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Health and Knowledge Progress among Diabetic Patients after Implementation of a Nursing Care Program Based on Their Profile

Zeinab Hussen Ali

Nursing College, Hellwan University, cairo, Egypt

Introduction

Diabetes mellitus is a major worldwide problem with tremendous clinical and public health burden [1]. The disease is one of the most important public health challenges for the 21st century. More than 150 million adult persons are affected worldwide, and the number is expected to double in the next 25 years. The increase will be much higher in developing countries. For instance, between 1995 and 2025, the number of diabetic patients is expected to increase by 170% in the developing countries, compared to only 42% in developed ones[2]. In Egypt, the WHO reported that 5%-9.9% of the total population have diabetes mellitus [3] by 2030, it is estimated to have 6.7 million diabetic patients in Egypt [4].

Diabetes is a serious, chronic disease that impairs the body's ability to use food because either the pancreas does not make insulin or the body cannot use insulin properly. Glucose builds up in the blood, and over many years this can cause damage to the eyes, kidneys, nerves, heart, and blood vessels [5,6] It is the leading cause of blindness, and of lower-limb amputations not due to trauma. Concerning mortality, adults with diabetes have rates of stroke and death from heart disease that are about 2 to 4 times higher than adults without diabetes [7].

Low blood glucose or hypoglycemia is the most common immediate health problem for patients with diabetes. It occurs when the body gets too much insulin, too little food, a delayed meal, or more than the usual amount of exercise. Severe hypoglycemia can be life-threatening if not treated promptly. On the other hand, high blood glucose or hyperglycemia occurs when the body gets too little insulin, too much food, or too little exercise; it may also be caused by stress or an illness such as cold. If untreated over a period of days, hyperglycemia can cause a serious condition called diabetic ketoacidosis (DKA), which is characterized by nausea, vomiting, and a high level of ketones in the blood and urine. It can be life-threatening and thus requires immediate medical attention [8].

There is a significant link between blood glucose control and the later development of diabetes complications, with improved glycemic control decreasing the risk of these complications [9] to achieve glycemic control, patients must monitor blood glucose frequently, follow a meal plan, and take medications. Crucial to achieving glycemic control is an understanding of the effects of physical activity, nutrition therapy, and insulin on blood glucose levels [10].

Type-2 diabetes is the most common form of the disease typically afflicting obese adults. Patients with type-2 diabetes may be able to control their disease through diet and exercise alone or may require oral medications and/or insulin injections. Type-1 diabetes is treated with insulin, exercise, and a diabetic diet. All people with diabetes must carefully balance food, medications, and activity level to keep blood glucose levels as close to normal as possible [11,12].

To facilitate the appropriate care of diabetes, the patients and the members of his/her family must have an understanding of the disease and must be trained in its management and in the treatment of related emergencies. Knowledgeable trained personnel are essential to avoid the immediate health risks of low blood glucose and to achieve the metabolic control to prevent later complications [13]. A study of the [14] showed that the majority of hospitalized diabetic patients and their relatives had inadequate understanding of diabetes consequences or its complications, and they had lack of confidence in own ability to manage diabetes effectively. Consequently, the study recommended that diabetes education must be targeted toward patients themselves and significant others who interact with them.

Significance of the study

Diabetes affects patients' physical, emotional and psychological status, leading to many diseases and complications which burden patients, family and community. According to the [15]. the percentage of people aged 20 and above with diabetes in Egypt is 5%-9.9% of the total population. Studying patients' profile will help in determining their needs for care and knowledge. Achieving unmet needs through implementing suitable care for those patients will reduce admission rates to hospital as well as the length of stay through decreasing the frequency of complications by improving patients' knowledge and skills. The study will also help in identifying the responses to nursing care provided to diabetic patients at Helwan Hospitals, raising related professional awareness, and increasing motivation for providing educational and caring programs for those patients.

Aim of the study

The aim of the study was to estimate the effect of a nursing care program developed and provided for diabetic patients at Helwan hospitals on their health and knowledge progress based on the finding of patients' profile.

Research hypotheses

1. Diabetic patients' knowledge and skills related to diabetic care as measured by questionnaire and checklist will be significantly higher after attendance of the program.

