

## Effects of an Education Program to Promote Behavioral in Working Patients with Type 2 Diabetes

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### Key Words :

Theory of planned behavior  
diabetes education program  
type 2 diabetes  
working males

### ABSTRACT

Objective: To evaluate the effects of a patient educational program, in order to promote behavioral intentions in patients with type 2 diabetes, based on the theory of planned behavior. Methods: The education program consisting of 3 sessions was implemented for 6 weeks, involving 5 working male patients with type 2 diabetes undergoing treatment in a clinic. Results: The scores of the Diabetes Self-management and -efficacy Scales significantly improved during the study period. Conclusion: The education program may be effective to promote behavioral intentions to perform diabetes self-management in patients through approaches to the 3 concepts of the theory.

### I. Introduction

The number of diabetic patients is increasing yearly, and the incidence of diabetes is higher in males<sup>1)</sup>. Among the 30 trillion yen for national medical costs, approximately 1 trillion is spent on the treatment of diabetes complications<sup>2)</sup>. The maintenance of favorable glycemic control reduces the incidence of diabetes complications<sup>3)</sup>, preventing the occurrence of diabetes and its advancement and consequently contributing to the reduction of future medical costs. Therefore, it is important to provide diabetic patients with education to improve and maintain favorable glycemic control.

Diabetic patients without marked subjective symptoms have been reported to withdraw from treatment more frequently. Particularly late middle-aged males, who work and play an important role in society, tend to give priority to work over health-related activities. It is also difficult for them to visit a hospital for consultation due to the coincidence between the time zone in which medical services are usually provided and business hours<sup>4)</sup>. In this respect, the provision of efficient and effective education may be crucial to support working diabetic patients in the continuous control of the disease while maintaining their daily lives.

At present, education for diabetic patients is mostly provided during hospitalization. Educational hospitalization has been reported to improve patients' glycemic control more effectively than outpatient education, as it facilitates the obtainment of appropriate knowledge and self-care skills, in addition to motivating them to improve their inappropriate lifestyles<sup>5)</sup>.

The period of such educational hospitalization is 1 to 2 weeks in the majority of medical facilities. In recent years, weekend educational hospitalization services and outpatient education sessions have been increasingly provided in consideration of late middle-aged patients' living conditions.

The purposes of today's diabetes education include: enhancing the level of self-efficacy<sup>6-8)</sup>, performing foot care<sup>9)</sup>, and providing telephone or e-mail consultation services<sup>10,11)</sup>. However, the number of studies examining diabetes education programs<sup>12)</sup> has been limited, and none of them was based on theories of behavior. Under these circumstances, the development of effective education programs for outpatients with diabetes is urgently required, while considering

rapidly increasing medical costs and those spent on outpatient education.

In our clinic, patient education is provided in a short period of time during consultation, and has successfully improved glycemic control in a large number of patients. On the other hand, as detailed education programs are not yet available, the contents of this education depend on the needs of individual patients. Considering this situation, in this study, an education program was developed to promote behavioral changes toward appropriate self-management in working male patients with type 2 diabetes. This paper reports its contents and effects.

### II. Methods

#### 1. Conceptual framework for the study

On the basis of the theory of planned behavior<sup>13)</sup>, a conceptual model<sup>14)</sup> to promote behavioral intentions in male patients with type 2 diabetes (Figure 1) was created.

According to the theory of planned behavior, behavioral intentions as a theoretical base for this conceptual model are under the direct influence of the following 3 concepts: <attitudes toward the behavior>, <subjective norms>, and <perceived behavioral control><sup>15)</sup>. Intentions to show appropriate behavior arise from positive feelings. Behavioral intentions are promoted, and lead to the performance of a given behavior when <a positive attitude toward the behavior>, <subjective norms> to meet surrounding people's expectations for its performance, and <perceived behavioral control> to perform it without difficulty are appropriately combined. The theory of planned behavior defining intentions to show appropriate behavior has been focused on in the field of behavioral sciences, being regarded as contributing to the prediction of health-related behaviors, as behavioral intentions are promoted in those showing a positive attitude toward the behavior, with highly elaborated subjective norms and increased perceived behavioral control<sup>16)</sup>.

