



EFFECTIVENESS OF TELENURSING IN THE MANAGEMENT OF TYPE 2 DIABETES MELLITUS IN THE ELDERLY: A SCOPING REVIEW

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ABSTRACT

Type 2 Diabetes Mellitus (T2DM) results from insulin resistance and is linked to obesity, which accounts for 80% of diabetes cases. The elderly are particularly vulnerable, facing high treatment costs and self-care challenges, including blood sugar monitoring and diet adherence. Complications include hypoglycemia, neuropathy, and cardiovascular diseases. Telenursing is a promising intervention that enhances adherence and provides remote education. However, further research is needed to assess its long-term effectiveness. Objective: this study aims to assess the effectiveness of telenursing in managing type 2 diabetes mellitus in the elderly. Method: This scoping review follows the PRISMA-ScR guidelines, analyzing studies from ProQuest, PubMed, and Scopus. Inclusion criteria focused on studies evaluating the impact of telenursing on elderly patients with T2DM using quantitative or mixed-method approaches. Results: From 716 screened articles, seven met the inclusion criteria. Most studies were conducted in Iran, Saudi Arabia, and Slovenia, with one multinational study involving ten countries. Six studies employed quantitative methodologies, including randomized controlled trials and clinical studies. Findings indicate that telenursing significantly improves medication adherence, blood glucose control, and self-management. It reduces the need for in-person visits and enhances patient education, leading to better glycemic control and lower complication risks. Conclusions: Telenursing proves to be an effective approach for managing T2DM in the elderly, promoting adherence and self-care while reducing healthcare facility visits. Further research is required to evaluate its long-term sustainability and effectiveness.

Keywords: elderly; telenursing; type 2 diabetes mellitus

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INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disorder caused by changes in insulin secretion and its effects. Type 2 DM is characterized by high blood glucose levels resulting from insulin resistance or relative insulin deficiency (Esmaeilpour-BandBoni et al., 2021). Type 2 diabetes is recognized as a metabolic disease that leads to dysfunction of vital organs due to chronic hyperglycemia. It is commonly associated with age, environmental changes, and behavioral patterns (Shahsavari & Bavarsad, 2020). One of the major risk factors for type 2 diabetes is obesity. The World Health Organization (WHO) in Europe reports that 80% of type 2 diabetes cases are caused by overweight and obesity. Recent evidence suggests that weight loss through medication and surgery has a positive impact on improving diabetes symptoms (Shahsavari & Bavarsad, 2020).

Age is a critical factor in the development of type 2 diabetes. Its prevalence increases with age, making it more common in older individuals. The global elderly population is expanding rapidly and is expected to double in the next four decades, particularly in developing countries (Esmaeilpour-BandBoni et al., 2021). The World Health Organization (WHO) estimates that 171 million people worldwide suffer from diabetes, and by 2030, this number will rise to 366

million (Esmailpour-BandBoni et al., 2021). The International Diabetes Federation (IDF) predicts that the global prevalence of diabetes will increase from 382 million in 2013 to 592 million by 2035 (Shahsavari & Bavarsad, 2020). WHO has classified diabetes mellitus as an undetected epidemic, with 190 million people currently diagnosed with diabetes. It is among the leading causes of morbidity and mortality, with 4 million deaths annually due to diabetes complications, equating to one death every 10 seconds (Akbarirad et al., 2023). Diabetes is prevalent among the elderly, incurring significant treatment costs for both patients and governments. Elderly individuals face limitations in performing essential self-care activities such as regular blood glucose monitoring, adherence to dietary management, and a lack of knowledge, necessitating patient training (Ravari et al., 2021).

