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Effect of Theory-Based Education on Diabetic Ulcer Prevention Among Diabetes Mellitus Patients



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Abstract

Diabetic ulcers are one of the complications often experienced by patients with diabetes mellitus. The incidence of diabetic ulcers has an impact on patients, families, health care, and society in general. Education plays an important role in the prevention of diabetic ulcers. This study aims to analyze the effect of health education based on the theory of planned behavior on the main factors of theory of planned behavior (attitudes, subjective norms, perceived behavioral control), intentions and diabetic ulcer prevention in patients with diabetes mellitus. The quasi-experimental approach pre-test and post-test with control group design was used in this study. There were 84 patients with diabetes mellitus divided into intervention groups and control groups. Questionnaires are used to assess attitudes, subjective norms, perceived behavioral control, intentions, and behavior prevention of diabetic ulcers. The statistical analysis showed significant differences in attitudes, subjective norms, perceived behavioral control, intentions, and diabetic ulcers prevention between the intervention group and the control group ($p=0,000$). This research suggests that education based on the theory of planned behavior can enhance the construction of the Theory of Planned Behavior (attitude, subjective norms, perceived behavioral control), intention, and diabetic ulcer prevention in patients with diabetes mellitus. Patient behavior change strategies can be done by applying health education based on the theory of planned behavior.

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INTRODUCTION

Diabetes mellitus (DM) is one of the health problems with a high prevalence. Data from the International Diabetes Federation (2021) show that Indonesia is ranked fifth globally with the prevalence of diabetes mellitus reaching 19.5 million patients with DM (International Diabetes Federation (IDF), 2021). Individuals with diabetes mellitus are at risk of complications if they do not perform optimal self-care. Complications caused an increased need for medical care (IDF, 2023). Diabetic ulcer is one of the most common complications experienced by patients with diabetes mellitus. The incidence of diabetes ulcers ranges from 19 to 34 %. In patients who have recovered from diabetes, the recurrence rate reaches 40 % in one year and 65 % within three years (IWGDF, 2023a). The incidence of diabetic ulcers affects patients, families, health care, and the general public (IWGDF, 2023b). Patients with diabetic ulcers may experience amputation which result in physical disability (Hüsers et al., 2020; Zhang et al., 2020). Psychological problems and decreased quality of life are also experienced by patients (Sekhar, Thomas, Unnikrishnan, Vijayanarayana, & Sunil, 2015). The incidence of diabetic ulcers also increases the burden of health financing (Syed et al., 2020).

Diabetic ulcer prevention should be done as soon as possible. Education is an important part of the holistic implementation of DM and the prevention of complications (PERKENI, 2021). Education plays an important role in preventing diabetic ulcers. The educational objective is to improve the knowledge, motivation, and skills of patients with diabetes mellitus in self-care and foot care (The International Working Group on the Diabetic Foot, 2023). Research suggests that most people with diabetes mellitus know about foot care after having a diabetic ulcer (Fayfman et al., 2020). Information about diabetic ulcers prevention can be provided since patients are diagnosed with DM and patients at high risk of developing diabetes ulcers. Providing foot care education by nurses and doctors can lower the prevalence of amputations in patients with diabetes mellitus (Anumah et al., 2022).

A literature review suggests that education with booklets can enhance foot care knowledge but can not improve foot care behavior (Stolt, Gattinger, Boström, & Suhonen, 2020). Therefore, researchers are interested in conducting research that focuses on theoretically based health education as a strategic approach to changing behavior. In the theory of planned behavior (TPB), the intention is a part of the individual's self that leads to the desire to perform

certain actions and is a determinant of behavior. Intention formation that is directly related to behavior is influenced by attitudes, subjective norms, and perceived behavioral control (Ajzen, 2019). A previous study showed that the formation of behavior prevention of diabetic ulcers is influenced by intentions directly influenced by the construction of the theory of planned behavior such as attitudes, subjective norms, and perceived behavioral control (Sukartini, Dee, Probowati, & Arifin, 2020). Behavior change strategies can be done with an education based on the theory of planned behavior. Providing education based on the theory of planned behavior can improve self-care behavior in patients with chronic diseases (Zeidi, Morshedi, & Otaghvar, 2021). Therefore, this study conducted to improve the behavior of patients with diabetes mellitus in performing prevention of diabetic ulcers optimally.

