



Information System Literacy Monitoring Health of Hemodialysis Patients: A Health Education Case Study

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Abstract: Limited health literacy is associated with faster kidney damage. Kidney failure patients are exposed to a lot of new information about the disease and its treatment, which often results in ineffective communication between the patient and the provider. Increasing the amount, timing, and individualization of information received has been identified as a priority in hemodialysis treatment at health centers. This literature review aims to determine the literacy of the Hemodialysis Patient Health Monitoring Information System. This research is a scoping review, using 4 databases, namely Google Scholar, Ebsco, Pro Quest, and Science Direct. The stages and flow of research article selection used the PRISM Flowchart (Preferred Reporting Items for Systematic Review and Meta-Analyses), and to assess the quality of the article, researchers used a checklist from the Joanna Briggs Institute. Two themes and five sub-themes were found among the 8 screening articles, namely: (1) Hemodialysis Perspective; (a) Hemodialysis Patient Perspective, (b) Professional Perspective, (c) Anxiety Level at the Beginning of Hemodialysis Treatment. (2) Monitoring the care of hemodialysis patients; (a) Use of Technology in improving compliance and self-management, (b) Health literacy level of hemodialysis patients. Health literacy technology tools such as hemodialysis patient-specific mobile applications are reliable and well-validated. Patients who are aware of and understand their disease have better knowledge for better nutritional diet fulfillment.

Keywords: health literacy, information system, hemodialysis patient

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INTRODUCTION

The administrative information system and clinical services streamline the service process by converting manual registration activities into digital form. This simplifies patient data retrieval, updates, and drug collection. The system also simplifies financial bookkeeping and simplifies the provision of drugs in pharmacies (Maulidia et al., 2023). The use of electronic medical record management improves the monitoring efficiency of hemodialysis patients, especially for routine scheduling of patients who are already integrated into the system. The need to search physical records or fill out forms manually is reduced when information is clearly documented and centrally available. This saves time and energy for medical professionals, allowing them to focus on patient care (Febyana & Nursamsiyah, 2023).

Chronic Kidney Failure (CKD) has been recognized as one of the most prevalent health problems worldwide with 13.4% of the total population (Yulisetyaningrum et al., 2023). The incidence of GKG globally increased by more than 500 million people and 1.5 million people had to undergo hemodialysis. The death rate caused by GKG is still quite high (Kurniawan & Yani, 2023). The prevalence of kidney failure in men (0.3%) is higher compared to women (0.2%). Based on the characteristics of the highest prevalence age in the age category above 75 years (0.6%), which began to increase at the age of 35 years and above (Kementerian Kesehatan Republik Indonesia, 2018). Based on data from the Ministry of Health as of November 3, 2022, the number of GGA cases in Indonesia was recorded as 323 people consisting of 99 cases recovered, 34 cases treated, and 190 deaths (Kementerian Kesehatan Republik Indonesia, 2022).

Providing communication, information, and education to overcome distance limitations is an advantage of telehealth services, so legal aspects, financing, and supporting infrastructure are needed so that this remote technology can be useful for patients with chronic kidney failure (Rasmiati & Mulyono, 2022). The difficulty faced at this time in the Hemodialysis Installation is that there is incompatible patient data between the patients served by hemodialysis and those in the application report, the transaction value of the use of tools and materials is sometimes empty or there is no transaction value in the application, resulting in customer losses (Priatna et al., 2021). Information systems designed for direct hemodialysis patients will simplify the work of registration officers, integrate patient and diagnostic data, and make reporting easier. This will improve hospital services and medical record management, thus increasing the efficiency of officer performance (Here et al., 2023). The need for data in hemodialysis services at each hospital follows the reference of the hemodialysis form which

contains the patient's identity, physical examination, psychosocial history, pain assessment, fall risk assessment, diagnosis, nutritional examination, and nursing intervention. The officer is ready and willing to use the electronic medical record (Renggani, 2023).

