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〈Regular Article〉

Evaluation of Short-Term Knowledge Changes through a Diabetes Education Program at Kawasaki Medical School Hospital

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ABSTRACT　**Background**: The aim of this study was to evaluate the impact of a short-term multidisciplinary diabetes education program on changes in knowledge scores in hospitalized type 2 diabetes patients.

Methods: This retrospective observational study included 316 type 2 diabetes patients who were hospitalized at Kawasaki Medical School Hospital between April 2018 and March 2022. Patients participated in a structured multidisciplinary educational program consisting of nine weekly sessions covering key topics such as pathophysiology, blood glucose self-monitoring, insulin administration, diet, and exercise. Patients' knowledge was assessed using a 46-item checklist administered on the day after admission and the day before discharge. Changes in scores were analyzed, and factors associated with higher knowledge scores were identified using multivariate regression analysis.

Results: The median checklist score significantly increased from 16 (11-22) at admission to 31 (21-37) at discharge ($p < 0.001$), with 93.4% of participants showing increase knowledge scores. Factors independently associated with the score at discharge included younger age (β = -0.365, $p < 0.001$), shorter duration of diabetes (β = 0.279, $p = 0.0063$), and better cognitive function (β = 0.279, $p < 0.001$). Improvements in knowledge were consistent across all checklist domains, indicating the comprehensive association with increased scores of the program.

Conclusions: A systematic diabetes education program for hospitalized patients led to a significant increase in knowledge scores over a short hospitalization period. These results support the importance to integrate similar multidisciplinary education programs into routine hospital diabetes care. doi：10.11482/KMJ-E202551161　*(Accepted on July 4, 2025)*

Key words：Diabetes, Education program, Retrospective study, Interprofessional collaboration

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INTRODUCTION

Diabetes mellitus is a chronic condition with a rapidly increasing global prevalence. Effective management of diabetes requires patients to acquire knowledge and develop self-management skills in areas such as blood glucose monitoring, insulin administration, nutrition, and exercise. Structured diabetes education programs play a crucial role in providing patients with the necessary knowledge to make informed decisions about their care[1, 2]. These programs aim to improve patients' understanding of their condition and promote self-care behaviors, which are essential for preventing complications and achieving optimal glycemic control[3].

Diabetes Self-Management Education and Support (DSMES) is a well-established framework that emphasizes patients' empowerment through education[4, 5]. DSMES programs are designed to provide ongoing support, focusing on improving patients' self-management behaviors over time. However, in clinical practice, inpatient diabetes education programs conducted during hospitalization period provide a unique opportunity to deliver structured, short-term educational interventions. These programs can be particularly valuable during periods of clinical instability when patients may be more motivated to learn and adopt new behaviors.

Despite the importance of inpatient diabetes education, few studies have evaluated the short-term impact of these programs on patients' knowledge. Understanding the immediate effects of structured education during hospitalization is essential for optimizing educational interventions and improving patient outcomes. At Kawasaki Medical School Hospital, patients admitted for diabetes education participate in a multidisciplinary program that includes nine sessions per week, covering a wide range of diabetes management topics. To objectively measure the effectiveness of this program, a knowledge assessment checklist is administered upon admission. This study aimed to evaluate the short-term impact of a structured diabetes education program on changes in knowledge among hospitalized patients with type 2 diabetes.

MATERIAL AND METHODS

Study subjects

The flowchart of the subjects of this study is shown in Fig. 1. The subjects of this study were 525 patients with type 2 diabetes who were hospitalized in the Department of Diabetes, Endocrinology and Metabolism at Kawasaki Medical School Hospital between April 1, 2018 and March 31, 2022. Patients were excluded if they met the following criteria: (1) minors (n = 4) to ensure legal and ethical considerations, (2) pregnant individuals (n = 2) as gestational diabetes follows a different disease course, (3) malignancy (n = 59) due to potential confounding factors from cancer treatments, (4) corticosteroid or immunosuppressant use (n = 12) due to their significant impact on glucose metabolism, (5) incomplete checklist assessment (n = 36) or only single assessment during hospitalization (n = 58), and (6) hospitalization for less than one week (n = 38), as this period was deemed insufficient for meaningful education. Finally, we examined 316 cases of type 2 diabetes where the checklist was assessed on the day after hospitalization and the day before discharge.