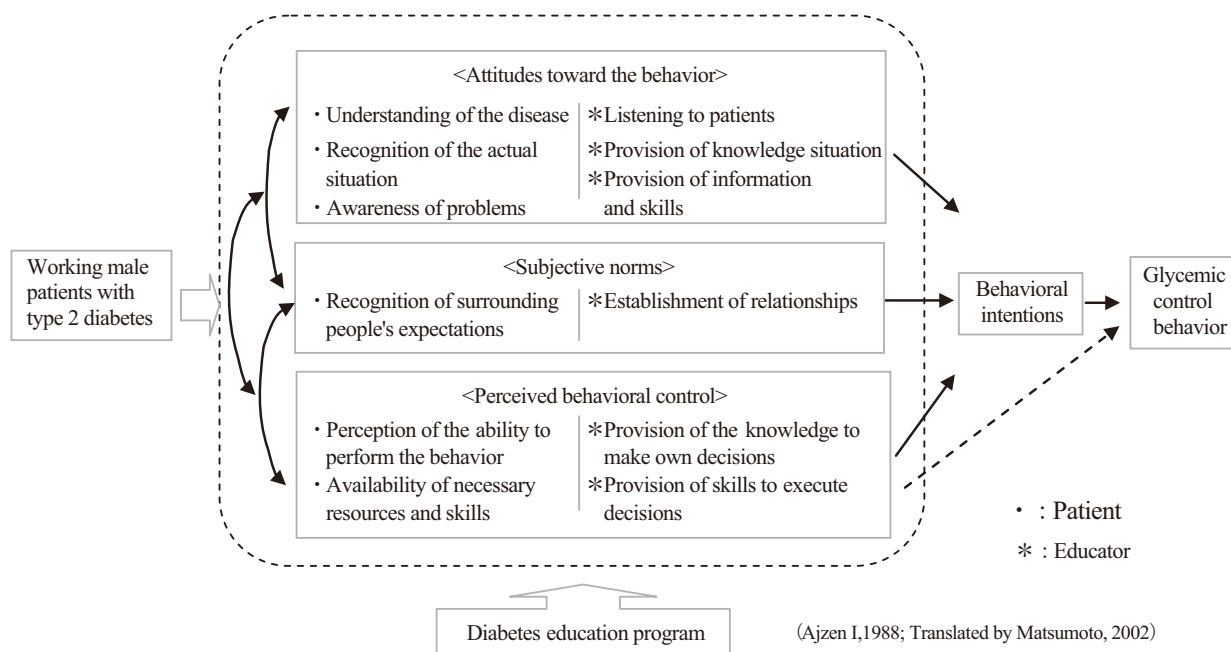
The conceptual model (Figure 1) aimed to support working male patients with type 2 diabetes to perform self-management comfortably as a behavior and not to consider it as interfering with their daily lives (work). The diabetes education program based on it was designed to promote their positive attitudes toward diabetes self-management, elaboration of subjective norms to meet their supporters' expectations for its performance, and perception of their own control to perform it appropriately in their daily lives. These approaches focused on the nurturing of glycemic self-management behavior as a

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**Figure 1. A Conceptual Model to Promote Behavioral Intentions in Working Male Patients with Type 2 Diabetes**

result of the development of behavioral intentions.

2. Definition of terms

Education programs: Programs to specify policies on patient education and its details and procedures

Positive attitudes toward the behavior: Positive feelings based on the belief that a given behavior leads to significant consequences

Subjective norms: Norms based on the belief that people important to the individual consider the behavior to be performed and the desire to meet their expectations

Perceived behavioral control: Perception of the individual's control to perform the behavior appropriately using necessary skills and resources

Behavioral intentions: Motivation to perform the behavior

3. Contents of the diabetes education program

The diabetes education program (education program) developed in this study aimed to provide patient education in a short period of time during consultation in clinics, increase patients' knowledge necessary for diabetes self-management, and promote their behavioral intentions to perform the

glycemic self-management behavior by guiding them toward appropriate recognition.

The contents of the education program were determined based on the literature on diabetes education<sup>17, 18)</sup> and the researcher's experience of providing health guidance for workers as an industrial nurse and educating outpatients, as well as the results of previous studies<sup>19, 20)</sup>, as follows:

1) reducing education-related psychological stress in patients, 2) providing the maximum information within the minimum time period, 3) personalizing education to meet individual patients' needs, and 4) specifying the details of dietary therapy as part of self-management in daily life. The education program consisted of 3 sessions and, to enhance patients' comprehension of its contents, brochures explaining the goals of each session were prepared. Table 1 outlines the contents of the education program, while Table 2 illustrates the points of nursing commitment based on the 3 concepts influencing behavioral intentions.

1) Purposes and structure of each session of the education program (Table 1)

The purposes and structure of each session of the education program were as follows: The first session aimed to motivate

**Table 1. Purposes and Structure of Each Session of the Education Program**

	Session 1	Session 2	Session 3
Purposes	Providing information regarding the pathology and treatment of diabetes and motivating to improve the lifestyle	Maximizing the effect of dietary therapy by reviewing the time and amount of food intake and promoting habitual exercise	Providing information to realize the influence of lifestyle (mainly eating habits) on the blood sugar level and continuously perform self-management
Title	[Understanding the Mechanism of Diabetes]	[Food and Exercise Influencing the Blood Sugar Level]	[To Perform Glycemic Control Continuously]
Content	Knowledge of diet's influence on the blood sugar level	Knowledge and skills to perform dietary and exercise therapies	Necessity and appropriate period of follow-up to perform glycemic control continuously
	Awareness of the necessity of glycemic control by examining the lifestyle and challenges		Methods to undergo long-term care comfortably