METHODS

This review used the Scoping Review method which aims to map the literature, determine the existing feasibility and relevance values, explore information on the topics studied, and also investigate any problems or gaps in the research area to be studied. Therefore, Scoping Review is used to be able to provide basic information about possible research needs (Arksey & O'Malley, 2005; Peterson et al., 2017). The scope of a scoping review was a broader scope review compared to a systematic review and meta-analysis (Tricco et al., 2016). The stages carried out in the Scoping Review based on the Arksey and O'Malley (2005) framework regarding the framework for the preparation of the scoping review which was later modified by Levac et al. (2010) consisted of (1) identifying Scoping Review questions, (2) identifying relevant studies, (3) article selection, (4) mapping data/charting data, (5) compiling, summarizing and reporting results. Extended to Systematic Review and Meta-Analysis Statements for Scoping Review (PRISMA-SCR) with Indications and recommendations published by Joanna Briggs Institute (JBI) that ensure rigor in research. This review was listed in the Open Science Framework, DOI: 10.7326/M18-0850. PRISMA-SCR checklist was used for guidance in the preparation of this scoping review as a method to improve the quality assurance of the completeness of the scoping review structure and process (Tricco et al., 2016). To identify scoping review questions, an effective search strategy could be used to formulate questions in the literature search. This process is called Population Exposure Outcome (PEO) to form questions and facilitate literature search.

Table 1. PEOS Scoping Review Framework

P (Population)	E (Exposure)	O (Outcome)	Research Study
Hemodialysis patients	Information system literacy	Health monitoring	Quantitative Qualitative

Based on the PEOs framework above, the scoping review question is: How is health monitoring information system literacy in hemodialysis patients? Based on the PEOs framework that has been selected by the researcher, the inclusion and exclusion criteria of the article are as follows:

Table 2. Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion Criteria
English articles/international articles	Incomplete article
Original Article	Book review letter
A Systematic Review	
Articles of the last 5 years	
Talking articles about hemodialysis patients	Incomplete article
Articles discussing health literacy for passivated hemodialysis	Literature grey

The information source item explains the literature search sources used. As for the database used to search for relevant articles in compiling this scoping review, there are 4 databases, namely Google Scholar, EBSCO, ProQuest, and Science Direct. This database was used to search for articles that matched the purpose of the topic and research questions. This search item explained the literature search strategy. The keywords that had been determined, by adding "OR", and "AND" which are by the topic, namely "literacy of health monitoring information systems in hemodialysis patients".

To select articles, in this case, the reviewer used the Covidence program, which is one of the web-based software that simplifies systematic reviews. First of all, go to the Covidence account, then we import the file or reference, after finishing sending the file, Covidence checks for duplicates and quarantines duplicate references. The number of duplicates detected and removed as well as inclusion and exclusion criteria had been automatically displayed in the PRISM. This Covidence program was to support the production of systematic reviews that are more efficient and easier to use. Evidence can be used starting from the title, abstract, and articles that follow the purpose of the study.

