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The Effectiveness of Smart Booklet Educational Media on Foot Care Behavior in Efforts to Prevent Diabetic Food Ulcer in Type 2 Diabetes Mellitus Patients At the Limboto Health Center

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ABSTRACT

Type 2 Diabetes Mellitus is a chronic disease with one of the complications being Diabetic Foot Ulcer (DFU). Prevention of DFU depends on good foot care behaviors, but there are still many patients who have not applied it optimally. Education using SMART Booklet media is one of the promotive and preventive efforts to improve foot care behavior. This study aims to determine the effectiveness of the SMART Booklet educational media on foot care behavior in type 2 Diabetes Mellitus patients at the Limboto Health Center. This study uses a pre-experimental design with a one group pre-post test design approach. The study population was 188 patients, with a sample of 33 respondents selected using purposive sampling techniques. The research instrument used the Nottingham Assessment of Functional Foot Care (NAFF) questionnaire. Data analysis was conducted using the Wilcoxon Signed Rank Test. The results showed an improvement in foot care behavior after the intervention with a p-value = 0.000 ($p < 0.05$), which means that there was a significant difference before and after education. The SMART Media Booklet is said to be effective because it is designed based on the principles of Specific, Measurable, Achievable, Relevant, and Time-bound which presents foot care steps in detail, systematic, and in accordance with the patient's condition, making it easier for patients to follow the stages of treatment gradually and form habits that are carried out regularly. The presentation of structured and readable material also strengthens the consistency of the implementation of foot care in daily life.

INTRODUCTION

Diabetes Mellitus is a chronic condition in which blood sugar levels are too high, called hyperglycemia. According to International Diabetes Federation (IDF)Diabetes Mellitus is a chronic disease that occurs when the pancreas does not produce enough insulin or when the body cannot use insulin properly to lower blood sugar levels. Diabetes Mellitus is a metabolic disorder characterized by high blood sugar levels. When insulin secretion is not functioning properly, blood sugar levels remain too high, and the body cannot cope with increased insulin resistance (Shawn) et al., 2024).

According to the World Health Organization (WHO) in 2022, there are 422 million people worldwide with diabetes and 1.5 million deaths are directly linked to diabetes each year. The number of cases has continued to increase in recent decades, and DM is among the most widely suffered diseases in the world and ranks fourth in degenerative disease research priorities. In 2021, the global prevalence of diabetes in 20–79 years was 10.5% (536.6 million people) and is expected to increase to 12.2% (783.3 million) by 2045. The IDF in 2021 stated that type 2 Diabetes Mellitus is the most common type, accounting for around 90% of all diabetes cases in the world (Indah et al., 2023). A total of 537 million adults or 1 in 10 people in the world live with diabetes, with 6.7 million deaths (1 death every 5 seconds). China, India, Pakistan, the United States, and

Indonesia are among the five countries with the highest number of diabetics in the world (Hartono & Ediyono, 2024).

According to International Diabetes Federation (IDF) In 2021, it predicts an increase in the number of people with DM in Indonesia from 9.1 million in 2014 to 14.1 million in 2035 (Kusuma & Suharyanto, 2024). Based on the results of the Indonesian Health Survey (SKI, 2023), the prevalence of type 2 Diabetes Mellitus in Indonesia reaches 50.2% of all recorded DM cases. The highest prevalence of type 2 diabetes mellitus was found in West Kalimantan at 65.1%, while the lowest was in mountainous Papua at 28.1%. Meanwhile, Gorontalo has a prevalence of 46.1% and ranks 26th out of 38 provinces in Indonesia.

Based on data from the Gorontalo Provincial Health Office Screening in May 2025, there were 7,529 cases of type 2 Diabetes Mellitus. The most cases were in Gorontalo Regency with 3,332 cases (44.24%), followed by Bone Bolango Regency with 1,533 cases (20.35%), and Gorontalo City with 1,097 cases (14.57%). In Gorontalo Regency, the number of cases is still high although it has decreased slightly from 5,847 cases in 2024 to 5,813 cases in August 2025. Of the 23 health centers, the three with the highest number of patients are the Limboto Health Center (778 cases), the Telaga Biru Health Center (482 cases), and the Tolangohula Health Center (431 cases) (Kabgor Health Office, 2025). Although there has been a slight decrease, this data shows that the burden of Diabetes Mellitus in Gorontalo Regency is still high, so priority is needed in disease prevention and control efforts.

With the increase in the prevalence of diabetes mellitus above, there can be a risk of increased complications that occur. Blood sugar levels that are not controlled for a long period of time can cause disorders in both large and small blood vessels, both in old and newly diagnosed patients (Cahyani et al., 2024). In addition, repeated trauma during activities such as walking, accompanied by a decrease in the sensitivity of the leg nerves, can cause skin damage and trigger the occurrence of diabetic foot ulcers (Handayani, 2025).

Diabetic Foot Ulcer (DFU) is a damage to foot tissue that starts from the dermis layer to deeper tissue in diabetic patients (Moulidiya & Fakhrizal, 2025). Globally, out of 537 million people with Diabetes Mellitus, about 19–34% will experience DFU in their lifetime. Approximately 20% of DFU cases require lower extremity amputation (minor or major), and 10% die within one year of the first diagnosis of DFU (Mcdermott et al., 2023). In Indonesia, the prevalence of DFU reaches 15%, with an amputation rate of 30% and mortality of 32%. DFU is also the main cause (80%) of Diabetes Mellitus patients undergoing treatment in hospital (Sari et al., 2023).

