

# Effect of Educational Intervention Based on PRECEDE Model on Preventive Behaviors among High-Risk Individuals for Diabetes Type 2

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## Abstract

Early detection of high-risk factors for diabetes can be prevented by informative programs designed and implemented to decrease the high prevalence and prevent complications. **Aim:** To determine the effect of educational intervention based on PRECEDE model on preventive behaviors among high-risk individuals for diabetes type 2. **Design:** Quasi-experimental research design pre-post-test was utilized. **Settings:** The study was applied in the medical outpatient clinics at El-Fayoum Medical University Hospital. **Sample:** A purposive sample of 160 individuals diagnosed as high-risk for diabetes type 2. **Tools:** Four tools were used: (1) Structured interviewing questionnaire, (2) Predisposing, Enabling, and Reinforcing Questionnaire (PRECEDE model questionnaire), (3) High-risk individual's reported practices questionnaire of diabetes preventive behavior, and (4) High-risk individual attitude questionnaire regarding diabetes prevention. **Results:** Mean score of knowledge, enabling factors and reinforcing factors have been increased with statistical significance immediately and after intervention. High-risk individuals had good practices toward diabetes type 2 preventive measures after three months post-intervention in comparison to the pre-intervention. High-risk individuals had a positive attitude toward diabetes type 2 preventive measures after three months post-intervention in comparison to the pre-intervention implementation. There was a statistically significant relationship between knowledge, enabling, reinforcing factors score and practices scores of diabetes type 2 preventive measures throughout the intervention phases. **Conclusion:** It was concluded that the PRECEDE model was effective in promoting preventive behaviors among high-risk individuals for diabetes type 2. **Recommendation:** The educational intervention based on PRECEDE model about preventive behaviors should be integrated into care among high-risk individuals for diabetes type 2.

**Keywords:** Diabetes type 2, educational intervention, PRECEDE model, preventive behavior.

## Introduction:

Diabetes mellitus Type 2 is considered one of the chronic diseases whose prevalence rates have increased in recent years; it is prevalent as a chronic disease in the world that has been associated with high rates of hospital admissions in recent years (**American Diabetes Association, 2011**).

In recent decades, the number of individuals affected with diabetes type 2 is increasing rapidly; the spread of diabetes type 2 will increase from 171 million among people in 2000 to 366 million people in 2030. Well, metabolic control and sufficient education related to outcomes and control of

diabetes can be improved the clinical outcome of people with diabetes (**Rakhshanderou et al., 2016**).

Diabetes mellitus is an increasingly prevalent condition. This condition is characterized by hyperglycemia. The two main types of diabetes are type 1 diabetes mellitus and type 2 diabetes mellitus, with type 2 diabetes accounting for 90% of all cases. Other types of diabetes mellitus include gestational diabetes, drug-induced diabetes, and monogenic diabetes. Complications of diabetes mellitus affect all body systems and can include lethal consequences (**Zheng et al., 2018**).

Causes In type 2 diabetes mellitus, the body cannot properly utilize insulin, commonly referred to as “insulin resistance.” Insulin production can eventually decrease. Drug-induced diabetes can occur in patients who receive corticosteroids. Sometimes the patient’s diabetes resolves once the corticosteroids are discontinued; however, sometimes, the patient’s diabetes persists despite discontinuation of the corticosteroids (Choi & Chung, 2016).

Multiple factors increase the risk of developing diabetes mellitus. Risk factors for type 2 diabetes mellitus include belonging to a certain ethnic group (Native American, African American, Hispanic, Asian American, Pacific Islander), being increased in age, being overweight or obese, family history of diabetes, history of heart disease, or hypertension, hyperlipidemia, and history of gestational diabetes (Thewjitcharoen et al., 2018).

Early detection of high-risk factors for diabetes can be prevented by informative programs designed and implemented to decrease the high prevalence and prevent complications. The main method of control is the prevention of its occurrence in high-risk individuals by enhancing their knowledge and understanding of the predisposing factors, complications, and course of the disease (Zareban et al., 2013).

Education is a cornerstone of the care and treatment of chronic diseases. In other words, lifestyle modification and self-care improvement have been mentioned as the ultimate target of education for patients with chronic diseases. Individual health education is considered to be essential in the overall care of patients with DM2, although there is some uncertainty regarding its metabolic control benefits (Maheri, 2017).