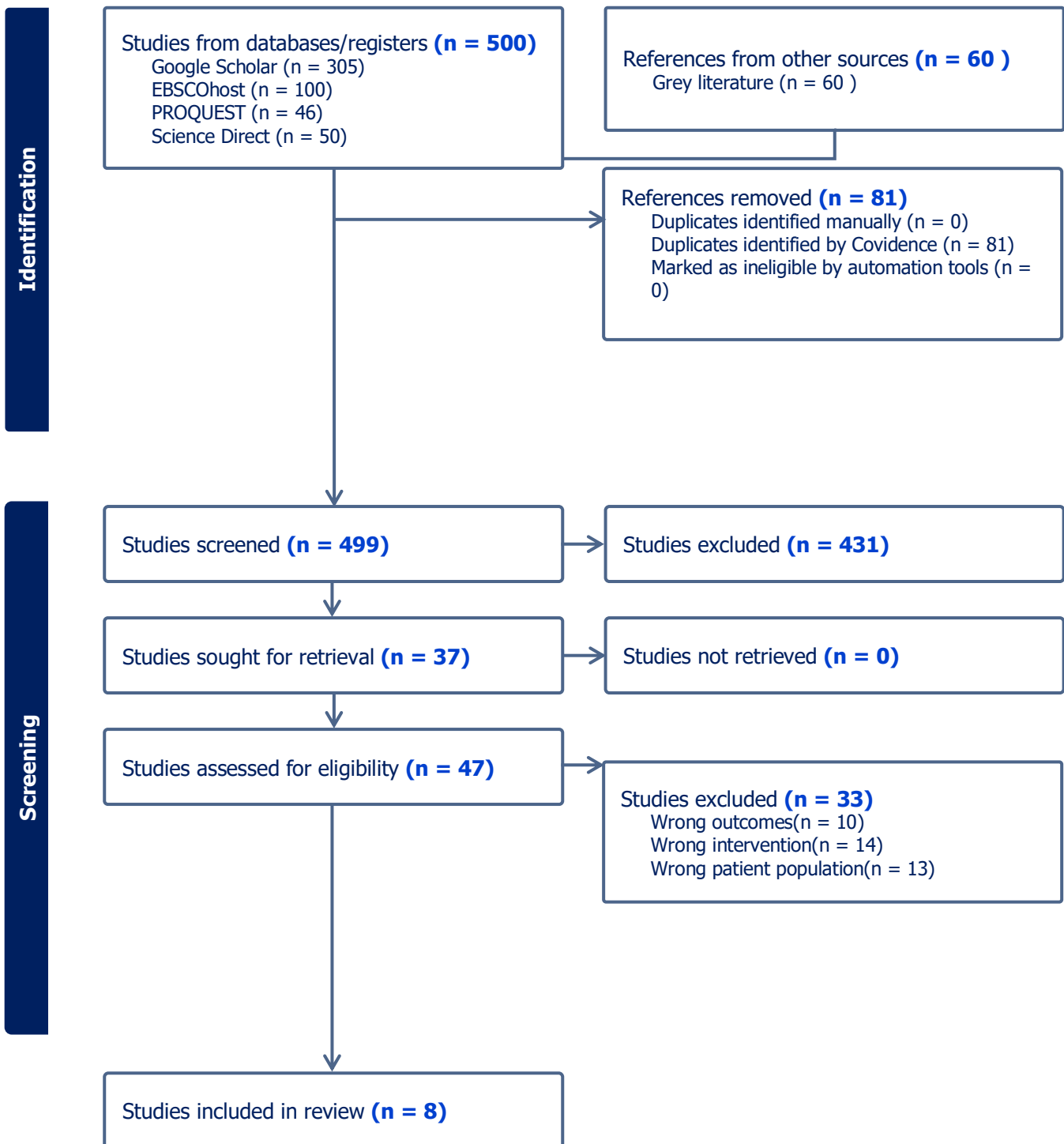


Figure 1. Flowchart prism

Table 3. Data Charting

No.	Title/author/year	Country	Objectives	Types of Research	Data Collection	Participant/Narrow Size	Results
A1	A longitudinal qualitative study to explore and optimize self-management in mild to end-stage chronic kidney disease patients with limited health literacy: Perspectives of patients and health care professionals (Boonstra et al., 2022)	Netherlands	to explore experiences and barriers in self-management from the point of view of LHL patients and Health Professions to identify strategies to optimize self-management.	longitudinal qualitative research	Data collection with semi-structured in-depth interviews	focused group between CKD and LHL patients (n = 24) and HCPs (n = 37) from general practice and hospitals.	The results showed that there are three ways to optimize self-management: providing information early, implementing strategies that human-centered to sustain change, and improving the competence of Health Professions.
A2	Development and application of a chronic kidney disease-specific health literacy, knowledge, and disease awareness assessment tool for patients with chronic kidney disease in Taiwan (Wei et al., 2021)	Taiwan	This study aims to develop a health literacy assessment tool and special knowledge of chronic kidney disease (CKD) to be used in examining the relationship between health literacy, disease-specific knowledge, and disease awareness among CKD patients in Taiwan.	Cross-sectional Study	Formal data were collected through population-based sampling with quotas set according to region and level of hospital accreditation	Patients at least 20 years old who have been diagnosed with CKD at any stage are eligible to participate.	Self-designed instruments are proven to have excellent reliability and validity. The use of instruments in the main study showed that CKD-specific health literacy was significantly associated with age ($\beta = -0.33$, $p < 0.00$), educational attainment, and disease awareness ($\beta = 0.13$, $p < 0.00$). CKD-specific knowledge was also significantly associated with age ($\beta = -0.18$, $p < 0.00$), educational attainment, and disease awareness ($\beta = 0.19$, $p < 0.00$). Among 82 patients/caregivers and
A3	Patient, Caregiver, and Provider Perspectives on	Canada: Calgary,	To describe and explain the	Qualitative study	Data collection with semi-	English-speaking adults who received hemodialysis at a	

	Improving Information Delivery in Hemodialysis: A Qualitative Study (Ferreira da Silva et al., 2021)	Edmonton, Winnipeg, Ottawa, and Halifax.	perspectives of patients, caregivers, and health care providers regarding challenges and information transfer solutions in clinical hemodialysis care.		structured in-depth interviews	health center for more than 6 months, their caregivers, and hemodialysis health care providers. 82 patients/caregivers and 31 healthcare providers	31 healthcare providers, 6 major themes emerged. The identified themes of the patient/ caregiver are (1) being overwhelmed in initiating hemodialysis treatment, (2) the need for peer support, and (3) an increased understanding of the hemodialysis process. The themes identified by the provider are (1) time constraints with patients, (2) relevance of the information provided, and (3) technological innovation to improve patient engagement.
