



Literature Review

The Benefits of Telehealth on Quality of Life of People Living with Type 2 Diabetes Mellitus: A Literature Review

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ABSTRACT

Introduction: Advancement technology and information benefit societies by way telehealth access, including those with diabetes mellitus. Telehealth implementation in diabetes mellitus management is a great solution of increasing access to healthcare and reducing geographical inequalities. Nevertheless, the effectiveness of service among people living with diabetes remains inconsistent. This review aims to summarize and evaluate the evidence on the effectiveness of telehealth on quality of life in type 2 diabetes mellitus.

Methods: This review considers the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline. The results reported in descriptive narrative approach. The following databases; Scopus, Science Direct, PubMed, and Web of Science were comprehensively searched to find article from January, 1st 2018 to December 31st 2023. Inclusion was made to English and full-text article.

Results: Two articles were included in the final review. A total of 482 type 2 DM patients were used telehealth. Findings on the impacts of the usability of telehealth on the QoL of Type 2 DM is telehealth relevant alternative to the care of DFU patients, with stable health, well-being and quality of life conditions and smartphone application-based interventions in the management of type 2 DM show that the quality of life in the following four dominants; psychological, social, environmental, and physical health revealed significant improvements.

Conclusions: Telehealth has good potential to be developed in the service of diabetes mellitus patients. The following internet-based delivered mode; web, and smartphones improve the quality of life and the well-being of patients with type 2 diabetes mellitus. However, lack of studies measuring the effectivity of telehealth among people with diabetes mellitus. Future development of internet-based interventions should further take into consideration the consolidated set of diabetes mellitus principles.

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1. INTRODUCTION

Diabetes Mellitus (DM) is a disease indicated by increased blood sugar levels or hyperglycemia, uncontrolled hyperglycemia for a long time can trigger damage to the nervous system and blood

vessels. It has been widely studied that diabetes mellitus affects the quality of life (QoL) (Apriliyani, 2018). As typically chronic disease, diabetes cannot be cured but its severity can be controlled (Suarilah & Lin, 2022). Nevertheless, people living with DM seem less

awareness on the signs and symptoms (Luthfa et al., 2019).

Data from *the World Health Organization* (WHO) documented of 422 million people in the world suffering from diabetes mellitus in 2014, an increase of around 8.5% in the adult population and an estimated 2.2 million deaths due to diabetes mellitus occurring before the age of 70 years. In fact, it is estimated that the prediction will continue to increase by around 600 million people in 2035 (Kemenkes RI, 2019). Based on data from *the International Diabetes Federation (IDF)*, there are 415 million people in the world suffering from DM and Indonesia is included in the ten countries with the highest number of cases of diabetes mellitus in the world. Indonesia is ranked seventh with an incidence of 10.0 million (IDF, 2015). WHO reports that in Indonesia, the number of diabetes mellitus is estimated to increase, which was initially only 8.4 million in 2000, will experience a jump in 2030 to 21.3 million (Riset Kesehatan Dasar Riskesdas, 2018). DM is a chronic disease that accompanies the sufferer for life and requires long-term treatment, causing a decrease in the sufferer's QoL (Nisa & Kurniawati, 2022). The result of research by Chaidir et al., (2017) on 89 DM sufferers, 52.8% (47 respondents) experienced poor QoL.

Several studies underlined living with DM may negatively impact on QoL. Suffering from diabetes mellitus for a long time will increase the complication rate even higher so that it will affect the QoL (Pranata et al., 2022). Many patients with type 2 diabetes experience psychological problems that affect their QoL and their ability to cope and manage their disease (Sinawang et al., 2020). As a result, there are continuous demands throughout the patient's life for maintaining the QoL, such as dietary restrictions or adjustments, blood sugar monitoring, activity restrictions symptoms that arise when blood sugar levels fall or while fear is high due to accompanying complications, sexual dysfunction (Hirani et al., 2017). Quality of life is an individual's perception of life in the context of the culture and value system in which the individual lives and in relation to life goals, expectations, standards and concerns (Prasestiyo, 2017). Factors that can affect the quality of life of diabetes mellitus patients include age, gender, level of education, health services, socioeconomic status, duration of diabetes mellitus, complications of diabetes mellitus (Prasestiyo, 2017).

