MEDIA PENELITIAN DAN
PENGEMBANGAN KESEHATAN
Vol 35 No 3, September 2025

e-ISSN: 2338-3445
p-ISSN: 0853-9987

TELENURSING INNOVATION IN EDUCATION TO PREVENT THE INCIDENCE AND COMPLICATIONS OF DIABETES MELLITUS CHANGING THE HEALTH BEHAVIOR OF DIABETES PATIENTS

Inovasi Telenursing dalam Edukasi Cegah Kejadian dan Komplikasi Penyakit Diabetes Melitus Merubah Perilaku Kesehatan Penderita Diabetes

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ABSTRAK

Edukasi mencegah kejadian dan komplikasi penyakit DM menggunakan media telenursing dapat menjadi strategi yang efektif untuk meningkatkan perilaku kesehatan penderita DM. Penelitian ini bertujuan untuk mengetahui dampak edukasi yang diberikan melalui telenursing terhadap perilaku kesehatan pasien diabetes melitus. Penelitian ini merupakan penelitian analitik dengan metode quasi-eksperimen menggunakan rencana pre-test dan post-test dengan desain kelompok kontrol. Jumlah sampel dihitung menggunakan rumus Slovin, dengan total 172 responden yang dibagi menjadi 2 kelompok. Kelompok intervensi diberikan kegiatan edukasi kesehatan menggunakan aplikasi EGP (edukasi Gadis pendiam) dengan mengirimkan video edukasi tentang DM. Sebaliknya, kelompok kontrol hanya mengikuti arahan normatif yang diberikan oleh pegawai puskesmas tanpa adanya pendekatan edukasi yang lebih mendalam. Teknik pengambilan sampel menggunakan purposive sampling. Uji yang digunakan adalah Wilcoxon, Fisher Exact, dan McNemar. Perbedaan antara pre dan post test signifikan secara statistik (p = 0,001) yang menunjukkan adanya peningkatan signifikan pada perilaku kesehatan pada kelompok intervensi. Perbandingan antara kelompok intervensi dan kontrol sebelum diberikan edukasi menunjukkan nilai p=0,000, yang berarti terdapat perbedaan yang signifikan antara kedua kelompok. Perbandingan antara kelompok intervensi dan kontrol setelah diberikan edukasi menunjukkan nilai p=0,000, yang berarti terdapat perbedaan yang signifikan antara kedua kelompok. Hasil uji statistik menunjukkan nilai p=0,001, yang berarti terdapat perbedaan yang signifikan antara perilaku kesehatan sebelum dan sesudah diberikan edukasi antara kelompok intervensi dan kontrol. Kesimpulannya, pendidikan memberikan dampak yang signifikan terhadap perilaku kesehatan pada kelompok intervensi dibandingkan dengan kelompok kontrol. Oleh karena itu, disarankan untuk terus melakukan program edukasi yang dapat meningkatkan perilaku kesehatan masyarakat.

***Kata kunci**: diabetes melitus, pendidikan, penderita, perilaku kesehatan, telenursing*

ABSTRACT

Education to prevent the occurrence and complications of DM using telenursing media can be an effective strategy to improve health behavior in DM patients. This study aimed to determine the impact of education provided through telenursing on the health behavior of diabetes mellitus patients. This study was an analytical study with a quasi-experimental method using a pre-test and post-test plan with a control group design. The number of samples was calculated using the Slovin formula, with a total of 172 respondents divided into 2 groups. The sampling technique used purposive sampling. The tests used were Wilcoxon, Fisher Exact, and McNemar. The difference between the pre and post tests was statistically significant (p = 0.001) indicating a significant increase in health behavior in the intervention group. The comparison between the intervention and control groups before being given education showed a value of 0.000, which means there is a significant difference between the two groups. The comparison between the

https://doi.org/10.34011/jmp2k.v35i3.2673

e-ISSN: 2338-3445
p-ISSN: 0853-9987

intervention and control groups after being given education showed a value of 0.000, which means there is a significant difference between the two groups. The results showed a value of 0.001, which means there is a significant difference between health behavior before and after being given education between the intervention and control groups. In conclusion, education has a significant impact on health behavior in the intervention group compared to the control group. Therefore, it is recommended to continue to carry out educational programs that can improve public health behavior.

