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Audio-visual learning for the prevention of bloodstream infections in hemodialysis patients with double-lumen catheters: A literature review

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Abstract

Background: Chronic Kidney Disease (CKD) with Double Lumen Catheter Hemodialysis therapy requires comprehensive education to improve patient knowledge of CDL care. Technological developments enable digital-based education to be an effective solution in improving patient understanding.

Purpose: To examine the effectiveness of digital video-based education in improving mental health outcomes and infection prevention behaviors among hemodialysis patients with double lumen catheters.

Method: A literature review by analyzing 20 articles from various databases such as Google Scholar, Science Direct, Scopus, Elsevier, and PubMed.

Results: The use of digital applications as educational media, such as educational videos, Pocket Book Application, EMALA-LISA and Hellodialisa, significantly improve patient understanding of aspects of self-care, diet, and symptom management.

Conclusion: Educational videos have proven effective in improving knowledge about CDL care in CKD patients undergoing hemodialysis therapy.

Keywords: Double Lumen Catheter Care; Educational Video; Hemodialysis; Infection Prevention Behavior.

INTRODUCTION

Hemodialysis is one of the most prevalent renal replacement therapies compared to other modalities such as kidney transplantation and peritoneal dialysis (Fitri, 2024). Hemodialysis is a therapeutic method that can be applied to patients for both short-term and long-term periods. In general, patients undergo hemodialysis sessions two to three times per week, with a minimum duration of four to five hours per session (Fadlalmola & Elkareem, 2020). The incidence of infection associated with the use of double lumen catheters (CDL) has been reported to reach 20–30% during the period of use (1–12 days), and CDL-related infections can lead to sepsis, loss of vascular access, prolonged hospitalization, increased treatment costs, and even death (Badrujamaludin, Budiman, & Erisandi, 2020).

Individuals undergoing hemodialysis generally have weakened immune systems, which increases their risk of infection (Li, Chiu, Zeng, Li, Huang, Yeh, & Yang, 2020). Patients undergoing hemodialysis who still rely on double lumen catheters often experience complications during the intervals between hemodialysis sessions. The incidence of catheter kinking has been reported at 13.6% in HD catheters (Flayyih & Mohammed, 2022). Complications of double lumen catheters include the risk of infection both at the exit site and along the tunnel, catheter dysfunction such as mechanical occlusion of the catheter lumen due to fibrin, occlusion caused by stenosis characterized by swelling and redness of the arm, and narrowing of blood vessels (Markossian, Boyda, Taylor, Etingen, Modave, Price, & Kramer, 2021). From a learning theory perspective, Social

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A literature review

Learning Theory developed by Albert Bandura provides an important foundation. This theory emphasizes that individual behavior can be shaped through observation, modeling, and reinforcement. Patients can learn healthy behaviors by observing examples through media, especially audiovisual media (Azzahra & Herlina, 2024).

Video media as an educational tool enables patients to better understand material because it combines both audio and visual aspects. Audiovisual media are more effective than printed media because they can simultaneously stimulate patients' thoughts, feelings, and actions (Leong, Aloweni, Choo, & Lim, 2023). Well-designed videos have been shown to improve memory related to adherence to fluid restriction among patients with chronic kidney disease undergoing hemodialysis, as well as patient understanding of health messages (Yasari, Taherian, Akbarian, & Vasheghani, 2024). Preliminary study findings indicated that patients often forget that they have a double lumen catheter in place and are hesitant to perform self-care for CDL wounds independently, even though they have received direct explanations and educational leaflets regarding the importance of double lumen catheter self-care (Suryadi, Wahyudin, & Hardianti, 2025).

RESEARCH METHOD

A literature review design. A literature review requires a process of searching and examining various sources, such as books, journals, and other scholarly materials. The framework used in this study was PICOT. PICOT is a framework or acronym used to formulate clear, structured, and specific research questions, particularly in the health field. The acronym includes the following components: Patient/Population/Problem, Intervention, Comparison, Outcome, and Time. The literature search was conducted in November 2025, focusing on journals published within the last five years (2020–2025). The databases used for the literature search were Google Scholar, ScienceDirect, Elsevier, and PubMed. The keywords used in this study were educational video, CDL care, infection prevention behavior, and hemodialysis. The inclusion criteria in this study were original research articles conducted by the authors, with titles related to video-based

education on double lumen catheter (CDL) care and infection prevention behaviors among hemodialysis patients, published in either Indonesian or English between 2020 and 2025, and categorized as research articles. Meanwhile, the exclusion criteria included systematic reviews and literature review articles.

