

*Review Article***Effect of telenursing on Glycosylated Hemoglobin in patients with diabetes: A systematic review**Tara Alizadeh ^a  | Poorya Takasi ^{a*} 

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Abstract

A systematic review was conducted to assess the impact of telenursing on glycosylated hemoglobin levels in diabetic patients. International electronic databases, including Scopus, PubMed, and Web of Science, were systematically searched from their inception to August 21, 2023, using keywords derived from Medical Subject Headings such as "Diabetes mellitus", "Telenursing", and "Glycosylated Hemoglobin". In addition, Iranian databases like Iranmedex were also consulted. The quality of randomized controlled trials and quasi-experimental studies was evaluated using the critical assessment checklist from the Joanna Briggs Institute. A total of nine studies involving 387 diabetic patients were participants across five studies. Among these patients, 65.48% were female, and 63.44% were allocated to the intervention group. The mean age of the study participants was 57.64 (SD=6.74). The mean duration of the studies and their respective follow-up periods were 48 and 12 weeks, respectively. Additionally, the average length of the intervention in all five studies, was approximately 17.5 minutes. Importantly, across all these studies, it was consistently observed that telenursing effectively reduced glycosylated hemoglobin levels. The findings demonstrated that telenursing, when utilized by nurses, was effective in controlling glycosylated hemoglobin levels and reducing them. We recommend that healthcare managers and policymakers establish a platform that not only incorporates telenursing via phone calls but also explores other methods such as video calls. This approach should consider cost-effectiveness to ensure accessibility for all individuals. Consequently, alongside traditional telephone calls, various telenursing methods can be employed to lower glycosylated hemoglobin levels.

Keywords: Telenursing, Glycosylated Hemoglobin, Diabetes, Nursing, Nurses, Systematic Review.

1 | Introduction

Type 2 diabetes is a metabolic disorder characterized by chronic hyperglycemia, which can disrupt the normal functioning of essential organs in the body. It is the most prevalent type of diabetes and is influenced by factors such as age, environmental factors, and individual behaviors [1, 2]. Type 2 diabetes can result in complications, including both macrovascular and microvascular issues, and can even lead to premature mortality [3]. However, it is important to note that despite these potential complications, type 2 diabetes can be managed effectively [4].

Nurses play a crucial role in educating patients on mitigating diabetes complications and managing the disease [5]. Continuous nurse-led follow-up is a vital component of patient care and can

prompt positive changes in patients' health behaviors [6]. Telenursing, a common approach, empowers diabetic patients by utilizing information and communication technology tools and services such as the internet, telephone, and video calls to provide nursing support [7, 8]. Moreover, telenursing has the potential to reduce healthcare costs, enhance the patient-nurse relationship, and decrease the necessity for frequent in-person visits [9]. Among the various communication tools used in telenursing, the telephone stands out as it is widely accessible to most individuals [10].

Managing glycosylated hemoglobin levels is a crucial aspect of controlling blood glucose in diabetic patients [11]. Nurses can employ group training sessions to achieve this, but these sessions

are time-consuming, requiring frequent face-to-face interactions. In this context, modern methods like telenursing can be employed to facilitate ongoing monitoring and review of the educational material provided [12]. An Iranian study demonstrated that telenursing can effectively contribute to the management and control of glycosylated hemoglobin levels in individuals with type 2 diabetes [13]. Additionally, another study conducted in Iran found that telenursing is a suitable solution for elderly individuals with diabetes, proving effective in glycosylated hemoglobin control [14].

Numerous studies have explored the impact of remote nursing on glycosylated hemoglobin levels in individuals with type 2 diabetes. However, to our knowledge, there is currently no published study that offers a comprehensive and concise review of the effects of telenursing on glycosylated hemoglobin. Given the significance of this topic and the conflicting findings in the existing literature regarding the influence of telenursing on glycosylated hemoglobin among type 2 diabetes patients, we conducted this systematic review to investigate the specific effects of telenursing on glycosylated hemoglobin in this patient population.