METHODS

This research aims to analyze the effect of health education based on the theory of planned behavior (TPB) on the main factors of TPB (attitude, subjective norm, perceived behavioral control), intentions and diabetic ulcer prevention in patients with diabetes mellitus. This research has obtained an ethics certificate under No.130/007/IX/EC/KEO/LCBL/2023. The research design was a quasi-experimental pre-test and post-test with a control group design. The respondents in this study were patients with diabetes mellitus in Sikumana Public Health Center, Kupang City. Based on sample calculation according to the foot care variable from previous studies, 35 respondents are in each group (Tekir, Çevik, & Özsezer, 2019). To anticipate the drop-out, the researcher added 20 %, so the sample in this study was 84 respondents, and each group consisted of 42 respondents. The technique used is purposive sampling. The selection of samples took into account the following culture criteria: 1) people who have been diagnosed with DM for more than six months, who are ≥ 18 years of age, can read and understand Indonesian, and have a mobile phone or a smartphone. The exclusion criteria in this study were patients with musculoskeletal disorders, hearing and speech impairment, and patients with diabetic ulcers. The drop-out criterion is for respondents who do not follow the research procedure until completion.

The independent variable in this study is health education based on the theory of planned behavior, whereas the dependent variable is the main factor in the Theory of Planned Behavior (perspective,

subjective norms, and perceived behavioral control), intention, and behavior prevention of diabetic ulcers. Instruments in this study are modules about the prevention of diabetic ulcers, video tutorials, and questionnaires. Questionnaires used to evaluate attitudes, subjective norms, perceived behavioral control, and intentions are structured based on the theory of planned behavior questionnaire which has been adapted to the research indicators by the researchers (Ajzen, 2010; Sukartini et al., 2020). The behavioral questionnaire for the prevention of diabetes ulcers The Modified Diabetic Foot Care Behavior Questionnaire was modified by researchers in accordance with the research theme by the researcher (Hadi Sulisty, Sae Sia, & Maneewat, 2018; Sukartini et al., 2020).

Health education based on the theory of planned behavior was conducted over a 12-week period. Intervention groups received health education based upon the theory of planned behavior followed by individual education sessions. In addition to providing material, the researchers also discussed with DM patients how to improve positive attitudes, subjective norms, perceived behavioral control, and patient intentions in the prevention of diabetic ulcers. Educational methods of lectures, discussions, demonstrations, and questions. Educational media are modules and video tutorials. In addition, patients receive positive information reminders and messages via WhatsApp or SMS once a week to prevent diabetic ulcers. Patients in the control group get routine interventions from Public Health Center. Data analysis using the Mann-Whitney U Test with software.

RESULTS

Table 1 Frequency Distribution of Respondents Characteristic

Characteristic	Kategori	f	%
Gender	Male	25	29.8
	Female	59	70.2
	Total	84	100
Age	45-54 years old	21	25
	55-65 years old	59	70.2
	66-74 years old	4	4.8
	Total	84	100
Level of education	Elementary	31	36.9
	Secondary	40	47.6
	Higher education	13	15.5
	Total	84	100
Duration of experienced DM	< 5 years	37	44.1
	5-10 years	38	45.2
	>10 years	9	10.7
	Total	84	100
The availability of information	Yes	37	44.1
	No	47	55.9
	Total	84	100

Table 1 shows the demographic characteristics of patients with diabetes mellitus in Sikumana Public Health Center. Of the 84 respondents, the majority of DM patients were female (70.2%). Based on age, most respondents were 55-65 years old (70.2%). Most respondents had a secondary level of education (47.6%), had been diagnosed with DM for 5-10 years (45,2) and most had never been informed about the prevention of diabetic ulcers (55.9%).

Table 2 Analysis of The Effect of Education Based on TPB On The Main Factors of TPB

The main factors of TPB	Group	Mean	SD	Min-Max	p-value
Attitude					
Pre-test	Intervention	34.69	2.005	31-39	0.822
	Control	35.35	2.66	31-45	
Post-test	Intervention	40.61	2.51	30-44	0.000
	Control	35.95	3.79	29-41	
Subjective norms					
Pre-test	Intervention	20.67	1.75	16-24	0.512
	Control	20.45	2.28	14-25	
Post-test	Intervention	23.38	1.92	20-26	0.000
	Control	19.88	2.38	14-25	
Perceived behavioral control					
Pre-test	Intervention	16.45	1.48	13-22	0.365
	Control	16.02	1.58	13-21	
Post-test	Intervention	20.9	1.63	18-24	0.000
	Control	18.45	2.96	13-24	