Diabetes Education Program

The diabetes education program at Kawasaki Medical School Hospital consists of a structured, multidisciplinary approach involving physicians, nurses, dietitians, pharmacists, and clinical technicians. Patients participated in nine educational sessions per week during their hospital stay, with each session lasting approximately 60 minutes. The sessions covered a wide range of diabetes management topics, including the pathophysiology of diabetes, self-monitoring of blood glucose

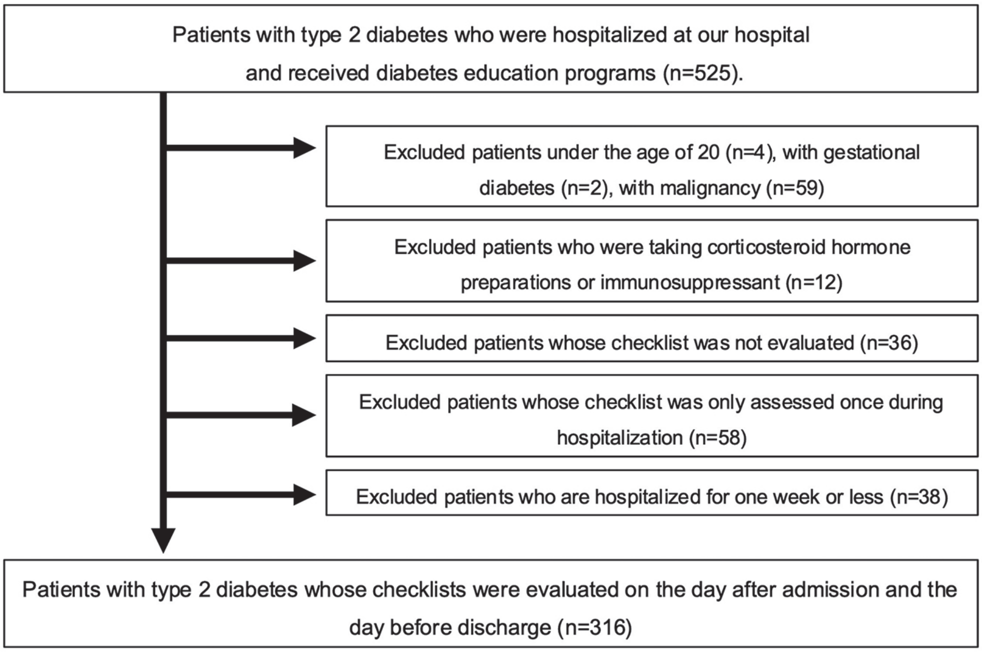


Fig. 1. Flowchart of subjects in this study.

Table 1. Timetable for a Diabetes Education Program at our hospital

Day of the week	10 : 30 - 11 : 20	14 : 45 - 15 : 45
Monday	What is diabetes mellitus? (Physician)	What is hypoglycemia? How to inject insulin Tests you can do yourself (Nurse)
Tuesday	Exercise therapy for diabetes mellitus (Physician)	A balanced healthy diet as a diabetic diet (Registered Dietitian)
Wednesday	Various tests for diabetes mellitus (Clinical technologist)	Proper understanding about diabetes medications (Pharmacist or Physician)
Thursday	Various diseases complicated with diabetes mellitus (Physician)	
Friday	Points to keep in mind in daily life (Nurse)	Points about diet therapy (Registered Dietitian)

(SMBG), insulin injection techniques, nutritional therapy, exercise therapy, hypoglycemia management, complication screening, and medication adherence. A detailed schedule of the program is shown in Table 1.

The program was designed to improve patients' understanding of diabetes and promote self-management behaviors. The multidisciplinary team worked collaboratively to address individual patient needs and reinforce key concepts throughout the hospitalization period.

In addition to the systematic diabetes education program, individual patient energy intakes were determined based on the Japanese Diabetes Care Guidelines 2019 as dietary therapy during hospitalization[6]. All subjects were placed on a diet based on total energy intake calculated according to their target weight; total energy intake per day was calculated using the formula (target weight) × (energy coefficient). The target weight was calculated by multiplying the square of the height (m) by 22 for those under 65 years old and by 22-25 for those over 65 years old. An energy coefficient of 25 to 30 kcal/kg was used, while 30 to 35 kcal/kg was used for elderly and undernourished patients[7]. All patients were given a 30-minute instruction by a dietitian upon admission and at discharge.

