



# **Telehealth Monitoring in Diabetes Care: A Literature Review on Nursing Interventions**

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## **ABSTRACT**

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Telehealth has become an essential tool in diabetes management, offering remote monitoring, virtual consultations, and digital health interventions. Nurses play a critical role in telehealth by providing patient education, monitoring glucose levels, and supporting self-management.

This literature review examines the effectiveness of nursing-led telehealth interventions in diabetes care and explores the challenges of implementation. A systematic review of peer-reviewed studies published in the last decade was conducted. Findings indicate that telehealth interventions improve glycaemic control, enhance patient adherence, and reduce hospitalizations. However, barriers such as digital literacy, connectivity issues, and data security concerns remain significant.

Addressing these challenges through improved infrastructure and policy integration is essential for optimizing health in nursing practice. This review contributes to the growing body of evidence supporting telehealth as a sustainable model for diabetes care.

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Key words: Diabetes care, telehealth, nursing interventions, remote monitoring, digital health

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## 1 INTRODUCTION

During the last decade, the provision of healthcare services has changed significantly with the advent of digital healthcare, with telehealth and telemedicine being the most important ones. These digital health technologies bring together healthcare providers and patients, bridging the geographical obstacles and providing care, especially to the lower socio-economic areas. (Lebar et al., 2022.) Telehealth is observed to be beneficial for patient care because it increases accessibility, minimizes the congestion caused by frequent visits, and provides timely consultations for diseases, such as diabetes mellitus (DM), which has shown significant positive outcomes through remote monitoring and critical interventions (Goh et al., 2022).

Diabetes mellitus, especially Type 2 diabetes (T2DM), is a major global health issue and the main cause of high morbidity and mortality (Galicia-Garcia et al., 2020). The steady increase of diabetes amplifies the stress on the health system and thus the demand for innovative telehealth solutions (Goh et al., 2022).

Nurses play a critical role in this telehealth framework. They are the primary virtual contact the patients have and the support that they provide is indispensable. (Lebar et al., 2022.) The central position of nurses in the telemedicine process includes their involvement in virtual checkups, carry out remote triage, and ensure the adherence of the medical instructions by the patients (Ochs et al., 2022).

Despite the positive outcomes associated with telehealth in diabetes management, gaps remain in optimizing nursing interventions (McElroy et al., 2020). This thesis aims to evaluate the role of nursing in telehealth-based diabetes care through a systematic literature review, assessing the effectiveness of nursing interventions, identifying limitations, and providing recommendations for enhancing nurses' roles (Aloke et al., 2022). By examining these interventions, this thesis will contribute to understanding how nurses can leverage telehealth technologies for more effective diabetes management, ultimately enhancing patient care and outcomes (Goh et al., 2022).

## **2 BACKGROUND**

### **2.1 Diabetes**

Diabetes mellitus is a chronic metabolic disorder which is characterized by persistent hyperglycaemia due to either the deficit in insulin secretion or insulin action or a combination of both. It is further sub-divided into two fundamental types: Type 1 Diabetes Mellitus (T1DM) which is a result of the autoimmune process which leads to the destruction of the insulin-producing beta cells and Type 2 Diabetes Mellitus (T2DM) which is primarily connected to overweight and the consequent insulin resistance. The occurrence of diabetes, especially Type 2, has been on the increase globally, affecting 8.5% of adults as of 2014 (WHO), contributing to the emergence of significant healthcare-related problems. (Antar et al., 2023.)

Diabetes targets multiple organs resulting in severe complications, including cardiovascular disease, neuropathy, nephropathy, and retinopathy (Kharroubi et al., 2015). Insulin resistance greatly impairs the main tissues such as the liver, skeletal muscles, and adipose tissue, thus aggravating these complications (Aloke et al., 2022). A comprehensive approach comprised of lifestyle modifications, medications, and regular monitoring is essential in managing diabetes, to achieve good blood glucose levels and prevent long-term complications (Galicía-García et al., 2020). Traditional diabetes treatment requires patients to visit doctors or hospitals in person. These consultations present obstacles because many individuals lack access to medical facilities, face expensive fees or fail to follow their care plans. The shift of healthcare systems toward digital options has made telehealth a very effective method to deliver diabetes care. (Lee et al., 2020.)