2. Diabetic patients' physical and lab findings will be significantly higher after attendance of the program.

Conceptual framework

The conceptual framework that guided this study was Orem's model which focuses on each individual's ability to perform self-care. This is

Corresponding author: Zeinab Hussen Ali, Nursing College, Hellwan University, cairo, Egypt, E-mail: salmame20003@yahoo.com

defined as "the practice of activities that individuals initiate and perform on their own behalf in maintaining life, health, and wellbeing. The basic premise of the model is that individuals can take responsibility for their health and the health of others. In a general sense, individuals have the capacity to care for themselves or their dependents" [16].

Subjects and Methods

Study design

A quasi-experimental study design with pre-post assessment was used in this research.

Setting

This study was conducted in El-nasr Health Insurance Hospital, Elentag Elharby Hospital, the University Students Hospital, and Helwan General Hospital, in Helwan city in Egypt.

Subjects

A convenience sample of 103 diabetic patients participated in this study. The sample was drawn from all patients admitted to the above mentioned Hospitals with a diagnosis of diabetes during the period of the study. No inclusion or exclusion criteria were set except being adult type-2 diabetic patient admitted to study settings during the period of the study.

Tools

The data collection tools consisted of an interview questionnaire form, an observation checklist and a physical exam and lab sheet. These were designed by the researcher after extensive review of related literature. They were then face and content validated by experts' opinions. These included five experts in the field of nursing and medical education, and necessary modifications were done.

Interview questionnaire form: This form included a section asking about patient's personal characteristics as age, sex, marital status, and job. This was followed by asking about medical history as duration of disease, history of previous diabetic coma, family history, as well as the habit of smoking. The knowledge assessment part consisted of multiple choice questions asking about the definition or meaning of diabetes, its signs and symptoms, the causes of hypo and hyperglycemia, the method of treatment, information about diet (diabetic meal content and amount, examples for each type of diet), importance and time of follow-up with physician, physical activity types and rules, and hygienic care for foot and eye. The correct answer for any knowledge item was given a score of 1, and the incorrect given zero. The scores of each area of knowledge were added and converted into a percent score. The area with 50% or higher score was considered satisfactory, while the area with lower than 50% was considered unsatisfactory.

Observation checklist: This was designed to observe patients' performance related to foot and self insulin injection. It included the correct steps of each of the two activities. Each step was to be checked as done or not done. The step checked to be done was given a score of 1, and the not done given zero. The sum of the scores of the steps of each of the two procedures was then converted into a percent score. The procedure with total score 60% or more was considered adequately done and inadequate if less than 60%.

Physical assessment sheet: This was designed to record the findings of patient physical assessment as height and weight to calculate the body mass index (BMI), blood pressure (systolic and diastolic), skin turgor (normal, dry, moist), and edema of lower limbs. It also included a section for recording the laboratory tests findings as blood sugar level, urea, creatinine, and uric acid.

Procedures

The study was achieved through four phases: assessment, planning, implementation, and evaluation.

Assessment phase: The aim of this phase was to collect patient's data as well as to identify individualized learning needs in order to design the suitable training program. Each diabetic patient recruited in the study sample was interviewed and physically examined upon admission using the interview and physical assessment forms. Then, a blood sample was taken for lab tests. Also, his/her practice of foot care and insulin injection was assessed using the observation checklist.

Planning phase: An individualized nursing care program was developed based on the findings of the assessment, and in the light of related literature. The program was designed to include two main elements, namely knowledge and practice. An illustrated handout was also prepared by the researcher to be given to participants.

The theoretical part of the program stressed mainly on the definition of diabetes, its causes, signs and symptoms, and effects on body system. It also covered the meaning of hypo and hyperglycemia, their causes, signs and symptoms, emergency treatment for each, and the method of avoid their occurrence. The issue of nutrition and exercise covered suitable diet for diabetic patient, its type, time, and suitable amount, the importance of exercises, suitable time, duration, when to start and when to end, as well as the special precautions before, during, and after exercise. The program also covered the types of treatment for diabetes, importance of compliance and regular follow-up with physician, and the signs and symptoms that need rapid consultation. Lastly, hygienic care included the importance and means to care for feet, eyes, and skin, and the method of insulin injection.