Checklist

To objectively measure patients' knowledge of diabetes management, a knowledge assessment checklist developed by Kawasaki Medical School Hospital was used (Table 2). The checklist consisted of 23 items with a maximum score of 46 points, covering various aspects of diabetes management, including disease knowledge, SMBG, insulin injection techniques, dietary principles, hypoglycemia recognition, and medication usage.

The checklist was administered at two time points: on the day after admission and the day before discharge. The scoring system was as follows: 2 points: Correct or nearly correct response. 1 point: Partially correct response. 0 points: Incorrect or no response

The assessments were conducted through interviews by nurses responsible for patient education. Changes in knowledge scores from admission to discharge were used to evaluate the effectiveness of the education program.

Evaluation of diabetic complications

This study is a single-center, retrospective, cohort study. All data for analysis were collected from medical records. Age, height, weight, body mass index (BMI), grip strength, and vital signs were recorded using physical measurements at the time of admission. Comorbidities, duration of diabetes, smoking history, and alcohol consumption history were obtained through interviews. The Hasegawa Dementia Scales Revised (HDS-R) and

Table 2. Knowledge assessment checklist used in our hospital

Questions	Score
Pathophysiology of diabetes mellitus	
1. What is diabetes mellitus?	0, 1, 2
2. What are the causes and triggers of diabetes mellitus?	0, 1, 2
3. How does insulin work?	0, 1, 2
4. What is the meaning of HbA1c and what is its normal value?	0, 1, 2
5. What are normal blood glucose levels and diurnal variation of blood glucose levels?	0, 1, 2
6. What are the symptoms of hypoglycemia?	0, 1, 2
7. What are the symptoms of hyperglycemia?	0, 1, 2
8. What are the complications of diabetes mellitus?	0, 1, 2
9. What should you do when you have hypoglycemia?	0, 1, 2
Everyday life	
1. Why is it necessary to keep the body clean?	0, 1, 2
2. Why is foot care necessary?	0, 1, 2
3. What are the causes of glycemic control disturbances in daily life?	0, 1, 2
4. Why are regular checkups necessary?	0, 1, 2
5. How do you need to cope with a sick day?	0, 1, 2
6. Why is it necessary to obtain the understanding of family and others around you?	0, 1, 2
Drug therapy	
1. What are the drug therapies for diabetes mellitus?	0, 1, 2
2. What is the name of the drug you are using?	0, 1, 2
3. What are the effects of the drugs you are using?	0, 1, 2
4. What are the side effects of the drugs you are using?	0, 1, 2
Diet therapy	
1. How many calories are in your own hospitalized diabetic diet?	0, 1, 2
2. Why is it necessary to have a balanced diet?	0, 1, 2
3. What is the recommended amount of food for one unit? (80 calories per unit)	0, 1, 2
Exercise therapy	
1. What is the best exercise therapy for you? What are its benefits?	0, 1, 2

the Mini-Mental State Examination (MMSE) were administered to inpatients aged 65 years or older on the day of admission or the day after admission by the physicians. The results of the tests for diabetic complications were those taken within six months of the date of admission. All blood test results were analyzed using results evaluated during hospitalization. Laboratory results for diabetic complications were analyzed using tests evaluated during hospitalization or within 3 months of the date of admission, whichever was closest to the date of admission. The evaluation method for each complication was as previously reported[7, 8].