### **2.2 Telehealth**

Telehealth represents direct healthcare delivery via digital tools or communication networks, which has become fundamental to nursing or patient treatment. The American Nurses Association (ANA) emphasizes how telehealth nurses serve patients, families plus communities through virtual settings in primary as well as specialty care. Medical services happen either in real time via video calls

or through stored data exchanges like emails along with remote patient checks. A result of this practice includes better medical access for underserved locations next to improved doctor consultations. (Lebar et al., 2022.)

The complexity involved in the management of diabetes has led to the popularity of newer forms of treatment such as telehealth that allow for constant care while monitoring the patient remotely. This form of treatment allows a timely intervention when it is required. Nurses are very important when it comes to integrating telehealth into healthcare systems. They can educate the patients and give them the necessary support which in turn improves self-management while decreasing the number of hospital admissions which enhances the life of diabetic patients. (Galindo et al., 2023.)

### **3 RESEARCH AIM, OBJECTIVES AND QUESTION**

#### **3.1 RESEARCH AIM**

The aim of this research study is to critically review and synthesize existing literature on telehealth monitoring in diabetes treatment, with an emphasis on nursing interventions.

#### **3.2 RESEARCH OBJECTIVE**

The objective is to examine and analyse the various nursing interventions employed in telehealth-based diabetes care.

#### **3.3 RESEARCH QUESTION**

This research study aims to answer the question:

What are the various nursing interventions employed in telehealth-based diabetes care?

## 4 METHODOLOGY

### 4.1 Research Method

A systematic literature review constitutes the main research method used in this thesis. The systematic approach delivers a thorough overview of research that focuses on one specific question. It identifies, selects, evaluates or synthesizes quality evidence for the research topic. (Khan et al., 2011.)

Systematic review process often begins with a thorough search strategy involving the selection of pertinent databases, i.e., PubMed, CINAHL, or Cochrane Library, and use of specific search terms that are relevant to the research question (Higgins et al., 2011). This is then supplemented by screening articles for inclusion based on the agreed criteria and key information extraction such as study design, participant data, and outcomes (Moher et al., 2015). All the studies included within the review are critically appraised for quality typically using established evaluation tools to verify that only quality studies are contributed to the synthesis (Critical Appraisal Skills Programme, 2018).

Once the studies relevant to the query are selected, results are combined to identify trends, gaps, or inconsistencies within the literature. It may either be qualitative synthesis or quantitative synthesis based on whether quantitative or qualitative studies are in play. (Higgins et al., 2011.) By offering a summary and balanced overview of the evidence, a literature systematic review can serve as a sound foundation for the understanding of a study question and the guiding of future studies or clinical practice. In addition, it elucidates some areas where additional research needs to be performed, thus enabling advancing the information within a topic field. (Liberati et al., 2009.)

## 4.2 Data Collection

The scientific databases utilized for this study included PubMed, CINAHL, Scopus, and Web of Science which yielded a broad range of results. Inclusion and exclusion criteria were developed to identify and select the relevant articles used for this research. The keywords used for this study included diabetes, nurses, telehealth, telemedicine, telenursing, and nursing interventions. These terms were combined to retrieve relevant articles, with the following combinations employed: 'diabetes and telehealth', 'nursing and telemedicine' and 'nurses and diabetes care'.

The initial search across the databases yielded a total of 120 articles. Duplicate articles (n = 40) were removed. A total of 35 articles were not considered as they were not peer reviewed, and 20 articles were excluded for not addressing the nursing interventions related to telehealth monitoring in diabetes care. Articles were further screened for relevance through their titles and thorough review of their abstracts in line with the objectives of this research, resulting in 10 eligible articles.

