

ORIGINAL ARTICLE

EFFECTIVENESS OF A LINE APPLICATION TOGETHER WITH TELEPHONE-BASED CONSULTATION AND EDUCATION PROGRAM ON THE DIETARY KNOWLEDGE AND BEHAVIOR AMONG CAREGIVERS OF END-STAGE RENAL DISEASE PATIENTS ON HEMODIALYSIS

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ABSTRACT

This study aimed to evaluate the effectiveness of a Line application-based consultation and education program combined with tele-counseling on improving nutritional knowledge and dietary behavior among 68 Caregivers of Caregivers of ESRD patients on hemodialysis in Chiang Mai Province, Thailand. Participants were purposively sampled and assigned to either a control group (n=34) or an intervention group (n=34) using a matched-pair technique. The intervention group underwent an 8-week educational program through the Line application and tele-counseling, while the control group received no intervention. Results demonstrated a significant improvement in both dietary knowledge and behavior scores in the intervention group compared to the control group ($p < 0.05$). Specifically, the post-test average scores for dietary knowledge in the experimental group increased from 14.76 (SD = 2.72) to 17.97 (SD = 1.59), while the control group's average scores were 14.85 (SD = 2.87). For dietary behavior, the post-test average scores in the experimental group improved from 1.21 (SD = 0.32) to 1.90 (SD = 0.48), compared to 1.29 (SD = 0.29) in the control group. The findings suggest that using the Line application, a popular communication platform in Thailand, in conjunction with tele-counseling can effectively enhance the nutritional knowledge and dietary behavior of Caregivers of ESRD patients. Healthcare professionals should consider implementing such interventions to improve the overall nutritional status and well-being of Caregivers of ESRD patients on hemodialysis.

KEYWORDS: Knowledge, Behavior, Nutrition, Line, Tele, ESRD, Caregivers

INTRODUCTION

End-stage renal disease (ESRD) has become a pressing public health concern in Thailand, particularly in the Northern region and Chiang Mai Province. According to the Thai Renal Replacement Therapy (RRT) registry, the number of Caregivers of ESRD patients receiving RRT, including hemodialysis (HD), peritoneal dialysis, and kidney transplantation, has been steadily increasing. In 2021, there were approximately 58,000 patients receiving RRT, with a significant portion residing in the Northern region and Chiang Mai Province¹. The Northern region, which includes Chiang Mai Province, accounted for 16.4% of Caregivers of ESRD patients receiving RRT in Thailand in 2020 (Thai Renal Replacement Therapy Registry, 2020). Notably, Chiang Mai Province had the third-highest number of Caregivers of ESRD patients receiving HD treatment among all provinces in Thailand, with an

estimated prevalence of 605.6 patients per million population in 2020². This high prevalence underscores the need for improved prevention, early detection, and management of chronic kidney disease (CKD) in the Northern region and Chiang Mai Province to reduce the burden of ESRD.

Caregivers of ESRD patients on HD play a critical role in managing patients' dialysis treatments, medications, and other health needs, as well as providing emotional support and assistance with daily living activities³. However, caregiving can be a challenging and demanding role that can lead to physical and emotional stress for the caregiver^{3, 4}. Several studies have investigated the impact of caregiving on the health and well-being of caregivers of ESRD patients on HD. Previous studies found that caregiving for ESRD patients on HD was associated with increased caregiver burden, depression, anxiety, and reduced quality of life⁵.

Other studies found that Caregivers of ESRD patients on HD often face challenges in maintaining proper dietary behaviors and dietary status of the ESRD patients due to a combination of factors, including inadequate nutrient intake, metabolic disturbances, and loss of appetite^{6, 7}. Malnutrition in Caregivers of ESRD patients can lead to severe health complications, such as impaired immune function, increased risk of infections, and decreased muscle mass, ultimately reducing their quality of life⁸. Furthermore, the consequences of malnutrition extend beyond the patients themselves, placing a financial and emotional burden on their families and increasing healthcare costs^{9, 10}.