Keywords:education, diabetes mellitus, telenursing, health behavior, patients

INTRODUCTION

Diabetes mellitus is a chronic metabolic disease characterized by high levels of glucose in the blood due to the body's inability to produce or use insulin effectively[1].This condition can lead to various long-term complications, such as cardiovascular disease, kidney failure, nerve damage, and vision loss[2]. With 10.7 million cases recorded in 2019, diabetes mellitus (DM) is the seventh most prevalent disease in the world, making it a serious public health problem in Indonesia[3]. Chronic hyperglycemia caused by insulin resistance or insufficient insulin production is the hallmark of this condition, and can lead to serious side effects such as kidney failure, neuropathy, and cardiovascular disease[3], [4]It is worrying that DM is becoming increasingly common in Indonesia; estimates suggest that by 2030, the number of people suffering from it could quadruple.[5].

Preventing the incidence and complications of diabetes mellitus is crucial to improving the overall health and well-being of individuals with this condition. One effective strategy to address this challenge is through the use of telenursing, which involves providing nursing care and education using telecommunications technology.[6].

For patients living in remote areas, telehealth programs have been shown to increase access to diabetes care, reduce health care costs, and improve health outcomes.Patient satisfaction was primarily related to the significant reduction in transportation time (7 hours). Reduced travel costs and saved workdays were the most important factors in making telemedicine arrangements economically efficient[7]. Existing literature indicates that education plays a crucial role in preventing the incidence and complications of diabetes mellitus. Several studies have demonstrated the positive impact of diabetes education on improving self-care behaviors, glycemic control, and overall health outcomes[8], [9].

Nurses can also provide individualized care, where each patient's needs are addressed individually. While this approach can be demanding, it has been shown to lead to better patient outcomes and should be promoted in diabetes care practice. Nurses engage in a variety of activities aimed at meeting the diverse care needs of their patients, which is part of the general nursing role in the UK.[10]Nurses can also play a role in improving the psychological well-being of patients with diabetes. Routine care can provide targeted nursing interventions for the care and treatment of elderly patients with type 2 diabetes, but often there is insufficient emphasis on the patient's psychological condition and overall well-being. Humanistic nursing care can not only provide basic clinical nursing interventions for patients but also ensure a healthy mental state and overall well-being[11].

By providing patients with the knowledge and skills needed to manage their condition, education can empower them to make informed decisions and adopt healthier lifestyle habits[12], [13]. Furthermore, integrating telenursing into diabetes education programs can further enhance the reach and effectiveness of these interventions. Telenursing can facilitate remote monitoring, personalized feedback, and ongoing support for patients, which can lead to improved treatment adherence and better

https://doi.org/10.34011/jmp2k.v35i3.2673

e-ISSN: 2338-3445
p-ISSN: 0853-9987

disease management[14], [15]. This study aims to investigate the impact of education provided through telenursing on the health behaviors of patients with diabetes mellitus. By utilizing this innovative approach, the researchers hope to provide valuable insights into how technology can improve diabetes management and reduce complications.

METHODS

Research Design

This type of research was analytical research, the research method used in this study was a quasi-experimental with a pre-test and post-test with a control group design. This design aimed to reveal the causal relationship by involving a control group in addition to the experimental group. The intervention group received treatment in the form of education on preventing the occurrence and complications of diabetes mellitus through the telenursing method. Telenursing is an approach that utilizes communication technology to provide health education, enabling long-distance interaction between health workers and patients. The intervention group was given health education activities using the EGP (Education of Silent Girls) application by sending educational videos about DM 4 times a month. This application is used to provide reminders to diabetes mellitus sufferers to have health checks at the nearest community health center at least once a month. This application is also set as a reminder for patients to take medication twice a day, morning and night. The application will provide a reminder once a day to take medication and a health check once a month for 5 months. The control group only followed the normative directions given by community health center staff without any more in-depth educational approach. The normative guidance provided to the control group included basic information related to diabetes mellitus management, including diet, physical activity patterns, and the importance of regular check-ups. The guidance was provided in the form of face-to-face meetings between community health center staff and patients, with sessions lasting approximately 30–45 minutes each month. Both groups underwent a pre-test to measure initial knowledge about diabetes and a post-test after the intervention to evaluate changes in knowledge. This method allowed researchers to analyze the effectiveness of telenursing in improving understanding and preventing diabetes complications compared to the conventional approach received by the control group.This research was conducted in the working area of the Bima City Health Office, from July to November 2024 in the working area of 5 community health centers.