The practical part focused mainly on insulin injection and foot care. For insulin injection, participants were trained in the technique of injection, how to select site in a rotating manner, fill syringe, empty air, and inject at right angle. Foot care training included care of skin, nails, foot, between fingers, checking foot daily for any injury using a mirror, how to select suitable shoes, and avoid dry of skin. The practical training sessions included demonstration and re-demonstration of the injection technique and foot care technique. Demonstration was used until patient or one member of his/her family did the skill correctly.

Implementation phase: During this phase, the developed program was provided to diabetic patients according to individualized needs. Theoretical and practical knowledge were provided to each patient as well as to one family member to follow the prescribed instructions in the afternoon or at home. Face-to-face teaching method was used to achieve individualized instructions as well as solve personal problems. This was done three times per week until patient discharge from the hospital. Each session lasted 30-45 minutes, and the number of sessions varied according to the level of understanding of the patient, and ranged from three to four sessions. The researcher used illustrations, examples of objects, and power point presentations using laptop personal computer. The number of practical sessions also varied according to patient or significant others understanding and mastering of the given skill. It ranged from 3-5 sessions. In these sessions, the researcher used supplies as needles, trays, medications, antiseptic solutions, as well as pictures to select the site in a rotating manner. Also, the researcher used a mirror to show patient how to clean and care for feet and fingers.

Evaluation phase: Each patient was evaluated three times during the study period utilizing the developed tools. The first evaluation was at the assessment phase; the second evaluation was two weeks after

implementation of the program, and the third evaluation was done one month after the second evaluation. The same data collection tools were used in the three evaluations.

Administrative design and ethical considerations

The study was conducted over a period of six months from September 2008- march 2009. An official approval was obtained from the responsible authorities after explaining the aim of the study. Patient's informed verbal consent to participate in the study was obtained after explaining its purpose and procedures. Patients were informed about their rights to refuse or withdraw, and about confidentiality of the information obtained. The study maneuvers could not cause any harmful effect on participants. Professional help was provided to them as needed.

Statistical methods

Data entry and statistical analysis were done using SPSS 14.0 statistical software package. Categorical variables were compared using chi-square test. To identify the independent predictors of knowledge and practice scores, multiple stepwise backward regression analysis was used, and analysis of variance for the full regression models were done. Statistical significance was considered at p-value <0.05.

Results

The socio-demographic and medical history of patients revealed that slightly more than half (55.3%) of the patients were males (Table 1). Their mean age was around fifty years (49.9±14.3). They were mostly married (58.3%), unemployed (52.4%), with duration of illness ranging between 5 and 10 years (60.2%). The majority of the patients had a history of previous diabetic coma (72.8%), and had a family history of diabetes (69.9%). Meanwhile, less than half of them were current smokers (45.6%).

Table 2 displays the changes in patients' knowledge about diabetes mellitus throughout study phases. At the pre-program phase, all the areas showed deficient knowledge. This was particularly evident regarding knowledge about hyper and hypoglycemia, 10.7% and 12.6%, respectively. The highest knowledge was related to symptoms and signs, and reached only 35.9%. At the post-program phase, there were statistically significant improvements in the patient's knowledge in all areas (p<0.001). This ranged from 56.3% for physical activity, to 72.8% for diet. These improvements continued throughout the follow-up phase, reaching from 94.2% for physical activity to 99.0% for hypoglycemia, treatment, and eye care (p<0.001). At the pre-program phase, only 6.8% of the patients had total satisfactory knowledge. This increased to 59.2% at the post-program phase, and 99.0% at the follow-up phase (p<0.001).

Concerning self-care skills, (Table 3) shows that none of the patients had adequate practice of any of the two tested skills at the pre-program phase. At the post-program phase, about half of the patients (50.5%) had adequate practice of foot care (p<0.001), but still none in the insulin injection skill. At the follow-up phase, statistically significant improvements were revealed in the two practices, reaching 100.0% in both (p<0.001).

Table 4 points to some improvements in physical and lab findings throughout study phases. The skin problems were reduced from 99.0% at the pre-program phase, to 39.8% at the follow-up phase (p<0.001). Similarly, moderate to severe edema dropped from 83.5% to 13.6% (p<0.001). also, regarding lab tests findings, high blood sugar decreased from 82.5% at the pre-program phase to 69.9% at the follow-up phase (p=0.03), and high creatinine from 30.1% to 0.0% (p<0.001). Other findings as hypertension, BMI, urea, and uric acid demonstrated similar improvements throughout program phases, but did not reach statistical significance.