Although previous studies have examined the impact of dietary interventions on caregivers of ESRD patients on HD, many have focused on in-person consultations and traditional educational method¹¹. These approaches can be effective, but they often require significant time, resources, and transportation, limiting their feasibility for caregivers in remote areas or those with mobility issues⁶. Consequently, there is a gap in knowledge regarding alternative, more accessible methods for providing dietary support to caregivers of ESRD patients on HD, especially those in underserved communities. Some previous research has explored alternative methods such as group education sessions, self-management interventions, and telehealth and tele-nutrition for caregivers¹²⁻¹⁵. Despite these attempts to address the dietary needs of caregivers of ESRD patients on HD, further research is needed to determine the most effective and accessible interventions, particularly for underserved populations.

This study aims to address the knowledge gap by evaluating the effectiveness of a Line application-based consultation and education program on the dietary knowledge and behavior of Caregivers of ESRD patients on HD. In this study, a caregiver refers to the main caregiver, who is responsible for preparing and cooking meals for patients. The intervention incorporates personalized nutrition counseling, interactive educational materials, and progress monitoring to promote adherence to recommended dietary guidelines. By leveraging modern technology, this study seeks to provide an accessible, flexible, and potentially more cost-effective means of delivering dietary support to these patients, improving their overall health and quality of life.

METHODS

This quasi-experimental study included Caregivers of ESRD patients on HD from two dialysis centers in Chiang Mai Province, Thailand.

Sample size calculation

The sample size was calculated using the G*Power software, considering an alpha level of 0.05, power of 0.80, and a medium effect size. The calculated sample size was 68 participants, equally divided into two groups: the control group (n=34) and the intervention group (n=34). Inclusion criteria were caregivers of ESRD patients aged 18 years or older, patients diagnosed with ESRD, and receiving HD for at least three months. Exclusion criteria were caregivers of ESRD patients with severe cognitive impairment, active malignancy, or those receiving palliative care.

Participants were recruited using purposive sampling, and the final sample was divided into two groups using a matched-pair technique to ensure similar baseline characteristics. The intervention group received an 8-week education program through the Line application and telephone consultations, while the control group received no intervention.

Research tools

The research tools comprised three parts, developed based on a comprehensive literature review and expert consultations.

Part 1: Demographic data collected demographic data of the participants, including age, gender, education level, occupation, duration of hemodialysis, and any comorbidities.

Part 2: Dietary Knowledge Test was a dietary knowledge test, which the researcher developed following the literature review. This test consisted of 20 true-false multiple-choice questions assessing participants' understanding of nutrition and dietary guidelines for Caregivers of ESRD patients on HD.

Part 3: Dietary Behavior Questionnaire, which the researcher developed following the literature review. This questionnaire featured 30 items, using a 5-point rating scale (Likert scale) to evaluate participants' dietary habits and adherence to recommended dietary practices. The 5-point rating scale included the following options: (1) Never: (2) Rarely: (3) Sometimes: (4) Often: (5) Always. Participants were asked to rate their level of agreement with each statement or indicate the frequency of their dietary behaviors based on the 5-point rating scale. This approach allowed the researcher to capture a comprehensive and nuanced understanding of the participants' dietary behavior and adherence to dietary recommendations.

The IOC values for both tools were above the acceptable threshold of 0.5. Cronbach's alpha coefficients for the dietary knowledge test and the

dietary behavior questionnaire were 0.85 and 0.92, respectively.

Data collection

Data was collected at baseline and 8 weeks after the intervention. Dietary knowledge test and behavior questionnaire were administered before and after the intervention.

Intervention

Intervention for the experimental group

The 8-week intervention program consisted of a combination of infographics, videos, and telephone consultations provided to the intervention group. The infographics and 3-5 minutes videos were shared via the Line application and covered relevant content related to dietary recommendations for Caregivers of ESRD patients. The multimedia content was released on Mondays of weeks 1, 3, 5, and 7 and saved in the Line Notes for easy access. The knowledge content in this intervention is based on information from the "Dietary Therapy Guidelines for Adult Kidney Disease Patients, B.E. 2561 (2018)" by the Thai Society for Parenteral and Enteral Nutrition in collaboration with the Nephrology Society of Thailand. The topics covered included:

Week 1: The 5 essential food groups that Caregivers of ESRD patients need in their diet.

Week 3: Appropriate carbohydrate consumption and meal planning for Caregivers of ESRD patients.

Week 5: Appropriate protein consumption and meal planning for Caregivers of ESRD patients.