Table 2 shows the results of the analysis of the influence of TPB-based education on the main factors of TPB. In the pre-test, the average score of attitudes was 34,69 ($\pm 2,005$) in the intervention group and 35,35 ($\pm 2,66$) in the control group. In the post-test, there was an increase in the average score of attitudes for intervention groups by 40,61 ($\pm 2,51$) compared to a control group of 35,95 ($\pm 3,79$). The statistical analysis showed that there were significant differences in attitudes between intervention and control groups ($p=0,000$) after giving the education based on TPB. This showed that there is an influence of education based on TPB on the attitudes of patients with diabetes mellitus in the prevention of diabetic ulcers. The average score of subjective norms before intervention was 20.67 (± 1.75) in the intervention group and 20.45 (± 2.28) in the control group. After the intervention, there was an increase of 23.38 (± 1.92) in the intervention group compared to 19.88 (± 2.38). The statistical analysis showed that there were significant differences in the subjective norm between intervention groups and control groups after the proceeding of the TPB-based education ($p=0,000$). It shows that there is an effect of education based on TPB on the subjective norms of patients with diabetes mellitus in the prevention of diabetic ulcers. The average score of perceived behavioral control prior to intervention was 16.45 (± 1.48) in the intervention group and 16.02 (± 1.58) in the control group. There was an increase in the average score of perceived behavioral control in the intervention group by 20.9 (± 1.63), compared to the control group by 18.45 (± 2.96) after the intervention. The results of statistical analysis showed that there were significant differences in perceived behavioral control between the intervention group and the control group after the intervention ($p=0,000$). It shows that there is an influence of education based on TPB on perceived behavioral control in patients with diabetes mellitus in carrying out the prevention of diabetic ulcers.

Table 3 Analysis of The Effect on Education Based on TPB on Intention

Intention	Group	Mean	SD	Min-Max	p-value
Pre-test	Intervention	35.52	2.27	30-41	0,483
	Control	34.97	3.73	30-46	
Post-test	Intervention	35.54	2.26	30-41	0,000
	Control	34.61	3.71	30-46	

Table 3 shows the results of an analysis of the influence of health education based on TPB on intention. In the pre-test, the average score of intention was 35.52 (± 2.27) in the intervention group and 34.97 (± 3.73) in the control group. There was an increase in the average score of the intention of 35.54 (± 2.26), in comparison with 34.61 (± 3.71) after the intervention. The results of the statistical analysis showed that there were significant differences in intention between the intervention groups and the control groups after education based on TPB ($p=0,000$). This suggests that there is an influence of education using the theory of planned behavior on the intentions of patients with diabetes mellitus in the prevention of diabetic ulcers.

Table 4 Analysis of The Effect on Education Based on TPB on Diabetic Ulcer Prevention

Diabetic ulcer prevention	Group	Mean	SD	Min-Max	p-value
Pre-test	Intervention	53.71	1.12	39-77	0.382
	Control	51.17	2.13	33-76	
Post-test	Intervention	67.57	2.56	39-78	0.000
	Control	55.92	1.26	36-79	

Table 4 shows the results of an analysis of the effect of health education based on TPB on diabetic ulcer prevention behavior. At the pre-intervention, the average score of behavior was 53.71 (± 1.12) in the intervention group and 51.17 (± 2.13) in the control group. There was an increase after education in the average score of behavioral of 67.92 (± 2.56) in the intervention group compared to 34.61 (± 1.26). Statistical analysis showed that there were significant differences in diabetic ulcer prevention between intervention groups and control groups after intervention ($p=0,000$). This result indicates that there is an influence of the Theory of Planned Behavior-based education on preventive behavior of diabetic ulcers in patients with diabetes mellitus.

DISCUSSION

Education based on the theory of planned behavior influences the main factors of TPB such as attitudes, subjective norms, and perceived behavioral control. Post-test results in week 12 showed improvements in attitudes, subjective norms, and perceived behavioral control in the intervention group. The results also show that there are significant differences in perceived control behavior between the intervention group and the control group after the intervention. This study in line with the previous study. A previous research also showed similar results where there was an increase in perceived behavioral control in group that received education based on the theory of planned behavior (Gholipour-Baboli et al., 2017). A study also showed the result where there was an improvement in attitude after education based on the theory of planned behavior (Siuki, Peyman, Vahedian-Shahroodi, Gholian-Aval, & Tehrani, 2019). The results of this study are also consistent with studies carried out in Iran where there were no significant differences in the score of the subjective norm between the intervention group and the control group before intervention. After giving education based on the theory of planned behavior there was an increase in the average score of subjective norms in the intervention group compared to the control group (Hajivandi, Noroozi, Mostafavi, & Ekramzadeh, 2021). The same findings were also obtained by Rahimdel et.al. (2019). This study showed that groups that received an education based on the theory of planned behavior had better attitudes, subjective norms, and perceived behavioral control than the control group (Rahimdel, Morowatisharifabad, Salehi-Abargouei, Mirzaei, & Fallahzadeh, 2019). Previous research on individuals with cardiovascular