Although there is no definitive cure for diabetes, it can be managed. Researchers identify five key components in diabetes management: nutrition, exercise, blood sugar control, medication, and patient education (Akbarirad et al., 2023). Poorly controlled type 2 diabetes leads to acute and chronic complications affecting various aspects of life. Acute complications include hypoglycemia, ketoacidosis, and hyperosmolar hyperglycemic syndrome. Long-term complications involve severe health issues due to macrovascular and microvascular changes and neuropathy (Esmailpour-BandBoni et al., 2021). Other diabetes-related complications include retinopathy, nephropathy, diabetic foot, depression, chronic kidney disease, and cardiovascular diseases (Akbarirad et al., 2023). Elderly patients often struggle with essential self-care activities such as regular blood glucose monitoring, dietary adherence, and lifestyle adjustments, highlighting the necessity for patient training (Ravari et al., 2021). An estimated 50% of diabetes patients make errors in self-care. Many forget important information, struggle with learning new skills, and face emotional barriers that reduce their ability to maintain consistent self-care (Shahabi et al., 2022). Patients with sufficient knowledge of self-care, medication use, and healthy lifestyle practices can significantly prevent most diabetes-related complications (Esmailpour-BandBoni et al., 2021). Lack of awareness among patients and their families regarding the importance of diabetes care leads to various issues at home (Shahabi et al., 2022). Additionally, busy schedules prevent many type 2 diabetes patients from regularly visiting healthcare providers. Many patients also reside in remote areas with limited or no access to healthcare services (Akbarirad et al., 2023).

Traditional diabetes education programs typically involve group training sessions and hospital-based training. However, these methods often fall short, as each individual has unique needs that must be addressed at different times (Shahsavari & Bavarsad, 2020). Initial face-to-face education, followed by telephone-based telenursing interventions, has been shown to improve diabetes management, as evidenced by significant reductions in HbA1c levels in previous studies (Esmailpour-BandBoni et al., 2021). Telephone-based telenursing has proven to be an effective strategy for managing type 2 diabetes in the elderly. This approach facilitates patient care and monitoring, encourages active participation from patients and their families, educates patients on healthy lifestyle choices, and helps them develop individualized care plans for maintaining and improving their health. Since many elderly patients are illiterate or have limited access to information technology, the intervention was conducted exclusively through phone calls (Esmailpour-BandBoni et al., 2021). Telenursing refers to remote nursing care that enhances the quality of healthcare services by providing training, collecting information, implementing nursing interventions, pain management, and supporting patient families through communication devices such as the internet, telephone, and video calls. Studies show that SMS follow-ups significantly reduce fasting blood sugar (FBS) and HbA1c levels, demonstrating the positive effects of telenursing (Ravari et al., 2021). Telenursing is an effective care approach to ensure continuity of care for elderly patients after hospital discharge and supports informal caregivers (Alhawiti, 2023a).

While telenursing offers time and cost-saving benefits, it also has limitations, especially for elderly patients with hearing and vision impairments (Ravari et al., 2021). Additionally, most studies focus on patients referred to outpatient clinics (Shahsavari & Bavarsad, 2020). Prospective controlled trials with larger samples are needed to evaluate the effectiveness of this strategy and confirm the findings from this review (Akbarirad et al., 2023). Further research should include a broader population and monitor patients for at least five years to assess long-term outcomes (Mihevc et al., 2022). The level of elderly patient satisfaction with telenursing services varies across different studies. Due to inconsistent findings, this study aims to assess the effectiveness of telenursing in managing type 2 diabetes mellitus in the elderly.

METHOD

Literature Search Strategy

Protocol and Registration

The scoping review was written following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines, which are divided into several sections, including the title, abstract, and introduction (which covers the rationale for topic selection and objectives), research methods, critical findings from sources of evidence, summary, and conclusion. PRISMA-ScR focuses on reporting reviews that evaluate randomized trials but can also serve as a basis for reporting systematic reviews of other types of research, particularly for assessing an intervention.

Search Databases

The data used in this scoping review consists of research articles published in reputable journals indexed nationally and/or internationally. The literature search was conducted using electronic journal databases, including Scopus, Scopus AI, ProQuest, and PubMed.

Keywords

The article search process utilized keywords and Boolean operators (AND, OR, and NOT) to broaden and specify the search, making it easier to determine relevant articles for use. The keywords used in this scoping review include:

Table 1.
Keywords

Diabetes Mellitus Type 2	Telenursing	Elderly
Diabetes Mellitus Type 2	Telenursing	Elderly
OR	OR	OR
Type 2 Diabetes	Telecommunications	Aged
OR	OR	OR
Noninsulin-Dependent Diabetes Mellitus	Telemonitoring	Older Adults
OR		
Glycemic control		

Inclusion and Exclusion Criteria

Inclusion criteria for this scoping review are:

1. Full-text articles published in the last five years (2019-2024).
2. Articles that include elderly participants aged >45 years.
3. Studies that evaluate telenursing as the primary method for managing type 2 diabetes mellitus.