To prevent an increase in the prevalence of diabetic ulcers, preventive and promotive efforts are needed from health workers. The World Health Organization (WHO) states that basic diabetes care, preventive and promotive efforts are education (Sylvia et al., 2024). Education helps the community maintain and improve health, prevent disease, maintain health conditions, and support patients and families in overcoming health problems (Jamaludin, 2023). Therefore, nurses as health workers are expected to play an active role in providing prevention education to prevent complications in the form of Diabetic Foot Ulcer (DFU) (Syarif, 2025).

Efforts to prevent Diabetic Foot Ulcer (DFU) are measures to prevent foot injuries due to complications of Diabetes Mellitus caused by blood circulation disorders, neuropathy, and infections. DFU prevention focuses on behavior modification and risk factor management, such as avoiding smoking, increasing physical activity, using safe footwear, controlling body mass index (BMI), and keeping blood glucose levels within normal limits. Regular foot examination and care is also an important part of preventing early injuries (Vitniawatia et al., 2023).

Foot care behavior in diabetics is an effort to prevent damage to the foot tissue and minimize the risk of amputation. However, there are still many DM patients who have not done optimal foot care (Shiddiq & Mulayadi, 2024). Foot care has been shown to be influential in lowering the risk of diabetic foot ulcers. The data showed that only 98 patients (28.0%) had regular foot care. About 73 patients (20.9%) did not dry between the fingers carefully after washing their feet, 62 patients (17.7%) did not regularly wear cotton socks, 201 patients (57.6%) sometimes walked barefoot, and 199 patients (56.9%) cut their nails every two weeks (Susilawati et al., 2024).

This condition shows that suboptimal foot care behavior can be influenced by a lack of adequate information and education regarding foot injury prevention. Health education on foot injury prevention is important as a non-pharmacological management to change patient behavior in maintaining health (Marliyana et al., 2024). This is in line with the Piuskosmas Fau Research (2023) showing that before education, 78% of respondents were at low risk and 22% were at high risk of destructive behavior on the feet. After education, all respondents (59 people) were in the low-risk category, with 13 people experiencing an increase in foot care behaviors. These results prove that there is a significant influence of education on the behavior of foot care in people with Diabetes Mellitus.

Research by Sari et al. (2021) states that interventions need to be accompanied by supporting media to facilitate the understanding of information. One effective medium is the diabetes smart booklet, which presents the material in detail, can be stored for a long time, is easy to carry, and can be read at any time. The

booklet conveys information in the form of writing and pictures so that it is more interesting and more detailed than oral delivery, and is suitable for use as an educational medium for type 2 Diabetes Mellitus patients.

Zainuddin et al.'s research (2024) uses the SMART Booklet based on Diabetes Self Management Education (DSME) which includes diet, physical activity, medication, blood sugar monitoring, and foot care. The results showed that the mean value of DM literacy increased from 31.27 before the intervention to 49.60 after education. These findings show a significant difference, so the DSME Smart Booklet is effective in increasing pre-ulcer type 2 diabetes mellitus literacy. Meanwhile, the research of Sentana et al. (2023) uses the RAKA (Foot Care) Booklet which focuses on improving foot care behaviors through practical guidance such as foot checks, hygiene, nail care, footwear selection, and foot gymnastics. The results showed a significant improvement in the treatment group from a mean score of 35.00 to 61.07, while the control group did not experience any significant changes. However, the RAKA Booklet emphasizes health education in general without using a theoretical framework approach or a specific method, so that the delivery of education is still general.

In contrast to previous research, this study uses a booklet based on the SMART (Specific, Measurable, Achievable, Relevant, Time-bound) approach which is focused on the prevention of diabetic foot ulcers through foot care education (Gapila et al., 2021). Specific points out that the booklet specifically targets the improvement of the behavior and skills of type 2 Diabetes Mellitus patients in self-sufficient foot care. Measurable means educational success is measured through an improvement in foot care behaviour scores using the Nottingham Assessment of Functional Foot Care (NAFF) questionnaire and is complemented by self-scoring on the foot care checklist sheet in the booklet. Achievable emphasizes that realistic behavior change targets according to the patient's ability with family support. Relevant shows the contents of the booklet focusing directly on the prevention of diabetic foot complications with illustrations and explanations of the importance of foot care. Finally, time-bound means that education and evaluation are carried out over a two-week period so that initial behavioral changes can be observed measurably (Efendi, 2023).

Initial observation data at the Limboto Health Center, Gorontalo Regency, shows a high number of visits to type 2 Diabetes Mellitus patients, namely 1,402 patients in 2024 and 1,202 patients until 2025. Based on the results of the researcher's interview on September 13, 2025 with 4 patients with type 2 DM, it shows that 3 people have not done regular foot care, such as daily check-ups, maintaining cleanliness, and using appropriate footwear, and have never received foot care education. While 1 person has received education through lectures using PowerPoint without booklets, but has not implemented foot care consistently. This shows that the methods and educational media used are still limited, so that it has an impact on the low behavior of independent foot care in Diabetes Mellitus patients

Based on the description above, the researcher is interested in researching more about "The effectiveness of the SMART Booklet educational media on foot care behavior in efforts to prevent Diabetic Foot Ulcer in patients with type 2 Diabetes Mellitus at the Limboto Health Center, Gorontalo Regency."