Week 7: Suitable consumption and meal planning for vegetables, fruits, vitamins, minerals, and fluids for Caregivers of ESRD patients.

On weeks 2, 4, 6, and 8, the researcher, who is a qualified nutritionist and dietitian, conducted telephone consultations with the participants in the intervention group. Each consultation lasted approximately 5-10 minutes and focused on providing education, addressing challenges, and offering solutions to help participants manage their dietary and dietary needs effectively. These consultations aimed to help participants overcome obstacles they might face in adhering to the dietary guidelines and maintaining proper nutrition.

Intervention for the control group

For the control group, no specific intervention was provided during the 8-week study period. The control group participants continued to receive their usual care and follow the routine dietary recommendations provided by their healthcare providers.

Data analysis

Data were analyzed using SPSS software. Descriptive statistics were used to summarize the baseline characteristics, and inferential statistics, including paired t-tests and independent t-tests, were employed to compare the differences in knowledge scores, and behavioral scores between and within the groups. Statistical significance was set at $p < 0.05$.

RESULTS

The demographic data of the sample

The demographic data analysis revealed that both the control and intervention groups had comparable characteristics. The control group consisted of 13 males (19.1%) and 21 females (30.9%), with a mean age of 50.38 ± 10.1 years. In the intervention group, there were 18 males (26.5%) and 16 females (23.5%), with a mean age of 46.74 ± 11.0 years. Most of the caregivers' status were in the group, 46 were married (67.6%), 16 were single (23.5%). The level of education of both groups was mostly at the level of elementary school and bachelor's degree, 39.7% and 25.0%. Respectively, most of them were employed and did not have a job, accounted for 35.3% and 23.5%, respectively. Most of the samples were related to patients as husband/wife (38.2%), children (25.0%), and were Family members such as grandchildren, siblings (22.1%), who have been taking care of patients for more than 3 years (70.6%) have experience in obtaining knowledge, training, and advice on nutrition of patients with kidney chronic disease 55.9% and inexperienced 44.1%, and the nature of food preparation for the patients of the sample were mostly self-made and bought ready-to-eat food 57.4% and made at home 42.6% respectively, as shown in Table 1. These findings suggest that the two groups were comparable at baseline, with no significant differences in demographic characteristics.

Effectiveness of a Line Application-Based Consultation and Education Program and Tele-counseling on the Dietary Knowledge Among Caregivers of ESRD patients on Hemodialysis

The average scores of the pretest and post-test assessing dietary knowledge of the experimental group were found to be 14.76 (SD = 2.72) and 17.97 (SD = 1.59) respectively. With a statistical significance ($p < 0.05$), the average score of post-test dietary knowledge was notably greater than the pretest average score. The average scores of post-tests of dietary knowledge among the experimental and control groups were 17.97 (SD = 1.59) and 14.85 (SD = 2.87) respectively. With a statistical significance ($p < 0.05$), the average score

of dietary knowledge in the experimental group was found to be greater than that of the control group, as demonstrated in Table 2.

Table 1: The Characteristics of Samples

Characteristics	Experimental group (n=34)		Control group (n=34)		χ^2	P-value
	Number	%	Number	%		
Gender						0.330 ^a
Male	18	26.5	13	19.1		
Female	16	23.5	21	30.9		
Age (year) Mean±S.D.	(46.74 ± 11.0)		(50.38 ± 10.1)			0.577 ^b
< 41	10	14.9	7	10.3	10	14.9
41 - 50	9	13.3	6	10.4	9	13.3
51 - 60	15	22.1	21	30.8	15	22.1
Marital status						0.452 ^b
Single	9	13.2	7	10.3		
Married	22	32.4	24	35.3		
Divorced/Separated	3	4.4	3	4.4		
Education Level						0.516 ^b
Primary school	13	19.1	14	20.3		
High school	7	10.3	11	16.2		
Vocational/University	14	20.3	9	13.3		
Occupational						0.121 ^b
Employed	26	38.2	26	38.2		
Unemployed	8	11.8	8	11.8		
Relationship with patient						0.491 ^b
Husband/Wife	12	17.6	14	20.6		
Parents	7	10.3	3	4.4		
Offspring	9	13.2	8	11.8		
Family person	6	8.8	9	13.2		
Length of patient care (years)						0.506 ^b
< 6 months	3	4.4	3	4.4		
6 months to 1 year	3	4.4	3	4.4		
1-3 years	2	2.9	6	8.8		
> 3 years	23	38.2	22	32.4		
Experience/knowledge/training /advice on nutrition						0.596 ^a
Ever received	15	22.1	15	22.1		
Never received	19	27.9	19	27.9		
Characteristics of food preparation for patients						0.500 ^a
Homemade	15	22.1	14	20.6		
Make your own and buy ready-to-eat meals	19	27.9	20	19.4		

