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Health promotion models to improve quality of life type 2 diabetes mellitus sufferers

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Abstract: Health Promotion Model to Improve the Quality of Life of Type 2 Diabetes Mellitus Patients is a study that aims to improve the quality of life of type 2 diabetes mellitus patients through health promotion. This study uses a quantitative research method with a descriptive analytical research type and a cross-sectional research design. This study was conducted in Bekasi City, West Java Province, with a population of type 2 DM adults aged > 26 years who live in Bekasi City. Based on the health profile of the Bekasi City Service in 2020, there was a prevalence of type 2 DM of 57,029 people from 12 sub-districts in Bekasi City, with a sample of 269 respondents. From the results of the descriptive statistical analysis, it can be concluded that the respondents have an average age of 55 years with quite large variations. Respondent Knowledge is relatively high with an average score of 8.6799. Respondent income varies greatly with an average of IDR 4,723,395.6552000000. Scores on health promotion models, action triggers, community change strategies, self-empowerment, and quality of life varied considerably.

Keywords: *Health promotion model, Quality of life, Type 2 diabetes mellitus.*

1. Introduction

Type 2 Diabetes Mellitus (T2DM) is a chronic non-communicable disease whose prevalence continues to increase globally, including in Indonesia. According to the World Health Organization [1] more than 422 million people in the world live with diabetes, and the majority are type 2. In Indonesia, the 2018 Riskesdas data shows that the prevalence of diabetes in the population aged ≥15 years reached 10.9%, which shows an increasing trend compared to previous years [2].

DMT2 not only has an impact on medical aspects, but also affects the quality of life of sufferers in physical, psychological, and social aspects. Long-term complications such as neuropathy, nephropathy, and retinopathy can reduce the functional capacity of sufferers, which ultimately worsens the quality of life [3]. Therefore, the management of DMT2 is not sufficient with medical intervention alone, but requires a comprehensive approach, including through structured health promotion.

Health promotion plays an important role in improving patient understanding, compliance, and behavior in disease management. Various health promotion models have been developed to facilitate behavioral change, such as the Health Belief Model (HBM), Theory of Planned Behavior (TPB), and Precede-Proceed Model. The application of these models in community-based education and interventions has been shown to improve glycemic control and patient quality of life [4, 5].

The implementation of health promotion models in the context of DMT2 management in Indonesia still faces various challenges, such as low health literacy, limited educators, and suboptimal local culture-based approaches. Therefore, it is important to develop and implement contextual, sustainable, and patient-needs-based health promotion models. With this background, this study aims to design and analyze the effectiveness of health promotion models in improving the quality of life of Type 2 Diabetes Mellitus patients, especially in the aspects of education, self-management, and social support.

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Type 2 Diabetes Mellitus (T2DM) is a global public health problem that continues to increase in prevalence. The World Health Organization (WHO) noted that the number of people with diabetes increased from 108 million in 1980 to 422 million in 2014, and is expected to continue to increase significantly, especially in developing countries [1]. In Indonesia, the 2018 Riskesdas data showed that the prevalence of diabetes mellitus in the population aged ≥15 years reached 10.9%, making it one of the chronic diseases with the highest burden on the national health system.

People with T2DM not only face medical challenges, but also decreased quality of life (QoL) due to long-term complications, limitations in physical activity, psychological burden, and impacts on social and economic life [6]. Studies show that the quality of life of people with diabetes is greatly influenced by the ability to manage lifestyle, adherence to therapy, and knowledge about their disease [7]. Health promotion plays a central role in supporting chronic disease management, including T2DM, by improving patients' knowledge, motivation, and decision-making skills. Health promotion models such as the Health Belief Model (HBM), Theory of Planned Behavior (TPB), and PRECEDE-PROCEED have been widely used to support behavioral change in the context of chronic diseases [8]. However, many studies still focus on aspects of knowledge and adherence to treatment, while the influence of theoretical model-based health promotion interventions on improving the quality of life of people with T2DM is still relatively under-explored, especially in local contexts or communities with a culture and diverse health access.

Studies in developing countries such as Indonesia are still limited to conventional educational interventions and have not yet systematically adopted behavioral theory-based health promotion approaches [9]. For example, research by Sitorus, et al. [10] in Jakarta showed an increase in knowledge after education, but had not had a significant impact on dimensions of quality of life such as psychological well-being and social participation of sufferers. This shows a gap between the health education provided and the actual quality of life of sufferers.