RESEARCH METHODS

This study is a quantitative research with a pre-experimental method using a one group pretest-posttest design which aims to determine the effectiveness of Booklet SMART educational media on foot care behavior in an effort to prevent Diabetic Foot Ulcer in patients with type 2 Diabetes Mellitus at the Limboto Health Center. This research was carried out on November 29–December 27, 2025. The population in this study is all patients registered as PROLANIS participants at the Limboto Health Center, Gorontalo Regency with a total of 188 patients. The sampling technique uses purposive sampling in accordance with the criteria that have been set, so that the number of samples needed in this study is 33 respondents (adjusted to the rule of thumb approach).

The research instrument used the Nottingham Assessment of Functional Foot Care (NAFF) questionnaire to measure foot care behaviour. Data collection was carried out through pretests before interventions, education using SMART Booklet media as well as demonstrations to respondents, and posttests after two weeks to see changes in foot care behavior. Data analysis was carried out univariate to determine the frequency distribution of respondent characteristics and behavioral descriptions before and after, as well as bivariate analysis using the Wilcoxon Signed Rank Test to determine the difference in scores before and after the intervention with a significance level of $\alpha = 0.05$.

RESEARCH RESULTS

Respondent Characteristics

Table 1 Characteristics of Respondents by Age

Age	N	%
36-45 Years (Late Adult)	6	18,2
46-55 Years (Early Seniors)	11	33,3
56-65 Years (Late Seniors)	9	27,3

>65 years old (Senior)	7	21,2
Quantity	**33**	**100**

Based on table 1, it shows that the age of the most respondents is in early adulthood as many as 11 respondents (33.3%), and the lowest in late adulthood as many as 6 respondents (18.2%).

Table 2 Characteristics of respondents by gender

Gender	**N**	**%**
Male	9	27,3
Women	24	72,7
Total	**33**	**100**

Based on table 2, it shows that the respondents in this study are mostly women, namely 24 respondents (72.7%).

Table 3 Characteristics of respondents by Last Education

Education Level	**N**	**%**
No School	2	6
Elementary School (SD)	6	18,2
Junior High School/MTS	7	21,2
High School/Vocational School/MA	9	27,3
Bachelor/PT (S1)	9	27,3
Quantity	**33**	**100**

Based on table 3, it shows that most of them have a high school / equivalent and Bachelor/Higher Education (S1) education level, each as many as 9 respondents (27.3%) and a small level of education is not in school as many as 2 respondents (6%).

Table 4. Characteristics of respondents by Occupation

Jobs	**N**	**%**
Not Working	8	24,2
Housewives (IRT)	14	42,4
Farmer/Fisherman/Labourer	4	12,1
Self-employed	1	3,0
PNS/TNI/POLRI/BUMN	6	18,2
Quantity	**33**	**100**

Based on Table 4, it shows that most of them have jobs as housewives (IRT), namely 14 respondents (42.4%), while the least jobs are self-employed with 1 respondent (3.0%).

Table 5 Characteristics of respondents based on Length of Suffering from Type 2 Diabetes

Long Suffering from DM	**N**	**%**
≤ 10 Year	14	42,4
>10 years	19	57,6
Quantity	**33**	**100**

Based on table 5, it shows that most of the respondents have suffered from Diabetes Mellitus for more than 10 years, which is as many as 19 respondents (57.6%).

Table 6 Characteristics of respondents based on family history of diabetes mellitus

DM History	**N**	**%**
No history	10	30,3
There is a history	23	69,7
Quantity	**33**	**100**

Based on Table 6, it shows that most of the respondents have a family history of diabetes mellitus, namely 23 respondents (69.7%).

Table 7 Characteristics of respondents based on previous foot care educational experience

Educational Experience in Foot Care	N	%
Never get	29	87,9
Ever got	4	12,1
Quantity	**33**	**100**

Based on Table 7, it shows that most of the respondents have never received foot care education before, namely 29 respondents (87.9%).

Univariate Analysis

Patient Foot Care Behavior Before Being Given SMART Booklet Education in Type 2 DM Patients at Limboto Health Center

Table 8 Patient Foot Care Behavior Before Being Given SMART Booklet Education

Foot Care Behavior before Being Educated	N	%
Not Good	29	87,9
Good	4	12,1
Quantity	**33**	**100**

Based on Table 8, it is known that most of the respondents had poor foot care behavior before being given the SMART Booklet education , namely 29 respondents (87.9%).

Patient Foot Care Behavior After Being Given SMART Booklet Education in Type 2 DM Patients at Limboto Health Center

Table 9 Patient Foot Care Behavior after Being Provided with SMART Booklet Education

Foot Care Behavior after Being Educated	N	%
Not Good	0	0
Good	33	100
Quantity	**33**	**100**

Based on Table 9, it is known that all respondents as many as 33 people (100%) showed foot care behavior in the good category, after being given SMART Booklet education. These findings show that the SMART Booklet education is able to improve the optimal implementation of early foot care behaviors as an effort to prevent diabetic foot ulcers in type 2 diabetes mellitus patients at the Limboto Health Center.