disease showed that education based on the theory of planned behavior had a positive impact on attitudes, subjective norms, and perceived behavioral control (Khani Jeihooni et al., 2021). According to the researchers, the post-test results show a good impact of giving education based on TPB on the increase of the main factors of TPB such as attitude, subjective norms, perceived behavioral control. In this study, TPB-based educational interventions are carried out with the aim of improving attitudes, subjective norms, and perceived behavioral control. A positive attitude in the prevention of diabetic ulcers is formed by explaining and convincing patients of the benefits of prevention. The establishment of subjective norms is carried out by identifying support from the support system and giving motivation to the patient to follow the advice of the family, and health workers in carrying out prevention of diabetes ulcer. Enhanced self-control perception is achieved by identifying patient support and obstacles as well as the patient's ability to prevent diabetic ulcers. The education based on TPB not only focuses on knowledge of the patient about diabetic ulcer prevention but more than that there are educational sessions conducted to improve attitudes, subjective norms, and perceived behavioral control that also support behavioral changes of patients with diabetes mellitus.

In this study, there were significant differences in intentions between intervention groups and control groups after intervention. The same study also found a significant increase in intention values in the intervention group compared to the control group after receiving education based on TPB (Mokarrami, Jalili, & Ghouchani, 2019). The results of this study same as the previous research that found a significant increase in intention in the intervention group

(Ashrafi et al., 2020). The intention is one's desire in behavior. Intention is influenced by attitudes, subjective norms, and perceived behavioral control (Ajzen, 2019). Researchers argue that the education based on TPB can enhance the intention of patients with diabetes mellitus to prevent diabetic ulcers. The motivation given in the educational session can shape the patient's intention to carry out the prevention of diabetic ulcers. Attitudes, subjective norms, and perceived behavioral control can form the good intention of the individual.

The score of prevention behavior of diabetic ulcers in the intervention group after the intervention was higher than in the control group. A study by Hoseini, et al. (2021) also showed an improvement in the behavior of patients with type 2 diabetes mellitus in retinopathy prevention after intervention based on the theory of planned behavior (Hosseini, Shamsi, Khorsandi, & Moradzadeh, 2021). Previous research also found significant differences in behavior between the intervention group and the control group after giving them education based on TPB (Marashi, Safari-Moradabadi, Ahmadi, & Alipour-Anbarani, 2022). According to researchers, the education based on TPB has a positive impact on improving the prevention behavior of diabetic ulcers in patients with diabetes mellitus. In the session of education based on TPB, the main focus is on the formation of several elements that also influence the formulation of patient behavior. Intention is a determinant of behavior. When the individual has the intention to do prevention of diabetic ulcers then they will do it. Education using TPB improves patient behavior in preventing diabetic ulcers. Structured education can enhance patient understanding and skills in diabetes ulcer prevention. Educational methods such as giving material with lectures, demonstration of action, discussion, and questioning can increase the active participation of patients and thus support behavioral change. Patients also receive modules and video tutorials that guide the prevention of diabetic ulcers. Giving reminders with text messages through WhatsApp or SMS improves the intention and diabetic ulcer prevention.

CONCLUSION

There are significant differences in the main factors of theory of planned behavior such as attitudes, subjective norms, perceived behavioral control after the education based on theory of planned behavior. The intentions and diabetic ulcers prevention behavior also have significant difference after given education based on the theory of planned

behavior. Health education based on the theory of planned behavior can improve the main factors of TPB (attitudes, subjective norms, perceived behavioral controls), intentions and diabetic ulcers prevention in patient with diabetes mellitus.

SUGGESTION

Education based on the theory of plan can be one of the educational interventions for patients with diabetes mellitus specifically in improving behavior prevention of diabetic ulcers. Further research can develop health education by integrating families in the process of care to improve patient behavior. The research not only focuses on educating the patient but also on the support system.

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CONFLICTS OF INTEREST

All author declare no conflict of interest.

AUTHOR CONTRIBUTIONS

The first author contributes to the ideas of research, data collection, processing, reference, and manuscript. The second author contributes to data collection and reference.

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