Statistical Analysis

The data are shown as the median (interquartile range). The primary endpoint of this study was to clarify the short-term effect of diabetes education using the diabetes education program at our hospital. The secondary endpoint was to clarify the clinical parameters related to the effect of diabetes education. The Δ score was calculated as the difference between the discharge checklist score and the admission checklist score. It was used as an indicator of improvement, with higher values indicating greater improvement. Box-plots were created to reveal the distribution of scores on the checklists evaluated on the day after admission and the day before discharge. Spearman's rank correlation coefficient was calculated to evaluate the clinical parameters correlated with the checklist score. The Wilcoxon signed-rank test was used to compare the checklist scores at admission and discharge. Multiple regression analysis was performed with checklist scores as the dependent variable and factors correlated with the checklist as the explanatory variables, to evaluate the independent factors that affect the checklist. The explanatory variables in the multiple regression analysis were selected based on clinical relevance in patients with type 2 diabetes, including age, sex, duration of diabetes, BMI, diastolic blood pressure, HbA1c, serum albumin, serum creatinine, baseline checklist score, and HDS-R score. These variables were chosen based on prior clinical knowledge, rather than statistical correlation alone[7, 9, 10]. Although both the HDS-R and the MMSE were significantly correlated with the score on the checklist on the day before discharge, the MMSE, which was evaluated in fewer cases than the HDS-R, was not included as an explanatory variable due to concerns about multicollinearity. The statistical significance level for this study was set at $p < 0.05$. Normality of checklist scores was assessed using the Shapiro-Wilk test. Since the distribution of checklist scores at discharge was non-normal, additional analyses, including non-parametric methods and log-transformed regression models, were explored. However, the results remained consistent, and therefore, multivariate linear regression analysis was deemed appropriate. The statistical significance level for this study was set at $p < 0.05$. JMP Pro (17.0.0) was used for the analysis, and EXCEL for Mac (16.92) was used to create the graphs.

Ethical Considerations

The research protocol, including the opt-out system for informed consent, was approved by the Ethics Committee of Kawasaki Medical School (No. 6362-01). This study was conducted in accordance with the Declaration of Helsinki. As this was a retrospective study, instead of obtaining informed consent from each patient, information about the study was disclosed via the hospital website of each facility.

RESULTS

Clinical Characteristics

The clinical characteristics of the subjects in this study are shown in Table 3. The mean age was 65 (52-72) years old, the mean duration of diabetes was 10 (2-17) years, and the male-to-female ratio

Table 3. Clinical characteristics of the subjects in this study

Parameter	Subjects (n = 316)	Parameter	Subjects (n = 316)
Age (years)	65 (52 - 72)	Total protein (mg/dL)	7.1 (6.7 - 7.4)
Sex (Male/Female, n)	190 / 126	Albumin (mg/dL)	4.2 (3.9 - 4.4)
Duration of diabetes (years)	10 (2 - 19)	AST (U/L)	21 (16 - 28)
Smoking history (never/past /current, n)	152/71/93	ALT (U/L)	20 (14 - 34)
Drinking history (n (%))	99 (31.4)	Gamma-GTP (mg/dL)	26 (16 - 46)
Height (cm)	163 (155 - 170)	Urea nitrogen (mg/dL)	15 (12 - 19)
Body weight (kg)	69 (59 - 80)	Creatinine (mg/dL)	0.7 (0.6 - 1.0)
Body mass index (kg/m^2)	26.1 (23.3 - 29.2)	Uric acid (mg/dL)	5.2 (4.1 - 6.3)
Systolic blood pressure (mmHg)	131 (118 - 145)	Hemoglobin A1c (NGSP, %)	9.8 (8.5 - 11.5)
Abdominal circumference cm)	93 (85 - 102)	Total cholesterol (mg/dL)	169 (145 - 198)
Diastolic blood pressure (mmHg)	79 (69 - 89)	Triglyceride (mg/dL)	115 (90 - 169)
Pulse rate beats per minutes)	80 (71 - 92)	HDL-cholesterol (mg/dL))	42 (35 - 53)
Baba's diabetic neuropathy classification (BNC0/BNC1/BNC2/BNC3-4/unknown, n)	164/74/53/21/4	LDL-cholesterol (mg/dL))	95 (78 - 120)
History of diabetic retinopathy NDR/SDR/PPDR/PDR/unknown, n)	218/48/13/31/6	Grip strength (kg)	26 (18 - 35)
History of diabetic nephropathy (Stage 1/Stage 2/Stage 3/Stage 4, n)	178/92/34/12	Vibration sensation (seconds)	12 (9 - 14)
History of cardiovascular disease (n (%))	37 (11.7)	CVR-R at deep breath (%)	3.4 (2.4 - 5.0)
History of stroke (n (%))	21 (6.7)	Mean IMT (mm)	0.8 (0.7 - 1.0)
Hasegawa's Dementia Scale-Revised	28 (25 - 30)	Max IMT (mm)	1.1 (0.9 - 1.3)
Mini-Mental State Examination	29 (26 - 30)		
Insulin therapy on admission (n (%))	85 (26.9)		
GLP-1RA on admission (n (%))	67 (21.2)		
Sulfonylurea or glinide on admission (n (%))	66 (20.9)		
DPP-4 inhibitor on admission (n (%))	124 (39.2)		
Biguanide on admission (n(%))	158 (50.0)		
Thiazolidine on admission (n (%))	27 (8.5)		
Alpha-GI on admission (n (%))	27 (8.5)		
SGLT2 inhibitor on admission n (%))	107 (33.9)		