2 | Methods

2.1 | Study registration and reporting

The systematic review process was conducted following the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist [15]. Furthermore, it's worth noting that this systematic review has not been registered in the international prospective register of systematic reviews (PROSPERO) database.

2.2 | Search strategy

We systematically conducted searches in international electronic databases, including Scopus, PubMed, and Web of Science, covering the earliest available data up to August 21, 2023. Our search utilized keywords derived from Medical Subject Headings, such as "Diabetes mellitus", "Telenursing", and "Glycosylated Hemoglobin". For example, in the PubMed/MEDLINE database, our search strategy involved terms like ("Impact" OR "Effect" OR "Improve" OR "Encourage" OR "Promote" OR "Advocate" OR "Overcome" OR "Address" OR "Influence" OR "Optimize" OR "Decrease" OR "Intervention") AND ("Telenursing" OR "Telemedicine" OR "Nursing") AND ("Glycated Hemoglobin" OR "Glycosylated Hemoglobin A" OR "Glycosylated Hemoglobin A_{1c}") AND ("Diabetes mellitus" OR "Diabetes Mellitus, Type 2" OR "Diabetes Mellitus, Adult-Onset" OR "Type 2 Diabetes

Mellitus"). We used Boolean operators "OR" and "AND" to combine these terms. Additionally, the Persian equivalents of these keywords were employed to search Persian electronic databases. The systematic search process was independently conducted by two researchers. It's important to note that this review study excluded gray literature, comprising expert opinions, conference presentations, dissertations, research and committee reports, as well as ongoing research. Gray literature typically includes electronically published materials that have not undergone formal review by for-profit publishers [16].

2.3 | Inclusion and exclusion criteria

In this systematic review, we included interventional studies conducted in both English and Persian languages that specifically addressed interventions targeting Glycosylated Hemoglobin levels in patients with type 2 Diabetes. Excluded from our study were reviews, case reports, conference proceedings, letters to the editor, and qualitative studies.

2.4 | Study selection

The articles retrieved through the search were processed and analyzed using EndNote 20 software. Two researchers conducted independent assessments of the papers based on the predefined inclusion and exclusion criteria for this study. Following the initial electronic review, the titles, abstracts, and full texts of the articles were manually inspected, and any duplicate studies were removed. In the event of disagreements between the first two researchers, a third researcher was consulted to facilitate resolution. Ultimately, a comprehensive examination of the sources was conducted to ensure that no pertinent information was overlooked or omitted.

2.5 | Data extraction and quality assessment

In this systematic review, we examined the included publications for various data points, including the first author's name, publication year, study location, research design, sample size, intervention type, study duration, intervention duration, follow-up duration, participant age, gender distribution, characteristics of the control group, features of the assessment tools used, specific statistical tests employed, and key study findings. To assess the quality of randomized control trials (RCTs) and quasi-experimental research, we employed the Joanna Briggs Institute (JBI) critical evaluation checklist [17]. This assessment tool comprises 13 and 9 items for RCTs and quasi-experimental trials, respectively, evaluating aspects like internal validity, comparability of participant groups, measurement precision, and appropriateness of

statistical analysis. Two researchers independently rated each study's quality in the systematic review using a scoring system of "yes" (score 1), "no" (score 0), and "not applicable / not clear" (score 0) [18]. The quality assessment ratings based on JBI checklists categorized studies as either good (≥ 8), fair (6-7), or poor (≤ 5) [17].

3 | Results

3.1 | Study selection

As depicted in Figure 1, our comprehensive search of electronic databases initially yielded a total of 2,075 studies. After the removal of duplicate articles, we were left with 1,790 unique articles. Subsequently, a meticulous review of article titles and abstracts led to the exclusion of 1,620 studies that did not align with the specific objectives of our review. An additional 115 studies were excluded because they did not employ an experimental design. Among the fifty-two studies whose full texts were carefully assessed, thirty-three were found to be deficient in terms of both design and findings, while seventeen lacked the essential data required for inclusion. Ultimately, our systematic review retained five studies [12-14, 19, 20] for further analysis and consideration.