**Table 2. Points of Commitment in the Education Program**

Concept	Attitudes toward the behavior	Subjective norms	Perceived behavioral control
Points of commitment	Listening to patients and not denying their efforts and emotions toward diabetes self-management	Encouraging patients to express their emotions and make efforts to meet surrounding people's expectations	Providing the knowledge to make own decisions and skills to execute them in daily life
	Providing patients with knowledge of the pathology of diabetes and their pathological conditions	Confirming changes in the results of blood test, body weight, and oral medications, with a view to meeting surrounding people's expectations	Providing skills to perform dietary and exercise therapies in daily life appropriately
	Providing patients with knowledge and information to realize their lifestyle-related problems	Establishing favorable relationships with patients as one of their supporters expecting the behavior	
	Providing patients with information and skills to develop solutions by themselves		

patients to improve their lifestyles, while providing them with information regarding the pathology and treatment of diabetes. Its content focused on [Understanding the Mechanism of Diabetes] to lead patients to understand the pathology of diabetes and appropriately recognize the influences of their lifestyle on diabetes control. It also aimed to enhance patients' knowledge of diet, its influence on the blood sugar level, and awareness of the importance and necessity of glycemic control by reviewing their previous life patterns and clarifying their present challenges.

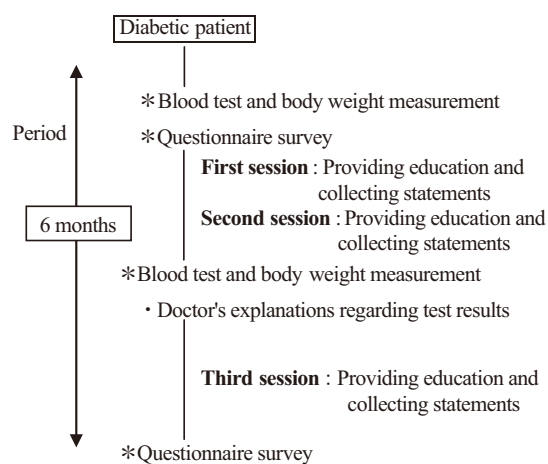
The second session focused on the appropriate time and amount of food intake, and evaluated patients' eating habits, with a view to maximizing the effect of dietary therapy. It also aimed to lead patients to execute habitual exercise effectively. To help them use their knowledge and skills on dietary and exercise therapies, aiming to control the time and amount of food intake appropriately, explanations regarding <food and exercise's influence on the blood sugar level> were also provided.

The third session aimed to provide patients with information necessary to realize the influences of their lifestyle (mainly eating habits) on their blood sugar levels and continuously perform diabetes self-management, such as the necessity and appropriate period of follow-up <to perform glycemic control continuously> and methods to undergo long-term care comfortably.

2) Scales used in the diabetes education program

In the education program, the following scales were used: the Diabetes Self-management Scale<sup>21)</sup>, to evaluate glycemic self-management behaviors related to diet and exercise, and the Diabetes Self-efficacy Scale<sup>21)</sup>, to measure <perceived behavioral control>; the latter was adopted, as Ajzen<sup>22)</sup> considered the components of <perceived behavioral control> to represent the sense of self-efficacy defined by Bandura<sup>23)</sup> as the second determinant of behavior.

The Diabetes Self-management Scale is a self-reported scale to evaluate the performance of diabetes self-management related to diet and exercise in daily life, and consists of 22 items: 16 diet- and 4 exercise-related ones, as well as 2 others, with 4 response options from "Never" to "Always". The Diabetes Self-efficacy Scale is a self-reported scale to evaluate



**Figure 2. Evaluation Design for the Education Program**

**Table 3. Patient Attributes**

Patient	Age (years)	Duration of the disease (approximately, years)	Complications	History of educational hospitalization
A	53	5	Absent	Absent
B	37	1	Absent	Absent
C	71	16	Absent	Absent
D	38	4	Absent	Absent
E	57	12	Absent	Absent

perceptions of one's ability to perform dietary and exercise therapies for diabetes self-management in diverse daily situations. It consists of 8 items, 4 diet- and 4 exercise-related ones, with 5 response options from "Not appropriately performing" to "Appropriately performing".

Furthermore, as part of the treatment, items of periodic blood tests that patients periodically undergo to examine the status of glycemic control, such as fasting blood glucose, hemoglobin A1c (Hb-A1c: JDS\*), total cholesterol, and triglyceride levels, were adopted, in addition to the BMI and body fat percentage.

\*JDS (Japan Diabetes Society)

The value for HbA1c (%) is estimated as an NGSP equivalent value (%) calculated by the formula HbA1c (%) = HbA1c (JDS)(%) + 0.4%.