Data are presented as median (IQR). NDR; non diabetic retinopathy, SDR; simple diabetic retinopathy, PPDR; pre-proliferative diabetic retinopathy, PDR; proliferative diabetic retinopathy, GLP-1RA; glucagon-like peptide-1 receptor agonist, DPP-4; Dipeptidyl peptidase-4, SGLT2; sodium-glucose cotransporter 2, AST; aspartate aminotransferase, ALT; alanine aminotransferase, GTP; glutamyl transpeptidase, HDL; high density lipoprotein, LDL; low density lipoprotein, CVR-R; coefficient of Variation of R-R interval, IMT; intima media thickness.

was approximately 1.5:1. The body mass index (BMI) was 26.1 (23.3-29.2) kg/m^2, and many of the patients were obese according to Japanese standards. The HbA1c level at the time of admission was 9.8 (8.5-11.5) %. Regarding diabetic microvascular complications, the proportion of patients with some abnormality in the nerve conduction test was 48.1%, the proportion of patients with retinopathy of grade 2 or higher was 29.1%, and the proportion of patients with microalbuminuria or macroalbuminuria was 43.7%.

Checklist scores before and after the diabetes education program

The median checklist scores significantly increased from 16 (11-22) at admission to 31 (21-37) at discharge ($p < 0.001$), with 93.4% of participants showing a higher knowledge score at discharge compared to admission. There was a significant positive correlation between the scores on the checklists on the day after admission and the day before discharge ($\rho = 0.590$, $p < 0.001$). Additionally, the checklist scores at discharge were significantly higher than those at admission (test

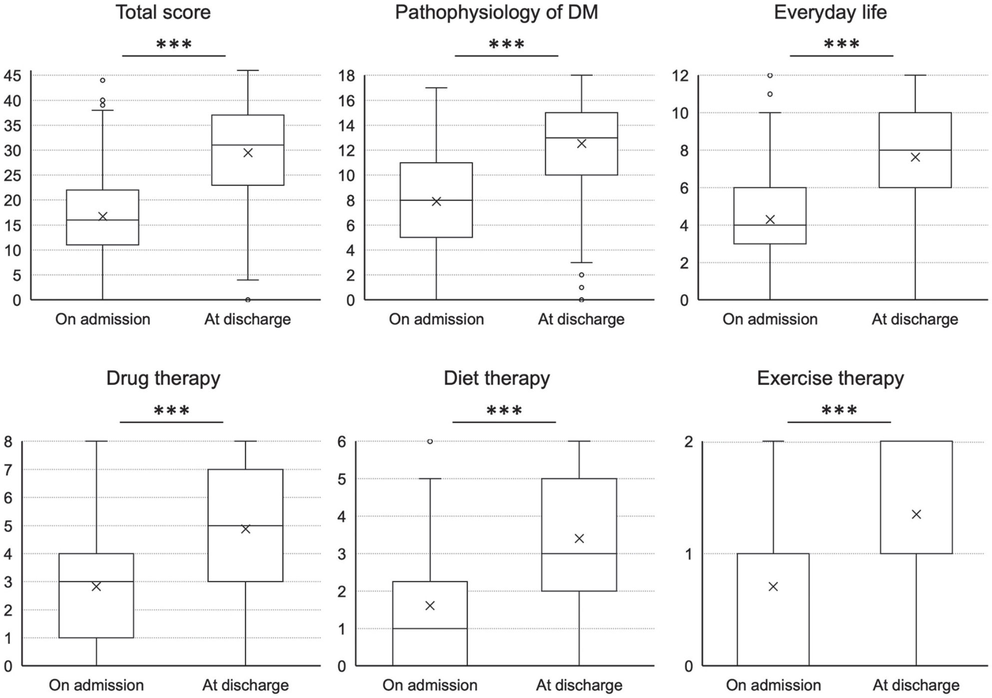


Fig. 2. Box plots showing the total scores of the admission and discharge checklists, as well as the scores for each item. The maximum score for each item is as follows: Total score is 46 points, Pathophysiology of diabetes mellitus (DM) is 18 points, Everyday life is 12 points, Drug therapy is 8 points, Diet therapy is 6 points, and Exercise therapy is 2 points. *** $p < 0.001$, analyzed using the Wilcoxon signed-rank test. Box plots show the box as the interquartile range (IQR), the central line as the median, and the whiskers extending to the smallest and largest values within 1.5 × IQR from the lower and upper quartiles, respectively. Outliers beyond this range are shown as individual points.