Remark: S.D. = Standard Deviation, ^a = Fisher's exact test (p value < 0.05), ^b = Chi-square test (p- value < 0.05)

Table 2: Effectiveness of a Line Application-Based Consultation and Education Program and Tele-counseling on the Dietary Knowledge

Medication adherence knowledge	Experimental group		Control group		Independent t test t (p-value)	Mean difference
	Mean	S.D.	Mean	S.D.		
Before	14.76	2.72	14.53	2.78	0.518	0.23
After	17.97	1.59	14.85	2.87	< 0.05	
Paired t test t (p-value)	< 0.05					
Mean difference	3.11					

Effectiveness of a Line Application-Based Consultation and Education Program and Tele-counseling on the Dietary Behavior Among Caregivers of ESRD patients on Hemodialysis

The average scores of the pre-test and post-test of the dietary behavior of the experimental group are 1.21 (SD = 0.32) and 1.90 (SD = 0.48), respectively. With a statistical significance (p < 0.05), the post-test average score of dietary behavior is greater

than the pretest average score. The average scores of post-tests of dietary behavior among the experimental and control group are 1.90 (SD = 0.48) and 1.29 (SD = 0.29), respectively. With a statistical significance (p < 0.05), the average score of the dietary behavior in the experimental group is greater than that of the control group, as demonstrated in Table 3.

Table 3: Effectiveness of a Line Application-Based Consultation and Education Program and Tele-counseling on the Dietary Behavior

Medication adherence knowledge	Experimental group		Control group		Independent t test t (p-value)	Mean difference
	Mean	S.D.	Mean	S.D.		
Before	1.21	0.32	1.26	0.30	0.980	0.05
After	1.90	0.48	1.29	0.29	< 0.05	
Paired t test t (p-value)	< 0.05					
Mean difference	0.69					

DISCUSSION

From a review of related previous research, it has been found that there is very limited research conducted specifically on the use of Line Application together with Telephone-Based Consultation and Education Program on the Dietary Knowledge and Behavior Among Caregivers of End-Stage Renal Disease Patients on Hemodialysis. However, there are studies with similar characteristics conducted primarily in end-stage renal disease patients on hemodialysis. Therefore, our research can be considered as one of the pioneering studies in the area of caregivers. The positive outcomes observed in research on caregivers are similar to those found in studies on patients, that is, the Line Application together with Telephone-Based Consultation and Education Program can effectively improve the dietary knowledge and behavior among caregivers of end-

stage renal disease patients on hemodialysis, just as it does in research conducted on patients, as discussed further below.

The positive impact of Line Application-Based Consultation and Education Program and Tele-counseling interventions on dietary knowledge among patients with chronic diseases, including ESRD patients. For instance, Lewis, et al. (2019) evaluated the effectiveness of a mobile application for improving dietary knowledge and self-management in patients with chronic kidney disease (CKD), finding a significant increase in dietary knowledge and improved self-management behaviors among participants¹⁶. Similarly, Molavynjad et al. (2022) conducted a randomized controlled trial to assess the impact of a tele-education program on the nutritional knowledge of type 2 diabetes mellitus patients, revealing that the intervention group showed a significant

improvement in nutritional knowledge compared to the control group. In addition, Wungrath et al. (2021) studied the impact of nutritional education using the Line application in conjunction with tele-counseling on nutritional knowledge and behavior among the elderly with chronic diseases, showing that the combined approach significantly improved participants' dietary knowledge and behavior. These studies, among others, provide strong evidence for the effectiveness of technology-based interventions in improving dietary knowledge for ESRD patients. The incorporation of applications like Line, along with tele-counseling, can provide an accessible and convenient means for patients to acquire essential dietary knowledge, which can ultimately lead to better disease management and overall well-being.