Based on the description above, there are several research gaps that are important bases for further study. There are not many studies that develop and test health promotion models based on behavioral theory (eg: HBM, TPB, Pender's Health Promotion Model) that are specifically aimed at improving the quality of life of people with T2DM. Most health promotion interventions only measure short-term outcomes (eg increased knowledge or changes in attitudes), without looking at their holistic impact on various domains of quality of life. There is still limited community-based or contextual research (local culture, social, and economy) in designing health promotion interventions that are appropriate to the needs and characteristics of people with T2DM in Indonesia. Family involvement and social support as important factors in the success of diabetes management are still rarely included in the design of structured health promotion models.

Type 2 Diabetes Mellitus (T2DM) is a non-communicable disease whose prevalence continues to increase globally and nationally. According to the International Diabetes Federation (IDF) [11] more than 537 million people in the world live with diabetes, and this figure is projected to increase to 643 million by 2030. Indonesia is ranked fifth with the largest number of diabetes sufferers in the world [11]. Type 2 Diabetes Mellitus is at high risk of reducing the quality of life (QoL) of sufferers due to long-term complications such as nephropathy, retinopathy, and cardiovascular disease, as well as significant psychosocial burdens [12]. Studies show that T2DM sufferers experience a significant decrease in quality of life if they do not receive health education and effective disease management [13].

Medical intervention alone is not enough in the management of T2DM. A health promotion approach based on behavioral change, patient education, and community empowerment is urgently needed. Health promotion has been shown to improve knowledge, adherence to treatment, and lifestyle changes that support glycemic control and patient well-being [14, 15]. However, to date there has been no comprehensive health promotion model that has been developed and contextually adapted for the Indonesian people, especially considering local cultural, economic, and social support system factors. Therefore, this study is very important to develop an evidence-based and contextual health promotion model. Improving the quality of life of T2DM sufferers through a promotive and preventive approach.

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Providing policy recommendations for primary care and decision makers in the health system. By developing a targeted health promotion model, it is hoped that there will be an increase in quality of life, better blood sugar control, and a decrease in the economic burden due to complications of T2DM [16].

The main objective of this study was to design and evaluate the effectiveness of a health promotion model based on education and behavioral change in improving the quality of life of type 2 Diabetes Mellitus (DM) patients. The specific objectives of this study include identifying the level of knowledge, attitudes, and practices (KAP) of type 2 DM patients regarding their disease management. Assessing the relationship between the implementation of health promotion strategies and changes in healthy living behavior in type 2 DM patients. Developing a contextual and community-based health promotion model for type 2 DM patients. Measuring the effectiveness of the health promotion model in improving the quality of life of type 2 DM patients holistically (physical, psychological, social). Providing recommendations for sustainable and applicable health promotion intervention strategies in primary health care [17].

This study makes a significant contribution to the field of public health and community nursing, especially in the development of an effective and evidence-based health promotion model for people with Type 2 Diabetes Mellitus (T2DM). The main contributions of this study are described as follows: This study develops a health promotion model that not only emphasizes physical aspects (blood glucose control), but also psychosocial aspects (family and community support), ongoing education, and spirituality. This model addresses the limitations of the health promotion approach which has tended to be fragmented . The developed model encourages increased health literacy through ongoing, community-based educational interventions that are tailored to the patient's socio-cultural conditions [18]. This helps patients understand and practice consistent self-management.

Practical Implications for Nursing and Community Health Interventions
The results of this study provide practical guidance for health workers, especially community nurses, in designing promotive and preventive interventions based on empowerment and support group approaches to improve the quality of life of T2DM patients. This study adopted and modified the quality of life evaluation indicators from WHOQOL-BREF and Diabetes Quality of Life (DQOL) so that they are more appropriate for local contexts and chronic conditions such as T2DM at the primary level. This study contributes to strengthening the theory-based and community-based health promotion approach that can improve the quality of life of people with type 2 diabetes mellitus. This model can not only be used in health service practices but also in the development of evidence-based national health policies.