#### 4. Patients

A total of 6 male patients with type 2 diabetes, who visited a clinic monthly or more frequently and met the following criteria, were studied: aged 35 or over, absence of serious diabetes complications or other diseases possibly interfering with the study, and consent to participate in the study.

#### 5. Site and period of the study

The study was conducted for 6 weeks from April 2005 to the end of May --- a sufficient period of time to observe changes in the Hb-A1c level representing the status of glyce-mic control --- in a clinic located in the business district of a city, specializing in internal medicine.

#### 6. Data collection

Data were collected, as shown in Figure 2. The 3 sessions of the education program were performed by the researcher as a diabetes educator. A questionnaire survey was conducted before and after the implementation of the education program using the 2 scales to evaluate its effects. Values of biological indices, such as the items of periodic blood testing, BMI, and body fat percentage, were also measured before and after it. In addition, the patients' statements were collected during each session, and interviews were conducted after termination to clarify their views on its content. Data regarding the patients' attributes were collected from their medical records.

#### 7. Methods of evaluation

1) The patients' views and statements on the contents of the education program were collected to perform narrative analysis based on the 3 concepts.

2) Changes in the patients' self-management and motivation were evaluated based on the scores of the 2 scales.

3) Changes in the metabolic status were evaluated based on values of objective biological indices, such as the fasting blood glucose, Hb-A1c, total cholesterol, and triglyceride levels, as well as the BMI and body fat percentage.

#### 8. Statistical analysis

All values were simply totaled, and are shown as means  $\pm$  standard deviations.

#### 9. Ethical considerations

The patients were provided with written explanations regarding the study objective, voluntary participation, unconditional withdrawal, and guarantee of anonymity by the researcher through the doctor to obtain their consent.

### III. Results

#### 1. Characteristics of the patients

The education program was implemented in 6 male patients with type 2 diabetes, 5 of whom participated in all 3 sessions. Table 3 shows the characteristics of these 5 patients.

#### 2. Patients' views and statements on the education Program

Table 4 lists the participants' views and statements on the 3 sessions of the education program based on the 3 concepts.

##### 1) First session

Before the implementation of the education program, periodic test values were shown to the patients. They also underwent measurement of their body fat percentage, followed by completion of the 2 questionnaire sheets.

Subsequently, as an approach to <attitudes toward the behavior>, the patients reviewed their daily life patterns, while being provided with information regarding the course of diabetes and eating habits to learn the difference between the amount of actual daily energy intake and that instructed by the doctor; such a difference was observed in all patients, indicating their excessive energy intake equivalent to approximately one meal. Provided with such information, the patients stated the following: Patient B: "Am I supposed to lose weight?", C: "My physical strength will decrease if I become thin", and E: "I am not eating so much".

As another approach to <attitudes toward the behavior>, the patients learned about the pathology of diabetes to enhance their awareness of their own pathological conditions. Those treated with oral medications were also provided with explanations regarding their side effects, while those with sufficient knowledge of diabetes concentrated on important points. Table 4 lists their statements during this session.

After termination, the following statements on the education program were recorded: Patient A: "I need to be much more scared", B: "I want to know what I can expect if I continue this lifestyle", D: "Explanations regarding pathological conditions are absolutely necessary", and D: "It is interesting to learn the details". The duration of the first session was 37.0 $\pm$ 7.6 minutes.

##### 2) Second session

The second session took place approximately 2 weeks after the first one. The patients' statements on this session were as follows: Patients A and B: "I have become aware of the importance of continuing care", A: "It was easy to understand, although such information is also available through the doctor, nurses, and media", B and C: "In daily life, newspapers are the main source of information regarding diabetes. Now I read them more carefully than previously".

As an approach to <perceived behavioral control>, the patients' improvements after the first session were initially discussed to enhance their perception that it is possible to perform self-management simply by controlling the amount of energy intake. During the discussions, the following statements were recorded: Patient A: "Now I eat a reduced amount of food more slowly and frequently", B: "I eat the same amount for breakfast and lunch, but that for dinner is slightly reduced", C: "My goal is to limit my daily energy intake to 1,700 kcal, as instructed by the doctor, not exceeding 2,000 kcal", C: "I eat only half a slice of bread for breakfast now. I have also reduced the amount of salad dressing", D: "I have reduced the amount of rice by half for lunch", E: "I order half a bowl of rice for lunch, and consume reduced amounts of side dishes for dinner. My body weight has decreased by 1 kg", E: "On the basis of my calculation, I am limiting my daily energy