statistic S = 24,488.0, $p < 0.001$). The scores for all items on the checklist increased significantly at discharge compared to those at admission (Fig. 2).

Next, we evaluated the clinical parameters that correlated with the scores on the checklist assessed on the day after admission. There was a significant negative correlation between the scores on the checklist assessed on the day after admission and age, max IMT ($\rho = -0.331$, $\rho = -0.223$, $p < 0.001$, respectively), and a positive correlation with grip strength, and HDS-R ($\rho = 0.169$, $\rho = 0.256$, $p < 0.001$, respectively). There was no significant correlation between the checklist evaluated on the day after admission and the BMI. Similarly, we evaluated the clinical parameters that correlated with the scores on the checklist assessed on the day before discharge. There was a significant negative correlation between the scores on the checklist assessed on the day before discharge and age, max IMT ($\rho = -0.509$, $\rho = -0.256$, $p < 0.001$, respectively), and a positive correlation with BMI, grip strength, and HDS-R ($\rho = 0.205$, $\rho = 0.292$, $\rho = 0.410$, $p < 0.001$, respectively). There was no significant correlation between the checklist evaluated on the day before discharge and the duration of diabetes.

Independent factors affecting the discharge checklist score

Multiple regression analysis was conducted to

Table 4. Multiple regression analysis was conducted to evaluate the factors that affect the score on the checklist on the day before discharge

Parameters	Regression coefficient (95%CI)	Standard β	VIF	P value
Sex (Female)	-0.302 (-1.496 to 0.892)	-0.031	1.254	0.618
Age	-0.262 (-0.458 to -0.067)	-0.181	1.497	0.009
Duration of diabetes	0.015 (-0.082 to 0.111)	0.019	1.319	0.766
Checklist score on admission	0.621 (0.456 to 0.785)	0.498	1.443	< 0.001
Body mass index	0.087 (-0.316 to 0.490)	0.038	2.547	0.672
Abdominal circumference	-0.058 (-0.180 to 0.064)	-0.083	2.526	0.350
Diastolic blood pressure	-0.032 (-0.123 to 0.059)	-0.043	1.189	0.483
Hemoglobin A1c	-0.015 (-0.180 to 0.064)	-0.083	1.224	0.957
HDS-R	0.573 (0.238 to 0.907)	0.212	1.267	< 0.001
Albumin	0.325 (-2.438 to 3.087)	0.014	1.156	0.817
Creatinine	-2.227 (-4.983 to 0.528)	-0.102	1.310	0.112

95%CI; 95% confidence interval, VIF; variance inflation factor, HDS-R; Hasegawa's Dementia Scale-Revised.

Table 5. Clinical parameters correlated with the difference between discharge and admission checklist scores (Δ score)

Parameters	ρ	P value
Checklist score on admission	-0.238	< 0.001
Checklist score at discharge	0.582	< 0.001
Age	-0.269	< 0.001
Duration of diabetes	-0.301	< 0.001
Body weight	0.154	0.006
Handgrip strength	0.204	< 0.001
Diastolic blood pressure	0.164	0.004
Hasegawa's Dementia Scale Revised	0.259	< 0.001
Hemoglobin A1c	0.159	0.005