2. Literature Review

Based on the literature review provided, the relationship between self-efficacy and quality of life in patients with Type 2 Diabetes Mellitus was examined. The review analyzed articles that met the inclusion and exclusion criteria from Tanjung, et al. [19] with the results of the literature review showing that self-efficacy in patients with Type 2 Diabetes Mellitus was related to their quality of life. The review found varying results regarding the prevalence of good, poor, or moderate self-efficacy and quality of life among the studies analyzed. Specifically, that the majority of Type 2 DM patients had good self-efficacy reported that the majority had poor self-efficacy, and 1 reported that the majority had moderate self-efficacy [20]. Regarding quality of life, it was reported that the majority of Type 2 DM patients had good quality of life, 3 reported that the majority had poor quality of life, and 1 reported that the majority had moderate quality of life [21].

A study involving 112 respondents with Type 2 Diabetes Mellitus found that the length of time a person suffers from the condition affects their quality of life [22]. Decreased quality of life is caused by poor patient management, which can lead to various complications affecting the eyes, kidneys, heart, blood vessels, and nerves. These complications are potentially life-threatening [23].

The study, which used a cross-sectional design and the WHOQoL-BREF questionnaire for data collection, concluded that there was a relationship between the duration of suffering and the quality of life of Type 2 Diabetes Mellitus sufferers [24]. The analysis produced a p-value of 0.024, which

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supports this conclusion. Based on these findings, it is hoped that health workers will carry out health promotion activities aimed at improving the quality of life of diabetes mellitus sufferers.

The review concluded that self-efficacy is needed for Type 2 DM patients to carry out disease management and care [25]. The level of self-efficacy (high or low) can be developed by the patient themselves; having self-confidence will form certain behaviors in managing their disease, which in turn affects their quality of life [26]. Factors that influence self-efficacy in Type 2 DM patients include education, family support, age, and education received from health workers. Factors that influence quality of life in Type 2 DM patients include family support, age, education, and blood sugar levels [27].

3. Research Methods

This study uses a quantitative research method with a descriptive analytical research type with a *Cross-sectional research design*. This study was conducted in Bekasi City, West Java Province. The population in this study were patients with type 2 DM with an adult age of $\geq$ 26 years who live in Bekasi City. Based on the health profile of the Bekasi city service in 2020, there was a prevalence of type 2 DM of 57,029 people from 12 sub-districts in Bekasi City and a sample of 269 respondents .

4. Analysis Results

4.1. Research Data Description

The description of the data presented in this section includes Independent Variables: Age, knowledge, income, health promotion model, action initiator, community change strategy. The Dependent Variable is Quality of Life. The intervening variable is self-empowerment. Table 1. shows a description of the health promotion model, action initiator, community change strategy, self-empowerment, and quality of life.

Table 1.
Description of Health Promotion Model, Action Initiator, Community Change Strategy, Self-Empowerment, and Quality of Life.

Variables	Mean	Median	Mode	Standard Deviation	Min.	Max.
Age	55.05	55	58	9,813	25	82
Knowledge	8.67	9	9	2,056	4	25
Income	4723395.65	5200000	0	4956320.13	0	75000000
Health Promotion Model	119.02	118.00	115	12,719	82	163
Action Initiator	18.38	20.00	22	5,615	4	26
Community Change Strategy	9.61	10.00	10	4,135	1	18
Self Empowerment	15.46	16.00	24	6,008	0	24
Quality of Life	48.82	49.00	49	7,238	21	69

4.2. Classic Test

Before carrying out the analysis, there are several statistical tests that must be met by the data in path analysis, including:

(1) Normality Test,
(2) Homogeneity Test, and
(3) Linearity and Significance Test of regression coefficients.

4.3. Normality Test

The following table shows the Kolmogorov Smirnov normality test on Ta so that the variables of knowledge, income, action triggers, and self-empowerment use skewness/SE.

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Table 2.
Kolmogorov Smirnov Normality Test.

Variables	Test Name	P value	Caption
Age	Kolmogorov Smirnov Test	0.322	Data is normally distributed
Health Promotion Model	Kolmogorov Smirnov Test	0.282	Data is normally distributed
Community Change Strategy	Kolmogorov Smirnov Test	0.06	Data is normally distributed
Quality of Life	Kolmogorov Smirnov Test	0.393	Data is normally distributed

Table 3 explains the normality test using Skewness and SE. If Skewness/SE <= 2, it shows that the data is normally distributed. The results of the analysis show that the knowledge and income variables have Skewness/SE> 2 results, so that knowledge and income have data that is not normally distributed. While the trigger variables for action and self-empowerment have Skewness/SE <= 2 values, so that the triggers for action and self-empowerment have normally distributed data.