Table 4. Patients' Views and Statements

	Attitudes toward the behavior: Methods to improve the current situation	Subjective norms: Surrounding people's expectations	Perceived behavioral control: Perceptions of the ability to perform the behavior	Behavioral intentions: Motivation to perform the behavior
A	1 I should increase my physical activity level. I need to exercise.	My wife just asks me about the results after testing.	Maybe I can walk for about 30 minutes after dinner on Fridays and Saturdays.	My physical condition is too favorable to realize that actually I am ill. I think I can do it.
	2 I have slightly reduced the amount of food intake, particularly meat. I go for a walk at weekends.	She helps me appropriately dine.	I need to take my situation more seriously to make further efforts.	Should I really improve my lifestyle? If so, I have to try all methods for such improvement. I am continuously making efforts, although they are absolutely insufficient.
	3 I may need more exercise. I am walking at weekends, but this is not sufficient at all.	She is generally cooperative.	I should do everything I can do if my condition is so poor...	It should be my problem; there may be a lack of awareness. OK, I will try.
B	1 I should stop eating my children's leftovers. I should also reduce the amount of alcohol consumption.	My wife does not trust me. She says that I need further control.	Not so difficult.	I will surely do it.
	2 I have to reduce the amount of food intake, particularly at dinner.	She said that she knew what was expected of me.	I will do my best.	I have stopped eating my children's leftovers. I am trying to eat more vegetables these days. I will surely do so.
	3 I should further reduce the amount of food intake.	They are cooperative, but, after all, this is my problem.	It is not so difficult to control my meals, except for lunch, as I cannot have dinner until late at night. I can continue this if I am doing well.	I had never made so much effort like I am doing now, so I expected improvement (in test results)... I should make further efforts. I will surely do so.
C	1 It may be effective to reduce the amounts of side dishes at dinner. I am going to reduce the amount of food intake. I have to be more self-directed.	Wife: I am not so anxious (I like cooking).	It is easy to reduce the amounts of meals.	I will try. Yes, it is possible.
	2 I have reduced the amounts of my meals.	My wife is an easygoing person, and always tells me to eat without worry.	It is becoming easier.	My goal is to limit my daily energy intake to 1,700 kcal, not exceeding 2,000 kcal. Yes, I am continuing to do this.
	3 I am going to go mountain climbing on my holidays.	I asked my wife not to cook so much, as I am on a diet.	I have just tried small things, but despite it being early, I see an effect.	I will try to improve them further (test results). This value should decrease to 7%. I should avoid excessively eating when I go mountain climbing.
D	1 I am just living routinely. I eat less when I am busy working. Maybe I can change my drinking style (diluting with water).	There is nobody expecting it (not married).		I am always trying to improve.
	2 I noticed that I had been exercising in the wrong way. I often eat at an inappropriate time.		I will try as much as I can.	Moderate.
	3 I am trying to satisfy myself with reduced amounts of food and drink. I enjoy small amounts of food and diluted drinks.	I don't want to worry my parents by talking about my problems.	I am going to start from basic things. I don't eat much when I eat with others.	I know I am not living well. It is time to restart.
E	1 I tend to eat excessively at lunch. I should review the amount.	My wife also has hyperlipidemia, so she understands what I need, and helps me when we dine.	Yes, I can.	I am already on a diet. I am going to reduce the amounts of meals gradually in consideration of changes in the size of my stomach.
	2 Now I am eating more carefully.	Following my wife's advice, I have started eating vegetables.	It is easy.	
	3 I am holding on.			On the basis of my calculation, I am limiting my daily energy intake to about 2,000 kcal.

intake to about 2,000 kcal”, and E: “Following my wife’s advice, I’ve started eating vegetables”. Furthermore, to increase the amount of energy consumption, A: “I go for a walk at weekends” and C: “I walk 4,000 to 5,000 steps a day”.

During the second session, the patients reviewed the knowledge they had obtained during the previous session, while being provided with explanations regarding dietary and exercise therapies as another approach to <perceived behavioral control>. Regarding support from other family members as <subjective norms>, the patients stated the following: A: “Nothing special. My wife just asks me about the results after testing” and B: “They are cooperative, but, after all, this is my problem” (Table 4).

Their learning during this session was as follows: D: “I noticed that I had been exercising in the wrong way” and A and D: “I have learned about nutrient absorption”. The duration of the second session was 28.0±4.5 minutes.

### 3) Third session

Before the initiation of the third session, the patients were informed of the results of the test they had undergone 1 month after the first one by the doctor. When they were asked about their feelings toward the test results, they stated the following: Patient A: “I did not expect good results, as my lifestyle has not changed much yet”, B: “I had never made so much effort as I am now, so I expected improvement... The data are severe”, C: “It is so early, but I see an effect (happily)”,

D: “It is difficult to comment...”, and E: “I have just started”.

During the third session, the patients reviewed the contents of the previous 2 sessions, while being provided with explanations regarding points of diabetes self-management. When they were asked about changes in their lifestyles after the session, they stated the following: A: “I am not exercising so actively (just walking at weekends). I may still lack awareness of my problem”, D: “I reduced the amount of rice for lunch as soon as this program started”, and E: “I am consuming reduced amounts of side dishes (for dinner)”. Regarding the contents of the 3 sessions, they stated the following: A: “It is very clear what I have to do, and it should be my problem; it may be a lack of awareness if I am not doing it well”, B: “I was shocked when I learned that diabetes is an incurable disease of the blood vessels, and all I can do now is prevent it from deteriorating”, and A and C: “The sessions were informative and easy to understand”.