3.2 | Study characteristics

As indicated in Tables 1 & 2, a total of 387 diabetic patients were participants across five studies [12-14, 19, 20]. Among these patients, 65.48% were female, and 63.44% were allocated to the

intervention group. The mean age of the study participants was 57.64 (SD=6.74). Among the included studies, one [13] adopted a quasi-experimental design, while the remaining four [12, 14, 19, 20] were randomized controlled trials (RCTs). Furthermore, all five studies [12-14, 19, 20] were conducted in Iran, and they featured control groups. Additionally, four of the studies [12-14, 19, 20] included the control group and four [12, 14, 19, 20] incorporated follow-up periods. In terms of the method for measuring HbA_{1c}, three studies [13, 14, 19] utilized the Biosystem kit, one study [12] employed the BIONIK kit, and one study [20] utilized the Drew-DS5 analyzer.

3.3 | Methodological quality assessment of eligible studies

As depicted in Figures 2 & 3, among the five studies included in our analysis [12-14, 19, 20] it is noteworthy that all of them exhibited a high level of quality.

3.4 | Effect of telenursing on Glycosylated Hemoglobin in patients with Diabetes

The mean duration of the studies and their respective follow-up periods were 48 and 12 weeks, respectively. Additionally, the average length of the intervention in all five studies [12-14, 19, 20], was approximately 17.5 minutes. Importantly, across all these studies, it was consistently observed that telenursing effectively reduced glycosylated hemoglobin levels (Tables 1 & 2).