Table 3.
Skewness/SE Normality Test.

Variables	Skewness	SE	Skewness/SE	Caption
Knowledge	1,676	0.149	11.2876555	Data is not normally distributed
Income	10,591	0.149	71.30562814	Data is not normally distributed
Action Initiator	-0.675	0.149	-4.54624711	Data is normally distributed
Self Empowerment	-0.267	0.149	-1.79837607	Data is normally distributed

4.4. Multicollinearity Test

The multicollinearity test is to see whether or not there is a high correlation between independent variables in a multiple linear regression model. If there is a high correlation between the independent variables, then the relationship between the independent variables and the dependent variable is disturbed.

Multicollinearity can be seen from the tolerance value and *Variance Inflation Factor* (VIF). If VIF >10, then there is a multicollinearity problem between the independent variables and vice versa if VIF <10, then there is no multicollinearity problem between the independent variables. The results of the multicollinearity test can be seen in Table 4.

Table 4.
Multicollinearity Test Results.

Variables	VIF	Information
Age	1,041	There is no multicollinearity
Health Promotion Model	1.127	There is no multicollinearity
Action Initiator	2,346	There is no multicollinearity
Community Change Strategy	2.486	There is no multicollinearity
Self Empowerment	1,478	There is no multicollinearity

Based on Table 4. it can be seen that the calculation results show that the VIF value is less than 10. So, it can be concluded that the regression model equation does not contain multicollinearity problems, which means there is no significant correlation between the independent variables so that it is suitable for further analysis.

4.5. Heteroscedasticity Test

The heteroscedasticity test is to see if there is inequality of variance from the residuals of one observation to another. A regression model that meets the requirements is where there is equality of variance from the residuals of one observation to another observation remains or is called homoscedasticity and if there is a difference in variance then there is a problem of heteroscedasticity. A good regression method is one that does not occur heteroscedasticity. The statistical test used in this study is the Spearman test. The test uses a significance level of 0.05, if the Prob value> 0.05 then there

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is no heteroscedasticity, if the Prob value <0.05 then there is heteroscedasticity. The results of the heteroscedasticity test are presented in Table 5.

Table 5.
Heteroscedasticity Test Results.

Variables	Significance	Information
Age	0.283	There is no heteroscedasticity
Health Promotion Model	0.339	There is no heteroscedasticity
Action Initiator	0.776	There is no heteroscedasticity
Community Change Strategy	0.363	There is no heteroscedasticity
Self Empowerment	0.18	There is no heteroscedasticity

Based on Table 5 it can be seen that the calculation results show that all independent variables have a probability value greater than the significance level of 0.05, so it can be concluded that there is no heteroscedasticity in the regression model.

5. Discussion

From the results of the descriptive analysis above, it can be seen that the average age of respondents is 55.055558 years with a standard deviation of 9.813258 years. The minimum age of respondents is 0 years and the maximum is 89 years. The mode of respondent age is 82 years. The average knowledge of respondents is 8.6799 with a standard deviation of 1.056425. The minimum knowledge of respondents is 0 and the maximum is 10. The average income of respondents is Rp 4,723,395.6552000000 with a very large standard deviation, which is Rp 4,956,320.1307500000. The minimum income of respondents is Rp 0 and the maximum is Rp 40,000,000.

The average score of the Health Promotion Model is 119.02118 with a standard deviation of 12.71982163. The minimum score of the Health Promotion Model is 0 and the maximum is 150. The average score of the Action Initiator is 18.3820 with a standard deviation of 5.615426. The minimum score of the Action Initiator is 0 and the maximum is 25. The average score of the Community Change Strategy is 9.6110 with a standard deviation of 4.135118. The minimum score of the community change strategy is 0 and the maximum is 15. The average score of self-empowerment is 15.4616 with a standard deviation of 6.008024. The minimum score of self-empowerment is 0 and the maximum is 25. The average score of Quality of Life is 48.8249 with a standard deviation of 7.2382169. The minimum score of Quality of Life is 20 and the maximum is 69. From the results of descriptive statistical analysis, it can be concluded that respondents have an average age of 55 years with quite large variations. Respondent Knowledge is relatively high with an average score of 8.6799. Respondent income varies greatly with an average of Rp 4,723,395.6552000000. The scores of health promotion models, action initiators, community change strategies, self-empowerment, and quality of life have quite large variations .