Bivariate Analysis

Table 10 Analysis of the Influence of SMART Booklet Educational Media on Foot Care Behavior in Type 2 Diabetes Mellitus Patients at Limboto Health Center

Foot Care Behavior	N	*Red*	*Median*	Std. Dev	*Min*	*Max*	*P-value*
Pre-Test	33	35,27	35,00	6,21	26	52	**0,000**
Post-Test	33	70,21	70,00	5,21	62	80	

Based on Table 10, it is known that the average (mean) score of foot care behavior in the pre-test was 35.27 and increased in the post-test to 70.21 after being educated using the SMART Booklet media . The results of statistical analysis using the Wilcoxon Signed-Rank Test showed that the p-value = 0.000 ($p < 0.05$), so that H_0 was subtracted and H_1 was accepted. This shows that there is a significant difference between the score of foot care behavior before and after the educational intervention, so that the SMART Booklet educational media is effective in improving foot care behavior in type 2 diabetes mellitus patients at the Limboto Health Center.

DISCUSSION

Level of Foot Care Behavior of Type 2 Diabetes Mellitus Patients Before Being Given Health Education using SMART Booklet Media

Based on the results of the study, it is known that before being educated using the SMART Booklet media , out of 33 respondents, most of the type 2 DM patients at the Limboto Health Center had poor foot care behavior as many as 29 respondents (87.9%), while only 4 respondents (12.1%) had good category foot care

behavior. This shows that before the intervention, the majority of respondents had not applied optimal foot care so they were at risk of developing diabetic foot complications (diabetic ulcers).

In daily life, some respondents have done foot care such as washing feet, cutting nails, and using footwear outside the house, but it has not been done regularly and with the correct techniques. The results of the interviews showed that respondents focused more on adherence to drug consumption and dietary regulation because they considered blood sugar control to be sufficient. In addition, foot treatment is generally only carried out when complaints such as pain, tingling, or wounds appear, so it has not been used as a primary prevention effort for diabetic foot complications.

The findings of this study are in line with the Health Belief Model (HBM) theory which explains that foot care behavior in patients with type 2 diabetes mellitus is influenced by perceived susceptibility, perceived severity, perceived benefits, self-efficacy, and cues to action (Rachmawati, 2019). According to (Darvishi et al., 2025) shows that patients' low understanding of the risk of diabetes complications and the benefits of preventive measures causes self-care behaviors to not be optimally carried out and focus more on treatment and dietary regulation. This condition explains the tendency of respondents who have just done foot care when complaints arise, so foot care has not been used as a primary prevention effort. Foot care measures that are carried out unknowingly and not in accordance with the correct technique reflect low self-efficacy and lack of cues to action in the prevention of diabetic foot complications.

A total of 29 respondents (87.9%) showed poor foot care behavior, as reflected in foot examinations that were only carried out when in pain, less than optimal drying of the feet and between the fingers, the use of inappropriate footwear (flip-flops outside the house, not wearing footwear indoors), and non-routine sock changes (4-6 times/week). Poor behavior is also seen in low efforts to prevent foot injuries, such as not checking the water temperature before soaking, not doing diabetic foot exercises, not checking shoes after use, and not handling foot injuries is not optimal.

Poor foot care behavior conditions are related to the experience of receiving health education. Most of the respondents have never received foot care education, so they do not know the correct and safe steps, so foot care behavior is still simple and unstructured. Research by Malisngorar & Tunny (2021) shows that respondents' knowledge of foot care before health education is categorized as lacking because they have never been exposed to education before, and are influenced by the lack of information sources such as books, the internet, and health workers. while Putri et al. (2023) found that the majority of Diabetes Mellitus patients had poor foot care behavior (77.5%) and there was a significant relationship between foot care knowledge and behavior ($p = 0.011$). These findings confirm that low knowledge due to lack of education contributes to suboptimal foot care behaviors.

Theoretically, health behavior is formed by predisposing factors that include age, occupation, education, knowledge and attitudes. Enabling factors consisting of the physical environment and access to health facilities. As well as strengthening factors that are manifested in the support provided by families and community leaders (Mayasari & Ikalius, 2021).

The first contributing factor is age. Age also contributes to foot care behaviors due to degenerative processes such as decreased cell function β pancreas, increased insulin resistance, and decreased peripheral nerve function and blood circulation, which decreases the sensitivity of the feet. This condition makes it difficult for patients to notice small wounds, so the risk of diabetic foot ulcers increases if foot care is not optimal. Most of the respondents in this study were in the early elderly (46–55 years, 33.3%) and the late elderly (56–65 years, 27.3%), the majority belonging to the elderly age group. This is in line with the research of Saprianto et al. (2022) who said that the level of foot care by age shows that most respondents who do good foot care are under the age of 55 on average. Some of them are over 55 years old and above doing poor foot care.

