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Telemedicine-Based Diabetes Education: A Systematic Review

Bernard Allan V. Mangaron¹, Sunny Vhie D. Saniel², Dorothy Joy D. Tan³, Carlo Jason S. Dela Cruz⁴, Imelda H. Mariano⁵

¹Nurse II, Health and Nutrition Section, Department of Education - Schools Division Office of Cotabato ²Nurse II, Nursing Service, Rural Health Unit of Makilala

³Instructor I, Nursing Department, Zamboanga Peninsula Polytechnic State University

⁴Associate Professor I, Midwifery Department, University of Southern Mindanao - College of Health

Sciences

⁵Clinical Instructor, Nursing Department, Cotabato Medical Foundation College

Abstract

Diabetes mellitus remains a pressing global health concern, exacerbated by the COVID-19 pandemic's disruption of conventional healthcare services. This systematic review evaluates the effectiveness of telemedicine-based diabetes education in controlling blood sugar levels among individuals with Type II diabetes, aiming to synthesize current evidence and identify key enablers and barriers to implementation. A systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor and transparency. A comprehensive literature search was performed using EBSCOhost (CINAHL and MEDLINE) and Google Scholar, focusing on peer-reviewed studies published between 2016 and 2020. Boolean search terms targeted telemedicine, diabetes education, and blood sugar control. After screening and eligibility assessment, five studies were included for final synthesis. The Critical Appraisal Skills Programme (CASP) checklist was employed for quality assessment. Data extraction focused on study design, intervention type, glycemic outcomes (HbA1c and fasting blood glucose levels), and patient engagement. The reviewed studies demonstrated that telemedicine-based diabetes education effectively improves glycemic control, enhances patient engagement, and supports self-management behaviors. Interventions incorporating behavioral counseling, remote monitoring, and structured virtual consultations yielded statistically significant reductions in HbA1c levels. Additionally, online health communities facilitated psychological well-being and adherence to treatment regimens. However, barriers such as digital literacy disparities, limited access to telehealth infrastructure, and suboptimal patient engagement were identified as challenges to implementation. The findings underscore the potential of telemedicine as a viable and effective alternative to conventional diabetes education, particularly during healthcare disruptions. While telehealth interventions improve glycemic outcomes and patient self-management, their long-term efficacy depends on sustained patient engagement, digital accessibility, and structured support systems. Future research should explore scalable telehealth models, address digital inequities, and refine telemedicine frameworks for chronic disease management. These insights inform healthcare policy and practice, advocating for the integration of telemedicine into routine diabetes care to optimize patient outcomes.



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Keywords: Telehealth; Telemedicine; Diabetes Education; Glycemic Control; Type 2 Diabetes; Remote Patient Monitoring; Digital Health; Online Health Communities; COVID-19; Diabetes Self-Management.

INTRODUCTION

Diabetes mellitus remains a major global health challenge, with rising prevalence and significant morbidity and mortality risks, exacerbated by the COVID-19 pandemic. Disruptions in conventional healthcare have limited access to in-person consultations, routine monitoring, and timely interventions, underscoring the need for alternative approaches such as telehealth (Monaghesh & Hajizadeh, 2020). Telehealth, as defined by the World Health Organization (2021), encompasses digital health services, including telemedicine, mobile applications, and remote monitoring. Telemedicine, in particular, has facilitated continuity of diabetes care by enabling virtual consultations, reducing hospital visits, and enhancing self-management (Bonvissuto & Seed, 2023).

Despite its potential, telehealth adoption faces challenges, including disparities in digital literacy, internet accessibility, and concerns over data privacy and patient engagement (Tee-Melegrito, 2022). While existing studies suggest telemedicine can improve glycemic control through structured virtual consultations and real-time monitoring (Haleem et al., 2021), its effectiveness during pandemic-induced healthcare disruptions remains unclear. A comprehensive synthesis of evidence assessing telehealth's direct impact on diabetes outcomes is needed, particularly regarding its long-term feasibility in chronic disease management.

This systematic review evaluates the effectiveness of telehealth interventions in regulating blood glucose levels among diabetic patients during the COVID-19 pandemic. By synthesizing existing literature, it aims to provide evidence-based insights, identify barriers to implementation, and offer recommendations for optimizing telehealth strategies. The findings will contribute to the ongoing discourse on digital health, guiding policymakers, healthcare providers, and researchers in refining telehealth frameworks for chronic disease management.

METHODS

This systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). A comprehensive literature search was conducted in EBSCOhost (CINAHL and MEDLINE) and Google Scholar using Boolean search terms such as "diabetes education" AND "telemedicine" and "controlling blood sugar level" AND "Type 2 diabetes" AND "telehealth." The search was restricted to peer-reviewed articles, systematic reviews, and research reports published in English between 2016 and 2020.