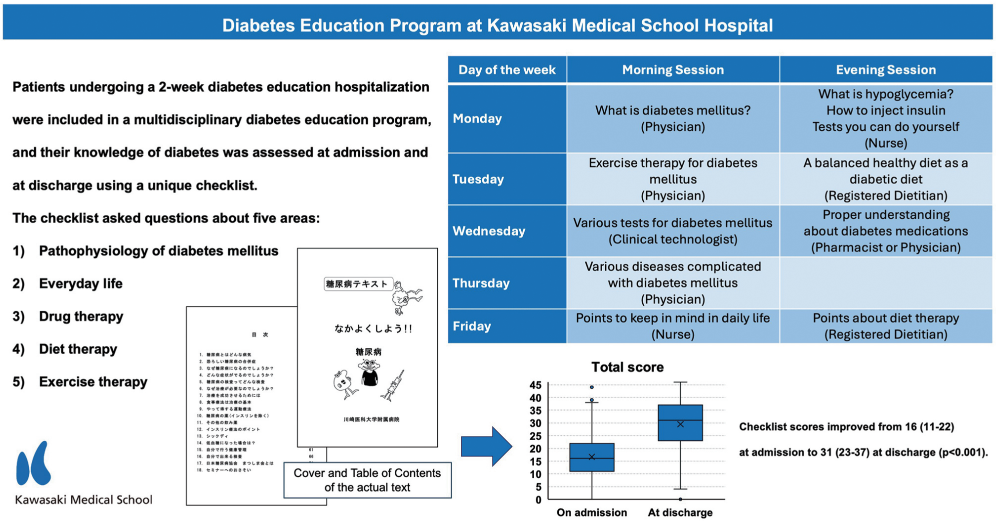
The Δscore was calculated as the difference between the discharge checklist score and the admission checklist score. The Spearman's rank correlation coefficient was used for analysis.

evaluate the factors that affect the score on the checklist on the day before discharge (Table 4). As a result, age, admission checklist score, and HDS-R were independent factors that affected the checklist score on the day before discharge.

Finally, we evaluated patients with a significant difference between discharge and admission scores (Δscore). Clinical parameters correlated with the Δscore are shown in Table 5. The Δscore showed a weak negative correlation with the admission checklist score (ρ = -0.238, $p < 0.001$). This suggests that participants with lower knowledge at admission may have derived greater benefits from our diabetes education program. Additionally, a moderate positive correlation was observed between the Δscore and discharge checklist scores (ρ = 0.582, $p < 0.001$). This indicates that patients with higher discharge checklist scores demonstrated greater educational outcomes. Other factors included a negative correlation between the Δ score and age, as well as duration of diabetes, and a positive correlation with body weight, handgrip strength, diastolic blood pressure, HbA1c, and the Hasegawa's Dementia Scale Revised. These results suggest that the effectiveness of our diabetes education program is reduced in elderly patients, those with impaired cognitive function, and those at high risk for sarcopenia.

DISCUSSION

This study evaluated the short-term impact of a structured diabetes education program on the knowledge improvement in hospitalized patients with type 2 diabetes. The results demonstrated a significant increase in knowledge assessment scores from admission to discharge, with 93.4% of participants showing improvement. These findings suggest that a multidisciplinary education program during hospitalization can lead to a measurable increase in knowledge scores related to diabetes management within a relatively short period



(Graphical Abstract).

The observed improvement in knowledge scores indicates that structured inpatient education programs can be a valuable tool in addressing gaps in patients' diabetes knowledge. The program covered essential aspects of diabetes management, including self-monitoring of blood glucose, insulin administration, dietary therapy, and complication prevention. Knowledge improvement across all checklist items suggests that the program provided comprehensive education that addressed various domains of diabetes care. This is consistent with previous studies highlighting the importance of structured education in promoting self-management behaviors among diabetes patients[11]. Multivariate regression analysis identified factors associated with higher knowledge scores at discharge, including age, duration of diabetes, and cognitive function. Older patients and patients with longer duration of diabetes had lower knowledge scores at discharge. Older patients have been reported to have a decreased understanding of diabetes complications[12]. Older patients have been also reported to show lower participation in diabetes education programs[13]. Appropriate self-management education for the elderly has been reported to be effective in medication adherence and prevention of complication progression[14, 15]. Patients with cognitive decline also had lower scores, suggesting that tailored educational strategies are needed for these patients. Previous studies have shown that early and ongoing educational interventions can help overcome these barriers and improve knowledge retention in older, cognitively impaired patients[2, 16]. For the elderly population, educational strategies tailored to the patient population are needed, and individualized attention by attending physicians and ward staff should be considered in addition to existing diabetes education programs. For example, in our diabetes education program, instructors provide lectures to participants, but it can be challenging for instructors to determine what participants understand and what they do not. Ideally, attending physicians or nurses should provide additional individual guidance outside the diabetes education program to address areas where participants are struggling. Furthermore, analyzing the trends in scores from admission checklists would help identify areas where individual patients lack understanding. The results of this study showed that older patients, those with impaired cognitive function, and patients with low scores on the admission checklist tended to have lower scores on the discharge checklist. Additionally, the study suggested that patients with a long history of diabetes and those suspected of having sarcopenia may have reduced effectiveness of diabetes education. Therefore, it is anticipated that individualized interventions may be effective for patients with such underlying factors. This is a current challenge in our hospital's diabetes education program, and further improvements are necessary to enhance the quality of our program in the future.

