limiting external validity to other healthcare settings or ethnic populations. Food and drug consumption behaviors are factors that affect GFR changes, but conclusions may not be immediately drawn as there may be other factors that affect GFR. Incorporating pre- and post-intervention data on mean blood pressure, glycemic control, and lipid profile would allow a more explicit demonstration of their impact on chronic kidney disease management and the progression of eGFR decline. If further studies are to be conducted on this issue, the investigators recommend that a clinical trial design be employed in order to obtain more robust and conclusive evidence.

Highlights

1. Patient education that is easy to remember and delivered consistently leads to more effective behavioral change.
2. Providing patient education in a clear, memorable, and continuous manner contributes to improved and sustained behavior modification.
3. Educational interventions for patients that emphasize simplicity, retention, and continuity are more effective in facilitating behavioral change.
4. When patient education is designed to be easily recalled and consistently reinforced, it results in better behavioral outcomes.

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Competing Interests

The authors declare that they have no competing interests.

Author contributions

Pichet Noihoon was responsible for literature review, methodology design, data collection, and interpretation the results. Chawanwat Jindamporn was responsible for data cleansing, data analyzing, and writing the manuscript. All authors critically reviewed and revised the manuscript for intellectual content and approved the final version for submission.

Ethics approval and consent to participate

Ethical approval was obtained from the Human Research Ethics Committee of Pathumthani Hospital. Written informed consent was obtained from all participants after comprehensive explanation of study objectives, procedures, and risks. Participation was voluntary, and withdrawal was permitted at any time without affecting medical care. All data were kept confidential and used solely for research purposes.

Availability of Data and Materials

The datasets analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

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