The PRECEDE model (Predisposing, Reinforcing, Enabling, Causes in Educational Diagnosis, and Evaluation) model developed by Green and Kreuter is one of the different educational models that focus on factors influencing health-related behavior, based on the relationship between the health professional and the patient, and is particularly appropriate for application in chronic diseases (Green & Kreuter, 2005). The efficiency of the

PRECEDE model has been proven in different studies in the health environment, such as improving care habits among asthmatic children and improving medication adherence in patients with a chronic disease; however, it has rarely been used in DM2 (American Diabetes, 2011).

Thus, the implementation of educational programs for these individuals is very important. Evidence shows that the most effective educational programs are the ones that are theory-based and take approaches that originate from changing behavioral patterns. The selection of an appropriate model of health instruction is the first step for the design and implementation of educational programs for health promotion (Kashfi et al., 2014).

The PRECEDE–PROCEED model is among the models used for programming behavioral changes. This model was first introduced by Green et al. in 1970 and titled the preceding model. The PRECEDE–PROCEED model has specific phases as other programming models. As researchers gained more knowledge of and experience in using it, this model underwent some modifications. In 2005, Green and Kreuter introduced the latest modified version of the precede–proceed model containing four phases of programming, one phase of implementation, and three phases of assessment as follows: social assessment, epidemiological assessment, behavioral and environmental assessments, educational and ecological assessments, management and political assessments, program implementation, assessment of the process, assessment of the effect, and assessment of the outcome. This model determines the factors affecting health status and helps the policymakers achieve the program goals (Green & Kreuter, 2005).

The PRECEDE model is considered one of the most important and applicable theories at present (Didehvar et al., 2016). It can be used to design and evaluate a health promotion plan. The PRECEDE component allows the researchers to work backward from the goal of the research to create a project to instruct the formation of the educational intervention. PRECEDE stands for Predisposing, Reinforcing, and Enabling Constructs in Educational/Environmental Diagnosis and

Evaluation. In studies conducted by **Hosseini et al., (2014)** and **Hazavei et al., (2012)** they have reported and approved the efficiency of this model and obtained acceptable educational results. Moreover, the PRECEDE model has been recognized as an effective method for creating and providing the phases which are necessary for improving health.

Several studies have reported the positive effects of using the precede– proceed, model, such as its positive effect on knowledge, attitude, reinforcing factors, enabling factors, and coping behaviors in epileptic patients (**Zigheymat et al., 2009**),

Nurses play an important role in equipping patients with the proper knowledge to mitigate their risk of developing diabetes mellitus or the associated complications is critical. Nurses should assess the patient's knowledge related to diabetes care and provide education regarding dietary intake (such as limiting carbohydrate intake), exercise, and medications since these factors influence blood glucose levels. While providing patient education, the nurse should also assess for any potential barriers such as limited access to healthy foods in the community, limited income, or language barriers. Nurses are also responsible for teaching certain skills such as conducting self-monitoring of blood glucose and how to administer insulin injections. Furthermore, the nurse should encourage self-monitoring of blood glucose, daily foot inspections, and regular eye exams. Smoking cessation is another key lifestyle modification to prevent complications (**Lai et al., 2018**).

### Significance of the study

More than 29 million diabetics and 86 million pre-diabetic individuals are living all over the world. The International Diabetes Federation is predicted that by 2040, patients with diabetes will be reached 642 million worldwide (**Ogurtsova, 2017**).

Care of diabetic patients should involve changes in the lifestyle such as dietary habits, exercise, taking medication, monitoring of blood glucose, foot care, as well as the timing, and integration of all of these activities. Evidence has shown that T2DM can be prevented by practicing ½ h of moderate

activity 5 days per week (**Al-Hayek et al., 2013**). Hence, the researchers in the current study aimed to determine the effect of educational intervention based on PRECEDE model on preventive behaviors among high-risk individuals for diabetes type 2.

### Operational definitions:

#### Precede

It refers to Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation.

#### Predisposing factors:

They included some characteristics or socioeconomic situations that put an individual at risk of developing a disease or disorder. Educational intervention can affect some of the predisposing factors which include: knowledge, attitude, self-efficacy, and self-care.

#### Enabling factors

They mean the availability and accessibility of resources and skills.