Sampling Techniques

The sample in this study were DM patients in the Bima City Health Office work area and in accordance with the research criticism. The number of samples in this study was calculated using the sample size formula according to Slovin. The total sample in this study was 172 with a division of n1: 86 respondents and n2: 86 respondents. The sampling technique in this study used a purposive sampling technique. The researcher divided the respondents into two groups: 86 respondents in the intervention group and 86 respondents in the control group.

Sample inclusion criteria were type 2 diabetes mellitus patients aged 18-60 years. Diabetes mellitus patients who had never received education about diabetes management using telenursing media. Diabetes mellitus patients who were willing to be respondents and participate in the study until completion. The exclusion criteria were diabetes mellitus patients with severe complications such as kidney failure, stroke, or cardiovascular disease, diabetes mellitus patients with cognitive or mental disorders, diabetes mellitus patients who were pregnant or breastfeeding. Diabetes mellitus patients who did not have access to or the ability to use telenursing technology.

https://doi.org/10.34011/jmp2k.v35i3.2673

e-ISSN: 2338-3445
p-ISSN: 0853-9987

Data collection tools and techniques

The variables studied included age, gender, occupation, duration of DM, DM history, and behavior. The tools used were questionnaires, Android mobile phones, and the EGP (quiet girl education) application. Data collection techniques in the study included researchers conducting a time contract on the field and explaining the purpose of the study to respondents, as well as providing informed consent forms. A pretest was conducted by distributing questionnaires in the first week of the treatment group and the second week of the control group to determine respondents' attitudes before being given treatment. Health education activities were carried out in the third week according to the predetermined time, using the EGP application by sending educational videos about DM. Then, a post-test was conducted by observing respondents' visits/attendance at the health center in the treatment and control groups.

Validity and reliability of the questionnaire

Psychometric analysis is one of several important processes used to assess the validity of a questionnaire. The first step is to ensure the questionnaire is content valid, which is achieved by having professionals in the fields of nursing and diabetes evaluate it. According to the calculation of the item-level content validity index (i-CVI), questions 1 to 25 scored at least 0.89. Therefore, it can be said that the questions are relevant and practical. All 25 questionnaire questions had i-CVI values between 0.80 and 1.00, indicating that the items are considered to have very high or excellent validity. The questionnaire also demonstrated strong reliability, based on the Cronbach's alpha coefficient, which was 0.87. A value above 0.7 is considered adequate.

Data analysis

Univariate analysis included data such as age and gender. Furthermore, univariate tests examined the health behavior of DM patients. Prior to bivariate analysis, data normality was tested using the Shapiro-Wilk test. The data distribution was non-normal, with a p-value of 0.003.To determine the differences in health behavior in the intervention and control groups, the pre and post test Wilcoxon test was used.To compare the proportion of subjects with the "Good" and "Poor" categories between the intervention and control groups in the pre-test, it was usedFisher's Exact Test. To compare the proportion of subjects with the "Good" and "Poor" categories between the intervention and control groups in the post-test, theFisher's Exact TestTo compare the proportion of subjects with the "Good" and "Poor" categories between the pre-test and post-test in each group, the McNemar test was used. Behavior was measured using a questionnaire. The cut points were True: 2, False: 1, Don't know: 0. Categories: good and poor. The higher the mean value in the post-test results, the better the change.With 25 questions and each correct answer worth 2 points, the maximum possible score is 50 (25 x 2). To classify health behavior as good, a standard of 70% of the maximum score is used. Therefore, a good score is 35 or higher (50 x 70% = 35). A score below 35 is considered poor.