Based on 20 articles that met the eligibility criteria out of 195 identified articles, the results were described as follows: titles and abstracts were screened from multiple databases and journal sources, resulting in 119 articles from Google Scholar, 11 articles from ScienceDirect, 44 articles from Elsevier, and 21 articles from PubMed, with a total of 195 articles identified. These articles were then further screened and refined according to the relevance of the discussed topics, resulting in conclusions that met the predetermined criteria, with a final total of 20 articles included in the review.

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RESEARCH RESULTS

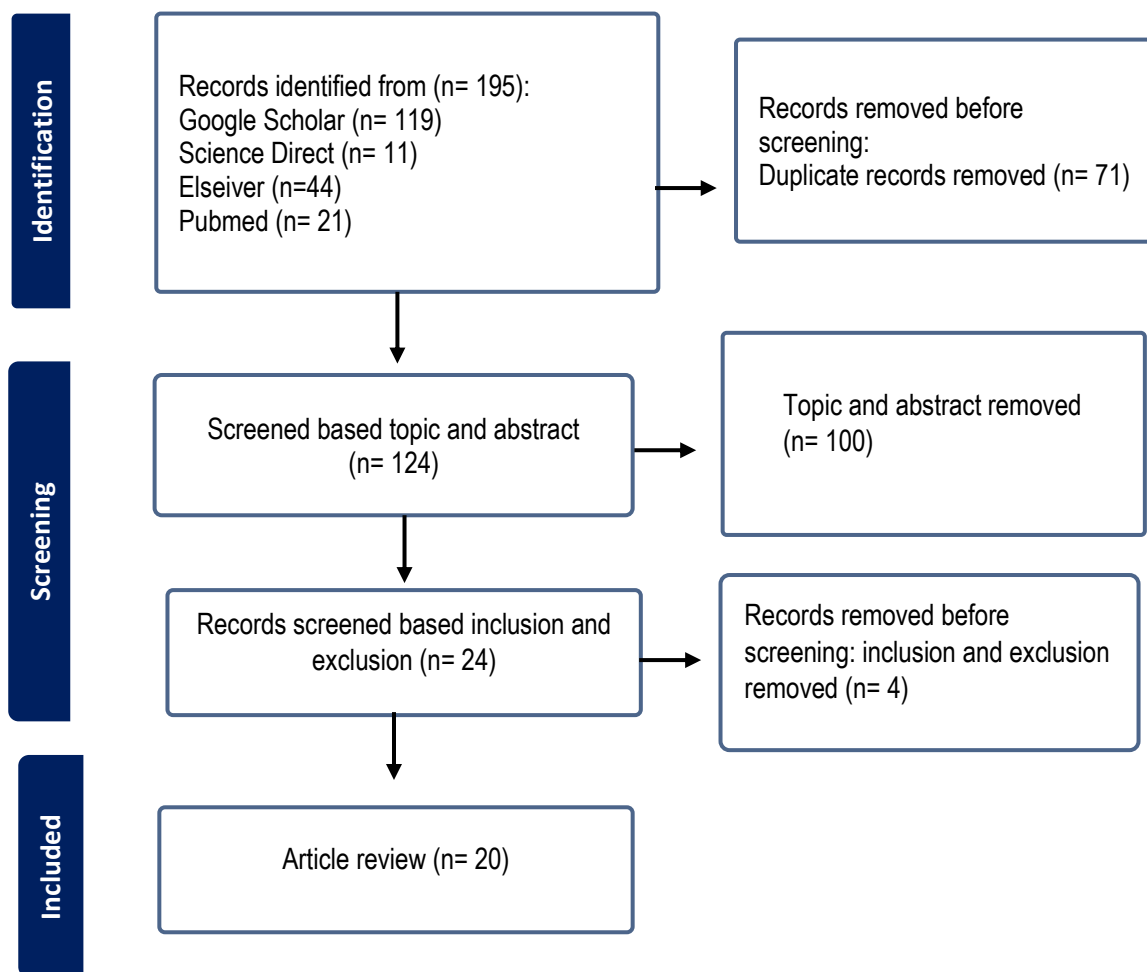


Figure. Diagram Prisma Flow

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Table. Article Review

(Author, Year) (Country)	Purpose	Method	Results
(Badrujamaludin et al., 2020) (Indonesia)	To examine the effectiveness of educational interventions in hemodialysis patients with catheter access.	Quasi-experimental	Education improved patient knowledge and infection prevention practices.
(Pessoa NRC et al., 2024) (Brazil)	To evaluate nursing interventions for catheter care in hemodialysis patients.	Randomized/clinical study	Structured education significantly reduced infection risk indicators.
(Markossian et al., 2021) (USA)	To assess self-care behaviors among dialysis patients.	Observational study	Better education correlated with improved adherence and outcomes.
(Suetsugu-Ishizawa et al., 2025) (Japan)	To analyze patient education strategies in dialysis settings.	Mixed methods	Digital education enhanced patient engagement and confidence.
(Žulpaitė et al., 2025) (Lithuania)	To explore infection prevention practices in vascular access care.	Cross-sectional	Education level influenced compliance with infection prevention.
(Flayyih & Mohammed, 2022) (Iraq)	To determine the impact of educational programs on catheter care.	Experimental	Training improved knowledge and reduced complications.
(Fresia et al., 2024) (Indonesia)	To evaluate video-based education for hemodialysis patients.	Quasi-experimental	Video education increased knowledge and behavioral compliance.
(Al Hasbi, 2021) (Indonesia)	To analyze factors affecting infection prevention behavior.	Cross-sectional	Education and support significantly affected patient behavior.

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(Suryadi et al., 2025) (Indonesia)	To assess interventions to prevent catheter-related infections.	Clinical research	Preventive protocols reduced infection incidence.
(Shi et al., 2024) (China)	To evaluate digital health education in chronic disease patients.	Experimental	Digital media improved self-management ability.