Strategies to support people living with DM have been widely implemented in the clinical and community settings. From the conventional face to face intervention to the application of the advancement of technology and information. Within the last 10 years, delivering health education and assisting DM management by way connectivity of the internet is going to be popular. Telehealth has been involves the remote exchange of physiological data or symptoms between patients and healthcare professionals (Hirani et al., 2017). The effectiveness of telehealth interventions may also be related to the

usefulness of the telehealth device itself (Suarilah et al., 2022). Telehealth technology has also been found to be very useful for empowering patients who are in remote locations through video conferencing between patients and healthcare providers, uploading physiological data and receiving input from healthcare providers. And also known as an internet-based self-management system, this technology also offers several health services and access to information (Pudiyanti & Afriani, 2020).

Concerning, the impact of DM on QoL, variations in the delivery of interventions to maintain QoL among those with DM, treatment non-adherence continues to be a significant problem for various reasons, one of which includes access to treatment. The necessity for continuous monitoring and commitment to therapy and lifestyle adjustments has a significant impact on patients' QoL (Sunil Kumar et al., 2020). One strategy that can be utilized is the use of telehealth. This study aims to summarize and evaluate the evidence for the effectiveness of telehealth on quality of life in type 2 diabetes mellitus.

2. METHODS

This review uses preferred reporting items for systematic review and meta-analysis (PRISMA). Searches were performed on four databases: Scopus, Science Direct, PubMed, and Web of Science. Keywords based on MESH terms are "Type 2 Diabetes Mellitus OR Type 2 DM" AND "Quality of Life OR QOL" AND "Telehealth OR Telecare OR Telenursing OR e-health OR m-health" AND RCT OR randomized controlled trial OR Randomized clinical trial. The handling of the criteria in this study used a population, intervention, comparison, outcome, and study (PICOS) framework.

Table 1. PICOS framework

Frameworks	Inclusion Criteria
Population	Focuses on Type 2 Diabetes Mellitus patients
Intervention	Use of telehealth
Comparison	No comparison
Outcomes	Quality of life
Study Design	RCTs
Publication Years	2018-2023
Language	English

The search results obtained 89 articles that were selected and then adjusted with an assessment based on the full text, resulting in 2 articles. The flowchart in this study is as follows in Figure 1.

3. RESULTS

Four articles were included in the final review consisting of 2 RCTs (Table 2), to describe the effectiveness of telehealth on quality of life in type 2 diabetes mellitus. All of the included studies were RCTs that were published between 2018 – 2023. The first study Iversen *et al.*, (2020) was carried out in the Norway, a total of 182 patients with DM with an age