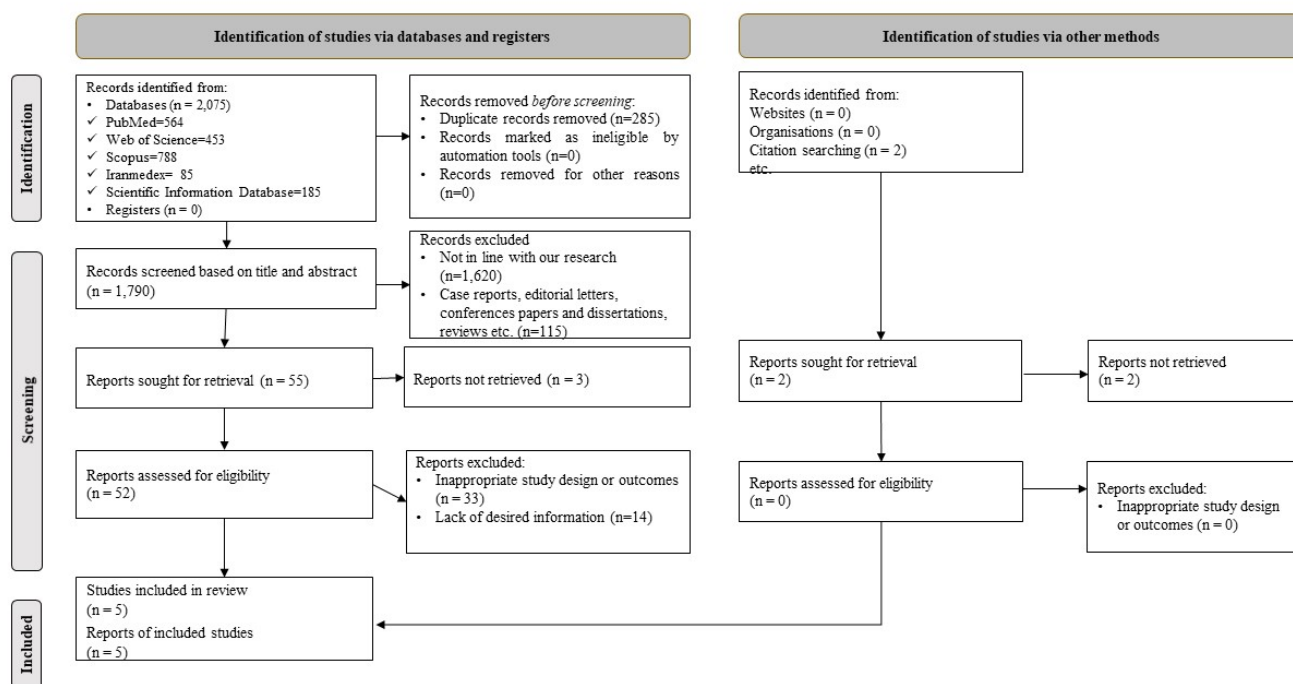


Figure 1. Flow diagram of the study selection process.

Table 1. Basic characteristics of the included studies in this systematic review.

First Author/ year	Location	Study characteristics				Control group	Key results	JBI Score
		1. Design	2. Sample Size (I/C)	M/F ratio (%)	Age (mean±SD)			
Shahsavari <i>et al.</i>, 2020 [20]	Iran	1. RCT 2. 60 (30/30) 3. Telephone conversation 4. N/A 5. 20 minutes 6. 12 weeks	28.33/71.67	62.63 (SD=9.03)	People of control group had not received telephone conversation.	The HbA _{1c} level of patients decreased more after the intervention in the intervention group compared to the control group (P<0.001).	Good	
Esmailpour-BandBoni <i>et al.</i>, 2020 [19]	Iran	1. RCT 2. 60 (28/32) 3. Telephone conversation 4. N/A 5. 15 minutes 6. 12 weeks	36.67/63.33	66.06 (SD=4.57)	People of control group had not received telephone conversation	The HbA _{1c} level of patients decreased more after the intervention in the intervention group compared to the control group (P<0.001).	Good	
Azhdari Mamaghani <i>et al.</i>, 2021 [12]	Iran	1. RCT 2. 137 (88/49) 3. Telephone conversation 4. 48 weeks 5. 20 minutes 6. 12 weeks	N/A	54.12 (SD=8.55)	People of control group had not received telephone conversation	The HbA _{1c} level of patients decreased after the intervention in the telenursing group compared to the control group (P<0.001).	Good	
Ravari <i>et al.</i>, 2021 [14]	Iran	1. RCT 2. 70 (35/35) 3. Telephone conversation 4. N/A 5. 15 minutes 6. 12 weeks	38.57/61.43	64.75 (SD=5.27)	People of control group had not received telephone conversation	The HbA _{1c} level of patients decreased after the intervention in the telenursing group compared to the control group (t=-4.849, P<0.001).	Good	
Ghalavand <i>et al.</i>, 2021 [13]	Iran	1. Quasi-experimental 2. 60 (40/20) 3. Messaging over the phone 4. N/A 5. N/A 6. N/A	N/A	40.66 (SD=6.28)	People of control group had not received massage	The HbA _{1c} level of patients decreased after the intervention in the telenursing group compared to the control group (P<0.001).	Good	

4 | Discussion

The primary objective of this systematic review was to assess the impact of telenursing on glycosylated hemoglobin levels in diabetic patients. Consequently, the findings of this systematic review affirm that telenursing, particularly in the form of telephone-based interventions, has a significant influence on the management and reduction of glycosylated hemoglobin levels.

Diabetes is among the prevalent diseases that can lead to disability and impose substantial costs on both individuals and governments [21]. Many individuals with diabetes lack sufficient awareness and may struggle to perform essential tasks such as regular blood glucose monitoring, dietary adherence, and daily regimen management [22]. Educating and providing ongoing support for these patients is crucial, and nurses can play a pivotal role in this regard. Instead of traditional face-to-face methods, telenursing through telephone and other telecommunication devices is emerging as an effective approach [23]. In the present

systematic review, it was found that telenursing, facilitated by nurses, can significantly enhance patient awareness regarding diabetes. Consequently, patients are more adept at managing diabetes-related tasks and activities, ultimately leading to a reduction in glycosylated hemoglobin levels [12-14, 19, 20]. Moreover, another systematic review highlighted the positive impact of nurses conducting phone calls and motivational interviews in improving blood sugar control in children [24]. Thus, the utilization of telenursing by nurses holds the potential to influence glycosylated hemoglobin levels, keeping them within a healthy range or even causing a reduction.