In multivariate analysis for knowledge score (Table 5), the only statistically significant independent predictor of improvement was the attendance of the training program. As revealed by the value of r-square, it explains 51% of the improvement. Other factors as age, sex, marital

	Frequency	Percent
Age (years):		
<50	51	49.5
50-	23	22.3
60+	29	28.2
Range	21.0-77.0	
Mean±SD	49.9±14.3	
Sex:		
Male	57	55.3
Female	46	44.7
Marital status:		
Married	60	58.3
Single	26	25.2
Divorced/widow	17	16.5
Job status:		
Unemployed	54	52.4
Working	49	47.6
Duration of illness (years):		
<5	26	25.2
5-	62	60.2
10+	15	14.6
Positive family history	72	69.9
Smoking	47	45.6
Had previous diabetic coma	75	72.8

Table 1: Socio-demographic and medical history of patients in the study sample (n=103).

Satisfactory knowledge (50%+) of DM:	Time						X^2 Test (p-value) Per-post	X^2 Test (p-value) Pre-FU
	Pre (n=103)		Post (n=103)		FU (n=103)			
	No.	%	No.	%	No.	%		
Definition	21	20.4	67	65.0	100	97.1	41.98(<0.001*)	125.00(<0.001*)
Symptoms/signs	37	35.9	65	63.1	100	97.1	15.22(<0.001*)	86.49(<0.001*)
Hyperglycemia	11	10.7	66	64.1	99	96.1	62.74(<0.001*)	151.07(<0.001*)
Hypoglycemia	13	12.6	48	46.6	102	99.0	28.53(<0.001*)	155.92(<0.001*)
Treatment	20	19.4	62	60.2	102	99.0	35.74(<0.001*)	135.16(<0.001*)
Diet	22	21.4	75	72.8	100	97.1	54.73(<0.001*)	122.30(<0.001*)
Follow-up	22	21.4	71	68.9	100	97.1	47.06(<0.001*)	122.30(<0.001*)
Personal hygiene	39	37.9	72	69.9	99	96.1	21.27(<0.001*)	79.03(<0.001*)
Physical activity	19	18.4	58	56.3	97	94.2	31.54(<0.001*)	120.05(<0.001*)
Foot care	23	22.3	63	61.2	100	97.1	31.94(<0.001*)	119.64(<0.001*)
Eye care	25	24.3	65	63.1	102	99.0	31.57(<0.001*)	121.74(<0.001*)
Total								
Satisfactory	7	6.8	61	59.2	102	99.0		
Unsatisfactory	96	93.2	42	40.8	1	1.0	64.01(<0.001*)	175.84(<0.001*)

(*) Statistically significant at p<0.05

Table 2: Knowledge about diabetes mellitus among patients in the study sample throughout study phases.

Adequate practice (60%+) of:	Time						X^2 Test (p-value) Per-post	X^2 Test (p-value) Pre-FU
	Pre (n=103)		Post (n=103)		FU (n=103)			
	No.	%	No.	%	No.	%		
Foot care	0	0.0	52	50.5	103	100.0	69.65(<0.001*)	206.00(<0.001*)
Insulin injection	0	0.0	0	0.0	103	100.0	0.00(1.00)	206.00(<0.001*)
Total practice:								
Adequate	0	0.0	2	1.9	103	100.0		
Inadequate	103	100.0	101	98.1	0	0.0	2.02(0.16)	206.00(<0.001*)

(*) Statistically significant at p<0.05

Table 3: Self-care practices of foot care and insulin injection among patients in the study sample throughout study phases.

status, job, family history, duration of illness, or previous coma had no effect on knowledge score. That is means the attendance of the program had a positive impact on knowledge score regardless other personal and these characteristics.

Concerning practice score, (Table 6) shows that the attendance of the training program and the knowledge score were statistically significant independent positive predictors of improvement, while age was a negative predictor. The value of r-square indicates that these factors explain 88% of the improvement. Other factors as sex, marital status, job, family history, duration of illness, or previous coma had no effect on practice score. That means the program effectors was better among younger age than older regarding practice. It also show that improvement in the knowledge leads to better practice.