Exclusion criteria:

1. Studies involving patients with type 1 diabetes mellitus.
2. Studies using non-telenursing technology or where telenursing is only a supplementary method.

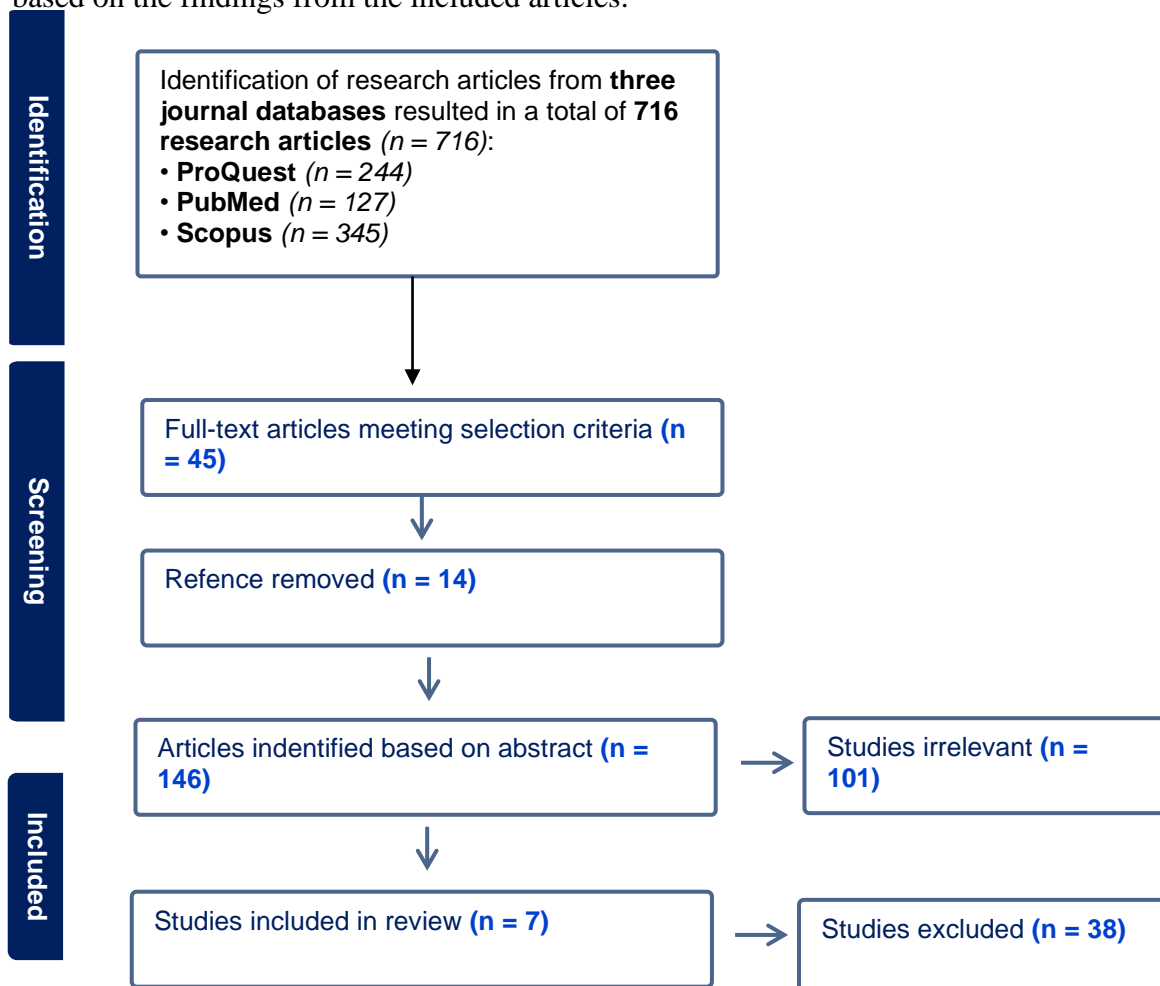
The article search process was conducted based on the predetermined criteria and relevant keywords.