Young DM patients have better self-efficacy than the elderly because they have a higher motivation to recover, while in old age they tend to be resigned to diseases so that it has an impact on reducing the quality of life. This is in line with research by Susanti & Sukarni (2021) which explains that increasing age leads to a decrease in body functions and abilities which contributes to a decrease in self-efficacy in DM management, thereby increasing the risk of complications and reducing the quality of life in the elderly.

In addition to age, socioeconomic factors, such as employment status, also affect foot care behavior in patients with diabetes mellitus. Job status affects an individual's potential and self-efficacy in managing health conditions, but busyness and work pressure can lower this confidence (Usman et al., 2023). Most of the respondents were in the group of not working or working in the informal sector, which was related to limited self-care routines, high physical activity, and low health prevention priorities. This condition causes foot care behavior to not be optimal. This assumption is supported by research Rondhianto & Widayati (2023) which states that occupational factors and socioeconomic conditions are related to foot care behavior in patients with type 2 diabetes mellitus, where irregular work or strenuous physical activity is related to low foot care compliance due to limited time, energy, and access to health services, thereby increasing the risk of diabetic foot complications.

Based on research from Monoarfa & Arsad (2025), suggesting that gender and length of suffering from DM can affect foot care behavior. Most respondents had suffered from DM for more than 10 years (57.6%). Patients with longer illness tend to experience self-care saturation, so compliance with foot care behaviors decreases, in contrast to newly diagnosed patients who have high learning motivation and are more receptive to health information. This assumption is supported by research by Redjeki & Frisca (2022) which showed that newly diagnosed patients with diabetes mellitus generally had better motivation and adherence to foot care behaviors after health education compared to patients who had been suffering from diabetes for a long time, where the increase in pain length is often related to saturation in performing self-care such as examination and foot care.

In addition to suffering from the disease for a long time, gender characteristics also play a role in shaping the respondents' foot care behavior. Based on the results of the study, most of the respondents were female, namely 24 respondents (72.7%). According to the researchers' assumptions, women tend to have a higher concern for health and self-care than men, so they are more active in participating in health services and receiving education. This is in line with the research of Hu et al. (2024) which stated that men have a higher risk of developing diabetic leg ulcers than women (OR = 1.74; p = 0.0001). This condition is related to higher exposure to risk factors in men, such as strenuous physical activity, smoking habits, delays in seeking health services, and lower adherence to foot care, thus increasing the risk of trauma and vascular disorders in the feet.

On the other hand, a total of 4 respondents (12.1%) showed foot care behavior in the good category before being given Booklet education. This is in line with Table 4.7 which shows these 4 respondents who have received previous foot care education, so that good foot care behavior in these respondents can be associated with previous educational experiences. The 3 respondents were postoperative patients with diabetic foot ulcers who had recovered and received information from health workers, thus encouraging the implementation of good foot care behaviors, although they were not consistent in aspects such as drying between the fingers, avoiding lotions between the fingers, and checking footwear before and after use. Meanwhile, 1 respondent obtained independent information through the internet, encouraged by the experience of families with a history of diabetic foot injuries, so that they had prior knowledge and began to apply foot care behaviors, although it was not comprehensive and consistent.

This finding is in line with the Health Belief Model theory which explains that perceived severity is an individual's belief in the severity of the disease they experience, which is often shaped by information and knowledge related to the disease and its treatment. In addition, cues to action are factors in the form of cues or stimuli that encourage a person to take a health action, such as sick experiences, complications they have experienced, or exposure to health education (Pakpahan et al., 2021).

The difference in foot care behavior between patients with postoperative diabetic foot ulcers and patients who have not experienced complications suggests that direct experience of complications increases awareness and vigilance in performing foot care. This is in line with the Transtheoretical Model (TTM), which states that changes in health behavior occur through several stages. Patients who have experienced foot ulcers tend to be in the action to maintenance stage, because they are aware of the risks and impacts of complications directly, so that they are more consistent in foot care. In contrast, patients without experience of complications are generally still in the precontemplation or contemplation stage, with low risk awareness and not optimal foot care behavior (Hasriani, 2021).

Continuous foot care health education plays a role in increasing respondents' understanding of the risks and benefits of foot care, thereby encouraging motivation to make self-prevention efforts until it is formed as a daily habit. Effective educational media, such as booklets, contain readable writings and images, serve as knowledge enhancers and a stimulus for behavior change. Research by Narmawan (2022) shows that health education through booklet media increases the motivation of type 2 Diabetes Mellitus patients in foot care.

Level of Foot Care Behavior for Type 2 Diabetes Mellitus Patients After Health Education Using SMART Media Booklet

After being provided with health education using the SMART Booklet media , the researcher conducted a re-measurement (post-test) of the foot care behavior of type 2 diabetes mellitus patients within two weeks. In the first week, initial measurements (pre-tests) were carried out and education was provided by providing the SMART Booklet, while on the last day of the second week, home visits were carried out again to observe and assess the foot care behaviors that had been implemented by the respondents, including identifying obstacles experienced during the implementation of foot care.

Based on the results of the study presented in Table 4.9, it is known that out of a total of 33 respondents, all respondents (100%) showed initial foot care behavior in the good category and there were no respondents with a poor category after being given SMART Booklet education. These results showed a very significant change compared to the conditions before the intervention.