#### Reinforcing factors

They included the attitudes of influential people (family, friends, peers, healthcare providers, media, teachers, community leaders, policymakers, etc.) who influence adopting healthy behaviors. An intervention may aim the influential people to successfully reach the actual target group.

#### PRECEDE-PROCEED model:

According to this model, there are two categories of enabling resources that affect the use of health services which include community and personal enabling resources.

### Aim of the study

The study aimed to determine the effect of educational intervention based on PRECEDE model on preventive behaviors among high-risk individuals for diabetes type 2.

#### Research Hypotheses:

Hypothesis (1): High-risk individuals' knowledge regarding diabetes type 2 will be enhanced after the application of educational

intervention based on PRECEDE model than before.

Hypothesis (2): High-risk individuals' practice regarding diabetes type 2 will be developed best practice after the application of educational intervention based on PRECEDE model than before.

## Subjects and Methods:

### Research design:

A quasi-experimental research design pre-post-test was utilized in this study.

### Setting:

The study was applied in the Medical Outpatient Clinics at El-Fayoum Medical University Hospital, Egypt, which is located on the first floor of the hospital. It consists of one room for examination. It includes only one bed, table, chairs, ECG, and emergency drugs. The study was conducted due to the increased flow rate of diabetic patients for the hospital from El-Fayoum and beside countries and to identify and prevent high-risk patients. Also, there was a waiting area for individuals and a lecture room which included an adequate number of seats, and data show where the researchers interviewed the recruited individual to conduct this study. The medical outpatients' clinics provide diagnostic and therapeutic services for high-risk individuals for diabetes from Saturday to Wednesday, from 9 a.m. to 1 p.m.

### Subjects

**Sample type:** A Purposive sample was used.

### Sample size:

A purposive sample of 160 individuals diagnosed as high-risk for diabetes type 2 was recruited from the mentioned setting, who attended the medical outpatient clinics at El-Fayoum Medical University Hospital.

### Sample size calculation:

Sample size was calculated based on considering level of significance of 5%, study power of 80%, and by using the following formula:  $n = [2(Z \alpha/2 + Z \beta)^2 \times p(1-p)] / (p_1 - p_2)^2$ . This depends on power, for 80% this is 0.84,  $n = [2(1.96 + 0.84)^2 \times 0.55(1-0.55)] / (0.2$

$= 160$ . Based on the previously mentioned formula, 160 high-risk individuals were recruited.

### Inclusion criteria included:

Individuals who are diagnosed as high-risk for diabetes type 2, their age from 18-60 years old, and agree to participate in this study.

### Tools of data collection:

Four tools were used to collect the data of the study as the following:

**Tool I: Structured interviewing questionnaire:** it was developed by researchers: It included demographic data of the high-risk individuals such as age, educational level, occupation, residence, and question about family history.

### Tool II: Predisposing, Enabling, and Reinforcing Questionnaires

**(Precede Model questionnaire):** it was done by researchers after reviewing the literature and based on the educational and ecological approach of precede model. It included the following parts:

**Part 1: Predisposing factor which included high-risk individuals' knowledge regarding diabetes:** it was developed by the researchers after an extensive reviewing of the related literature to assess the level of high-risk individual's knowledge regarding diabetes and their source of information. It included 6 questions about the definition of diabetes type 2, risk factors, symptoms, complications, and management & prevention.

**Scoring system:** The scoring system was calculated as: (1) was given to the "correct" answer and (0) given to the "incorrect" answer. The total score ranges from 0 – 12, a higher score indicates good knowledge. It was categorized into "good, fair and poor knowledge" as follows: poor less than 50 %. Fair was from 50% to 75 %, and good more than 75 %.

**Part 2: Enabling factors assessment:** It included 3 questions as: Do you

previously receive an educational program regarding diabetes?, Do you know available resources and facilities for diabetes type 2 prevention and management, and Do you have easy access to healthcare facilities?. Scores were given in the following way: A response of "Yes" to each question was given one score and response of "No" to questions received no score.

**Part 3: Reinforcing factors assessment:** It included two questions as: Do you have emotional support from your family?, and Will you have support from family and your health care provider in implementing diabetes preventive behavior?. Scores were given in the following way: A response of "Yes" to each question was given one score and response of "No" to questions received no score.