They also expressed their views on medical professionals as follows: A, B, and D: “It is nice to have someone who cares about me besides my family”.

At the end of the third session, they completed the diabetes self-management and -efficacy scale sheets. The duration of this session was 26.6±7.6 minutes.

### 3. Changes in index values

Figures 3-1 and 3-2 show self-efficacy and -management scale scores before and after the implementation of the

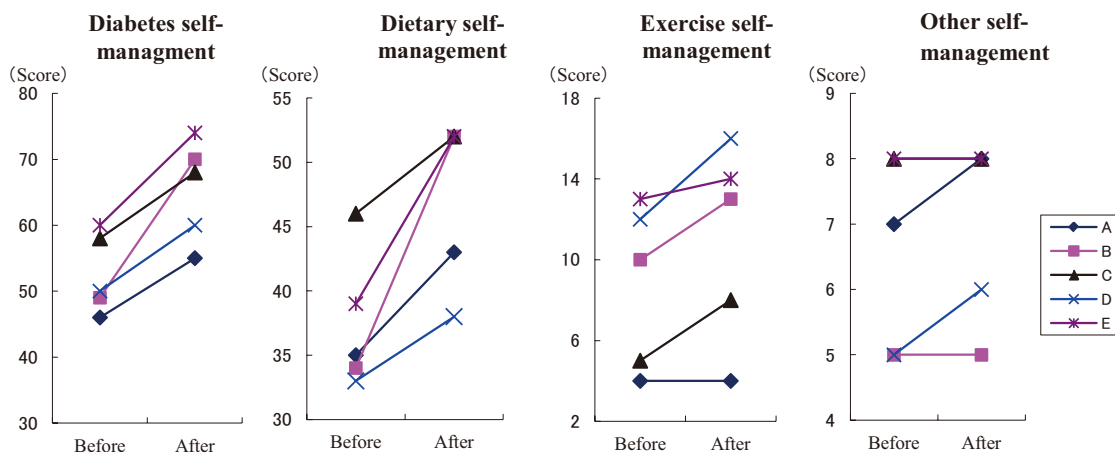


Figure 3-1. Changes in Diabetes Self-management

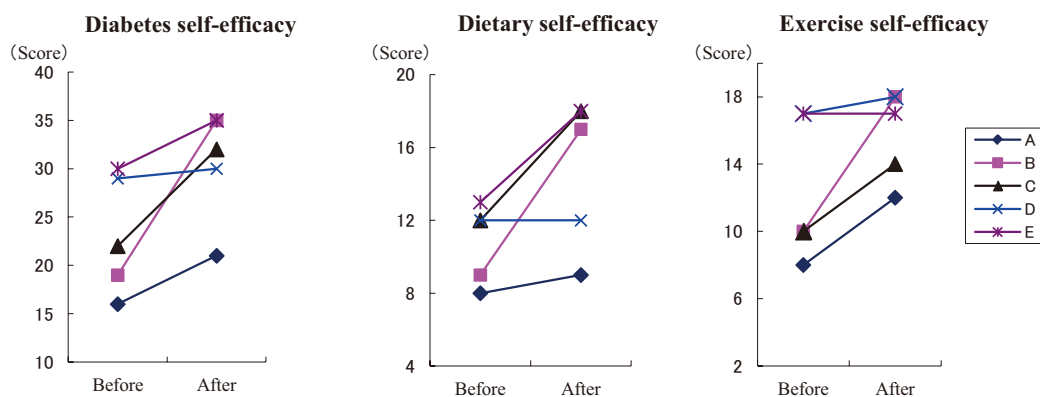
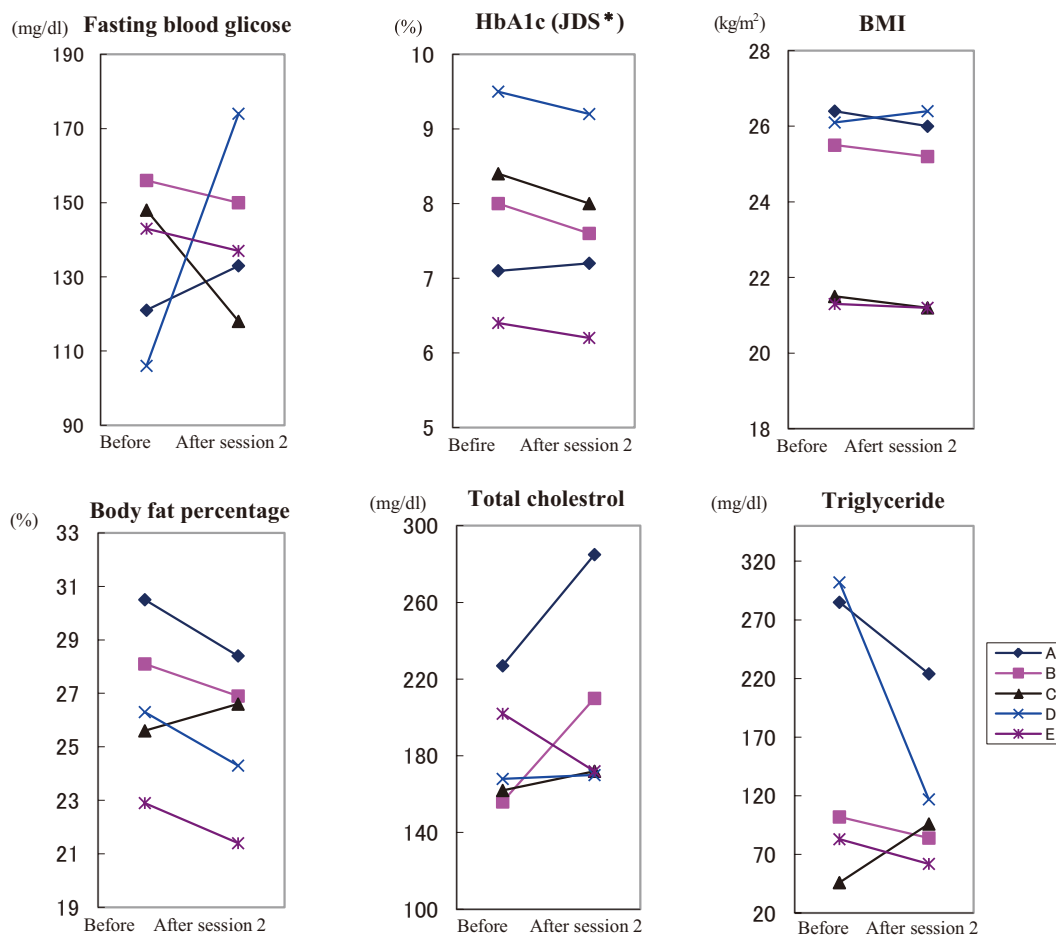