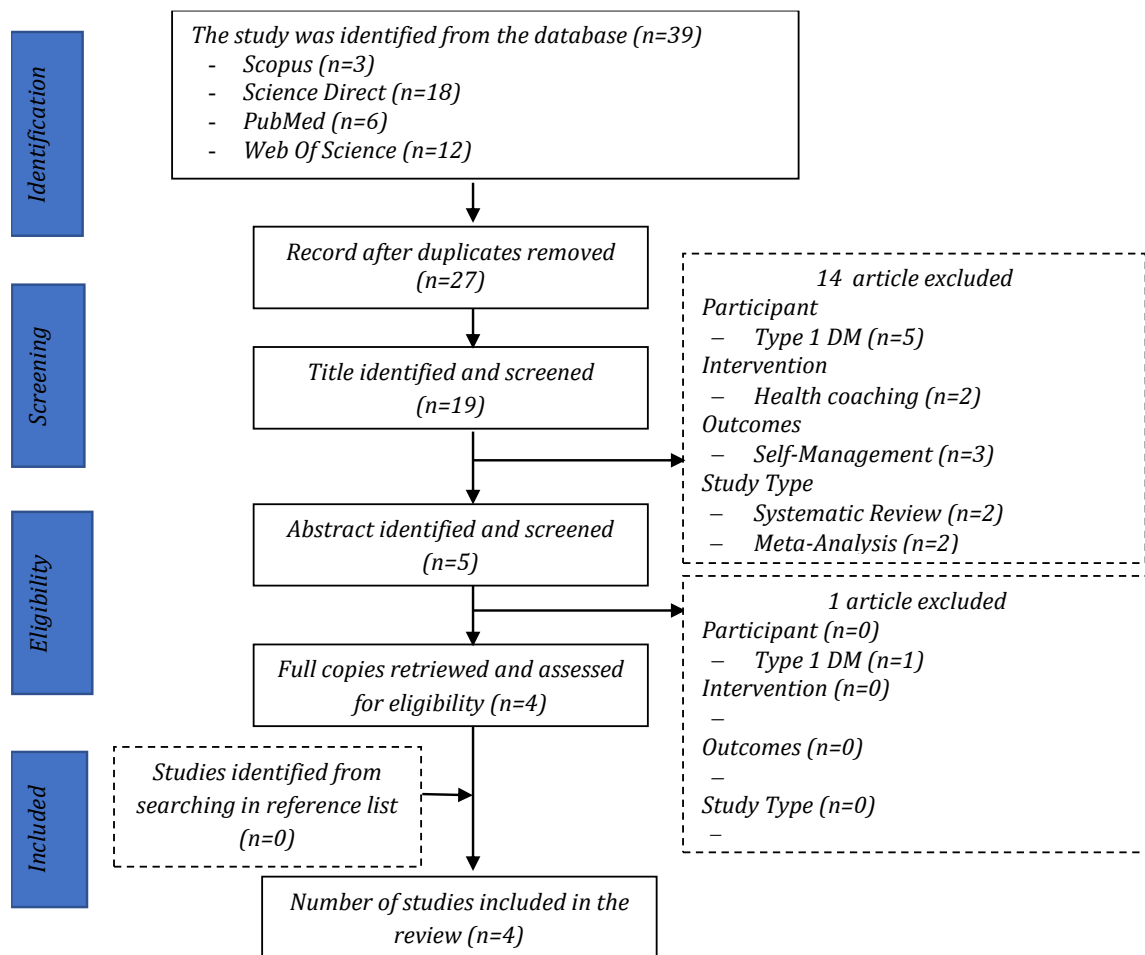


Figure 1. Process Flow

20 years, intervention group given using a web-based ulcer record system accessible from mobile devices and computers every week for 6 months and control group with standard care, instrument used to measure the outcomes is Euro-QoL Including three common instruments (Euro-QoL EQ-5D-5L / EQ5D-VAS, Hospital Anxiety and Depression Scale (HADS), WHO Five Well-Being Index (WHO-5)), researchers used the EQ-5D-5L questionnaire as a utility score. health Part one consists of five single items: mobility, self-care, usual activities, pain/discomfort and anxiety/depression (the health dimension). The second part is the Visual Analogue Scale (VAS) ranging from 0 (worst health condition) to 100 (best health condition), and is used as an overall measure of perceived health status. WHO-5 is used to describe well-being during the previous 2 weeks. Five items are ranked from 0 to 5. Item scores add up 0 - A scale of 100 with a higher score indicating better well-being. HADS assessed anxiety and depressive symptoms over the past week. This instrument consists of seven items about anxiety (HADS-A) and seven items about depression (HADS-D), NeuroQoL assessed patients' perception of the impact of foot ulcers on their QoL. This instrument consists of six domains: 1) symptoms of pain and paresthesia; 2) symptoms of feeling reduced/disappeared in the legs; 3) diffuse sensory motor symptoms; 4) restrictions in

daily activities; 5) interpersonal problems and 6) emotional burden. Higher scores indicate a greater negative impact of foot ulcers on QoL, and PAID this instrument covers frequently reported emotional states. Outcomes from the research is telemedicine technology is a relevant alternative with maintenance on patient with DFU, with condition health, well-being and quality life stable. QoL showed a significant increase ($p = 0.02$), HADS = 0,89, PAID = 0,04 (Iversen et al., 2020).