**Tool III: High-risk individual's reported practices questionnaire of diabetes preventive behavior (pre-post tool) (International Diabetes Federation, 2015):** it included eight questions to assess the high-risk individual's practices as: Do you have rest during the day?, Do you consume recommended diet for diabetes prevention (low-carbohydrate diet, eating fruits and vegetables) ?, Do you engage in activities that make you relax (watching TV)?, Do you measure your blood sugar frequently?, Do you check your urine and your weight frequently?, Do you follow the medication regimen as prescribed? Do you have regular follow up with your physician? and Do you take enough sleep (8 hours or more per day)?.

**Scoring system:** The scoring system was calculated as (0) given to "no" response, and (1) given to "yes" response. The questionnaire's total score was given a score of 0 – 8. The total score was categorized into "good and bad practices" as follows: bad less than 50% and good more than 50%.

**Tool IV: High-risk individual attitude questionnaire regarding diabetes prevention:** It was developed by the

researchers after reviewing the literature (**Population Council, 2015**). It included 5 questions: Do you think that stress may cause diabetes type 2? Do you think that a high carbohydrates diet may cause diabetes? Do you think that exercise may cause diabetes type 2? Do you think obesity may cause diabetes type 2? Do you think that regular medical follow-up is important?. It is divided into 3 score (neutral =0, disagree =1, and agree = 2). A total score equal 10. Total attitude scores more than or equal to 5 considered positive attitude, score less than 5 considered negative attitude.

#### **Validity and reliability of the tools:**

The content validity was tested for clarity, comprehensiveness, appropriateness, and reviewed by five experts in the medical-surgical nursing field. No modifications were done. The reliability of the tools was assessed through Cronbach's alpha test was  $\alpha = 0.891$  for the first tool,  $\alpha = 0.83$  for the second tool,  $\alpha = 0.78$  for the fourth tool, and  $\alpha = 0.76$  for the fifth tool.

#### **Pilot study**

A pilot study was carried out on 10% of the sample (16) high-risk individuals to observe the clarity and testing of the feasibility of the research process. No modifications were done. High-risk individuals involved in the pilot study were included from the study.

#### **Ethical considerations:**

Before starting the research, official permission was obtained through an issued letter from the Dean of Faculty of Nursing. The researchers met both medical and nursing directors of the selected setting to clarify the purpose of the study and take their approval. Written consent was obtained from the high-risk individuals to participate in the study after the aim of the study was explained to them. The researchers informed the high-risk individuals that, the study was voluntary, they were allowed not to participate and they had the right to withdraw from the study at any time, without giving any reason. Moreover, they were assured that their information would be confidential.

#### **Field work:**

The study was applied in the period from September 2020. The researchers attended the previously mentioned setting two days per week (Sunday and Monday); from 9 a.m. to 1 p.m. It included the application of educational intervention based on PRECEDE model which focuses on the predisposing factors that included diabetes knowledge. Enabling factors are defined as those that help the progress of

the performance of the health action such as resources and supportive approaches that are important to conducting behavior. In this study, the enabling factors are knowledge regarding available health facilities and informational resources (educational sessions and booklet), the reinforcing factors included support from family and health workers.