Discussion

While many infectious and parasitic diseases regressed as health problems in many developing countries, non-communicable diseases related to lifestyle have been on the rise over the last two decades. This had a negative impact on the already short health services' budgets in these countries. For instance, type 2 diabetes mellitus in sub-Saharan Africa demonstrated a ten-fold increase in prevalence in the last two decades [17]. Similarly, diabetes is a major emergency clinical and public health problem in Egypt. The researcher observed that a large proportion of beds in the medical departments within the studied hospitals was occupied by diabetic patients who needed care and knowledge about diabetes, care for themselves, diabetic complications and how to deal with. These complications, in addition to the burden on patients and their families, affect the hospital budget. With adequate

attention to improving patients' knowledge and self-care skills, these problems could be eliminated. The aim of this study was to assess the effect of a nursing education program on diabetic patients' knowledge and self-care skills.

The finding of the present study revealed major deficiencies in diabetic patients' knowledge. These deficiencies indicate that the health care providers do not give due importance to health education for these patients. It is known that diabetes mellitus is a disease closely related to lifestyle. Hence this health educational role is of major importance as an integral part of the successful treatment of the disease. In congruence with this, [18] stressed that lifestyle changes in the habits of food consumption and exercise are associated with marked increases in obesity, and consequently increase the rates of type-2 diabetes in many countries. Also, in line with the present study findings, [19] in Poland, reported that diabetic patients in rural areas had lack of knowledge concerning the basic parameter of diabetes monitoring and complications.

The lack of patient's information about the disease nature, causes, clinical manifestations, and management may lead to low compliance, as well as increase the incidence of complications. In agreement with this, a study in South Africa [20] identified different factors hindering utilization of diabetes clinics services. For patients, the most frequently reported barriers were lack of understanding of diabetes, mistaken beliefs about insulin, fear of injections, and lack of knowledge. Furthermore, epidemiological studies have identified overweight, sedentary lifestyle, and family history as main risk factors associated with type 2 diabetes [21].

	Time						X² Test (p-value) Per-post	X² Test (p-value) Pre-FU
	Pre (n=103)		Post (n=103)		FU (n=103)			
	No.	%	No.	%	No.	%		
Hypertension:								
No	55	53.4	61	59.2	67	65.0		
Yes	48	46.6	42	40.8	36	35.0	0.71(0.40)	2.89(0.09)
Skin problem:								
No	1	1.0	8	7.8	62	60.2		
Yes	102	99.0	95	92.2	41	39.8	Fisher(0.04*)	85.08(<0.001*)
Edema:								
None	6	5.8	9	8.7	63	61.2		
Mild	11	10.7	87	84.5	26	25.2	126.65(<0.001*)	105.01(<0.001*)
Mod/severe	86	83.5	7	6.8	14	13.6		
Blood sugar:								
<126	18	17.5	20	19.4	31	30.1		
126+	85	82.5	83	80.6	72	69.9	0.13(0.72)	4.53(0.03*)
BMI:								
Normal	26	52.2	28	27.2	31	30.1		
Overweight	51	49.5	51	49.5	50	48.5	0.15(0.93)	0.78(0.68)
Obese	26	25.2	24	23.3	22	21.4		
Urea:								
Normal	31	30.1	36	35.0	41	39.8		
High	72	69.9	67	65.0	62	60.2	0.55(0.46)	2.14(0.14)
Creatinine:								
Normal	72	69.9	87	84.5	103	100.0		
High	31	30.1	16	15.5	0	0.0	6.20(0.1*)	36.49(<0.001*)
Uric acid:								
Normal	92	89.3	97	94.2	99	96.1		
High	11	10.7	6	5.8	4	3.9	1.60(0.21)	3.52(0.06)

(*) Statistically significant at $p<0.05$

Table 4: Physical and lab findings among patients in the study sample throughout study phases.

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value
	B	Std. Error	Beta		
Constant	33.942	1.370		24.768	<0.001*
Program attendance	29.796	1.678	.712	17.753	<0.001*

r-square=0.51
Model ANOVA: F=316.17, p<0.001
Variables excluded by model (non-significant): age, sex, marital status, job, family history, duration of illness, previous coma

Table 5: Best fitting multiple linear regression model for knowledge scores.