Ethical Worthiness

This research has received ethical approval from the Mataram Ministry of Health Polytechnic with the number DP.04.03/F.XLVIII.14/421/2024.

RESULT

Table 1 presents the frequency distribution of respondents' characteristics in two groups, namely the intervention and control, related to diabetes mellitus (DM). In terms of age, the intervention group was dominated by respondents aged 41-50 years (55%), while the control group also showed a dominance of the same age group (67%). In terms of gender, there were more women than men in both groups, with the proportion of women in the intervention group reaching 60.5% and in the control group 86%. Regarding occupation, the majority of respondents in the intervention group were

https://doi.org/10.34011/jmp2k.v35i3.2673

e-ISSN: 2338-3445
p-ISSN: 0853-9987

housewives (40.7%), while in the control group, housewives also dominated (52.3%). Duration of DM showed that 60.5% of the intervention respondents had suffered from DM for more than 4 years, compared to 16.3% in the control group. Finally, family history of DM showed that 66.3% of the intervention respondents had a family history, compared to 60.5% in the control group. Overall, this table provides an overview of the demographic characteristics and health history of respondents that are relevant in the context of research related to DM.

Table 1. Frequency Distribution of Respondent Characteristics

Characteristics	Intervention		Control	
	n	%	n	%
Age				
31-40	37	43	23	27
41–50	47	55	58	67
>50	2	2	5	6
Gender				
Man	34	39.5	12	14
Woman	52	60.5	74	86
Work				
Housewife	35	40.7	45	52.3
Self-employed	13	15.1	12	14
Farmer	11	12.8	12	14
Trader	17	19.8	8	9.2
Doesn't work	10	11.6	9	10.5
Long-term DM Suffering				
1-2 Years	13	15.1	20	23.3
3-4 Years	21	24.4	52	60.2
>4 Years	52	60.5	14	16.3
Family History of DM				
There isn't any	29	33.7	34	39.5
There is	57	66.3	52	60.5

Table 2 presents comparative data on health behavior between the intervention and control groups before and after the implementation of the intervention. The "Mean" column shows the average health behavior for both groups in the pre- and post-intervention states. The intervention group showed a significant increase in the average health behavior from 1.05 (SD=0.212) in the pre-test to 1.80 (SD=0.401) in the post-test, with a p-value of 0.001, indicating a statistically significant difference. In contrast, the control group showed only a slight increase from 1.10 (SD=0.308) in the pre-test to 1.12 (SD=0.322) in the post-test, with a p-value of 0.320 indicating no significant difference between the measurement times. The Wilcoxon test conducted on the intervention group showed a significant increase in health behavior after the intervention, while the control group showed no significant change. This confirms the effectiveness of the intervention in improving health behavior.

Table 2. Differences in Health Behavior in the Intervention and Control Groups Pre and Post Test

Variables	Group	Mean	Elementary School	95% CI	P value
Behavior	Intervention				
	Pre	1.05	0.212	0.663 – 0.848	0.001
	Post	1.80	0.401		
	Control				
	Pre	1.10	0.308	0.029 – 0.052	0.320
	Post	1.12	0.322		

Wilcoxon test

Table 3 presents an analysis of differences in the health behavior of diabetes mellitus patients who visited the community health center before and after education. The data

https://doi.org/10.34011/jmp2k.v35i3.2673

e-ISSN: 2338-3445
p-ISSN: 0853-9987

were divided into two groups: intervention (patients who received education) and control (patients who did not receive education). Before the intervention, only 19.8% of the intervention group demonstrated good health behavior, while 80.2% demonstrated poor behavior. In the control group, 9.3% demonstrated good behavior and 90.7% demonstrated poor behavior. After the intervention, there was a significant increase, with 95.3% of the intervention group demonstrating good behavior, while only 10.5% of the control group demonstrated good behavior. The P-value obtained from the McNemar test and Fisher Exact test showed statistical significance (P < 0.05), indicating that education had a positive effect on the health behavior of diabetes mellitus patients. These results demonstrate the importance of education in improving health behavior in diabetes patients.