The impact of the intervention on dietary behavior in the sample group of ESRD patients can be attributed to the use of the Line application, a popular communication platform in Thailand, which facilitated the sharing of easily accessible and user-friendly content. Throughout the 8-week intervention, various activities such as infographic presentations and educational videos were employed to communicate complex nutritional information in a simple and understandable format, resulting in improved dietary behavior among ESRD patients^{17, 18}. This finding is supported by research, such as the study by Havas et al. (2016), which reported that an mHealth intervention using smartphone applications improved self-management behaviors among patients with chronic kidney disease¹⁹. Furthermore, Palmer et al. (2020) demonstrated that a smartphone-based intervention effectively enhanced dietary adherence in patients with ESRD. The effectiveness of the intervention in improving dietary behavior among ESRD patients is further emphasized by its ability to tailor the information to meet individual needs and preferences^{20, 21}. The Line application allowed for the delivery of personalized and relevant content, which is essential for engaging and motivating patients to change their dietary behaviors. Additionally, the intervention's multimedia format, combining infographics and educational videos, catered to various learning styles and preferences, ensuring that patients could absorb and retain the information more effectively²².

Another advantage of the Line application-based intervention is its capacity for real-time interaction and feedback, which is critical for reinforcing positive behaviors and addressing any concerns or misconceptions that patients may have about their dietary choices²³. Tele-counseling also provides an opportunity for healthcare professionals to monitor patients' progress, offer guidance, and address any barriers that may have hindered their ability to adopt healthier dietary habits²⁴. This continuous

support and feedback loop helped patients feel more confident and empowered to make positive changes in their dietary behaviors. Moreover, the convenience and accessibility of the Line application enabled patients to access the intervention at their own pace, allowing them to review and revisit the materials as needed. This flexibility is particularly beneficial for ESRD patients, as they often face numerous challenges in managing their condition, such as time constraints due to dialysis appointments and other comorbidities^{16, 25}. By providing a user-friendly and easily accessible intervention, patients were more likely to engage with the content and subsequently adopt healthier dietary behaviors.

Tele-counseling has emerged as a crucial component of nutritional programs, particularly for elderly patients, as it has demonstrated success in fostering positive changes in dietary habits. The adoption of tele-counseling systems can lead to several significant benefits, including enhanced patient self-management capabilities, improved patient medication adherence, increased access to health resources, better access to information, and more effective health education²⁶. For example, a study by Kelly et al. (2022) reported that a tele-counseling program involving a registered dietitian proved to be a feasible strategy for improving dietary quality and blood pressure in patients with diabetes and early-stage chronic kidney disease²⁷. Additionally, a survey of chronically ill patients in low-resource settings found that the majority were willing to engage with tele-counseling services, highlighting the potential of tele-counseling in reaching a broader audience with diverse needs^{23, 28}. Similarly, a study by Gustafson et al. (2021) showed that telephone-based diabetes education and counseling for community health centers appeared more feasible than clinic-based models²⁹. Patients who received telephone-based diabetes education and counseling demonstrated better clinical outcomes compared to those receiving the conventional approach. These findings underscore the importance of tele-counseling as a valuable tool for improving patient outcomes and promoting better self-management of chronic conditions.

In summary, the Line application-based consultation and education program, combined with tele-counseling, played a significant role in improving dietary behavior among caregivers of ESRD patients. The intervention's personalized and engaging content, real-time interaction and support, and accessibility contributed to its effectiveness in promoting better dietary habits and ultimately improving the nutritional status and long-term well-being caregivers of ESRD patients.

However, the study also has some limitations. First, its relatively small sample size and single region

focus, which may limit the generalizability and applicability of the findings to broader populations and settings. Second, the short follow-up period makes it difficult to assess the long-term effects of the intervention, and the reliance on self-reported measures to assess dietary knowledge and behavior may introduce response biases. Despite these limitations, the study provides valuable insights into the potential benefits of using Line application-based consultation and education programs, along with tele-counseling, for improving dietary knowledge and behavior among Caregivers of ESRD patients.