	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value
	B	Std. Error	Beta		
Constant	-11.130	3.134		-3.551	<0.001*
Age	-.092	.048	-.038	-1.904	0.0058
Program attendance	41.979	2.082	.578	20.159	<0.001*
Knowledge score	.749	.050	.432	15.060	<0.001*

r-square=0.88
Model ANOVA: F=720.82, p<0.001
Variables excluded by model (non-significant): sex, marital status, job, family history, duration of illness, previous coma

Table 6: Best fitting multiple linear regression model for practice scores.

Moreover, none of the patients in the present study had adequate self-care skills related to foot care or insulin self injection. This is certainly due to lack of training in such skills, which is also an essential role of physicians and particularly nurses in the management of diabetes. The lack of performance of such roles might be attributed to lack of time, as well as shortage of staff in these general hospitals, where a large number of diabetics are admitted. The importance of self care practices in diabetes was emphasized by [22] who recommended that health care providers should train diabetic patients in self-care, which could enhance good compliance.

After implementation of the educational program, statistically significant improvements were shown in patients' knowledge regarding all aspects of diabetes included in the program. Similar improvements were also revealed in their self-care practices. The findings indicate success of the program in realizing the research hypotheses. This success of the program can be attributed to two reasons. First, it was

individualized and tailored to each patient needs. Second, it emphasized the practical part associated with self-care, which provides the patient with skills that make him/her feel independent in the care of his/her own condition. This would improve patient's quality of life, which would have a positive impact on diabetes control. In agreement with this, [23] highlighted that a key goal in treating diabetes is to help patients to improve their quality of life by identifying and addressing diabetes-related issues, which is the ultimate goal of all health interventions.

The effect of the educational program on improvement in the present study diabetic patients' knowledge and self-care skills was further confirmed by multivariate analysis. It was shown that the attendance of the program was a positive independent predictor of both knowledge and practice. Moreover, the improvement in knowledge score was associated with better practice, which supports the effect of providing information to patients in ameliorating their self-care practices. Furthermore, the improvement was gradual and further increased during the follow-up, which indicates the importance of continuity of such interventions. The findings are in congruence with [24] who demonstrated a similar success of an intervention program in improving lifestyles of diabetic patients.

In addition to improvement of patients' knowledge and self-care practices, the present study has also shown improvement in their physical and lab findings. This was most evident regarding skin changes and edema, as well as glycemic control. The findings demonstrate that the improvement in patient's information about the disease, and the acquisition of some related important skills can help in the control of diabetes. In agreement with these findings, [25] demonstrated a significant success of an intervention focusing on patients' personal understanding of their illness in the metabolic control of type 2 diabetes mellitus. Similar findings were reported by 26] in Lebanon. This control would certainly decrease the incidence of diabetic complications as peripheral neuropathy, neuropathic foot ulceration, and peripheral vascular disease as reported by [27]

Lastly, according to the present study findings, the only socio-economic characteristic that had a significant relation to improvement of practice was patient's age. The results indicated that young patients got more improvement and more benefit from the practical part of the educational program, specifically in foot care and insulin injection. The finding is quite expected since older age patients may have more difficulty in psychomotor training, especially with self injection for fear of inducing harm to themselves. Moreover, they might have other diseases, especially rheumatic problems that make foot self-examination practically difficult to them. The findings are congruent with [28] who clarified that diabetes self-management education for older adults is complicated by the high prevalence of medical comorbidities and declining functional status among this patient population.

Conclusion and Recommendations

It is concluded that diabetic patients admitted to Helwan hospitals have a major deficiency in knowledge and self-care practices regarding their illness. The implementation of a nursing educational program based on their profiles and needs was successful in improving their knowledge, self-care skills, and consequently on their health status.

Therefore, it is recommended to generalize such educational programs in hospitals for teaching diabetic patients hygienic care, diet, and compliance to physician's instructions regarding nutrition, exercise and medication. This would decrease the incidence of complications, and reduce hospital admissions and length of stay. It is also important that all health care team members give more emphasis to their roles as health educators. The developed illustrated booklet should be made available and distributed for each diabetic patient admitted to hospitals. More research is needed to investigate the long-term effect of such educational interventions.

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