Article Selection

The article search process began by inputting keywords using Boolean operators into the selected electronic journal databases. Once a set of articles was retrieved, a selection process was conducted following the PRISMA-ScR 2009 Flow Diagram, which included:

4. Screening based on title similarity,
5. Applying inclusion-exclusion criteria to abstracts, and
6. Applying inclusion-exclusion criteria to full-text articles.

In this scoping review, critical appraisal was not conducted to assess the quality of the articles, as the aim was to explore the role and effectiveness of telenursing in diabetes management across various research designs. Once the selection process was completed, the articles were extracted, followed by synthesis analysis, and then structured into a review based on the findings from the included articles.



RESULT

Seven articles were reviewed, employing a quantitative approach through randomized controlled trials, clinical studies, narrative reviews, and quasi-experimental designs. Most of the research was conducted in middle- to high-income countries, including Iran, Saudi Arabia, and Slovenia. Findings indicate that telenursing is effective in improving health outcomes for elderly individuals with chronic conditions like diabetes. However, its success is influenced by cultural factors, technological access, and the limitations of study designs, such as small sample sizes and short durations. Telenursing positively impacts chronic disease management in the elderly, including blood sugar control, medication adherence, quality of life, and self-efficacy, though operational challenges exist in its implementation.

Glycemic Control / HbA1c

Diabetes Mellitus (DM) is a metabolic disorder resulting from insulin secretion abnormalities or resistance, leading to elevated blood glucose. Type 2 DM occurs due to insulin deficiency, while Type 1 DM is linked to insulin resistance or relative deficiency. Major complications of DM, like coronary heart disease, myocardial infarction, retinopathy, and neuropathy, can be reduced with proper glycemic control. A UK study showed a 1% reduction in HbA1c levels led to a 25% reduction in diabetes-related mortality and a 10% reduction in myocardial infarction (Esmailpour-BandBoni et al., 2021). HbA1c and fasting blood glucose are the main markers for glycemic control, with HbA1c reflecting blood glucose over the past three months. Modern tools, such as web-based diabetes management systems (eMOD), have shown effectiveness in reducing HbA1c levels (Mihevc et al., 2022). Telenursing has also proven successful, reducing HbA1c by 0.68% compared to conventional care (Shahsavari & Bavarsad, 2020). Further research has revealed that family-based empowerment telenursing can improve patient adherence to dietary plans, directly impacting significant reductions in HbA1c levels. In the study by Shahabi et al., (2022), Additionally, family-based telenursing interventions have improved patient adherence to dietary plans, with a study showing a 1.82% HbA1c reduction, higher than the 1.54% reduction seen in conventional treatment. These findings highlight the effectiveness of telemedicine and telenursing in managing diabetes, improving glycemic control, and enhancing patients' quality of life.

Table 2.
Identified Themes

Themes	Specific Aspect	Source
Glycemic Control	HbA1c	(Esmailpour-BandBoni et al., 2021) (Shahsavari & Bavarsad, 2020) (Ravari et al., 2021) (Shahabi et al., 2022) (Faleh AlMutairi et al., 2021) (Mihevc et al., 2022)
	Fasting Blood Sugar	(Ravari et al., 2021) (Alhawiti, 2023a) (Mihevc et al., 2022)
Patient Satisfaction	Disease Management	(Shahsavari & Bavarsad, 2020)
	Glycemic control without the risk of infection	(Faleh AlMutairi et al., 2021)
Clinical Outcomes	Reduction of diabetes complications	(Esmailpour-BandBoni et al., 2021)
	Effect of Telenursing on BMI	(Shahsavari & Bavarsad, 2020)
	Patient Adherence to Dietary Regimen	(Shahabi et al., 2022)
	Improvement in Self-Efficacy	(Shahabi et al., 2022) (Alhawiti, 2023a) (Mihevc et al., 2022)
	Quality of Life	(Mihevc et al., 2022)
	Success in Blood Glucose Control	(Ravari et al., 2021)