A4	Dietary Application for the Management of Patients with Hemodialysis: A Formative Development Study (El Khoury et al., 2019)	Netherlands	To explain the step-by-step development of a person-centered and theory-based KELA.AE application for Arabic-speaking hemodialysis patients	Qualitative study	Data collection with semi-structured in-depth interviews	6 hemodialysis patients and 6 health practitioners (dietitians and nephrologists)	The KELA.AE application, which includes self-monitoring features, CKD-friendly recipes, and theory- and evidence-based educational features was developed. Qualitative analysis of interviews revealed two main themes from patient interviews' Experiences with diet ', 'Evaluation of applications', and one theme from interviews with healthcare practitioners' Evaluation of applications'. The

							patient expressed frustration with the accessibility of current dietary information as well as the need for educational materials in the application.
A5	Adequate Management of Phosphorus in Patients Undergoing Hemodialysis Using a Dietary Smartphone App: Prospective Pilot Study (El Khoury et al., 2021)	Arab	The purpose of this trial was to assess the potential efficacy of the intervention using the KELA.AE self-education and self-monitoring mobile application regarding phosphorus management in hemodialysis patients.	Prospective pilot study	-	A total of 26 participants were recruited. Patients undergoing hemodialysis for at least 3 months	The findings of this prospective trial reveal the potential efficacy of smartphone applications as supporting nutritional education tools for phosphorus management in patients undergoing hemodialysis. This pilot study shows that the KELA.AE application has the potential to improve knowledge and dietary choices. Strict randomized controlled trials should be conducted to evaluate efficacy and assess the application use of long-term interventions.
A6	Development of Health Literacy for Regular Hemodialysis Patients in Menoufia Governorate: A Cross-Sectional Study (Khamis et al., 2021)	Egypt	To assess the health literacy level of hemodialysis patients in Egypt,	cross-sectional study	439 patients were willing to participate and 6 patients refused resulting in a 98.6% response rate.	Adult patients receiving hemodialysis treatment for more than 3 months and able to communicate with their interlocutors and patients undergoing kidney transplantation or actively working for a living donor transplant, diagnosed with	It was found that poor health literacy was associated with low income (OR = 2.54, CI 95%: 1.66_3.89, P< 0.001), increasing age (OR = 0.12 CI 95%: 0.07_0.19, P< 0.001), low education (OR =