The second study Sunil Kumar *et al.*, (2020) was carried out in India with total of 300 patients and an age of patients with DM from 18 - 65 years, intervention group given using diabetes mobile during 6 months and control group with standard care, instrument used to measure the outcomes is WHO QoL BREF questionnaire, and outcomes from the research is the differences in the change in scores of quality of life of participants recruited in intervention and non-intervention groups were statistically significant in all the four domains after the intervention with a p value < 0.001 (Sunil Kumar et al., 2020)

The third study Bohnert et al., (2023) was carried out in USA with total of 21 respondents an age 66 years, intervention group given using zoom application and intervention given to 5 months and control group with standard care, instrument used to

measure the outcomes is Patient-Reported Outcomes Measurement Information System (PROMIS), and outcomes from research is showed that all participants completed the survey well via the zoom application, and participants reported minimal levels of depression and good QoL (anxiety: Adams = 49.1 ± 7.2 , Bohnert = 48.2 ± 7.4 , depression: Adams = 48.3 ± 8.2 , Bohnert = 48.9 ± 7.6 , and fatigue: Adams = 50.9 ± 8.5 , Bohnert = 50.8 ± 8.4) (Bohnert et al., 2023).

The fourth study Duruturk & Özköslü, (2019) was carried out in Turkey with total of 50 respondents an age of patients with DM from 18 – 65 years, intervention group given using internet based video conferences and intervention given to three times a week for 6 weeks months and control group with standard care, instrument used to measure the outcomes is BDI questionnaire, and outcomes from the research is the intervention given was proven to be safe and effective and could be and alternative treatment for managing T2DM where levels of depression and QoL varied significantly ($p= 0,000$) (Duruturk & Özköslü, 2019) as seen in the Table 2.

4. DISCUSSION

This study aimed to review published articles on the effectiveness of telehealth on quality of life in type 2 diabetes mellitus. The findings showed in intention-to-treat analyses, differences between treatment groups were small but significant for health and well-being scale scores, diabetes-related distress, and foot ulcer-specific quality of life, and the evidence generated in this study suggests that such technological approaches can be used as a public health measure to improve the quality of life of patients with type 2 Diabetes Mellitus.

Telehealth technology as a relevant alternative to usual care for people with Diabetic Foot Ulcers (DFU) facilitates flexible health care services and close cooperation between levels of healthcare services, with a sample size of 182 possible mechanisms or pathways telemedicine can improve PROM including telemedicine can produce outcomes better DFU treatment to condition health, well- being and quality life (Iversen et al., 2020). The Effect of m-Health intervention in the integrated management of non-communicable disease such as hypertension and diabetes mellitus is proven to be a difference in in the average change from the beginning to the end of the intervention, smartphone application based intervention efforts can be used as a public health benchmark to improve overall health outcomes in sufferers type 2 diabetes mellitus (Sunil Kumar et al., 2020).

The first randomized Iversen *et al.*, (2020) controlled trial assessing the effect of a telemedicine intervention for DFU versus SOC designed primarily to study its effect on ulcer healing, interventions on self-reported health and well-being, and quality of life. Briefly, community nurses used a mobile phone to take pictures of the ulcer which was then sent via a web-based platform to the hospital for review by a

specialist health care professional, facilitating counseling and feed-back. Measurements can be compared over time to visualize the healing process of the ulcer. This allows all involved staff to contribute, even though they are on a distance. This system is customized for collaboration, discussions, and advice regarding the treatment between cooperating medical staff in different health care institutions. The main reason for using the web-based ulcer record system is the collaboration functionality that enables integrated care across different levels of the health care sector. Relevant ulcer data are accessible to the involved staff, regardless of employment in community care or specialist health care. During follow-up, the community nurses provided care under supervision of the specialist nurses at the outpatient clinics and communicated at least weekly with the specialist nurses at the outpatient clinic. Researcher used both generic and disease-specific Patient-Reported Outcome Measures (PROMs) to assess the patients' perceptions of the intervention on self-reported health and well-being, and QOL (Iversen et al., 2020). The questionnaire used in this study is the Euro-QoL (EQ-5D-5L) where this questionnaire is a well-known and widely used health status instrument where in 2015 there were more than 17,000 studies using this questionnaire, this instrument is also concise and can be used to measure, compare, and assess health status across disease areas, and to provide evidence on the cost-effectiveness of healthcare technologies (Devlin & Brooks, 2017). Another instrument used is the NeuroQoL questionnaire where this questionnaire assesses patient perceptions of the impact of foot ulcers on the quality of life of type 2 DM patients, the measurement system in this questionnaire tends to be short, reliable, valid, responsive, and quite consistent (Cella et al., 2012).