Improvements in foot care behaviors were reinforced through interviews and observations during home visits in the second week. Respondents who previously had risky behaviors began to show initial

changes for the better after being given the SMART Booklet education . These changes include: using footwear inside and outside the house, using socks when wearing shoes, cutting nails in a straight direction and not too short, washing your feet regularly, checking your feet at least once a day, and paying attention to drying between the toes to prevent moisture that can trigger infections.

Changes in foot care behavior that occurred in all respondents were influenced by educational factors. The results of the study showed that the most education was high school equivalent and Bachelor (S1), while the least did not finish school. According to Harlin & Irfan (2022), it is stated that the level of education affects the behavior of foot care, where higher education tends to form better behavior than low education. The researcher assumes that education plays a role in the ability to understand and apply health information, where respondents who have higher education are more likely to understand and find out information about their illness so that it will affect one's self-efficacy and adherence in DM management to prevent complications. These findings are in line with research conducted by Ginting et al., (2024) which stated that education level is significantly related to foot care behavior in type 2 diabetes mellitus patients.

Conceptually, changes in health behavior do not occur instantaneously, but through a gradual process. In the early stages, individuals often show a denial of the risk of disease or complications (culture of denial). With the increase in personal experience, the experience of others, and exposure to health information, there is a risk awareness and a culture of fear. The next stage is the emergence of awareness to protect oneself (culture of self-interest), encouraging self-care actions to become a daily habit (Rojuaniah, 2022). In addition, behavior influenced by driving factors is a factor that facilitates the occurrence of a person's behavior such as knowledge, attitudes, traditions, beliefs, beliefs, values, and so on. Sometimes even though people know and are able to behave healthily, they do not do it (Khofifah et al., 2022).

Behavior is an individual's response to a stimulus or an action that can be observed and has a specific frequency, duration and purpose whether consciously or not. Behavior that is based on knowledge, awareness, and positive attitudes, then the behavior will be long lasting and vice versa if the behavior itself is not based on high knowledge and awareness, it will not last long (Safitri, 2022).

The results of Piuskosmas Fau (2023) research show that increased understanding after health education plays an important role in improving foot care behavior in patients with diabetes mellitus, where patients with good knowledge show more optimal, consistent, and directed behavior, so that the risk of diabetic foot complications can be reduced. Ariga (2022) states that the level of education influences an individual's behavior in seeking treatment and treatment, as well as in choosing and deciding on actions or therapies. Researchers emphasize that knowledge is an important domain in the formation of actions or behaviors, where actions based on good understanding tend to be more persistent and consistent than actions without an adequate knowledge base.

In addition, in 4 respondents who had previously had foot care behaviors in the good category, the results Post-test showed an increase in the score of foot care behavior. Improvements are seen in specific indicators, such as the consistency of drying the feet especially between the toes, the examination of shoes after use, and the proper use of moisturizers, avoiding finger gaps. Footwear selection behavior also improved, with the reduced use of flip-flops replaced by diabetic footwear covered with adhesive. Other improvements include the gradual use of new shoes and the frequency of diabetic foot exercises increased >1 time a day. These findings are supported by Jeffcoate and Harding (2003), foot care education not only aims to form new behaviors, but also plays an important role in correcting and strengthening (Laughs)) foot care behaviors that patients already have (Paton et al., 2021).

According to the researchers' assumptions, the improvement of foot care behavior is influenced by the delivery of educational materials that are clear, simple, and according to the patient's needs. The SMART booklet provides practical, easy-to-understand and re-readable information, helping patients remember and apply foot care independently without relying on healthcare workers. This is in line with the research of Sylvia & Puspitasari (2021) which states that health education with the support of individual booklet media (home visite) improves understanding, strengthens memory, helps provide the correct concept or impression, and makes respondents more focused so that it is easier to receive, remember, and capture learning properly.

The success of improving foot care behavior is also supported by the application of the SMART approach in education. The material was prepared Specific, focusing on the treatment of diabetic patients' feet, Measurable focusing on behavioral changes measured through NAFF questionnaire scores, Achievable meaning that actions are tailored to the respondent's ability, Relevant related illustrations of images and sequence of actions provide a clear picture, especially for patients with low education or limited health literacy, and Time bound, as seen from behavioral changes within two weeks after the intervention. This is supported by Damayanti et al. (2023) who report that the SMART method is able to significantly increase participant understanding and engagement, as shown by increasing pretest and posttest scores so as to help participants make plans or achievement targets.

The improvement in foot initial care behavior after the SMART Booklet education was influenced by a two-week continuous intervention. Education is not just a one-time event, but it is equipped with direct demonstrations, reinforcement through reminders, as well as evaluation and re-mentoring, so that patients

understand and apply foot care gradually. Practice evaluation and identification of obstacles in the second week also strengthened behavior change. This is in line with Julianda et al. (2025) who stated that the majority of participants who routinely performed foot care for two weeks showed excellent skills, influenced by habits and familiarity of movements. Participants with good foot care attitudes also tended to have more optimal skills, thus strengthening the relationship between continuous education, positive attitudes, and foot care skills.