						dementia or mental disorder, having <12 months to live, or undergoing palliative renal care are not included.	1.08, CI 95%: 1.04_1.11, P< 0.001) and patients not undergoing kidney transplant (OR = 4.19 CI 95%: 1.12_15.62, P= 0.033). There was a low level of health literacy among the routine hemodialysis patients studied, this was influenced by education, age, and income and in turn affected treatment adherence. Understanding the relationship between HL and self-care attitudes should enhance efforts to improve hemodialysis outcomes.
A7	The effect of an educational app on hemodialysis patients' self-efficacy and self-care: A quasi-experimental longitudinal study (Hosseini et al., 2023)	Canada	This study aims to determine the effect of educational applications on the self-efficacy and self-care of hemodialysis patients.	quasi-experimental longitudinal single-group research	Simple random sampling is used to take patient samples. The intervention includes educational application	participation of 60 Patients undergoing hemodialysis	The results of the study indicate that education through mobile applications can produce significant improvements in self-care behavior and patient self-efficacy over time. Educational interventions should be provided to hemodialysis patients for several months to enable appropriate integration of learning.
A8	Application of Empowerment Program	Iran	The purpose of this study is to	Randomized, single-blind,	Data were collected with a	The participants were 60 patients who were referred	This study was completed by 58 participants.

on Self-Efficacy of
Patients Under
Hemodialysis: A Clinical
Randomized Controlled
Trial ([Saiednejad et al.,
2018](#))

determine the
effectiveness of the
BASNEF model-
based
empowerment
program on the
self-efficacy of
patients
undergoing
hemodialysis.

parallel,
controlled
trial.

general self-
efficacy
questionnaire

to the hemodialysis center of
Kashan Hospital, Iran.
The intervention group (n =
30) received 8
empowerment program
sessions and the control
group (n = 30) received
routine care for 4 weeks.

However, because the
analysis was based on an
intent-to-treat approach,
all 60 patients were
included in the final
analysis. The comparison
of the two groups showed
that the total self-efficacy
score increased after the
intervention
(65.86 ± 16.42 vs.
 50.3 ± 18.02 , $T=3.24$, P
 <0.002). In addition,
there were significant
differences between self-
efficacy mean scores in
the intervention group
before and after the
empowerment program
($P < 0.0001$), whereas no
significant changes were
observed in the control
group, before and after
the study ($P = 0.17$).
There were no hazards or
side effects associated
with the intervention in
the group.

Critical appraisal results from 8 selected articles were assessed for article quality using critical appraisal from The Joanna Briggs Institute (JBI).

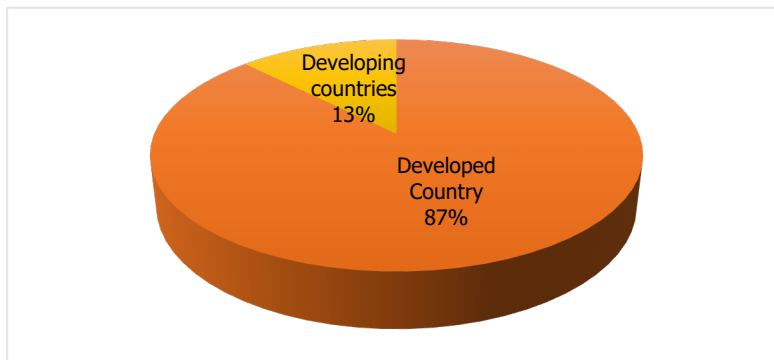
Table 4. Critical Appraisal Score Results

No.	Author/ Year	Critical Appraisal Score Results
A1	Boonstra et al. (2022)	30.a.
A2	Wei et al. (2021)	24.a
A3	Ferreira da Silva et al. (2021)	22.a
A4	El Khoury et al. (2019)	33/A
A5	El Khoury et al. (2021)	29/A
A6	Khamis et al. (2021)	31 (a))
A7	Hosseini et al. (2023)	24.a
A8	Saiednejad et al. (2018)	30.a.