Table 3. Analysis of Differences in Health Behavior of Diabetes Mellitus Patients Visiting the Community Health Center Before and After Education

Behavior	Intervention		Control		P value
	n	%	n	%	
Pre					
Good	17	19.8	8	9.3	0.000*
Not enough	69	80.2	78	90.7	
Post					
Good	82	95.3	9	10.5	0.010*
Not enough	4	4.7	77	89.5	
P value			0.001**		

**McNemar Test
*Fisher Exact Test

DISCUSSION

Telenursing has emerged as an impactful method for improving healthcare delivery, particularly in situations where traditional face-to-face interactions are hampered by geographic distance. Analysis of health behaviors before and after the intervention indicates that telenursing can result in significant improvements in health behaviors. In this study, the intervention group demonstrated a significant increase in their mean health behavior score from 1.05 (SD=0.212) to 1.80 (SD=0.401) with a p-value of 0.001, thus strongly demonstrating the efficacy of the telenursing-based intervention.

The intervention results demonstrate not only how telenursing technology is used, but also how nursing practice is integrated with patient-centered telenursing strategies. This study explains how telenursing helps patients develop self-management and adherence practices. Telenursing applications can increase independence in individuals, especially those recovering from illness[16], [17].

In contrast, the control group showed little improvement, increasing from a mean of 1.10 (SD=0.308) to 1.12 (SD=0.322) with a p-value of 0.320, indicating no statistically significant improvement. This difference emphasizes that structured interventions, such as telenursing, may be more successful in strengthening health behaviors than conventional methods.According to research, telenursing is effective in improving patient outcomes and experiences by continuing to participate in their care plans and providing healthcare providers with useful data that they can use to continually modify interventions[18]. In addition to providing education and symptom management to patients, telenursing is very useful in empowering patients, which in turn increases compliance with health advice recommended by health workers[19].

The Wilcoxon test used in the intervention group showed statistically significant changes in health behaviors, further confirming that specific and tailored telenursing programs can substantially change health-related outcomes[20]. These findings

https://doi.org/10.34011/jmp2k.v35i3.2673

e-ISSN: 2338-3445
p-ISSN: 0853-9987

emphasize the need to incorporate evidence-based practices into nursing care, particularly in the emerging field of telehealth.

The changes in health behaviors in the group undergoing the telenursing intervention validated statistically significant improvements relative to baseline measurements, which is crucial within the framework of clinical practice. This provides a strong argument for healthcare systems to adopt telenursing more broadly as a sustainable and effective health strategy, particularly in optimizing patient outcomes across diverse populations. Further research in this area will strengthen the understanding of how telenursing can bridge gaps in health interventions, particularly in less accessible settings or during public health crises[22].

These findings collectively advocate for recognizing telenursing not simply as a complement to conventional care but as a fundamental aspect of patient management strategies that meet the evolving health care needs of modern society. Establishing rigorous protocols and practices around telenursing will strengthen the health care system's ability to effectively and efficiently address contemporary challenges[16], [18], [23].

Analysis of Table 3 reflects improvements in health behaviors among diabetes mellitus patients who received education through the telenursing application compared to those who did not receive the intervention. Before receiving the treatment, the majority of both the intervention and control groups demonstrated unsatisfactory health behaviors. However, post-intervention results demonstrated the important role of telenursing in enhancing patient engagement and encouraging positive health behaviors, as evidenced by substantial improvements in health behaviors among the intervention group, with those demonstrating satisfactory health behaviors increasing to 95.3%, compared to only a slight increase in the control group[24].