<b>Stage of Data Collection</b>	<b>Number of Articles</b>
Total articles retrieved from Pubmed, CINAHL, Scopus, Web of Science	120
Duplicate articles removed	40
Non-peer reviewed articles excluded	35
Articles not addressing nursing interventions in telehealth monitoring for diabetes care	20
Eligible articles after screening and abstract review	10

Table 1: Result of structured data search

### 4.2.1 Inclusion and Exclusion Criteria

All information was systematically gathered, ensuring the avoidance of repetitions and misinterpretations. A total of 10 articles were abstracted from reliable databases. The language used for obtaining materials for this study was limited to English. Articles published between the years 2014 and 2024 were included in the analysis process. The selected articles specifically focused on the role of nurses in telehealth monitoring of diabetes patients, emphasizing their interventions and practices. Additionally, studies addressing the treatment of diabetes were incorporated into the review. Articles focusing on specific populations, such as the elderly and children, were excluded to maintain a focused analysis on adult diabetes care.

Inclusion	Exclusion
Peer-reviewed articles	Non-peered reviewed articles
Studies published within the last 10 years (2014 - 2024)	Studies published before 2014
English language publications	Publications in other languages
Adults ( $\geq 18$ years) with Type 1 or type 2 diabetes	Paediatric or geriatric
Nursing-led interventions, remote patient monitoring	Non-nursing telehealth interventions (e.g physician-led)

Table 2: Inclusion and Exclusion Criteria

### 4.2.2 Data Analysis

A systematic review of selected articles followed a thematic analysis pattern. The approach revealed multiple patterns related to nursing interventions through remote diabetes monitoring. The analysis was done in distinct phases: first getting acquainted with results, then coding them, next developing themes and finally refining those concepts to match actual findings. Common themes and gaps in the literature regarding nursing interventions in telehealth for diabetes care were identified. Key findings were categorized based on the nature of interventions,

outcomes achieved, and the challenges identified in the implementation of telehealth services. This approach ensured a comprehensive understanding of the current landscape of telehealth in diabetes management.

#### **4.2.3 Selected Articles**

The articles selected for this literature review were organized based on their relevance to the study's objectives. Each article was summarized to highlight its contribution to understanding the role of nursing in telehealth monitoring and diabetes management. "See Appendix 1 for a summary of reviewed studies"

## **5 FINDINGS**

### **5.1 Nursing Interventions used in Telehealth-Based Diabetes Care**

#### **5.1.1 Patient Education**

Telehealth enables nurses to provide e-visits to educate patients on monitoring of blood glucose levels, insulin administration, medication adherence, and lifestyle modifications (Antar et al., 2023). The primary approach for diabetes management includes lifestyle modifications such as weight loss, diet, and physical activity. Nurses provide patient education on dietary adjustments, exercise planning, and weight management to improve diabetes outcomes. (Kharroubi et al., 2015.)

#### **5.1.2 Continuous Glucose Monitoring (CGM) Support**

Continuous blood glucose monitoring is a valuable tool for evaluating glycemic control and avoiding complications, such as diabetic retinopathy and neuropathy. Effective glucose measurement, especially via continuous glucose monitoring (CGM), is particularly useful in patients receiving basal insulin treatment or intensive insulin treatment, especially when coupled with remote telemonitoring. (Galindo et al., 2023.)

Nurses play a vital role in leveraging telehealth platforms to remotely monitor patients' glucose levels, interpret the data received, and make necessary adjustments to individualized care plans. Patients who are unable to adjust insulin doses on their own are recommended to have weekly remote follow-ups via telehealth to ensure timely and accurate titration of doses. Additionally, nurses have a key role in enabling insulin dose adjustments and providing expert advice through telehealth consultations, thus enhancing patient safety and maximizing therapeutic outcomes. (Kharroubi et al., 2015.)

### **5.1.3 Supporting Medication Adherence**

Early treatment is important to preserve glucose homeostasis, decrease insulin resistance, minimize inflammation, and avoid irreversible metabolic damage linked to disease progression. Lifestyle changes, drugs, and individualized treatment can prevent disease progression and reduce long-term complications. (Galicia-Garcia et al., 2020.)

Though the above interventions have been effective in the efficient management of diabetes, the act of communicating or reminding individuals to adopt these interventions can be cumbersome. Internet-based programs have been utilized to enhance compliance with lifestyle modification. These online interventions offer an effective solution for promoting self-management in diabetes care. Continuous reminders and follow-ups ensure patients comply with prescribed lifestyle changes and treatment plans. Nurses assist in medication adherence monitoring, insulin administration guidance, and addressing side effects of diabetes drugs. (Aloke et al., 2022.)