A total of 88 studies were retrieved, with 38 duplicates removed using EndNote and manual screening. Title and abstract screening excluded six articles that did not align with the study objectives, leaving 11 full-text articles for eligibility assessment. Inclusion criteria required studies to be peer-reviewed, focus on telemedicine-based diabetes education for Type II diabetes, and meet the specified publication and language criteria. Following a rigorous appraisal using the Critical Appraisal Skills Programme (CASP) checklist (2018), seven articles were excluded, resulting in four studies for final synthesis.

Data extraction captured study design, sample characteristics, intervention type, and outcome measures (e.g., HbA1c and fasting blood glucose). Findings were synthesized to identify key themes, trends, and research gaps. The PRISMA flow diagram illustrates the selection process.



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Table 1: Summary of Individual Findings			
Study	Population	Intervention	Key Findings
Aghdam et al. (2020)	Diabetes patients in OHCs	Online peer support and education	Enhanced psychological well- being and self- management
Lee et al. (2017)	Type 2 diabetes patients	Telemedicine interventions (various platforms)	Significant improvement in glycemic control
Schramm (2016)	Veteran diabetes patients	Home telehealth program	Higher success rates among fully engaged participants
Lipari et al. (2019)	Online diabetes education materials	Assessment using PEMAT	Low scores in understandability and actionability

Figure 1: PRISMA flow diagram for literature search process

PRISMA CHECKLIST





RESULTS

Aghdam et al. (2020) identified three key themes in online health communities (OHCs) for diabetes selfmanagement: (1) lifestyle-related advice exchange, (2) shared experiences, and (3) collaborative problemsolving. Participation in OHCs improved psychological well-being and disease management, highlighting their potential integration into structured diabetes education programs.

Lee et al. (2017) analyzed telemedicine interventions for glycemic control, incorporating telephone (42%), internet (34%), mobile devices (13%), SMS (9%), and video conferencing (7%). Behavioral therapy (90%) and educational counseling (84%) were common components. Despite variations in care, telemedicine significantly improved glycemic control, demonstrating its efficacy in diabetes management.

Schramm (2016) examined home telehealth among veterans, showing a 66% reduction in HbA1c levels of at least 0.5%. Active engagement in educational components correlated with better glycemic control, underscoring the importance of sustained participation in telehealth programs.

Lipari et al. (2019) assessed online diabetes education materials, finding that only five of 25 websites met inclusion criteria. While four materials were understandable, only one was actionable, emphasizing the need for improved readability and usability in patient education resources.

In the Philippines, limited access to diabetes educators presents challenges. Given the widespread use of mobile phones, a text-based hotline and web-based platform could enhance accessibility, providing real-time support, risk assessment tools, and educational resources to complement traditional diabetes education.

DISCUSSION

This systematic review highlights telemedicine's growing potential as an effective approach for diabetes education and glycemic control. The analyzed studies demonstrate that digital platforms—such as online health communities (Aghdam et al., 2020), mobile applications, and video conferencing (Lee et al., 2017)—enhance patient engagement and self-management. Beyond convenience, telemedicine fosters psychological well-being through peer support and knowledge sharing (Yan & Tan, 2014).

Despite its efficacy, challenges persist, particularly regarding patient adherence. Schramm (2016) emphasizes that engagement is crucial, with actively participating individuals achieving better glycemic outcomes. However, Lipari et al. (2019) reveal a critical gap in the quality and actionability of online diabetes education resources, highlighting the need for more accessible materials. These findings suggest that telemedicine's success hinges on structured educational content and sustained patient involvement.

In low-resource settings like the Philippines, telemedicine offers a promising solution to healthcare disparities. The proposed integration of mobile-based hotlines and web platforms could facilitate real-time consultations and access to evidence-based educational materials, complementing traditional diabetes care. This aligns with global recommendations advocating telehealth integration in chronic disease management (World Health Organization, 2021).

CONCLUSION

This review reaffirms telemedicine's efficacy in diabetes education and glycemic control, demonstrating its ability to enhance self-management and psychological well-being. However, patient adherence and the quality of educational resources remain significant challenges. Sustained engagement is essential for optimal outcomes, necessitating improvements in content accessibility and interactivity.



Given the increasing burden of diabetes, particularly in underserved regions, telemedicine presents a viable strategy to expand healthcare access. Future research should focus on optimizing telehealth interventions through personalized education, long-term adherence assessments, and strategies to enhance patient engagement. Addressing these gaps will further establish telemedicine as a sustainable and impactful approach to diabetes management.

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