Numerous studies have confirmed the efficacy of telenursing in chronic disease management. For example, Zhou et al. found that type 2 diabetes (T2DM) patients who utilized a telenursing platform were more likely to seek health education and respond well to their treatment programs, highlighting the need for professional healthcare knowledge in managing complications arising from diabetes[24].Telenursing helps improve patient adherence to prescribed programs and facilitates lifestyle adjustments that can reduce long-term complications of diabetes, such as peripheral neuropathy and cardiovascular disease[25].

Further supporting this, a systematic review by Ghoulami-Shilsari and Esmaeilpour-Bandboni highlighted the effectiveness of telenursing interventions in chronic disease scenarios, finding that telephone-based educational initiatives can significantly improve self-management abilities of diabetes patients when compared to traditional care methods.[21]This is in line with the findings that suggest that improved health behaviors among the intervention group may be attributed to a structured educational program that addresses the basics of diabetes management through telenursing.

Additionally, intervention strategies utilizing technology such as telenursing have shown promising results in improving health literacy and promoting self-care practices essential for diabetes management. This is evidenced by the observations of Mamaghani et al., who found that combining an empowerment program with telenursing resulted in a significant increase in self-efficacy among patients, which was directly correlated with better glycemic control, as indicated by a decrease in HbA1c levels[26].

The current investigation provides important insights into the importance of ongoing support and follow-up in diabetes care. Improvements in the intervention group demonstrated that ongoing engagement through telenursing not only provided patients with essential knowledge but also fostered a lasting relationship with their healthcare providers. This aligns with the findings of Akbarirad et al., who noted that telenursing significantly contributed to improved dietary adherence and self-care management in

https://doi.org/10.34011/jmp2k.v35i3.2673

e-ISSN: 2338-3445
p-ISSN: 0853-9987

diabetes patients compared with standard care[25].As emphasized by Carpenter et al., self-management interventions that include consistent follow-up have a profound impact on diabetes control, indicating that telenursing embodies a proactive approach to patient education and health behavior modification[27].

While the benefits of telenursing are clear, challenges remain, particularly in ensuring equitable access to technology for all diabetes patients. This uneven distribution can lead to disparities in health outcomes, as highlighted in studies focusing on populations with limited access to technology and digital literacy[28].Therefore, while telenursing improves health education and behavior modification, simultaneous efforts must address the digital divide to ensure all patients can benefit from these advances.

Data from the current study highlighted the statistical significance of the observed changes in health behaviors before and after the intervention ($P < 0.05$), further confirming the positive influence of tailored educational initiatives through telenursing on diabetes management[24].This encapsulates the essence of telenursing as an adjunct to traditional healthcare methodologies, reinforcing the notion that technology-assisted interventions can indeed redefine the paradigm of chronic disease management.

In addition, Ju et al. demonstrated the use of telehealth programs such as telenursing in significantly increasing diabetes knowledge and improving self-care behaviors relevant to managing certain complications such as foot health.[29]This multifaceted approach empowers patients and encourages adherence to comprehensive diabetes care, consistent with the good outcomes observed in the intervention group of this study.

The implications of these findings extend beyond individual patient outcomes. They signal the potential for restructuring diabetes care models to incorporate telenursing as a cornerstone of ongoing education and support. Consequently, healthcare institutions may consider integrating this modality into standard operating procedures while developing training protocols for healthcare professionals to effectively utilize telenursing, thereby leveraging its benefits while addressing its inherent limitations.

Collectively, data from this study and other investigations demonstrate the transformative power of telenursing in managing diabetes. This underscores the importance of adapting healthcare delivery mechanisms to incorporate technology-based solutions to enhance patient autonomy and health literacy. The progression from inadequate health behaviors to significantly improved outcomes reinforces the critical role of telenursing in bridging the gap between patient knowledge and effective disease management.

CONCLUSION

In conclusion, the marked improvement in health behaviors of patients with type 2 diabetes who participated in a telenursing program underscores the transformative potential of this approach. With evidence supporting its efficacy, telenursing is emerging as a key strategy for improving diabetes management and serves as a model for future interventions targeting chronic disease self-management. Future research should continue to explore optimizing telenursing applications to ensure they are accessible to all demographics, thereby improving the overall standard of care in diabetes management.

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