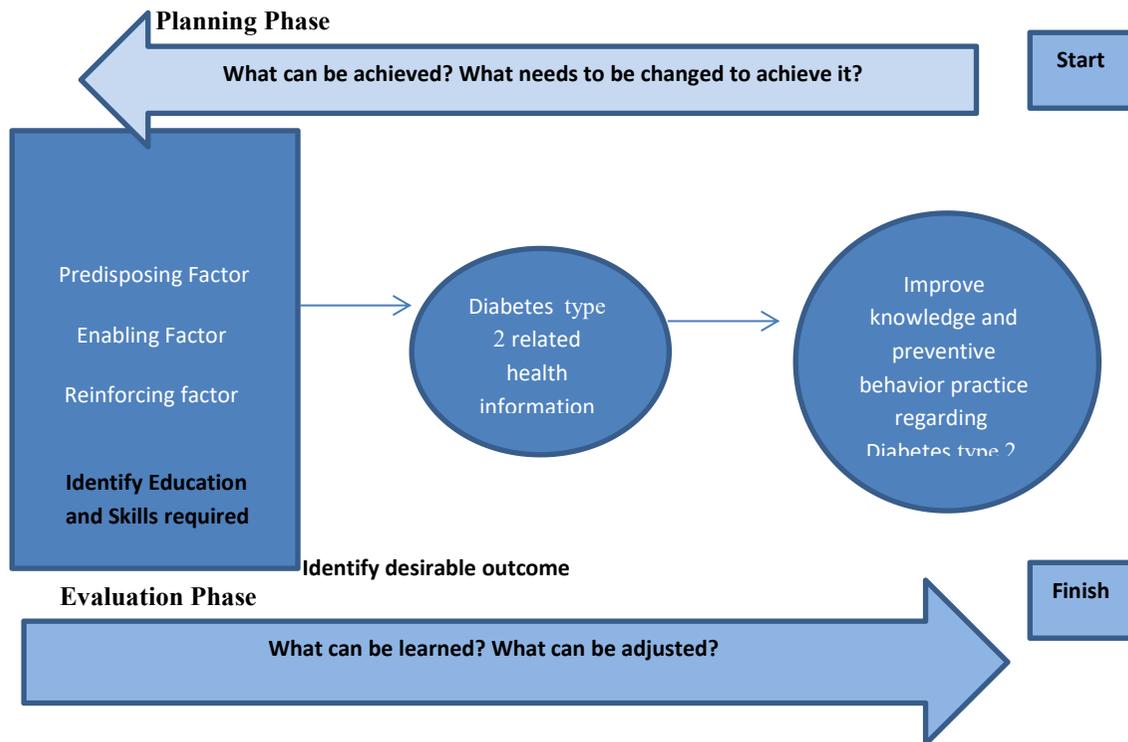


Figure (1) Application of PRECEDE model for improving knowledge and Practice of preventive behavior regarding Diabetes type 2 (Green & Kreuter, 2005).

Application of educational intervention based on precede model: It was done through the following phases:

**A-Preparatory phase:**

Contents of the educational sessions based on PRECEDE model about diabetes type 2 were designed. Several methods of teaching were used such as videos, attractive pictures, and booklet, and were prepared. Booklet was written in simplified Arabic language, covered all contents of the sessions, printed out regarding the sample size, and given to them.

**B-Assessment phase:**

Data were collected by the researchers after introducing themselves to the high-risk

individuals. Clear and simple explanations about the aim and nature of the study were discussed by them with individuals. The structured interviewing questionnaire was used to collect high-risk individual's characteristics.

During this phase, high-risk individual's predisposing factors, enabling factors, reinforcing factors were assessed based on Predisposing, Enabling, and Reinforcing Questionnaires (Precede Model questionnaire). The practice of preventive behavior regarding diabetes type 2 was assessed by using high-risk individual's reported practices of diabetes type 2 preventive behavior tool and also the attitude towards diabetes type 2 by using an attitude

questionnaire regarding diabetes type 2 prevention such as a pretest. The questionnaires were distributed to high-risk individuals and collected after filling.

### Implementation phase:

Two educational sessions regarding diabetes type 2 based on PRECEDE model were given to high-risk individuals. One theoretical and one practical session were provided to them in sixteen groups of 9–10 high-risk individual, one session every one week for two weeks at the lecture's room at the medical outpatient clinic of El-Fayoum Medical University Hospital in the form of lectures and group discussion with a duration of 40 - 60 minutes for each session. In the 1st session, the definition of diabetes type 2, risk factors, symptoms, complications, and management & prevention were discussed. Also education regarding enabling factor which included education regarding resources and supportive approaches that are important to conducting behavior and reinforcing factor which included the importance of support from family and health provider.

While the 2nd session was concerned with the discussion of high-risk individual's practices of preventive behavior about diabetes type 2 such as taking rest during the day, low carbohydrate consumption. Practice exercise at least 30 minutes daily, Engage in activities that make relaxation (watching TV), follow the medication regimen as prescribed by a physician, regular follow up with a physician, taking enough sleep (8 hours or more per day). High-risk individual training on self-monitoring of blood sugar, self-measuring body weight, checking sugar in urine was done. Prepared videos and attractive pictures were presented. At the end of each session, the important points were reviewed. The educational sessions were repeated to each group of high-risk individuals. Each high-risk individual was provided with the educational booklet at the end of the 1st session to be a guide and they were informed about the time of the next session.

### The Evaluation phase:

The effect of the educational intervention based on precede model was evaluated immediately and after three months of

implementation phase using the same Tool II, III, and IV.