Figure 3-2. Changes in Diabetes Self-efficacy



JDS\*(Japan Diabetes Society): HbA1c (NGSP)(%) ≈ HbA1c (JDS)(%) + 0.4

Figure 4. Changes in Biological Index Values

education program. Both scores increased after education. Figure 4 shows changes in the fasting blood glucose, Hb-A1c, total cholesterol, and triglyceride levels, as well as the BMI and body fat percentage.

#### IV. Discussion

##### 1. Details and effects of the education program

On the basis of the durations of the 3 sessions of the education program in the 5 patients, a time frame of 30 minutes may be feasible for a consultation; considering that interviews were conducted after the termination of each session, the times actually needed to perform them are likely to be even shorter. The content and structure of each session were shown to be appropriate to accomplish its purposes. The appropriateness of the approaches to the 3 concepts, <attitudes toward the behavior>, <subjective norms>, and <perceived behavioral control>, during each session of the education program, aiming to promote positive glycemic self-management behavior in patients, is discussed below.

During the first session, almost all patients sufficiently understood the necessity of decreasing their blood sugar levels, and showed a positive attitude toward dietary therapy. On the other hand, they were not fully convinced that they still needed control. To address this, their fasting blood glucose

and Hb-A1c levels, body weights, and oral medications were compared between the past and the present, while clarifying related changes in their lifestyles, including age-related metabolic changes, as an approach to <attitudes toward the behavior> to promote positive glycemic self-management. As a result, the patients realized their problems, and stated that they needed solutions (Table 4).

Behavioral improvement is considered necessary in education<sup>24)</sup>. In the present study, as an approach to <attitudes toward the behavior>, the patients reviewed their previous and present lifestyles and self-management to clarify their problematic life patterns, and recognized the possibility of performing glycemic control by changing their behaviors. Knowles<sup>25)</sup> reported that the accumulated experiences of late middle-aged patients are valuable resources for learning, and it is necessary to use them effectively in education. In the present study, the patients learned the factors influencing glycemic control after reviewing their care-related experiences, and this may have led them to examine methods to improve their lifestyles during the first session. Furthermore, the review of their present lifestyles during the second and third sessions may have guided them toward the effective use of their past care-related and present life experiences, consequently strengthening their positive attitude toward the glycemic control behavior.

Regarding <subjective norms>, wives provided an

important normative belief for the male patients in this study. The patients regarded their wives as cooperative, but considered it necessary to address diabetes management by themselves (Table 4). In this respect, the availability of support may be important for such patients to recognize their pathological conditions appropriately, and to perform self-management. In fact, the patients stated that it was nice to have someone who cared about them besides their families, highlighting their expectations for support from medical professionals, including diabetes educators who implement patient education programs. Donna<sup>26)</sup> defined patient education as a dynamic process in which medical professionals and patients exchange information, pointing out the necessity of establishing social support systems and clarifying social and environmental factors that influence the methods of treatment and its provision. As such, it may be necessary for those who implement patient education programs to identify accurately patients' varying social and environmental factors and non-verbal information from them, such as facial expressions and behaviors, in order to establish favorable relationships with them during education. Through these approaches, diabetes educators may also provide patients with an important belief in <subjective norms>.

