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The influence of health locus of control on health behaviors of patients with diabetes mellitus

Diabetes mellitus is a disease characterized by glucose metabolic disorder which occurs due to deficits in production or utilization of insulin, hence maintenance of high blood glucose level, called a state of hyperglycemia (Tatoń 1992). There are two main types of diabetes: type 1 and type 2. In type 2 diabetes there is a decreased sensitivity of tissues to insulin with preserved secretion of the hormone by beta cells (β -cells) in the pancreas. In type 1 diabetes, however, the organism loses the ability to produce insulin due to the destruction of beta cells (β -cells) in the pancreas. Maintained hyperglycemia causes distinct and fast weight loss despite increased appetite, lack of strength and loss of energy, fatigue, vision damage and pollakiuria. These are the first clear symptoms of diabetes (Tatoń 2004, Otto-Buczowska 2003). Acute health complications may appear if the disease is not treated or adequately controlled. These include the following: damage of the organ of vision (cataract, glaucoma, diabetic retinopathy, retinal changes of an eye, due to retina's small vessels damage), kidney and urinary system diseases (diabetic nephropathy – microvascular damage of a kidney, penetration of protein to urine and high blood pressure), changes in the cardiovascular system (atherosclerotic changes in arteries, coronary heart disease, cerebral stroke, myocardium damage), changes in the nervous system, (diabetic neuropathy – peripheral nerves damage which gives the symptoms of numbness, burning, pain in hands and feet and sensory disorder), diabetic foot (narrowing of arteries, foot ischemia and sensory disorder cause greater vulnerability of feet to injuries and scalds and are the main causes of poor wound healing, which can lead even to an amputation), sexual disorder (impairment of sexual drive in women and erectile dysfunction in men) (Otto-Buczowska 2003).

Type 2 diabetes requires oral medication, whereas type 1 diabetes – daily and repeated injections of insulin. Intensive insulin therapy runs a high risk of an occurrence of hypoglycemia – abnormally low blood glucose level which may lead to the

loss of control over one's behavior, loss of consciousness, in some cases to coma or even death. Patients with diabetes are afraid that hypoglycemia may appear in a public place or in a situation in which they may not get necessary help.

Taking insulin in the form of injections is not sufficient to maintain optimal blood glucose level. Patients with diabetes must also obey numerous medical recommendations concerning proper control of the disease. The activity is defined as a pro-health behavior aimed at metabolic glucose. Glucose level measurements are of basic importance in order to counteract the states of hypo- and hyperglycemia. Skin puncture is necessary to measure blood glucose level (Tatoń 1992). Due to frequent injections of insulin, glucose level should be marked from 5 to 8 times a day (Tatoń 2004). Many patients with diabetes perceive the activity as arduous, especially when they have to take injections or measure glucose level in the presence of other people, e.g. in a public place. In both types of diabetes, proper diet control, in which simple carbohydrates (present in sweets, cakes and sugar) are reduced to the minimum, is of vital importance (Otto-Buczowska 2003; Campbell, Lebovitz 2003). Above all, consumption of 6 or 7 meals a day is very important. Meals should contain an approximate amount of carbohydrates, proteins and fats and be consumed at regular hours. In practice, a regular diet control appears extremely difficult, especially for professionally and socially active young people.

Another activity which has an influence upon metabolic processes of patients with diabetes is physical activity, namely exercises such as gymnastics, march, jogging and tennis. Using glucose as an energetic substrate during a physical effort decreases its level in blood. Therefore patients should exercise at least four times a week (Boule, Hadda, Kenny, Wells Sigal 2001).

Intensity of health efforts undertaken by patients with diabetes is equal with the result of metabolic control of glucose level, which reflects a good adaptation to the disease. An objective measure of such an equalization is called an indicator of glycosylated hemoglobin – HbA1c. The indicator allows to investigate, with great accuracy, the average glucose concentration in a given patient within the last 2 months (Otto-Buczowska 2003). The higher the blood glucose concentration, the higher the value of glycosylated hemoglobin. The result of this research is susceptible to any neglects in the process of self-control. The value of an indicator of glycosylated hemoglobin HbA1c in a healthy person should be less than 5,0%. In an adequately treated patient, this value should be less than 6,0% (Otto-Buczowska 2003). There is a close correlation between repeated, poor results of HbA1c and an early appearance of serious, long-term complications, e.g. in the heart or vascular system (Tatoń 2004).