### Administrative design:

An Approval was obtained from the Dean of Faculty of Nursing and the directors of medical outpatient clinics at El-Fayoum Medical University Hospital to carry out this study.

### Statistical Analysis:

Statistical Package for Social Sciences (SPSS) version 21 was used for statistical analysis of the obtained data. Data presented using descriptive measures in the form of a number, percentage, mean and standard deviation. Chi-square test used for the differences between variables pre and post-intervention. Pearson correlation test was used to the association between variables. The Cronbach's alpha was used to assess the reliability of the second, third and fourth tool.

### Results:

**Table (1):** Represented that 79% of high-risk individuals their age ranged between 30 < 45 years with mean  $\pm$  SD  $39.13 \pm 4.56$ , 33% of them had secondary education, it is pointed out that 71% of high-risk individuals were living in urban areas.

**Figure (1):** Demonstrated that 73% of high-risk individuals not working and 27% of them were working.

**Table (2)** clarified that the mean knowledge, enabling, and reinforcing factors scores regarding diabetes were decreased pre-educational intervention implementation. While there was an increase in the mean scores of knowledge, enabling and reinforcing factors score with statistical significance immediately and after three months of nursing intervention implementation.

**Figure (2)** revealed that the diabetes type 2 preventive behavior total practices score of the high-risk individuals' pre and three months post-intervention. It observed that most of the high-risk individuals (92%) had bad practices toward diabetes type 2 prevention pre-intervention and decreased to become 11% three months post intervention. Reversely, 8% of them had good practices toward diabetes type 2 prevention pre-intervention in comparison to 89 % three months post-intervention.

**Figure (3)** represented that the total attitude score of the high-risk individuals

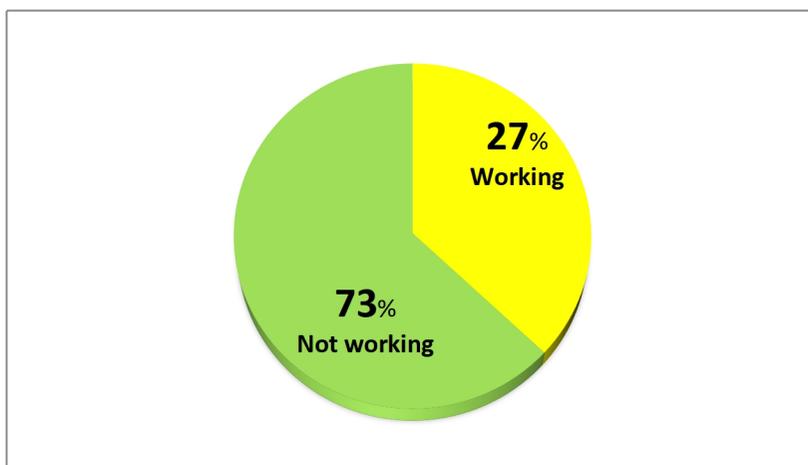
regarding diabetes type 2 prevention pre and three months post-intervention. It noticed that 71% of high-risk individuals had a negative attitude toward diabetes type 2 prevention pre-intervention and decreased to 13% three months post intervention. Reversely, 29% of the high-risk individuals had a positive attitude toward diabetes type 2 prevention pre-

intervention in comparison to 87 % three months post-intervention.

**Table (3):** Showed that a statistically significant relationship was found between knowledge, enabling factors, and reinforcing factors scores and diabetes type 2 preventive behavior practices scores of the high-risk individual throughout the intervention phases.