As an approach to <perceived behavioral control> to provide a belief in appropriate glycemic self-management behavior, in the present study, the patients reviewed their lifestyles and became aware of their excessive energy intake based on test values; those expected after improvement were also shown to them. During the second session, they learned about physical activities to consume energy effectively as an approach to <perceived behavioral control> to recognize their ability to perform the behavior. Considering the direct influence of <perceived behavioral control> on behavioral intentions as reported by Sheeran<sup>27)</sup>, the approach to <perceived behavioral control> during each session in the present study may have led the patients to perceive that it was unexpectedly easy to change their behaviors (Table 4). In addition, when they heard about the improvement in their test results and body weights during the third session (Figure 4), they became aware of the importance of appropriate daily behaviors to improve glycemic control. This may have developed a positive attitude toward the behavior, leading to behavioral intentions to perform glycemic self-management (Figures 3-1 and 3-2).

Donna<sup>26)</sup> reported that patient education focuses on knowledge, and one of its goals is supporting the use of information appropriately by patients. In short, patient education should not be limited to the provision of information and, in order to achieve such a goal, it is necessary to identify individual patients' needs, experiences, and attitudes, as well as the information they need for health management. In line with this, the education program consisted of 3 sessions with basic contents to enable patients to perceive that they have obtained new, useful knowledge, rather than simply providing them with general information and explanations, aiming to promote behavioral intentions through approaches to the 3 concepts of the theory of planned behavior. As a result, the patients' diabetes self-management behavior improved (Figure 3-1), with them giving positive statements on the 3 sessions, such as "It was easy to understand" and "I could realize the need for improvement". On the basis of these results, the education program is likely to be effective to provide patients with necessary information in consideration of their needs and experiences, and help them to use it appropriately

as a goal of patient education. The availability of brochures and explanations during the sessions, according to the individual's level of knowledge, may also have contributed to the reduction of education-related psychological stress.

Among the 3 concepts to promote behavioral intentions, <subjective norms> was not shown to influence such intentions markedly, while approaches to <attitudes toward the behavior> and <perceived behavioral control> were effective to lead the patients to express their behavioral intentions (Table 4) and perform diabetes self-management (Figures 3-1 and 3-2). After objectively examining their lifestyles through these approaches, the patients actively began to show a positive attitude toward the behavior as enhanced problem-solving ability and awareness. Therefore, the setting of clear behavioral goals may strengthen <perceived behavioral control>, consequently enabling patients to realize the positive effect of behavioral changes.

While further studies may be necessary to examine the contents of the education program in more detail based on these results and in consideration of patients' reactions, the appropriateness of its structure and procedures was confirmed in the present study.

The possibility of achieving the goal of each session of the education program while promoting patients' diabetes self-management was also demonstrated.

## 2. Changes in index values

Before and after the implementation of the education program, a questionnaire survey was conducted using the Diabetes Self-management and -efficacy Scales. After education, both scale scores improved (Figures 3-1 and 3-2), suggesting that the approaches to the concepts to promote behavioral intentions may have led to behavioral changes to perform diabetes self-management. This also suggests the enhanced sense of diet- and exercise-related self-efficacy. A number of previous studies confirmed the direct influence of the 3 concepts on behavioral intentions<sup>16, 28)</sup>.

Furthermore, after the second session, the Hb-A1c level improved in 4 patients (Figure 4), supporting the effect of intervention using the education program to promote behavioral intentions and improve glycemic self-management behavior. The absence of changes in other biological index values may be explained by the short period of the study, 6 months, which was not sufficient to improve such values, as the study objective was limited to examination of the contents of the education program. However, considering that the BMI and body fat percentage slightly improved (Figure 4), it may be possible to improve other biological index values by reviewing the period of its implementation.

On the basis of these results, the education program developed to improve the lifestyles of working males with type 2 diabetes may be effective to promote behavioral intentions.

## V. Conclusion

In this study, a diabetes education program was developed based on the theory of planned behavior to promote behavioral changes toward behavioral intentions, with a view to improving the lifestyles of working males with type 2 diabetes undergoing inpatient treatment in a clinic; the following findings were obtained:

1. It may be possible to implement this education program



in a short period of time during consultation, and its contents may meet working male patients' need for diabetes self-management.

- 2) The education program may be effective to promote behavioral intentions and behavioral changes toward appropriate glycemic self-management, as diabetes self-management and -efficacy scores increased, and the Hb-A1c level improved in all patients except 1.

### Acknowledgement

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