Many patients with diabetes do not have sufficient motivation to obey medical recommendations as it comes to a proper diabetes control, even though there is a possibility of appearance of serious health problems as a result of neglect in the process of glucose level self-control. Patients differ between themselves in respect to conscientious fulfillment of such duties as glucose level control, diet control or

taking physical exercises. Daily observation of diabetics shows that there are people who, despite numerous professional and family duties, remember about a proper diet and regular hours of meals. Regular physical training can be found in their schedules, too. They try to control glucose level regularly, in order to avoid dangerous states of hypo- and hyperglycemia. On the other hand, there are patients who, despite full awareness of real threats of not adhering to medical recommendations, still commit many neglects in the area of health activity which is written into diabetes. Therefore the question arises: what does this state of affairs depend on? What factors have an influence upon intensification of health behaviors connected with patients' self-control of glucose level?

Patients' system of beliefs on diabetes, in other words, a cognitive representation of the disease plays a vital role. It is a complex, dynamic, cognitive schema which focuses upon beliefs, knowledge and patients' personal opinions of diabetes, which is the effect of coding various information connected with the disease (Leventhal, Nerenz 1980). In the case of patients with diabetes, a special role is ascribed to perceived health locus of control, which has a crucial meaning in the process of adaptation to the somatic disease. Health locus of control construct differs from personality locus of control in the view of Rotter, because the former concerns beliefs that refer specifically to a field of health. Health locus of control refers to people's opinions on the possibility of the control of his/her illness, as well as the possibilities of influencing his/her own state of health (Wallstone 1992). Health locus of control construct contains three dimensions:

- a) perceived internal control (personal) – a degree in which an individual expresses belief that he/she can have an influence upon his/her health.
- b) perceived medical control (other people matter) – a degree in which an individual expresses belief that his/her state of health depends chiefly on activities of other people, namely medical services.
- c) external control (situational) – a degree in which an individual expresses belief that chance and external conditions have an influence upon his/her health

Aims of research

The aim of the research was to obtain an answer to the question of how health locus of control, which is characteristic of patients with diabetes, influences the degree of adherence to medical recommendations as well as the result of glucose metabolic control. It was expected that patients who appreciate their influence on the course of diabetes will undertake numerous activities aimed at the self-control of glucose level, which, consequently, will influence its concentration in blood, namely a better adaptation. It was also supposed that these people will have a lower indicator of glycosylated hemoglobin – HbA1c. It was believed that patient's faith in a

diabetic specialist or a doctor, who looks after him/her and additionally has sufficient competences and knowledge to control the course of the disease, will have an influence upon their scrupulous fulfillment of medical recommendations. Therefore, perceived health medical control of diabetes should be connected with more conscientious fulfillment and adherence to medical recommendations, that is efficient control of blood glucose level expressed through a low concentration of glycosylated hemoglobin – HbA1c. It was expected that patients who are characterized by strong beliefs that the course of diabetes depends on chance, fate and situation will be less engaged into health activity aimed at glucose level control, believing that they have not got an influence on the ultimate blood glucose concentration. Thus, perceived health situational control of diabetes influences more frequent neglect in the area of fulfillment of medical recommendations and results in higher blood glucose concentration – HbA1c, that is reflected by weak adaptation to diabetes.

Subjects

50 adult patients with type 1 diabetes (15 men and 35 women) were investigated. The average age was 43 years. The subjects were patients in diabetic clinics in Cracow and Chrzanów. All people engaged in the investigation were given four insulin injections a day. The minimal duration of the disease was one year. The average duration of the disease was eleven years. Within the last three months, each patient was put through the examination of sugar curve oscillation (glycosylated hemoglobin – HbA1c).

Method

Two questionnaire methods were used in the research. Perceived Control of Diabetes Scale was used to measure perceived health control of diabetes and Diabetes Self-Care Activity Questionnaire was used to measure health behaviors connected with self-control of glucose level in patients with diabetes.

Perceived Control of Diabetes Scale by Bradley and others (1984) measures in what degree a patient with diabetes attributes himself/herself a control of the course of the disease (perceived personal control), how he/she perceives the control of other people – especially medical services (perceived medical control), and how he/she evaluates the role of fate and situation in the course of diabetes (situational control). The scale contains the description of six situations connected with diabetes, such as the occurrence of a state of hyperglycemia, or the loss of control over body weight.

The subjects' role was to mark on a six-level scale a degree due to which a situation took place, namely his/her own activities, medical service activities or chance.

Diabetes Self-Care Activity Questionnaire by Toobert and Glasgow (1994) serves to measure the frequency of the appearance of certain activities aimed at glucose level control, used by patients within the last seven days. These are the following: diet, exercises, glucose level measurement, medicines intake/doing insulin injections. The questionnaire consists of 12 questions. A subject marks on the scale how often he/she undertakes a given activity (in percentages).