Themes	Specific Aspect	Source
Cost-Effectiveness	Cost-Effective Method	(Ravari et al., 2021)
	Incremental Cost-Effectiveness Ratio (ICER)	(Faleh AlMutairi et al., 2021) (Mihevc et al., 2022)
Educational Interventions	Diet	(Esmaeilpour-BandBoni et al., 2021) (Shahsavari & Bavarsad, 2020) (Ravari et al., 2021) (Shahabi et al., 2022)
	Blood Sugar Management	(Esmaeilpour-BandBoni et al., 2021)
	Complications	(Esmaeilpour-BandBoni et al., 2021)
	Self-Care	(Esmaeilpour-BandBoni et al., 2021)
	Exercise	(Shahsavari & Bavarsad, 2020) (Ravari et al., 2021)
	Medication Use	(Shahsavari & Bavarsad, 2020) (Ravari et al., 2021) (Faleh AlMutairi et al., 2021)
	Caregiver Training on Care Strategies	(Alhawiti, 2023a)
	Stress Management	(Alhawiti, 2023a)
	Device Usage	(Mihevc et al., 2022)
	Technological Aspects	Phone Calls
WhatsApp		(Alhawiti, 2023a) (Faleh AlMutairi et al., 2021)
SMS		(Faleh AlMutairi et al., 2021)
Smartphone Android LG K22®		(Mihevc et al., 2022)

Patient Satisfaction

The study by Shahsavari & Bavarsad (2020) highlighted that telephone follow-ups are an effective method for improving blood sugar levels and BMI in illiterate adults with type 2 diabetes, particularly those aged 50 and above. This simple and accessible telenursing approach is especially beneficial for patients in remote areas, offering a practical solution for diabetes management through better nurse-patient communication. Telenursing improves care quality, saves time, and enhances patient satisfaction. (Shahsavari & Bavarsad, 2020). Similar studies have also shown that telenursing not only contributes to diabetes management but also enhances various aspects of patient quality of life, particularly in terms of resilience and physical health. For example, a study by Faleh AlMutairi et al., (2021) found that telenursing enhanced patient satisfaction with diabetes treatment, though it didn't show significant changes in quality of life. During the COVID-19 pandemic, 97% of patients were satisfied with telemedicine, which helped maintain blood sugar control while avoiding infection risks. Most patients supported the ongoing use of telemedicine, indicating its potential as a sustainable tool for diabetes management, especially during times of social distancing.

Clinical Outcomes

Several studies highlight the effectiveness of telenursing in improving clinical outcomes for diabetes management, including reductions in HbA1c, BMI, and fasting blood sugar (FBS). The study by Esmaeilpour-BandBoni et al., (2021) demonstrated that telenursing improves care outcomes by enhancing education and reducing complications. Similarly, Shahsavari & Bavarsad, (2020) found significant improvements in blood glucose control and BMI in elderly diabetes patients. Consistent findings were reported by Ravari et al., (2021), emphasized that better adherence to dietary patterns and self-management leads to improved diabetes control. Moreover, Shahabi et al., (2022) noted that telenursing enhances patient self-efficacy and

reduces caregiver burden. In parallel, Alhawiti (2023) confirmed that telemedicine results in better clinical outcomes, including HbA1c reductions. Additionally, while the study by Faleh AlMutairi et al., (2021) found no definitive results, their study suggested that telemonitoring increases patient engagement and may improve quality of life. Telemonitoring is expected to reduce diabetes complications by tracking clinical indicators, such as blood pressure (systolic and diastolic reduction) and glycemic levels (Mihevc et al., 2022). Overall, these studies underscore the role of telenursing and telemedicine in improving diabetes management and patient quality of life.