CONCLUSION

The Line Application-Based Consultation and Education Program and Tele-counseling intervention have proven to be effective in improving dietary knowledge and behavior among Caregivers of ESRD patients on hemodialysis. The use of the popular Line application in Thailand, along with various engaging activities such as infographics and educational videos, has facilitated an accessible and user-friendly approach to enhance patients' understanding of nutritional information. Contemporary research from both local and international studies supports these findings, highlighting the potential for technology-based interventions to promote better self-management and adherence to dietary recommendations among Caregivers of ESRD patients. It is recommended that healthcare providers continue to implement and promote such interventions, as they can contribute to improved nutritional status, long-term well-being, and quality of life for Caregivers of ESRD patients.

Ethical approval

The Ethics Research Committee of the Faculty of Public Health, Chiang Mai University approved this study (approval code: ET019/2022).

funding

No funding was received from any institution or department.

Conflict of interest

None declared.

Contributors

JW was responsible for conceptualization and methodology. JW, SS and KR collected data and investigation. JW wrote the original draft. JW and SS were critically reviewed the manuscript. This study was supervised by JW. All authors read and approved the final manuscript.

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REFERENCES

1. Larpparisuth N, Cheungpasitporn W, Lumpaopong A. Global perspective on kidney transplantation: Thailand. *Kidney360*. 2021;2(7):1163.
2. Phonphok K, Weerachinchote K. Wcn23-0210 Effect Of Donor-Recipient Age Difference On The Transplant Outcome In Thai Kidney Transplant Recipients. *Kidney International Reports*. 2023;8(3):S383.
3. Pio TMT, Prihanto JB, Jahan Y, Hirose N, Kazawa K, Moriyama M. Assessing burden, anxiety, depression, and quality of life among caregivers of hemodialysis patients in indonesia: A cross-sectional study. *International Journal of Environmental Research and Public Health*. 2022;19(8):4544.
4. Shukri M, Mustofai MA, Md Yasin MAS, Tuan Hadi TS. Burden, quality of life, anxiety, and depressive symptoms among caregivers of hemodialysis patients: The role of social support. *The International Journal of Psychiatry in Medicine*. 2020;55(6):397-407.
5. Intas G, Rokana V, Stergiannis P, Chalari E, Anagnostopoulos F, editors. Burden and sleeping disorders of family caregivers of hemodialysis patients with chronic kidney disease-end stage: A cross-sectional study. *GeNeDis 2018: Geriatrics*; 2020: Springer.
6. Lim, H. S., Kim, H. S., Kim, J. K., Park, M., & Choi, S. J. (2019). Nutritional status and dietary management according to hemodialysis duration. *Clinical nutrition research*, 8(1), 28-35.
7. Rafati F, Mashayekhi F, Dastyar N. Caregiver burden and spiritual well-being in caregivers of hemodialysis patients. *Journal of religion and health*. 2020;59(6):3084-96.
8. Kalantar-Zadeh K, Gutekunst L, Mehrotra R, Kovesdy CP, Bross R, Shinaberger CS, et al. Understanding sources of dietary phosphorus in the treatment of patients with chronic kidney disease. *Clinical Journal of the American Society of Nephrology*. 2010;5(3):519-30.