(Liu et al., 2023) (China)	To examine catheter care outcomes after education.	Cohort study	Education improved clinical outcomes and reduced complications.
(Li et al., 2020) (China)	To assess patient education effectiveness in dialysis.	Quasi-experimental	Knowledge and adherence increased after intervention.
(Zhou et al., 2025) (China)	To evaluate multimedia education for vascular access care.	Randomized study	Multimedia education improved patient self-efficacy.
(Fitri, 2024) (Indonesia)	To analyze educational interventions in hemodialysis care.	Quasi-experimental	Education improved prevention behavior significantly.
(Mashuri et al., 2024) (Indonesia)	To determine factors influencing infection prevention behavior.	Cross-sectional	Knowledge and attitude were major predictors.
(Leong et al., 2023) (Singapore)	To evaluate patient-centered education in dialysis units.	Mixed methods	Education improved satisfaction and adherence.
(Fadlalmola & Elkareem, 2020) (Sudan)	To assess infection prevention knowledge among dialysis patients.	Cross-sectional	Knowledge gaps were identified, requiring education programs.
(Khah et al., 2023) (Iran)	To evaluate educational interventions on catheter complications.	Experimental	Education reduced complication rates.

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(Hosseini et al., 2023) (Iran)	To analyze self-care training effectiveness in dialysis patients.	Randomized trial	Training improved self-care and reduced infection risk.
(Azzahra & Herlina, 2024) (Indonesia)	To examine video-based education on catheter care.	Quasi-experimental	Video education significantly improved knowledge and behavior.

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DISCUSSION

This literature review aimed to evaluate the effect of educational videos on double lumen catheter (CDL) care on infection prevention behavior among patients undergoing hemodialysis. The results from 20 studies showed various methods used, including quasi-experiment, descriptive observational, forward chaining, Research & Development (R&D), and the Multimedia Development Life Cycle Model, indicating that the provision of educational videos using digital innovation through applications and mobile devices has a significant effect on improving knowledge and self-care management in patients with Chronic Kidney Disease (CKD) undergoing hemodialysis (Khah, Farsi, & Sajadi, 2023). Several studies also implemented various media innovations for CKD patients, including educational videos, the EMALA-LISA application, Dialysis Patient Pocket Books, leaflets, smartphones, and Hellodialisa (Mashuri, Widyaningsih, Premanawasti, Koot, Pardoel, Landsman-Dijkstra, & Probandari, 2024).