## **5.2 Benefits of Telehealth Monitoring of Diabetes**

A combination of telehealth monitoring along with nursing interventions offers real benefits for diabetes management.

### **5.2.1 Patient involvement in care**

The main advantage of telehealth appears in patient involvement with their own care. Mobile applications as well as wearable devices let patients check blood glucose levels or receive quick responses from medical staff, which leads to better treatment adherence. (Lebar et al., 2022.) By empowering patients with tools and knowledge, telehealth encourages greater participation in their care, leading to improved adherence and self-management (Ochs et al., 2022).

### **5.2.2 Easy access to care**

Telehealth improves accessibility to care by reducing in person visits so patients receive medical attention at home. This option really helps people who face problems with movement or transport. It also enhances access to quality care for patients in remote areas, ensuring they receive necessary support. (Ochs et al., 2022.) The ability to schedule video consultations and communicate asynchronously with healthcare providers enhances the overall patient experience (Lebar et al., 2022).

### **5.2.3 Real time monitoring and interventions**

Real-time monitoring capabilities enable healthcare providers to obtain critical data on patients' health. This real time data collection enables nurses to assess patients' conditions remotely, conduct virtual visits, and provide timely interventions, all aimed at maintaining patients' health within their home and reduce hospital readmissions and enhance patient outcomes. (Rutledge et al., 2021.)

### **5.2.4 Improved Patient Outcome**

Evidence indicates that telehealth enhances glycemic control and patient satisfaction while decreasing the frequency of hospital visits. Through the prevention of frequent hospital visits, telehealth systems allow patients to take greater control of their health, which translates to improved long-term health outcomes. (Goh et al. 2022.)

### **5.2.5 Cost Reduction**

Telehealth has the ability to cut costs through the reduction of face-to-face visits and visits to emergency departments, thereby rendering diabetes management cost-effective and the use of healthcare resources. It allows patients to access timely expert opinion, remotely monitor their condition, and manage their health without any extra cost of personal interaction. In addition, telehealth significantly increases access to specialist health care, particularly for patients residing in far-off or disadvantaged locations. Through these advantages, telehealth not only

ensures enhanced health outcomes for diabetic patients but also increases the sustainability and affordability of disease management. (McElroy et al. 2020.)

### **5.3 Limitations of Telehealth in Diabetes Care**

#### **5.3.1 Technological Challenges**

A significant problem lies in digital literacy, because numerous patients especially the older adults cannot operate remote healthcare systems. Patients need proper education to access medical resources or understand their health information. Poor internet connections in the countryside or underserved locations create obstacles for remote medical care. The lack of proper internet infrastructure prevents video calls along with instant blood sugar tracking, which affects medical response times. (Lebar et al., 2022.)

#### **5.3.2 Integration of Telehealth platforms with Health Record**

The combination of remote health platforms with current electronic medical files presents another obstacle. When these systems don't work together, it results in disconnected care or poor management of patient information. (Gagnon et al., 2019.)

#### **5.3.3 Data Protection**

Security as well as privacy issues also make remote healthcare more complex. The online storage or transmission of confidential medical data increases the possibility of cyber threats besides unauthorized viewing, which creates both ethical and legal problems. (Rutledge et al., 2021.)

#### **5.3.4 Reduced Personal Interactions & Assessment**

The change to remote healthcare services reduces in person contact, which nurses need to read body language and build patient relationship (Ochs et al., 2022). A decrease in face-to-face meetings through virtual platforms damages

trust between medical staff and patients, which affects the quality of medical evaluations. Medical staff face difficulties when they examine patients through screens, so subtle health symptoms often remain unnoticed. (Lebar et al., 2022.)

### **5.3.5 Lack Of Adequate Training for Nurses**

The lack of training and education for nurses in telehealth practices further compromises care effectiveness, as many may not have received adequate preparation for this modality (Rutledge et al., 2021). Technical difficulties, such as connectivity problems and unfamiliarity with devices, can distract nurses from patient care (Ochs et al., 2022).