The outcomes of this systematic review unequivocally demonstrate that telenursing exerts a significant impact on glycosylated hemoglobin levels in diabetic patients. Furthermore, previous research has suggested that this intervention can also effectively manage other chronic diseases [25]. Hence, it is advisable for healthcare managers and policymakers to establish a

comprehensive platform that not only includes telenursing via telephone calls but also incorporates alternative methods, such as video calls. This approach should prioritize cost-effectiveness to ensure accessibility for all individuals. Consequently, alongside traditional telephone-based telenursing, other modalities can be leveraged to successfully lower glycosylated hemoglobin levels.

4.1 | Limitations

Similar to any systematic review, this study had several limitations. Firstly, it did not conduct a meta-analysis. Despite the absence of meta-analysis, a rigorous and systematic approach was maintained for data collection, organization, and analysis.

Additionally, despite the comprehensive database search, it is possible that not all relevant studies on this topic were identified. Lastly, this systematic review was limited to research published in English and Persian, potentially leading to the exclusion of studies published in other languages.

4.2 | Implications for clinical practice in nursing

Given the findings of this study and the critical significance of reducing and managing glycosylated hemoglobin levels in diabetic patients, nurses have the potential to effectively lower and control glycosylated hemoglobin through the application of telenursing.

Table 2. Interventions of the studies are included in the systematic review.

First Author/ year	Intervention Program	Description
Shahsavari <i>et al.</i> , 2020 [20]	Telephone conversation	Before the intervention, all participants underwent a three-day group training program on diabetes self-management. Subsequently, individuals in the intervention group received regular phone calls from the researcher to assess their adherence to the treatment plan, encompassing exercise, dietary practices, and medication. These telephone interactions occurred twice a week during the first and second months, and once a week during the third month. Each conversation lasted approximately 20 minutes. At the conclusion of the three-month intervention period, HbA _{1c} levels were measured using the Drew-DS5 analyzer.
Esmailpour-BandBoni <i>et al.</i> , 2020 [19]	Telephone conversation	Participants in the intervention group received a total of 8 phone calls, each lasting approximately 15 minutes, from the researcher. These calls were structured as 4 weekly calls during the first month and 4 bi-weekly calls during the second and third months of the intervention period. Each phone call involved discussing one element from the diabetes mellitus educational package, ensuring that all the contents of these packages were effectively conveyed to the participants. For the measurement of HbA _{1c} , venous blood samples were collected using test tubes containing ethylenediamine tetraacetic acid. The HbA _{1c} measurement was conducted utilizing the HbA _{1c} kit (Lot: 21856; Code: 11044; Biosystems, Barcelona, Spain).
Azhdari Mamaghani <i>et al.</i> , 2021 [12]	Telephone conversation	Prior to the telenursing intervention, participants in the intervention group underwent an empowerment process. This empowerment comprised two sessions, with one lasting 90 minutes and the other 120 minutes. The 90-minute session primarily focused on imparting self-care principles. During the 120-minute session, the initial 30 minutes were dedicated to introducing successful patient cases, followed by 90 minutes of instruction based on the Funnel model. Following these empowerment sessions, telenursing was conducted over a period of 12 weeks through telephone calls with the participants. Each telephone conversation had a duration of 20 minutes. In the first month, participants received telephone calls twice a week, while in the second and third months, the calls were made once a week. The primary focus of these telenursing conversations encompassed topics such as dietary practices, exercise, foot care, and the content covered in the earlier sessions. After the 3-month intervention period, HbA _{1c} levels were assessed using the BIONIK kit.
Ravari <i>et al.</i> , 2021 [14]	Telephone conversation	Before the intervention, participants in the intervention group received training in nutrition, lifestyle, exercise, and adherence to dietary recommendations. Their HbA _{1c} levels were also measured at this stage. Subsequently, participants in the intervention group received phone calls from the researcher to assess their compliance with the prescribed treatment plan, which included exercise, diet, and lifestyle modifications. The telenursing component of the intervention spanned a period of 12 weeks and involved regular phone calls with the participants. Each telephone conversation had a duration of 15 minutes. During the first month, participants received phone calls twice a week, while in the second and third months, the calls were reduced to once a week. HbA _{1c} levels were monitored by collecting a 5cc venous blood sample from each patient.
Ghalavand <i>et al.</i> , 2021 [13]	Messaging over the phone	Participants in the telenursing group underwent a comprehensive training session covering various aspects, including nutrition, physical activity, medication management, as well as the proper use of a glucometer for blood sugar monitoring. Additionally, the group members' contact information was provided to the nurse to establish a virtual group in an online platform, allowing for the prompt addressing of any questions or concerns raised by the participants. Throughout the intervention, educational messages related to nutrition, physical activity, and medication adherence were regularly posted for the participants within the group. HbA _{1c} levels were assessed by collecting a 10cc venous blood sample from each patient, with 2 cc of this blood being placed in a container containing EDTA. The intervention also utilized the Biosystem kit, manufactured in Spain.