RESULT AND DISCUSSION

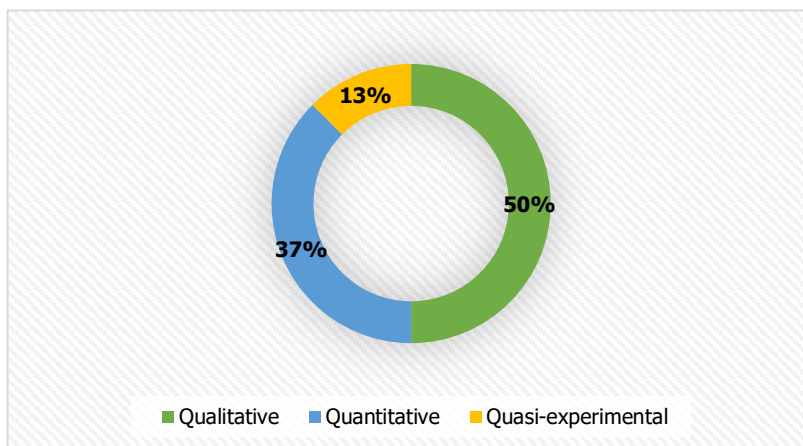
The results of the review show that 8 articles have been selected and are in accordance with good quality, then classified based on the characteristics of the articles, the first characteristics based on characteristics based on country, and research methods. Of the 8 articles extracted, the results of research conducted from developed countries were 2 from the Netherlands, 1 from Taiwan, 2 from Canada, 1 from Egypt, and 1 from Arabia. Meanwhile, from Developing Countries, 1 article was obtained from Iran.

Figure 2. Characteristics by Country



Based on the selected articles and in accordance with the quality obtained, the results showed that the 8 articles used 4 qualitative studies, 3 quantitative studies, and 1 experimental study.

Figure 3. Characteristics Based on Research Methodology



In this mapping step, the authors grouped the interesting study findings reviewed in the article.

Table 5. Thematic Mapping

Theme	Sub-themes	Article
Hemodialysis Perspective	Perspective of Hemodialysis Patients Professional Perspective Level of Anxiety at the Beginning of Hemodialysis Treatment	Boonstra et al. (2022), Wei et al. (2021), Ferreira da Silva et al. (2021), El Khoury et al. (2019), El Khoury et al. (2021), Khamis et al. (2021), Hosseini et al. (2023), Saiednejad et al. (2018)
Treatment monitoring of hemodialysis patients	Use of Technology in improving compliance and self-management Health literacy level of hemodialysis patients	El Khoury et al. (2021), Khamis et al. (2021), Hosseini et al. (2023), Saiednejad et al. (2018), Wei et al. (2021), Ferreira da Silva et al. (2021).

Patients have difficulty understanding this chronic kidney disease so that patients often do not realize the need for self-treatment and even experience a sudden decrease in kidney function or are warned by a specialist (Boonstra et al., 2022). Misunderstanding important information related to disease management is an obstacle for patients to take a more active role in managing their condition (Wei et al., 2021). Diagnosed patients are very difficult to accept the reality and are not yet ready to undergo hemodialysis treatment (Ferreira da Silva et al., 2021). The need for self-efficacy makes patients with chronic kidney disease more obedient to care and diligent inquiries about kidney treatment and important health information for patients with kidney failure (Kurniawan & Yani, 2023). Patients with kidney failure still find it difficult to understand a safe diet and still need informational support from doctors or health workers in guiding foods that can be consumed without nausea. For this study, smartphone applications were created as a nutritional education support tool (El Khoury et al., 2021).