Results

The analysis of step regression model was used to examine the influence of independent variables on a dependent variable. The dependant variables were: diet, physical exercises, glucose level measurement, medicines/insulin injections and an objective result of blood glucose level concentration – glycosylated hemoglobin – HbA1c.

The obtained results of the influence of each factor on the degree of intensification of health behaviors aimed at the self-control of glucose level are presented in Table 1.

Health behavior	Factor	beta	t	p	R2	F
Diet	Age	-0,42	-3,28	0,001	0,215	F(2,47)=7,74
	Personal control	0,31	2,44	0,018		
Physical exercises	Situational control	-0,27	-1,28	0,041	0,214	F(2,47)=8,91
	Gender	0,32	2,07	0,001		
Glucose measurement	Medical control	-0,30	-2,15	0,036	0,069	F(1,48)=4,64

Table 1. Factors of health behaviors aimed at the self-control of glucose level – the analysis of step regression

The factors introduced to the step regression model explained 21% of diet variance variable. This value was statistically important. Patients' age turned out to have the most negative influence on their adherence to diet. Perceived personal control, however, positively influenced this variable. Direction of these dependencies shows that young people as well as those with strong beliefs of the possibility of personal control of diabetes more often controlled diet and ate at regular hours.

The perceived situational control had the most negative influence on the frequency of undertaking physical activity in a form of regular exercises. Gender, however, influenced positively this variable. These factors also explained 21 % of dependent variable variation. It turned out that men more often than women undertake

regular physical exercises. Individuals with perceived situational control of diabetes are characterized by lower intensification of this health activity.

Only one factor, among all introduced to the regression model, had an influence upon the frequency of glucose level measurement and that was perceived medical control of diabetes which negatively influenced the dependant variable.

None of the introduced factors considerably influenced the frequency of medicine intake and taking insulin injections.

The obtained results of the influence of each factors on the result of medical adaptation to diabetes expressed through the degree of glucose level oscillations are presented in Table 2.

	Factor	beta	t	p	R2	F
The indicator of glycosylated hemoglobin – HbA1c	Age	0,47	2,84	0,008	0,198	F(2,47)=9,01
	Personal control	-0,29	-2,16	0,031		

Table 2. Factors of medical effect of an adaptation to diabetes – the analysis of step regression

Two factors: age and perceived personal control of diabetes turned out to have an influence upon the final medical result of adaptation to diabetes, expressed through the indicator of glycosylated hemoglobin – HbA1c. The older the subject, the higher the indicator HbA1c, which provides evidence to less efficient control of glucose level. However, the stronger the patient's belief of the possibility of personal control of diabetes, the lower the value of the indicator – HbA1c, which means more efficient control of glucose level.

Discussion

Diabetes mellitus is a disease in which, due to metabolic processes disorder connected with production and utilization of insulin, it is necessary to regulate glucose level by numerous activities, namely: restrictive diet control, eating at regular hours, undertaking regular physical exercises, having repeated glucose level measurements and, last but not least, having insulin injections. Such activities are indispensable in order to obtain a good effect of medical adaptation to diabetes (Tatoń 1992). Daily observation of patients with diabetes shows that patients differ considerably between themselves in intensification of activities aimed at glucose level self-control. In the research the question was asked: what factors determine intensification of health activity of a patient?

Perceived control of diabetes played a crucial role in the formation of health activity in a patient, as well as in the final medical result of adaptation to the disease.

A manner of diet control, regularity of physical exercises, frequency of glucose level measurement as well as the level of oscillations of sugar curve HbA1c were under essential influence of selected categories of perceived health locus of control of diabetes. Only the frequency of medication intake and making insulin injections were independent from these factors. Neither demographic- nor diabetes – connected variables had an influence upon them. This result is clear in the light of the fact that such activities as using medicines and injections have a basic meaning for patients' health and their abandonment may have serious consequences of medical nature, sometimes leading even to death. Thus, the factors of psychological or demographic nature should not have an essential influence upon these activities.

Perceived personal control of diabetes had an essential influence on the precision in diet control. The stronger the patient's belief that he/she can have an influence upon the course of the disease and that by means of his/her own activities he/she can control the oscillation of glucose level and delay the appearance of further health complications, the better degree of adherence to medical recommendations connected with diet. Above all, the research has shown that not only does the perceived personal control of diabetes influence intensification of this health activity, but it also gives positive effects of medical adaptation to diabetes in the form of low indicator of glycosylated hemoglobin – HbA1c. Schab (1999) obtained similar results. He stated that patients who appreciate their own influence on the course of the disease are more inclined to engage themselves into activities connected with the improvement of a state of health such as: physical activity, healthy diet, restraint from smoking or alcohol consumption. Helgeson and Franzen (1998) showed that stronger patient's belief in the possibility of personal control of diabetes was linked with more conscientious adherence to medical recommendations, greater intensification of activities aimed at glucose level control and, consequently, better result of this control, measured with the indicator of glycosylated hemoglobin – HbA1c.