## **5.4 Ethical Concerns**

Telehealth monitoring for diabetes patients presents ethical issues that affect care quality. The main concerns include private information protection, secure data handling, patient agreement along with fair technology access. The protection of personal details as well as data safety requires attention because medical facilities now depend on digital records plus remote supervision. Medical staff must follow strict rules to protect sensitive details, which really helps build trust in digital healthcare systems. Patients need clear information about remote services, especially about how their data serves medical purposes. This knowledge allows them to make informed choices about their treatment. (Lebar et al., 2022.)

Equity in access to telehealth is another concern, as it may exacerbate healthcare disparities for low-income or elderly individuals lacking necessary technology or internet access (Lebar et al., 2022). Additionally, while integrating technology, the importance of compassionate care must be maintained, with healthcare professionals supporting patients who may struggle with new systems (Ochs et al., 2022).

A strict adherence to rules protects patient data but problems emerge when individuals don't understand how to use digital tools, which creates more service gaps (Antar et al., 2023). The medical sector must create methods to support all patients with telehealth services via materials or community reach out programs,

no matter their economic status (Galindo et al., 2023). Respect for patient choices requires direct talks as well as clear permission to build trust between medical staff and patients (Kharroubi et al., 2015).

## 6 DISCUSSION

The integration of telehealth monitoring into diabetes care significantly enhances patient engagement, convenience, and outcomes while lowering costs. This literature review underscores the essential role of nursing interventions such as remote monitoring, education, and follow-up care in optimizing health for individuals with diabetes. However, challenges like technological access, the quality of personal interactions, and the need for standardized nurse training must be addressed to fully leverage telehealth's potential. (Kharroubi et al., 2015.)

Despite promising results in improving patient outcomes, gaps persist in standardizing nursing education and addressing healthcare disparities. Future research should focus on expanding nursing roles in telehealth, refining training programs, and overcoming accessibility issues to benefit all diabetic patients. Nursing professionals are vital in this telehealth model, providing continuous monitoring and education that improve self-management and glycemic control. (Gagnon et al., 2019.)

Ultimately, telehealth monitoring has the potential to revolutionize diabetes care by fostering ongoing patient engagement and empowerment. This review emphasizes the importance of nursing interventions while highlighting the need for further research into the long-term impacts and ethical considerations of telehealth in diabetes management, aiming for a more equitable healthcare system for all patients.

## **7 RESEARCH ETHICS AND RELIABILITY**

### **7.1 Ethics**

This thesis was written in accordance with good scientific practice. Every article included in this systematic literature review has been extracted from credible and peer-reviewed scholarly journals. Ethical considerations were carefully maintained during the course of the research so that utmost care was followed to adhere strictly to well-established guidelines of academic ethics. Anything inferred or adopted from other sources has been appropriately credited with references given due credit to the original authors. References and the reference list were done according to Tampere University of Applied Sciences (TAMK) instructions. Conclusions of the research have been presented honestly and accurately.

### **7.2 Reliability**

The findings of this study are supported in terms of validity through the use of reputable and established sources and contemporary literature on telehealth-based management of diabetes. The data for this research was drawn from peer-reviewed journals and reputable publication with high accuracy and relevance level. The consistency of findings through a variety of studies that found comparable benefits and challenges of telehealth interventions works to enhance the reliability of conclusions. In addition, methods used in data collection and analysis aimed at reducing bias and maximizing objectivity, towards the validity of the study in general. By using diversified and credible evidence, this research offers a credible and trustworthy account of the effect of nursing intervention in telehealth diabetes management.

## 8 CONCLUSION

Telehealth-facilitated nursing interventions are a promising method to control diabetes by enhancing patient education, glucose monitoring, and medication adherence. The benefits of telehealth, including better accessibility, real-time monitoring, cost-effectiveness, and improved patient outcomes, make it an effective and sustainable intervention for the control of chronic diseases. However, it is important to deal with challenges presented by technical limitations, information security, integration issues, disconnection from human relationships, and ensuring proper training of nursing staff to enhance telehealth effectiveness.