The important role of health workers, especially doctors, is to increase patient awareness of kidney disease with the aim of inspiring commitment to disease management (Wei et al., 2021). Doctors mention that during consultations, they often discuss various other topics, such as diabetes or metabolic syndrome, and not about CKD. Health professionals know effective strategies, such as asking patients to repeat information, but feel untrained or rarely apply it (Boonstra et al., 2022). Professionals need to improve information delivery to facilitate patient-centered hemodialysis treatments (Ferreira da Silva et al., 2021). The implementation of telehealth must be supported by policies and regulations, health workforce resources, facilities, and infrastructure related to the application of telehealth in the health sector (Rasmiati & Mulyono, 2022).

The importance of health worker support for patients with CKD is to increase patient confidence in undergoing treatment so that patients will become more enthusiastic and better understand the needs of the body (Kurniawan & Yani, 2023). The importance of the role of professionals in improving self-efficacy in patients with kidney disease will benefit both patients, namely by preventing complications and receiving more treatment (Saiednejad et al., 2018). Chronic kidney disease will experience a negative response ranging from a sense of rejection of the disease to anger and even depression (Yulisetyaningrum et al., 2023). Patients who are undergoing hemodialysis therapy for the first time will experience psychosocial problems, which are most often patients experiencing mental disorders ranging from severe anxiety, and depression and very difficult to accept reality (Kurniawan & Yani, 2023). The importance of the support of health workers and families can make patients more valuable and receive medical care (Ferreira da Silva et al., 2021). 36.7% of patients with high spiritual quality experienced mild to moderate anxiety, while 20% of patients with moderate spiritual quality experienced panic (Alfiannur et al., 2019).

Health literacy is critical to accessing, understanding, assessing, and using health data so that patients can make better decisions about their health and quality of life. Limited health knowledge can hinder patients' ability to interact with health services and social networks in the right way, negatively impacting their health outcomes (Wei et al., 2021; El Khoury et al., 2021; Boonstra et al., 2022). Decreased health literacy is associated with decreased medication adherence, increased hospitalization, morbidity, and mortality (Taylor et al., 2018). The low level of health literacy among hemodialysis patients is influenced by education, age, and income (Khamis et al., 2021; Hosseini et al., 2023).

With proper health knowledge, kidney disease patients can handle complex treatments involving the use of large amounts of pills and adhere to strict fluid and dietary restrictions (Murali et al., 2019). Frequent and regular interactions with the health care system and nursing staff involved in the care of hemodialysis patients can improve health literacy (Saiednejad et al., 2018). A study states that health literacy is related to

low-income patients (Khamis et al., 2021). This is also in line with the study of Cavanaugh et al. (2015) which reported that lower income among participants, a lower level of health literacy compared to a higher level of health literacy (Cavanaugh et al., 2015). Low health literacy and low compliance are direct causes of high mortality, increased utilization of health resources, and poor quality of life for dialysis patients (Ferreira da Silva et al., 2021). Health literacy assists communication between patients, health care workers, and health care providers to increase knowledge, better understanding, and application of information useful for successful health decision-making (Hosseini et al., 2023). Lower literacy levels lead to reduced knowledge of one's health status, and reduced participation in self-care especially when cognitive impairment is high in patients undergoing dialysis leading to repeated hospitalizations and death (Saiednejad et al., 2018).

Chronic kidney disease (CKD) is a global health burden associated with significant morbidity, affecting about 10-16% of the general population worldwide, with a high impact on the quality of life of patients and their families, which is much higher when compared to chronic kidney disease (Saiednejad et al., 2018). Chronic Kidney Disease (CKD) has a slow progression in the treatment process (Aiyegbusi et al., 2018). The use of IT media (information technology) as an innovation to support health education in chronic kidney failure patients to improve knowledge and self-management is currently becoming trend (Husna et al., 2020).