Contrary to the expectations formulated in the studies, there was no positive influence of a doctor and medical service's participation in the control of the course of diabetes on the adaptation to the disease. On the contrary, this type of belief was linked with rare glucose level measurement, which could have serious health consequences in the form of repeated acute states of hypo- and hyperglycemia. Perhaps patients who express beliefs that diabetes control depends mostly on a doctor and his/her activities, in a way „give back” the responsibility for the course of the disease in his/her hands. Patients feel free from the duty of checking daily blood glucose concentration, burdening the doctor with this task. Bradley (1994) came up with similar conclusions. She claimed that patients with high perceived medical control of diabetes had unrealistic expectations of help from their doctors and other people. They rarely use their own resources and possibilities of the influence on the course

of diabetes and metabolic control. It refers to the group of patients who are additionally characterized by low perceived personal control of diabetes and those with low perceived situational control of diabetes. Bradley described them as patients with pure medical control.

Patients with beliefs that the course of diabetes and glucose level is a matter of chance, situation or fate were, indeed, less involved in physical exercises. This may be due to the fact that sport activity is perceived by many as less important in comparison to medicine intake or doing injections. Due to many necessities of time-consuming activities aimed at glucose level control, sport activity is pushed to the sidelines. For people who do not see the causal dependency between their own activity and the course of the disease, taking physical exercises is an activity of little importance, especially when compared to activities which they must perform, like medicines intake, thus patients neglect it.

The influence of demographic variables and variables connected with the disease on the course and the effect of medical adaptation to diabetes was also examined in the research. The subjects' age and gender turned out to be of crucial importance. The duration of the disease, however, did not significantly influence the frequency of behaviors aimed at diabetes control. Older people rarely followed diets. They were as well characterized by higher indicator of glycosylated hemoglobin, which is evidence of repeated states of hyperglycemia. Higher age of patients is linked to longer duration of type 1 diabetes. It can be assumed that with age the possibility of appearance of serious health complications arises. Moreover, body's fat increases with age. In older patients body's fat constitutes a major part of the entire mass of their bodies, leading to increase in insulin resistance and contributing to the rise of blood glucose level (Otto-Buczowska 2003). The result which shows less adherence to diet by older patients is surprising in the light of many findings in which contrary dependencies were obtained. For instance, in the research of Aalto and Uutela (1997), older patients with diabetes followed diet to a considerable degree in comparison to young people, because the former believed in higher probability of appearance of health complications due to diabetes. Gender, in turn, influenced the frequency of undertaking physical training. Men were more engaged in sport activity than women. This result can be explained by the fact that maintenance of physical condition is highly valued by men.

To sum up, it can be claimed that a degree to which a patient follows diabetic specialist's recommendations in order to keep a proper blood glucose level depends, to a large extent, on his/her way of thinking about the disease. It is confirmed that in case of diabetes – a disease of which a patient may have active control, a subjective belief of the possibility of controlling it plays a crucial role in the active pro-health patient's activity. The obtained results postulate for the introduction of intensive psychoeducational and therapeutic programs aimed at formation of proper cognitive representation of the disease.

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Wpływ umiejscowienia kontroli zdrowia na zachowania zdrowotne pacjentów z cukrzycą

Streszczenie

Celem przeprowadzonych badań było uzyskanie odpowiedzi na pytanie, jak zdrowotne umiejscowienie kontroli charakteryzujące pacjentów z cukrzycą wpływa na stopień przestrzegania przez nich zaleceń lekarskich oraz na wynik metabolicznej kontroli glukozy. Zdrowotne umiejscowienie kontroli dotyczy sądów osoby chorej na temat możliwości kontroli własnej

choroby oraz wpływania na swój stan zdrowia. Przebadano 50 osób dorosłych chorych na cukrzycę typu 1. Spostrzegana kontrola cukrzycy okazała się pełnić decydującą rolę w kształtowaniu się aktywności zdrowotnej chorego, jak również w ostatecznym medycznym wyniku przystosowania do tej choroby. Sposób przestrzegania diety, regularność podejmowania ćwiczeń fizycznych, częstotliwość pomiarów poziomu glukozy, jak również poziom wahań krzywej cukrowej HbA1c pozostawały po istotnym wpływie wybranych kategorii spostrzeganego zdrowotnego umiejscowienia kontroli w cukrzycy. Jedynie częstotliwość przyjmowania leków i wykonywania zastrzyków z insuliny okazały się być niezależne od tych czynników.