One of the key strengths of this study is the use of a knowledge assessment checklist to objectively measure knowledge improvement. This checklist allowed for standardized assessment of patient understanding across a range of diabetes management areas, providing valuable insight into the effectiveness of the educational program. However, there are some limitations to consider. First, this study focused only on short-term knowledge improvement during hospitalization and did not assess long-term knowledge retention or impact on clinical outcomes such as blood glucose control and prevention of complications. Future studies should include follow-up assessments to determine whether the knowledge gained during hospitalization leads to sustained behavior change and improved health outcomes. Second, this study was conducted at a single medical center, which may limit the generalizability of the results. In particular, the participants in this study were hospitalized for diabetes education purposes and agreed to participate in the analysis, and thus it is possible that many of them were highly motivated to receive diabetes education. In addition, although this study cited cognitive impairment as a characteristic of patients with low scores on the discharge checklist, most of the participants in this study had normal cognitive function. Thus, when interpreting the results of this study, it is necessary to consider the influence of selection bias. The educational program at Kawasaki Medical School Hospital includes a specific curriculum with a multidisciplinary team, and the results may differ in other medical settings with different educational approaches. Therefore, multicenter studies are needed to examine the effectiveness of similar programs in diverse populations. Additionally, the evaluation criteria for the checklist were subjective, based on face-to-face questions by the nurse in charge, which may result in varying scores depending on the nurse conducting the evaluation. Finally, patients with type 2 diabetes who were admitted to our hospital for educational purposes were required to participate in all programs upon admission. Still, there are no records of actual attendance, and thus further evaluation is not possible at present.

Despite these limitations, this study highlights the importance of structured inpatient education programs in improving patients' knowledge of diabetes management. The significantly higher knowledge scores observed during a relatively short hospitalization period underscores the potential of inpatient education as an important component of diabetes care. Moreover, the identification of factors associated with knowledge improvement provides valuable insights into the need for individualized education strategies, particularly for older patients and those with cognitive impairments or long-standing diabetes.

This study demonstrates that a structured, multidisciplinary diabetes education program was associated with a significant increase in patients' knowledge scores during hospitalization. However, as this study was an observational before-and-after comparison, causal conclusions regarding the effectiveness of the program should be interpreted with caution. These findings support the implementation of similar programs as part of routine inpatient diabetes care. Future research should focus on the long-term impact of such programs on self-management behaviors and clinical outcomes, as well as the development of tailored educational interventions to address the specific needs of diverse patient populations.

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AUTHORS' CONTRIBUTION

Y.I. researched data and wrote the manuscript. T.K., R.S., Y.F., J.S., M.S., S.N., K.K., T.M. participated in discussion. H.K. participated in the discussion and reviewed the manuscript.

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CONFLICT OF INTERESTS

H.K. has received honoraria for lectures, received scholarship grants from Novo Nordisk Pharma, Sanofi, Eli Lilly, Boehringer Ingelheim, Sumitomo Pharma, Daiichi Sankyo, Mitsubishi Tanabe Pharma, Manpei Suzuki Diabetes Foundation, Japan Arteriosclerosis prevention fund, Japan Association for Diabetes Education and Care. K.K. has been an advisor to, received honoraria for lectures from, and received scholarship grants from Novo Nordisk Pharma, Sanwa Kagaku, Taisho Pharma, Sumitomo Pharma, Astellas, Boehringer Ingelheim. S.N. has received honoraria for lectures from Novo Nordisk Pharma, Kowa and Daiichi Sankyo. T.K. has received honoraria for lectures from Sumitomo Pharma and Novo Nordisk Pharma. All other authors have no conflict of interests.

DATA AVAILABILITY

All data generated or analyzed during this study are included in this published article.

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