Cost-Effectiveness

Several studies have explored cost-effective healthcare methods, such as telenursing, which offers remote education and monitoring, particularly in low-income communities. In Iran, for example, health centers are widely used due to their affordability, with nearly 90% of the population insured (Esmaeilpour-BandBoni et al., 2021). However, access to health education is limited, especially in rural areas, making telenursing a promising solution. Telenursing, using phones or the Internet, is more cost-effective than in-person visits and has been shown to improve blood sugar control, prevent complications, and help manage chronic conditions. Research by Ravari et al. (2021) found that telephone consultations are popular and cost-effective, allowing patients in remote areas to access quality care. Telenursing also strengthens patient-caregiver relationships and reduces follow-up visits. It has been shown to improve the quality of life for type 2 diabetes patients, providing personalized care and yielding better clinical outcomes, including lower HbA1c and improved blood pressure control (Shahabi et al., 2022).

Educational Interventions

Several studies have shown that telenursing is an effective method for managing type 2 diabetes in the elderly through structured education. Based on materials from the Iranian Ministry of Health, this program covers topics like nutrition, blood sugar control, complications, and self-care, delivered via regular phone calls (Esmaeilpour-BandBoni et al., 2021). It includes eight 30-minute sessions for both patients and their families, empowering families to support the patient's care, particularly with nutrition and daily activities (Shahabi et al., 2022). Nurses also receive professional training through telemedicine on specialized diabetes care and stress management (Ravari et al., 2021). The program also covers medication adjustments, COVID-19 prevention, and equipment use for self-management. Overall, telenursing helps patients improve glycemic control, understand their condition, and involve family members in their care, leading to better disease management and quality of life (Faleh AlMutairi et al., 2021).

Technological Aspects

Research shows that technology, particularly telephones, plays a key role in telenursing by enabling effective communication between patients and nurses (Esmaeilpour-BandBoni et al., 2021). Telephones facilitate telehealth services, routine monitoring, and health education, allowing patients to access medical advice without visiting healthcare facilities (Shahabi et al., 2022). This technology allows real-time data analysis, rapid feedback, and adjustments to care plans, improving chronic disease management (Alhawiti, 2023a). By integrating various devices and platforms, telenursing enhances service quality, extends reach, and promotes patient independence in managing their health.

DISCUSSION

Telenursing is an effective approach in the management of diabetes among elderly patients with chronic conditions, leading to HbA1c reduction, increased patient satisfaction, and

improved clinical outcomes (Alhawiti, 2023; Esmaeilpour-BandBoni et al., 2021; Feigin et al., 2021; Shahsavari & Bakhshandeh Bavarsad, 2020). Telenursing supports patient medical adherence in multiple ways, including discussions to identify and overcome barriers, helping patients develop problem-solving strategies, providing reminders to take medications on time, and utilizing educational tools to enhance understanding of the importance of treatment (Shahsavari and Foroghi, 2015; AkbariRad et al., 2023). Telenursing has the potential to serve as an effective tool for improving the quality of care and promoting patient independence in sustained diabetes management. Telemedicine is an effective strategy for diabetes management, particularly in glycemic control (Esmaeilpour-BandBoni et al., 2021; Shahabi et al., 2022; Shahsavari & Bavarsad, 2020). Telemedicine facilitates medication adjustments, blood sugar monitoring, and improved patient adherence (Asadi et al., 2025; Duffy & Lee, 2018; İşleyen et al., 2025; Marlina et al., 2023; Mushcab et al., 2015; Sotomayor et al., 2023; Wahyuni et al., 2023). Remote monitoring using Continuous Glucose Monitoring (CGM) and Flash Glucose Monitoring (FGM) allows physicians to quickly adjust treatments, improving glycemic control and reducing glucose levels (Sotomayor et al., 2023). A study by De Groot et al., (2021) demonstrated that a six-month telemedicine intervention significantly reduced HbA1c levels, supporting better glycemic control in diabetes patients. Furthermore, various telemedicine methods, such as text messaging, mobile applications, interactive phone calls, and video conferencing, have proven effective in reducing HbA1c levels, with interactive phone calls and video conferencing yielding the most optimal results (De Groot et al., 2021). Text messaging has been effective in managing blood sugar levels and cardiovascular risk factors through a low-cost approach, focusing on diet, exercise, medication adherence, and blood glucose monitoring (Haider et al., 2019; Peimani et al., 2016). Personalized messages tailored to individual needs have shown better outcomes in lowering HbA1c levels and improving patients' lifestyles (Haider et al., 2019). Family empowerment-based telenursing has also demonstrated significant impacts by enhancing patient adherence to dietary plans and reducing HbA1c levels (Sotomayor et al., 2023). Additionally, interview-based interventions using telenursing are considered an effective implementation for addressing self-efficacy, self-management, and metabolic control parameters in individuals with type 2 diabetes (Asadi et al., 2025; İşleyen et al., 2025). Telemedicine emerges as an innovative solution that not only improves glycemic control in diabetes patients but also offers a more affordable, personalized, and effective approach to overall healthcare management.