In addition, the SMART Booklet is equipped with a two-week daily foot care checklist sheet as a tool for patients to remember and monitor their behaviors. Checklists help establish regular foot care habits, raise awareness of actions that have and have not been taken, and encourage consistency. Previous research has shown that the use of daily monitoring tools such as checklists can improve consistency in routine health measures. The principle of regular behavioral monitoring through checklists helps patients remember and monitor actions, thus encouraging the formation of more consistent habits in healthcare (Refialinata et al., 2023).

The Effectiveness of SMART Booklet Educational Media on Foot Care Behavior in Efforts to Prevent Diabetic Foot Ulcers in Type 2 Diabetes Mellitus Patients at Limboto Health Center

The results of statistical analysis using the Wilcoxon test in Table 4.10 show a p-value of 0.000 ($p < 0.05$). This shows that there is a significant difference between the behavior of foot care before (pre-test) and after (post-test) education is given using the SMART Booklet media. Thus, H_1 was accepted and H_0 was rejected, which means that the SMART Booklet educational media is effective in improving foot care behavior in efforts to prevent diabetic foot ulcers in patients with type 2 Diabetes Mellitus at the Limboto Health Center.

The increase in the average score (mean) of foot care behavior from 35.27 to 70.21 shows that education using the SMART Booklet media has a real impact on changes in respondents' behavior. This increase in score reflects the increasing understanding and application of foot care consistently and appropriately, thus strengthening the effectiveness of the SMART Booklet in the prevention of diabetic foot ulcers. This is in line with the research of Redjeki & Frisca (2022) which stated that education using booklet media significantly improved the foot care behavior of diabetic mellitus patients ($p = 0.000 < 0.05$), with a much higher increase of 94.64%.

The results of the field research showed that all respondents stated that the health education that has been received so far is generally through lectures, discussions, media leaflets, and power point presentations. The respondents have also never received special health education related to foot care using booklet media that can be re-read and used as a practical guide for independent foot care at home. This condition shows that there is a gap in the delivery of health education that is oriented towards the formation of long-term behaviors.

Theoretically, booklets are educational media in the form of small books that systematically combine text and images so that the information conveyed is more complete, clear, and easy to understand (Nurhidayanti et al., 2023). Health promotion using booklet media is considered more effective than the lecture method alone because of the presentation of varied, visual, and re-readable material according to the needs of the target. Attractive booklet design through the selection of appropriate typefaces, colors, and illustrations can also increase reading interest and help the information retention process (Tokan et al., 2024).

The main advantage of this research intervention lies in the integration of booklet media with the SMART (Specific, Measurable, Achievable, Relevant, and Time-bound) approach in the preparation and delivery of educational materials. Theoretically, the term SMART was first used by George T. Duran (1981) and developed by Robert S. Rubin to fit situations, conditions, and perpetrators (Efendi, 2023). This approach is widely adopted in the health field to design educational interventions that are targeted, measurable, and behavior-change-oriented, so that learning objectives become specific and can be evaluated systematically. Rahmawati (2024) proves that the application of SMART principles helps targets make the right decisions as needed and increase the effectiveness of interventions.

The Specific aspects of the SMART Booklet are reflected in the focus of the material which specifically targets the treatment of the feet of type 2 Diabetes Mellitus patients as an effort to prevent DFU. The material is presented in a structured manner, equipped with illustrations and a daily foot care checklist based on six main indicators. This specific and focused presentation makes it easier for patients to understand the actions to be taken and encourages the formation of consistent foot care habits, in line with Mehana et al. (2025) who show that specific and structured foot care education improves independent foot care practices and adherence to diabetic patients.

The measurable aspect is shown through the measurement of foot care behavior using the standard questionnaire Nottingham Assessment of Functional Foot Care (NAFF) as the main instrument, and supported by the daily foot care checklist scoring sheet as a monitoring tool. NAFF objectively assesses behavioral changes before and after interventions, while checklists serve as a self-monitoring tool to monitor and evaluate behavioral consistency on a daily basis. According to Bandura (1986), self-monitoring is part of self-regulation which plays an important role in behavior change because it increases an individual's awareness of his actions (Samsir, 2022). This is in line with the Middle Range Theory of Self-Care of Chronic Illness which emphasizes

that self-care monitoring helps individuals systematically monitor health behaviors in order to maintain adherence and health behaviors in chronic diseases (Magi et al., 2024). In this study, this principle is reflected in the use of a daily foot care checklist as a self-monitoring tool.

The Achievable aspect shows that the behavior change targets in the SMART Booklet are realistic and achievable. The material is arranged according to the respondents' physical, cognitive, and social conditions, without demanding complex actions. In patients with visual impairment or reduced mobility, especially the elderly, the use of simple aids such as mirrors for the inspection of the soles of the feet, as well as the involvement of family members if there are limitations of self-examination. This is supported by Iwan et al. (2022) who stated that self-efficacy and family support are meaningfully related to foot care behaviors in patients with type 2 Diabetes Mellitus, where high self-efficacy and good family support improve foot care behaviors.