In studies conducted by several researchers, there were differences in the procedures for implementing educational interventions, the target materials delivered, and the educational media used. The types of media and educational approaches provided by researchers were able to improve knowledge, awareness, behavior, and self-management in patients with double lumen catheters undergoing hemodialysis (Al Hasbi, 2021). This study focuses on improving behavior using video-based educational media. Several aspects of knowledge that patients should understand in performing double lumen catheter (CDL) care include the definition of double lumen catheter, complications of double lumen catheter insertion, prevention of double lumen catheter complications, and self-care management for preventing double lumen catheter complications (Žilpaitė, Vyčius, Deinoravičiūtė, Saukaitytė-Butvilė, Rimševičius, & Miglinas, 2025). After conducting research using educational videos about arteriovenous fistula self-care, it was found that patient knowledge and practice showed significant improvement at follow-up in both the control and intervention groups, while attitude improvement was not significant in either group (Zhou, Chen, Yang, Wang, Chen, Zhu, & Zhang, 2025).

The application of telemedicine technology, especially when integrated with smart devices such as smart bracelets, can improve the quality of life of patients with chronic kidney disease undergoing hemodialysis (Suetsugu-Ishizawa, Sakuma, Matsuki, Itano, Nagasu, Morinaga, & Nakagawa, 2025). The idea of an application called Hellodialisa emerges as a functional and innovative solution that can facilitate patients with chronic kidney failure in undergoing hemodialysis and focusing on self-care. Considering the importance of knowledge, it can influence changes in mindset and behavior (Hosseini, Jackson, Chegini, Dehghan, Mazloum, Haghani, & Bahramnezhad, 2023). Knowledge can be defined as an individual's ability to think critically, solve problems, and develop the skills needed to face new challenges, including improving quality of life and self-management in CKD patients undergoing hemodialysis therapy (Samsir, 2022).

Based on the literature search results, several studies have evaluated the effectiveness of mobile-based health applications in supporting the care of patients with chronic kidney disease (CKD) undergoing hemodialysis (Shi, Pu, Peng, Zhang, Li, Huang, & Luo, 2024). Some commonly used mobile health applications include self-care management knowledge, self-efficacy, dietary management, and access to medical information (Pessoa, Sales, Sousa, Lopes, Frazão, & Ramos, 2024). The prerequisites for self-management include attitudes, self-efficacy, perceived ability, and knowledge. Behavior includes individual engagement in self-management activities such as health-related behaviors, use of healthcare services, and medication adherence (Siregar, 2020). Study results indicate the positive potential of mobile-based health applications in improving health-related quality of life, motivation for a healthy lifestyle, treatment adherence, and illness perception.

Analysis of the 20 relevant research articles shows that mobile-based health applications have great potential to improve quality of life and treatment outcomes in patients with chronic kidney disease undergoing hemodialysis. Study results show that 20% of chronic kidney disease patients have low or possibly inadequate health literacy levels. Lack of knowledge and awareness reduces treatment

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A literature review

adherence and increases negative attitudes and perceptions among chronic kidney disease patients (Liu, Yu, Wang, Zhou, Yu, Chen, & Wang, 2023). Most studies recommend new technologies such as mobile applications with various media formats. Research and development results indicate that the implementation of an Android-based mobile expert system application to detect kidney disease facilitates patients or sufferers to easily access relevant information and improve their knowledge (Fresia, Herwina, Nur, Dinda, & Dharul, 2024).

CONCLUSION

There is a significant effect of using educational videos for double lumen catheter care on infection prevention behaviors among patients undergoing hemodialysis. The findings of this study may benefit the care of kidney patients undergoing hemodialysis with double lumen catheters as well as service management, as educational videos can be made available as an evaluated product that contributes to the development of infection prevention behaviors related to CDL use. In addition, video as an educational technology offers advantages such as the ability to replay content repeatedly within the dialysis unit itself without requiring healthcare professionals to demonstrate it each time. However, further research is needed to evaluate long-term effects, impacts on clinical outcomes, and patient satisfaction.

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Audio-visual learning for the prevention of bloodstream infections in hemodialysis patients with double-lumen catheters:
A literature review

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