Telephone-based telenursing enhances access in remote areas, facilitates information sharing, reduces costs, and increases patient satisfaction by providing safer and more effective diabetes management (Shahsavari & Bavarsad, 2020). Telenursing leverages information technology to support the care of type 2 diabetes patients through self-evaluation, monitoring, decision-making, and personalized recommendations outside of healthcare facilities (Akbarirad et al., 2023). This approach includes telemonitoring and tele-education, both of which have been proven effective in improving diabetes control by promoting healthy behavioral changes and ensuring access to medical care (Akbarirad et al., 2023). Remote monitoring facilitates continuous health assessment and provides quick access to medical care, enhancing patients' sense of security and overall quality of life (Sotomayor et al., 2023). The development and expansion of telenursing implementation should be prioritized, especially in remote areas, to ensure more equitable access to effective and affordable diabetes management. Sjattar et al., (2024) also utilized mobile telenursing to measure the reduction in fasting blood glucose (FBG) and found that health education through mobile-based telenursing and standard health education from health centers both had an impact on FBG levels in diabetes mellitus patients.

Type 2 diabetes affects patients' quality of life through dietary changes, medication dependence, complications, and financial burdens, making quality-of-life improvement a

primary goal in telenursing management (Akbarirad et al., 2023). Patient quality of life also depends on their resilience and physical health condition (Kaur et al., 2015; Shahsavari & Bavarsad, 2020). Telenursing has been proven effective in improving lifestyle and clinical conditions in diabetes patients and is recommended for integration into healthcare plans across various settings (Akbarirad et al., 2023; Magbool et al., 2021). Research by Asma et al. also demonstrated that telenursing effectively improves quality of life in women with gestational diabetes (Mohamed et al., 2023). Proper diabetes control can reduce the risk of complications and lead to an improved quality of life (Akbarirad et al., 2023). Therefore, the integration of telenursing into diabetes care can serve as a strategic approach to comprehensively improving patients' quality of life. However, several factors influence the implementation of telenursing, including cultural factors (Shahabi et al., 2022) and the process of integrating telenursing for elderly patients with type 2 diabetes mellitus (Firouzkouhi et al., 2021). Cultural differences within communities present specific challenges in telenursing implementation. Understanding cultural perspectives from both patients and nurses is essential in ensuring effective diabetes mellitus type 2 care (Shahabi et al., 2022). The operation and usage of the telenursing system pose another challenge in its implementation. The use of devices such as smartphones, tablets, or computers among elderly patients presents specific difficulties in managing type 2 diabetes (Firouzkouhi et al., 2021). Key aspects of care between patients and nurses, such as blood sugar monitoring, remote interventions, patient education, wound management, and dietary management, remain significant challenges in the current adoption of telenursing. Therefore, innovation is needed to enhance cultural understanding and improve methods or operational processes in telenursing. This will enable the optimal implementation of telenursing in type 2 diabetes care, ensuring more effective and efficient patient management.

CONCLUSION

Through the selection process of articles from three journal databases (ProQuest, PubMed, and Scopus), a total of 716 articles were evaluated, resulting in 7 selected studies. This research demonstrates that telenursing can be an effective method for improving the management of type 2 diabetes in the elderly, particularly by enhancing patient knowledge, medication adherence, and self-monitoring. This approach reduces the need for in-person visits to healthcare facilities, providing a practical and cost-effective solution for diabetes management. Involving family members in the implementation of telenursing programs for the elderly can enhance the effectiveness of type 2 diabetes care, ensuring optimal management and support throughout the treatment process.

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