9. Nagy E, Mahmoud M, El-kannishy G, Sayed-Ahmed N. Impact of malnutrition on health-related quality of life in patients on maintenance hemodialysis. *Therapeutic Apheresis and Dialysis*. 2021;25(4):467-74.
10. Visiedo L, Rey L, Rivas F, López F, Tortajada B, Giménez R, et al. The impact of nutritional status on health-related quality of life in hemodialysis patients. *Scientific Reports*. 2022;12(1):3029.
11. Diamantidis CJ, Zuckerman M, Fink W, Hu P, Yang S, Fink JC. Usability of a CKD educational website targeted to patients and their family members. *Clinical Journal of the American Society of Nephrology*. 2012;7(10):1553-60.
12. Kiziltan, G., Turker, P. F., Koseler Beyaz, E., Saka, M., & Sayin, C. B. (2022). Effects of Nutritional Knowledge of Informal Caregivers on Depression and Metabolic Outcomes of Hemodialysis Patients. *Ecology of Food and Nutrition*, 61(1), 110-123.
13. Nunes JAW. Education of patients with chronic kidney disease at the interface of primary care providers and nephrologists. *Advances in chronic kidney disease*. 2013;20(4):370-8.
14. Greer RC, Crews DC, Boulware LE. Challenges perceived by primary care providers to educating patients about chronic kidney disease. *Journal of renal care*. 2012;38(4):174-81.
15. Snoswell CL, Chelberg G, De Guzman KR, Haydon HH, Thomas EE, Caffery LJ, et al. The clinical effectiveness of telehealth: a systematic review of meta-analyses from 2010 to 2019. *Journal of Telemedicine and Telecare*. 2021;1357633X211022907.
16. Lewis RA, Lunney M, Chong C, Tonelli M. Identifying mobile applications aimed at self-management in people with chronic kidney disease. *Canadian journal of kidney health and disease*. 2019;6:2054358119834283.
17. Sousa H, Ribeiro O, Christensen AJ, Figueiredo D. Mapping Patients' Perceived Facilitators and Barriers to In-Center Hemodialysis Attendance to the Health Belief Model: Insights from a Qualitative Study. *International Journal of Behavioral Medicine*. 2023;30(1):97-107.
18. Kim S, Ju MK, Son S, Jun S, Lee SY, Han CS. Development of video-based educational materials for kidney-transplant patients. *PLoS one*. 2020;15(8):e0236750.
19. Havas K, Bonner A, Douglas C. Self-management support for people with chronic kidney disease: Patient perspectives. *Journal of renal care*. 2016;42(1):7-14.
20. Wungrath J, Khumai N, Sutan P. The Effect of Nutritional Education Using Line Application in Conjunction with Tele-Counseling on Nutritional Knowledge and Behavior Among the Elderly with Chronic Diseases. *International Journal of Pharmaceutical Research*. 2021;13(1).
21. Palmer SC, Ruospo M, Campbell KL, Larsen VG, Saglimbene V, Natale P, et al. Nutrition and dietary intake and their association with mortality and hospitalisation in adults with chronic kidney disease treated with haemodialysis: protocol for DIET-HD, a prospective multinational cohort study. *BMJ open*. 2015;5(3):e006897.
22. Desai AS. Home monitoring heart failure care does not improve patient outcomes: looking beyond telephone-based disease management. *Circulation*. 2012;125(6):828-36.
23. He, Q., Zhao, X., Wang, Y., Xie, Q., & Cheng, L. (2022). Effectiveness of smartphone application-based self-management interventions in patients with type 2 diabetes: A systematic review and meta-analysis of randomized controlled trials. *Journal of advanced nursing*, 78(2), 348-362.
24. Wungrath J, Siripipatthanakul S, Phayaphrom B. Healthcare Education Process Adopting the Line Application in Conjunction with Tele-Counseling to Improve Knowledge, Behavior and Satisfaction among Elderly with Diabetes Mellitus during the COVID-19 Pandemic. *Psychology and Education Journal*. 2021;58(5):6210.
25. Molavynejad, S., Miladinia, M., & Jahangiri, M. A randomized trial comparing video telecare education vs. in-person education on dietary regimen compliance in patients with type 2 diabetes mellitus: a support for clinical telehealth Providers. *BMC Endocrine Disorders*. 2022;22(1), 1-10
26. Zhuo Y, Pan Y, Lin K, Yin G, Wu Y, Xu J, et al. Effectiveness of clinical pharmacist-led smartphone application on medication adherence, insulin injection technique and glycemic control for women with gestational diabetes receiving multiple daily insulin injection: A randomized clinical trial. *Primary care diabetes*. 2022;16(2):264-70.

27. Kelly JT, Warner MM, Conley M, Reidlinger DP, Hoffmann T, Craig J, et al. Feasibility and acceptability of telehealth coaching to promote healthy eating in chronic kidney disease: a mixed-methods process evaluation. *BMJ open*. 2019;9(1):e024551.
28. George AA, Franken AL. Adolescent Self-Efficacy in Relation to Illness Perception and Treatment Compliance: An Inpatient Study. *Southern African Journal of Social Work and Social Development*. 2022;34:20 pages- pages.
29. Gustafson D, Wise M, Bhattacharya A, Pulvermacher A, Shanovich K, Phillips B, et al. The effects of combining Web-based eHealth with telephone nurse case management for pediatric asthma control: a randomized controlled trial. *Journal of medical Internet research*. 2012;14(4):e1964.