Various kinds of technology in the form of applications for diets are available and accessible to the public (El Khoury et al., 2021; Khamis et al., 2021; Hosseini et al., 2023). In some chronic diseases, such as chronic kidney disease, the complexity of managing diet puts a burden on patients (Wei et al., 2021; El Khoury et al., 2021; Ferreira da Silva et al., 2021; Boonstra et al., 2022). IT-based education on chronic kidney disease clients such as smartphones, computer-based applications, telehealth, movies, SMS, and website-based interventions can help patients find information about treatment, self-management, and disease management recommended by the healthcare team (Ferreira da Silva et al., 2021).

Nutrition education through mobile apps has resulted in significant improvements in outcomes when dealing with diabetes and weight management (Veinot et al., 2023). In the area of renal nutrition, several mobile applications have shown improvements in terms of self-glucose monitoring, inter-dialytic weight gain, and reduced intake of sodium, potassium, and fluids (de Oliveira et al., 2019). Patients with chronic kidney disease often do not comply with dietary restrictions and in particular phosphorus restrictions (Boonstra et al., 2022). Lack of knowledge and lifestyle changes, caused by dietary restrictions, are often reasons for compliance challenges (Ferreira da Silva et al., 2021). Hyperphosphatemia is therefore common in hemodialysis patients and is a major characteristic of mineral bone abnormalities (El Khoury et al., 2021). Hyperphosphatemia is associated with cardiovascular disease, hyperparathyroidism, and death (Khamis et al., 2021).

Mobile apps can provide hemodialysis patients with ongoing access to self-monitoring and nutrition education (Saiednejad et al., 2018). A diet application developed by a study from the Netherlands shows that a mobile application can serve as an effective self-monitoring tool and has the potential to provide education to patients (El Khoury et al., 2019). Several studies measure the usefulness and feasibility of the application, all of which find at least some aspects of the application feasible and useful, but there are several studies noting the difficulties experienced by some hemodialysis patients in using the application. Non-compliance is a frequently reported problem (El Khoury et al., 2019, 2021; Wei et al., 2021; Ferreira da Silva et al., 2021; Hosseini et al., 2023). Studies evaluating behavioral or dietary management changes related to self-management have all reported some positive changes, especially those related to fluid intake (Saiednejad et al., 2018; El Khoury et al., 2021; Boonstra et al., 2022). Patients evaluating the educational and decision-making processes of chronic kidney disease identified a lack of understanding of differences in modality choice and dialysis burden disclosure (Cassidy et al., 2018). Patient-related challenges include limited health knowledge, cognitive decline, depression, comorbidities, and cultural differences (Pérez-Morales et al., 2022).

This provides a reason to include health literacy evaluations in our participants, to deepen our understanding of their treatment decisions (Sheikh et al., 2021). Challenges that service providers face include limited time and resources, inadequate interdisciplinary care models, and a lack of awareness of patient-related challenges (Schiffer et al., 2021). Educational time and resources, tailored to patient preferences, are important for patient involvement in decision-making (Luyckx et al., 2021). Patients need enough time and information to understand what modalities best suit their lifestyle and to feel ready to start dialysis (Hueso et al., 2018). A joint approach is needed to develop flexible educational tools, decision-making aids that facilitate patient readiness, and decision-making regarding dialysis modalities (Zhianfar et al., 2020). Digital records through mobile apps are focused on improving patient engagement and healthy patient self-management, and hemodialysis helps improve compliance with dietary restrictions on fluids, sodium, potassium, phosphorus, protein, and calories, helping you get better (Saiednejad et al., 2018; El Khoury et al., 2019).

CONCLUSION

The literacy of the hemodialysis patient health monitoring information system urgently requires instrumental and informational support from professionals with the aim of patients being able to carry out hemodialysis treatment regularly and improve patient compliance in managing diet during treatment. Supporting information systems such as the use of applications about the nutrition of GKK patients through mobile phones are very easy to access, making it easier for patients to understand safe nutritional needs during hemodialysis treatment.

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