Aspect Relevant emphasized that the purpose and content of the SMART Booklet were prepared according to the main needs of respondents, namely the prevention of diabetic foot ulcers and complications such as amputation. The material is focused on the prevention of wounds, infections, and damage to the tissues of the legs that are common in diabetic patients. A visual illustration of a comparison of healthy feet and feet with ulcers as well as an explanation of the consequences if treatment is not done well increases risk awareness and patient motivation. This is in line with Emeliawati et al. (2025) who showed that foot care education significantly improves the prevention behavior of diabetic foot ulcers, so that relevant material can influence the prevention of complications in a real way.

The Time-bound aspect is shown through a clear time limit in the implementation of education and evaluation of interventions. Foot care education using the SMART Booklet is carried out through two home visits (±40 minutes per session) within two weeks, and is equipped with e-booklets/digital files that can be accessed via QR code. The researcher provides directions for the use of QR codes to respondents or families, so that the material can be accessed again at any time without carrying a physical booklet. This digital access helps respondents remember and apply foot care according to the target time, either independently or with family support. This is in line with Prihatini et al. (2025) who show that QR Code-based educational media is effective in increasing knowledge through easy access to materials from various locations.

Thus, the application of the SMART principle makes the SMART Booklet not only an information medium, but also a tool for behavior intervention that is structured, directed, and can be evaluated systematically. Its application in changing foot care behavior takes place through a gradual process, namely increasing knowledge, forming attitudes, and adopting real actions (practice/action). This is in line with the theory of behavior change which states that change in actions occurs gradually through increased knowledge, attitude formation, and real practice (Ariwati et al., 2024).

The results of this study are in line with the research of Sentana et al., (2023) which proves that health education using booklet media significantly improves foot care behavior in patients with type 2 Diabetes Mellitus, with a p-value of < 0.05, which shows significant differences before and after intervention. The study confirms that the RAKA (Foot Treatment) Booklet is effective because it presents the material in a systematic, easy-to-understand, and readable manner so as to help patients implement foot care independently.

In addition, the results of this study are also in line with Zainuddin et al., (2024) who show that the educational media of the SMART DSME Booklet (Diabetes Cell Management Education) provides a significant increase in the diabetes literacy of pre-ulcer DMT2 patients with a $p = 0.000$ value. This increase in literacy plays an important role in encouraging changes in self-care behavior, including foot care as an effort to prevent complications of diabetic ulcers.

The results of this study are also in line with the research Asrindo et al., (2024) which shows that the giving of Diabetes Self Management Education (DSME) through the media of electronic smart books has a significant effect on improving the self-care of people with type 2 Diabetes Mellitus. The study confirms that electronic book-based educational media is effective in increasing patients' understanding and independence in self-care as an effort to prevent complications.

The researcher assumes that this SMART booklet has an advantage over conventional booklets because it is designed based on the principles of Specific, Measurable, Achievable, Relevant, and Time-bound, equipped with a foot care checklist and digital access support through QR codes. This approach makes the SMART Booklet not only increase knowledge, but also be more applicable in encouraging real and sustainable changes in foot care behavior in efforts to prevent Diabetic Foot Ulcer. The nursing implications of these findings show that the SMART Booklet can be used by nurses as a structured and easy-to-apply preventive education medium, thereby assisting nurses in providing consistent foot care education and increasing patient independence in doing foot care at home.

CONCLUSION

The behavior of foot care of type 2 Diabetes Mellitus patients before being educated using SMART Booklet media is mostly in the poor category. A total of 29 respondents (87.9%) had poor foot care behavior and 4 respondents (12.1%) in the good category, indicating that before the intervention the majority of patients

had not applied optimal foot care as an effort to prevent Diabetic Foot Ulcer.

The foot care behavior of type 2 Diabetes Mellitus patients after being educated using the SMART Booklet media showed a very significant improvement. After the intervention, all 33 respondents (100%) were in the category of good foot care behavior, which shows that education using the SMART Booklet is able to improve overall foot care behavior.

The SMART Booklet educational media has proven to be effective in improving foot care behavior as an effort to prevent Diabetic Foot Ulcer in type 2 Diabetes Mellitus patients. The results of the Wilcoxon test showed significant differences before and after the intervention (p-value = 0.000; $p<0.05$), so it can be concluded that education using the SMART Booklet had a positive effect on changes in the initial behavior of foot care in type 2 DM patients.

ADVICE

Divide Research Places (Limboto Health Center)

The results of this study can be used as a basis for increasing promotive and preventive efforts through the implementation of foot care education using the SMART Booklet media as part of the routine services of type 2 Diabetes Mellitus patients. The booklet can be used in counseling, home visits, and Prolanis programs to prevent complications of diabetic foot ulcers.

For Educational Institutions

This research can be a reference in the development of innovative and applicable media-based nursing education methods and support the application of evidence-based practice, especially in medical, surgical nursing, and health promotion.

For Patients

The SMART Media Booklet is expected to help patients with type 2 Diabetes Mellitus improve their understanding, awareness, and foot care skills independently so that they are able to implement behavior to prevent complications of diabetic foot, especially diabetic foot ulcers.

For the Next Researcher

It is recommended to use a more robust study design (control group, larger sample, and 1–3 month follow-up) to assess the sustainability of behavior change. The research can also compare the SMART Booklet with other media. As well as examining variables such as knowledge, compliance, incidence of foot ulcers, and quality of life of type 2 Diabetes Mellitus patients.

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