Another study conducted by Sunil Kumar *et al.*, (2020) underlined effort from intervention application smartphone- based inside management of diabetes mellitus type 2 in south India where this study focused on type 2 diabetes mellitus patients undergoing treatment in outpatient polyclinics at the hospital. The mobile application focuses on lifestyle modification and treatment management for people with type 2 diabetes mellitus so that results are obtained. showing that quality life that has four such domains aspect health psychological , social , environmental , and physique showing more improvement good between receiving patient intervention, with thereby approach technology the can used For increase results health in a manner whole And quality life type 2 diabetes mellitus (Sunil Kumar et al., 2020). In this study the instrument used was only one questionnaire, WHO QoL BREF, this questionnaire is a generic instrument that can be applied across cultures, this questionnaire assesses the quality of life in four domains, physical health, psychology, social relations, and the environment (Amin et al., 2022).

The limitations of this systematic review are that there were only 2 studies analyzed regarding the use of telehealth on improving the quality of life of people with type 2 diabetes mellitus, and it was only limited to four databases Scopus, Science Direct, PubMed, and Web of Science. Therefore, further studies are necessary.

5. CONCLUSION

Telehealth demonstrates positive impacts on QoL of the diabetes mellitus type 2 patients. Telehealth has good potential to be developed in the service of diabetes mellitus patients, telehealth based on the internet, web, and smartphones, can improve the quality of life properly and greatly affect the well-being and quality of life of type 2 diabetes mellitus patients. Advances in technology and information can encourage the use of mobile health applications for the delivery of health services. Mobile health applications are able to implement innovative solutions, add information, build engagement between patients and those responsible for managing cases. Healthcare professionals can assess the complication prevention complex and well-being using a mobile health app validated for diabetes mellitus patients. However, the lack of scientific calculation of the sample and the estimation of the sample measurements carried out did not rule out the possibility that the study failed to detect positive or negative intervention effects. Therefore, further studies are required to confirm these findings.

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Table 2. Summary of the included studies

No	Author/Year	Study Design	Country setting	Number of Participants	Age (Range/mean age)	Intervention Given		Instrument Used to Measure The Outcomes	Outcomes
						Intervention	Control		
1.	(Iversen <i>et al.</i> , 2020)	RCTs	Norway	182	20	a web-based ulcer record system accessible from mobile devices and computers and intervention given to patients every week for 6 months	Standard care	Euro- QoL, HADS, PAID, Neuro-QOL questionnaires	Telemedicine technology is a relevant alternative with maintenance on patient with DFU, with condition health, well-being and quality life stable. QoL showed a significant increase (p = 0.02), HADS = 0,89, PAID = 0,04
2.	(Sunil Kumar <i>et al.</i> , 2020)	RCTs	India	300	18-65	Diabetes mobile application and intervention given to 6 months	Standard care	WHO QOL BREF questionnaire	The differences in the change in scores of quality of life of participants recruited in intervention and non-intervention groups were statistically significant in all the four domains after the intervention with a p value < 0.001

No	Author/Year	Study Design	Country setting	Number of Participants	Age (Range/mean age)	Intervention Given		Instrument Used to Measure The Outcomes	Outcomes
						Intervention	Control		
3.	(Bohnert et al., 2023)	et RCTs	USA	21	66	Zoom application and intervention given to 5 months	Standard care	Patient-Reported Outcomes Measurement Information System (PROMIS)	The research result showed that all participants completed the survey well via the zoom application, and participants reported minimal levels of depression and good QoL (anxiety: Adams = 49.1 ± 7.2, Bohnert = 48.2 ± 7.4, depression: Adams = 48.3 ± 8.2, Bohnert = 48.9 ± 7.6, and fatigue: Adams = 50.9 ± 8.5, Bohnert = 50.8 ± 8.4)
4.	(Duruturk & Özköslü, 2019)	et RCTs	Turkey	50	18-65	Internet based video conferences and intervention given to three times a week for 6 weeks.	Standard care	BDI questionnaire	Findings from the study showed that the intervention given was proven to be safe and effective and could be an alternative treatment for

No	Author/Year	Study Design	Country setting	Number of Participants	Age (Range/mean age)	Intervention Given		Instrument Used to Measure The Outcomes	Outcomes
						Intervention	Control		
									managing T2DM where levels of depression and QoL varied significantly (p=0,000)