**Table (1):** Distribution of studied high-risk individuals according to their demographic characteristics (n=160)

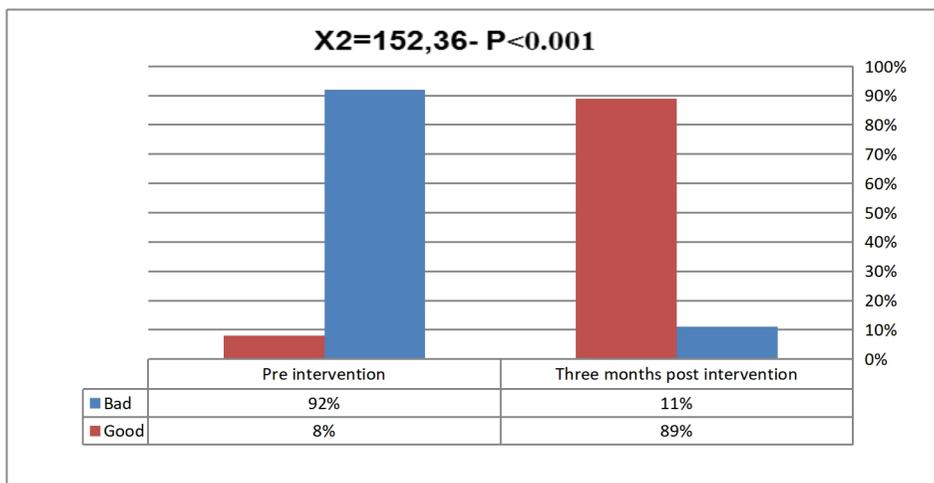
Items	No.	%
<b>Gender</b>		
- Male	69	43
- Female	91	57
<b>Age in years</b>		
21 < 30	34	21
30 < 45	126	79
<b>Mean ±Stander deviation</b>	39.13 ± 4.56	
<b>Educational level</b>		
- Illiterate	22	14
-Basic education	37	23
-Secondary education	53	33
-University education	48	30
<b>Residence</b>		
- Rural	46	29
- Urban	114	71



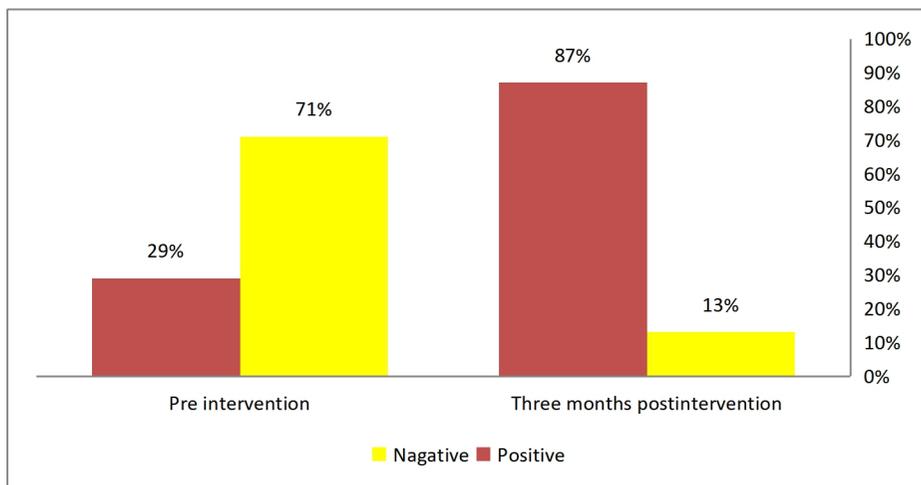
**Figure (1):** Distribution of studied high-risk individuals according to their Occupation (n=160)

**Table (2):** Comparison between the mean score of studied high-risk individuals related to their knowledge about diabetes, enabling factor and reinforcing factor pre, immediately, and after three months of nursing intervention implementation (n=160).

Variable	Pre-intervention	Immediately after intervention	After the three months post-intervention	Paired t-test	P-value
	Mean ±SD		Mean ±SD		
<b>Knowledge (Predisposing Factor)</b>	.48±.52	1.94±.62	1.82±.41	17.3	<0.001
Definition of diabetes type 2	.52±.35	1.75±.25	1.66±.32	16.1	<0.001
Risk factors	.45±.60	1.48±.26	1.27±.25	13.02	<0.001
Symptoms	.74±.32	1.75±.30	1.58±.33	15.3	<0.001
Complications	.63±.24	1.17±.38	1.13±.35	53.4	<0.001
Management	.64±.51	1.68±.35	1.52±.31	13.2	<0.001
Prevention	.54±.31	1.86±.32	1.73±.22	12.4	<0.001
<b>Enabling factors</b>	.63±.32	1.51±.38	1.39±.26	8.04	<0.009
<b>Reinforcing factor</b>	.64±.51	1.67±.23	1.60±.33	11.3	<0.001



**Figure (2):** The practices score of diabetes type 2 preventive behavior of the studied high-risk individuals' pre and three months post-educational intervention implementation (n=160).