	Shahsavari et al., 2020	Esmailpour-BandBoni et al., 2020	Mamaghani et al., 2021	Kavari et al., 2021	
RCT	Was true randomization used for assignment of participants to treatment groups?	Y	Y	Y	Y
	Was allocation to treatment groups concealed?	Y	Y	Y	Y
	Were treatment groups similar at the baseline?	Y	Y	Y	Y
	Were participants blind to treatment assignment?	Y	U	N	U
	Were those delivering treatment blind to treatment assignment?	N	U	N	U
	Were outcomes assessors blind to treatment assignment?	N	U	Y	U
	Were treatment groups treated identically other than the intervention of interest?	Y	Y	Y	Y
	Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	Y	Y	Y	Y
	Were participants analyzed in the groups to which they were randomized?	Y	Y	Y	Y
	Were outcomes measured in the same way for treatment groups?	Y	Y	Y	Y
	Were outcomes measured in a reliable way?	Y	Y	Y	Y
	Was appropriate statistical analysis used?	Y	Y	Y	Y
	Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?	Y	Y	Y	Y

Figure 2. Methodological quality assessment of RCT studies using JBI.

	Ghalavand et al., 2021	
Quasi-Experimental	Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?	Y
	Were the participants included in any comparisons similar?	Y
	Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Y
	Was there a control group?	Y
	Were there multiple measurements of the outcome both pre and post the intervention/exposure?	Y
	Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	U
	Were the outcomes of participants included in any comparisons measured in the same way?	Y
	Were outcomes measured in a reliable way?	Y
	Was appropriate statistical analysis used?	Y

Figure 3. Methodological quality assessment of quasi-experimental studies using JBI.

4.3 | Recommendations for future research

This systematic review exclusively included studies conducted in Iran. As a recommendation, it is advisable for researchers in other countries to explore the impact of telenursing on glycosylated hemoglobin levels in diabetic patients through interventional studies.

5 | Conclusions

In summary, the outcomes of this systematic study indicate that nurses can employ telenursing as an effective means to regulate and lower glycosylated hemoglobin levels.

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Authors' contributions

Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work: TA, PT; Drafting the work or revising it critically for important intellectual content: TA, PT; Final approval of the version to be published: TA, PT; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: TA, PT.

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Competing interests

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Availability of data and materials

The datasets used during the current study are available from the corresponding author on request.

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None.

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