Multicollinearity test is one of the important classical assumptions in multiple regression analysis. The goal is to detect whether or not there is a strong correlation between independent variables in the model. High multicollinearity can cause the regression coefficient estimates to be unstable, difficult to interpret, and have large standard errors, thus affecting the validity of the hypothesis testing results. One common indicator used to detect multicollinearity is the Variance Inflation Factor (VIF). The VIF value measures how much the variance of the regression coefficient of an independent variable increases due to correlation with other independent variables. In general, a VIF value of less than 10 (or sometimes less than 5, depending on the literature and research context) is considered to indicate the absence of serious multicollinearity problems.

Based on Table 4, the results of the multicollinearity test for the health promotion model in improving the quality of life of Type 2 Diabetes Mellitus sufferers show that there is no multicollinearity in all independent variables tested. The following are the details of the VIF test results for each variable:

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5.1. Age Variable

Has a VIF value of 1.041. This value is far below the threshold of 10 (and also below 5), indicating that the Age variable is not strongly correlated with other independent variables in the model. The description in the table explicitly states "No multicollinearity occurs".

5.2. Health Promotion Model Variables

Has a VIF value of 1.127. This value is also far below the threshold of 10 (and below 5), indicating that the Health Promotion Model variable does not have multicollinearity problems with other independent variables. The description in the table confirms "No multicollinearity occurs".

5.3. Action Trigger Variable

Has a VIF value of 2,346. Although higher than the previous two variables, this value is still far below the threshold of 10 (and below 5). This indicates that the Action Trigger variable does not experience significant multicollinearity. The description in the table states "No multicollinearity occurs".

5.4. Community Change Strategy Variables

Has a VIF value of 2.486. This value is also below the threshold of 10 (and below 5), indicating that there is no significant multicollinearity problem related to the Community Change Strategy variable. The caption in the table confirms "No multicollinearity occurs".

5.5. Self Empowerment Variable

Has a VIF value of 1.478. This value is far below the threshold of 10 (and below 5), indicating that the Self-Empowerment variable is not strongly correlated with other independent variables. The description in the table states "No multicollinearity occurs".

Overall, the results of the multicollinearity test in Table 4 show that all independent variables in the regression model used to analyze the effect of the health promotion model on the quality of life of Type 2 Diabetes Mellitus sufferers have low VIF values and are below the generally accepted threshold. This means that there is no strong correlation between the independent variables in the model. In the absence of multicollinearity problems, this classical assumption is met, which supports the validity and reliability of the regression coefficient estimates and the results of hypothesis testing in this study. This allows for a more accurate interpretation of the effect of each independent variable (Age, Health Promotion Model, Action Initiator, Community Change Strategy, and Self-Empowerment) on the quality of life of Type 2 Diabetes Mellitus sufferers.

6. Conclusion

Based on information from the sources provided, the health promotion model aimed at improving the quality of life of Type 2 Diabetes Mellitus sufferers, especially in vulnerable groups such as the elderly, focuses on efforts to prevent and control the disease systematically and sustainably. The health promotion model to improve the quality of life of Type 2 Diabetes Mellitus sufferers involves a series of activities that include health checks for early detection, socialization and education about diabetes mellitus and how to prevent and control it, and education through media such as posters containing healthy living steps . These prevention and control efforts, such as maintaining blood glucose levels within the normal range, are considered the main foundation in improving the health and quality of life for individuals who are susceptible to diabetes mellitus.

Specific components of the health promotion model outlined include blood pressure and blood sugar screening to detect potential risks early, allowing for more timely preventive action . In addition, socialization and education aim to increase patients' knowledge about how to manage the disease and encourage the adoption of a healthier lifestyle. This education can be delivered through a variety of methods, including the use of assistive media such as leaflets and posters detailing important steps such

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as quitting smoking, maintaining ideal body weight, engaging in physical activity, eating healthy foods, regularly checking blood sugar, and managing stress. Through shared attention and support from various parties, the community can be motivated to make positive changes in lifestyle, which in turn can reduce risks and help manage diabetes, contributing.

From the results of descriptive statistical analysis, it can be concluded that respondents have an average age of 55 years with quite large variations. Respondent Knowledge is relatively high with an average score of 8.6799. Respondent income varies greatly with an average of Rp 4,723,395.6552000000. Health promotion model scores, action initiators, community change strategies, self-empowerment, and quality of life have quite large variations.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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