**Figure 3:** Attitude among high-risk individuals regarding prevention of diabetes type 2 (n=160)

**Table (3):** Correlation between total knowledge, enabling factors, and reinforcing factors and preventive behavior practices scores of the studied high-risk individuals regarding diabetes type 2 pre and after three months of nursing intervention implementation (n=160).

Knowledge	Practice			
	Pre		Post	
	R	p	R	P
Pre	0.40	0.48*		
Post			0.86	0.001*

Statistically significant at  $p < 0.01$

## Discussion:

Results of the present study indicated that the mean knowledge, enabling, and reinforcing factors scores regarding diabetes were decreased pre-educational intervention implementation. While there was an increase in the mean scores of knowledge, enabling and reinforcing factors score with statistical significance immediately and after three months of nursing intervention implementation. This is reflected in the good effect of introducing the intervention based on PRECEDE model.

These findings match with results in a study conducted by **Mahdi et al., (2016)**, about "effect of PRECEDE -Proceed Model on behaviors prevention for type 2 diabetes Mellitus among high-risk individuals" and found that implementation of an educational program based on the PRECEDE model significantly improved the knowledge among intervention group regarding behaviors prevention for type 2 DM.

Also, these findings are in the line with a study in Mashhad city among students for prevention of diabetes conducted by **Peyman et al. (2015)**, who studied the effect of training diabetes prevention behaviors on the promotion of their knowledge, attitude, and practice and detected that the knowledge, attitude, and practice among students about prevention behaviors for DM were enhanced.

Also, the results are supported by **Moshki et al. (2017)** who conducted a study titled with "Effect of Precede-Proceed Model on Preventive Behaviors for Type 2 Diabetes Mellitus in High-Risk Individuals" and reported that PROCEED model was very effective in improving and promoting the

preventive behaviors for type 2 DM among high-risk patients.

Results of the present study indicated that diabetes type 2 preventive behavior total practices score of the high-risk individuals' has been increased pre and three months post-intervention. This is indicated the positive effect of the PRECEDE-PROCEED model on improving individuals practices.

These results are in accord with what **Neda et al. (2017)** who studied the "The effect of educational program based on the precede-proceed model on improving self-care behaviors in a semi-urban population with type 2 diabetes referred to health centers of Bavi and reported in their study in Iran that PRECEDE Model is an appropriate framework can help in educating patients with type 2 diabetes and promote self-care behaviors.

Also, this result is matched with **Dizaji et al. (2014)** who conducted a study titled with Effects of Educational Intervention Based on PRECEDE Model on Self-Care Behaviors and Control in Patients with Type 2 Diabetes" and found that self-care behaviors and control in patients with type 2 DM have been promoted.

Similarly, **Nazila et al., (2019)** is in the same line with the current result who found in their study that Self-management education program based on PRECEDE-PROCEED model enhances the self-management behaviors among diabetic patients type two.

Results of the present study revealed that a statistically significant relationship was found between knowledge, enabling factors, and reinforcing factors scores and diabetes type 2 preventive behavior practices scores of the high-risk individual throughout the intervention phases.

These findings agree with, **Farbod et al., (2017)** who studied the effect of intervention by using the PRECEDE model on the quality of life among diabetic patients and found that the mean score of enabling and reinforcing factors significantly increased in the intervention group compared to the control group. These findings are also, similar to **Solhi, Shabani, & Salehi., (2016), Ranjbaran et al., (2015), Dizaj et al., (2014), and Sabzmakan et al., (2016)** who reported that implementing intervention using the PRECEDE model could increase enabling and reinforcing factors.

The findings of the present study have supported the aim and hypothesis of the study and the knowledge, attitude, and practices among high-risk individuals for diabetes type 2 have been improved. This is reflected in the success of PRECEDE model implementation and its positive effects.

### Conclusion:

Depend on the results of the current study, it was concluded that implementing educational intervention based on PRECEDE Model among high-risk individuals was effective in improving their knowledge, attitude, and practice regarding the prevention of diabetes type 2.

### Recommendations:

**In the light of the study's findings, the researchers are recommended that:**

- 1- The educational intervention based on PRECEDE model about preventive behaviors should be integrated into care among high-risk individuals for diabetes type 2.
- 2- Continuous health education programs for high-risk individuals can help in providing continuous support and early detection of diabetes type 2.
- 3- Further research should focus on replication of the present study on a larger probability sample is recommended to achieve generalizability.

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