Future research will be aimed at coming up with strategies focused on addressing these limitations in an attempt to provide universal access and high-quality care for all patients. With ongoing growth and support, telehealth is poised to change diabetes care and improve the quality of life among patients globally.

## 9 RECOMMENDATIONS

The literature review highlights several strategies to optimize telehealth monitoring for diabetes patients through nursing interventions such as:

**Comprehensive Training for Telehealth Nurses:** Healthcare organizations should establish extensive training programs to prepare nurses for effective telehealth practices, including patient assessments and remote monitoring techniques. Expanding certification programs, like those from the American Academy of Ambulatory Care Nursing (AAACN), is essential.

**Improving Access to Telehealth Technologies:** Investments in user-friendly telehealth devices and applications are crucial, especially for older adults and low-income patients, to overcome technological barriers and enhance patient engagement in diabetes management.

**Enhancing Nurse-Patient Relationships:** Improving the interpersonal dynamics of telehealth nursing is vital. Implementing advanced video conferencing tools can strengthen communication and relationships between nurses and patients.

**Development of Integrated Care Models:** Telehealth monitoring should be part of multidisciplinary care models that promote regular communication among healthcare providers, ensuring coordinated and holistic diabetes management.

**Addressing Technological Disparities:** Policymakers must focus on reducing technological disparities, particularly by improving internet access in rural areas and providing resources to enhance digital literacy among patients.

**Strengthening Data Privacy and Security:** Establishing robust protocols to protect patient data privacy is essential for building trust in telehealth systems. Transparent communication about security measures can enhance patient confidence.

**Continuous Support for Self-Management:** Nurses should prioritize patient education and self-management, using telehealth tools to facilitate ongoing support and empower patients in their diabetes care.

**Integrating Patient Feedback:** Regularly incorporating patient feedback into telehealth services is crucial for adapting to their needs and preferences, which can improve satisfaction and adherence to management plans.

**Encouraging Long-Term Research:** Ongoing research is necessary to evaluate the long-term effects of telehealth on diabetes outcomes, enabling the refinement of nursing interventions and the establishment of best practices based on empirical evidence.

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**APPENDIX 1**

Table 3 – List of selected articles

Table 3

Title	Author (s)	Year	Aim
Diabetes Mellitus: Classification, Mediators and Complications; A Gate to Identify Potential Targets for the Development of New Effective Treatments	Samar A. Antar et al.	2023	To identify mediators and complications of diabetes, facilitating new treatment strategies.
Diabetes Mellitus: The Epidemic of the Century	Akeam T. Kharroubi, Hisham M. Darwish	2015	To provide an overview of diabetes as a global health challenge and its implications
Advances in the Management of Type 2 Diabetes in Adults	Rodolfo J. Galindo et al.	2023	To discuss contemporary approaches to managing Type 2 diabetes in adult populations.
Pathophysiology of Type 2 Diabetes Mellitus	Unai Galicia-Garcia et al.	2020	To explore the underlying pathophysiological mechanisms of Type 2 diabetes.
Current Advances in the Management of Diabetes Mellitus	Chinyere Alope et al.	2022	To review recent advancements in diabetes management and their practical applications.

Role of Nursing in Telehealth	Kiersten Lebar, Shruti Chandra, Judd E. Hollander	2022	To explore the various roles nurses play in telehealth settings, particularly for diabetes.
Telehealth in Nursing Education: Navigating the New Normal	Nancy Ochs, Hollis Franco, Belinda Gallegos, David Baba, Iohnna Crossland	2022	To examine the integration of telehealth in nursing education and its implications for practice.
Preparing Nurses for Roles in Telehealth: Now is the Time!	Rutledge, Carolyn M., Gustin, Tina	2021	To address the urgency of preparing nursing professionals for telehealth roles.
Effectiveness of the Chronic Care Model for Adults with Type 2 Diabetes in Primary Care: A Systematic Review	Lay Hoon Goh et al.	2022	To assess the effectiveness of the Chronic Care Model in managing Type 2 diabetes in adults.
The Influence of Telehealth for Better Health Across Communities	Jane A. McElroy et al.	2020	To analyse the impact of telehealth interventions on health outcomes in diverse communities.