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Evaluation of a diabetes education program

ABSTRACT

OBJECTIVE: To compare the effectiveness of individual and group strategies in a diabetes education program.

METHODS: A total of 104 type-2 diabetes outpatients enrolled in an education program of a teaching hospital in Belo Horizonte, Southeastern Brazil, were randomly selected and assigned to two different education strategies: group education (54 subjects) and individual education (50 subjects). Group education comprised three monthly sessions, which involved play and interactive dynamics. In parallel, a second group received individual education. Subjects were followed up for six months during 2006 and they were evaluated using specific questionnaires: knowledge of diabetes, psychological attitudes, change in behavior, quality of life. Clinical evaluation was performed at baseline, three and six months of intervention.

RESULTS: Mean age was 60.6 years. The results of group and individual education were similar in the assessment tests of attitude, change of behavior and quality of life. A reduction in HbA1c levels was seen in both groups, but a statistically significant difference ($p=0.012$) was found only in the group education.

CONCLUSIONS: Both strategies of diabetes education were effective, however, group education was more effective than individual education for blood glucose control.

DESCRIPTORS: Diabetes Mellitus, Type 2. Patient Education as Topic. Self Care. Patient Participation. Self-Help Groups. Health Education. Health Knowledge, Attitudes, Practice. Program Evaluation.

INTRODUCTION

Regardless of the degree of development of a country, diabetes mellitus (DM) is an important and growing global public health problem, in terms of the number of people affected, their disabilities, premature mortality and the costs involved in controlling and treating its complications. Particularly for type 2 DM, incidence and prevalence are increasing to epidemic proportions and affecting the population aged between 30 and 69.^{5,7} DM is the fourth cause of death in the world and one of the most frequent chronic diseases. Currently, there are about 120 million diabetics on the planet; by 2025 it is estimated that there will be approximately 300 million.⁸

In Brazil, according to the Brazilian Multicenter Study carried out in nine Brazilian cities between 1986 and 1988, the estimate is that there are five million diabetics. This study also showed a DM prevalence of 7.6% for the population between 30 and 69 years old. More recently, in a study with similar methodology carried out in the city of Ribeirão Preto, Southeastern Brazil, in 1996/1997, the prevalence of DM was found to be 12.2% in a population in the same age group.⁸

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The increase in the prevalence of diabetes, allied to the complexity of its treatment, such as dietary restrictions, use of medication and associated chronic complications (retinopathy, nephropathy, neuropathy, cardiopathy, neuropathic foot, among others) reinforces the need for effective education programs that are viable for the public health service. Behavioral changes, with the adoption of a balanced diet and the practice of physical activities, are essential for controlling and treating DM successfully.^{6,7} Studies^{7,8,a} show that it is possible to control and prevent diabetes complications by means of educational programs.

Considering that education is fundamental for the self-management of DM care, the endocrinology and metabology service of the hospital studied has carried out educational programs with patients with type 2 diabetes since 2001.¹¹ The main objective of these programs is to provide greater adherence to the treatment for controlling the disease.

The DM education program was systematized using both group and individual teaching strategies, comprising a set of interventions that were directed at the physiopathology of the disease, its signs, symptoms and complications, diet principles, the practice of physical activities and psychological aspects relating to behavior change for controlling the disease.^a

The group educational process was enriched by the use of games, which in addition to being basically instruments of communication, expression and learning,¹¹ facilitate knowledge acquisition and intensify knowledge exchange. In the individual consultations, questions were asked about the patient's life and treatment expectations; this was done in such a way as to educate them through dialogue. The work of the multidisciplinary team in the group sessions and individual consultations sought to develop topics in an interdependent and integrated way, thereby contributing to the interaction and reinforcing content.

The objective of this study was to compare group and individual education strategies in the diabetes education program.

METHODS

A randomized clinical trial was carried out, with individuals suffering from type 2 DM, aged between 30 and 70, who attended an outpatients clinic at a reference hospital in the city of Belo Horizonte, Southeastern Brazil, and who were taking part in a diabetes education program. The individuals were selected from patient records between May and June 2006.

Criteria for including them were: level of schooling above fourth grade of elementary education and the possibility of attending the clinic once every two months over a six-month period. Patients who were unable to read, had chronic complications (defined as renal insufficiency, blindness, amputation of members, among others) were not included.

All patients who signed the consent form were given guidance as to the diabetes education study-program, when the two types of intervention were explained. They were then allocated to one of the two groups, by draw, until the calculated sample size was reached.

Group education included meetings of, on average, 13 patients who took part in an operative group for two hours. In all of the groups a nurse led the process, starting with a relaxation dynamic involving the game "Expressions of the day", which encouraged participation in the educational program. At each meeting one or more health professionals presented a topic, using interactive and enjoyable dynamic exercises, involving theoretical and practical knowledge.

The group meetings were always carried out by the same multidisciplinary team, which tried to modify the teaching and learning methodologies used. The DM themes explored were: physiopathology, the prevention of acute and chronic complications, the importance of diet and the practice of physical activities and care of the feet.

The professionals were oriented as to posture, language and way of communicating. Eleven group meetings were held, with evaluation after the first and 11th. Anthropometric measurements were taken: weight, height, body mass index (BMI) and glycated hemoglobin (HbA1c) was examined at the beginning and after three and six months of monitoring.

In the individual sessions, guidance was given about managing diet and physical activity. The anthropometric measurements were taken and glycated hemoglobin (HbA1c) was examined at the beginning and after three and six months of monitoring. Two monthly consultations were guaranteed, one with an occupational therapist and the other with a nutritionist on the same day and at same time; these lasted 30 minutes, on average. In total, six consultations were carried out over a period of six months.

An interview guide was prepared for collecting the sociodemographic information from each participant. In addition data was also collected about their occupational history (work, leisure and self-care), the history of the disease and diet- and physical activity-associated treatment.

^a Torres HC. Avaliação de um programa educativo em diabetes mellitus com indivíduos portadores de diabetes tipo 2 em Belo Horizonte, MG [doctoral thesis]. Rio de Janeiro: Escola Nacional de Saúde Pública da Fiocruz; 2004.

The Figure shows the structure for evaluating the group and individual diabetes education programs, based on different theories and concepts, such as: (a) the social learning theory,² which defines social learning as a process for learning new behavior or modifying undesirable behavior, achieved through imitation; (b) health belief model,⁹ a conceptual model for understanding and explaining aspects of health promotion in relation to the personal values and opinions and beliefs of individuals; (c) health education,¹⁰ showing that the health professional should use understandable and simple language, which is appropriate to the reality; the individual is taken as the starting and their prior knowledge of the disease and their needs with regard to it must be ascertained.

The data were collected at the outset (T0), before starting the educational activities, and right after each educational cycle (moments in time), after three (T3) and six (T6) months monitoring of the educational program. The variables of interest included: knowledge of DM, attitudes (emotional responses to the disease), self-management (adhering to the diet and physical exercise), quality of life (physical and mental aspects). The instruments used for this were, respectively: general knowledge of the disease (DKN-A), psychological attitudes, (ATT-19) and DM care self-management (ESM),¹³ previously translated into Brazilian Portuguese and validated by Torres et al (2005).¹¹ To evaluate the quality of life the Short Form Health Survey (SF-36) was used.¹² These instruments comprised 15, 19, eight and 36 self-completed and anonymous closed questions, respectively. These were individually applied with the support of trained personnel.

The DKN-A knowledge test has a total score of 14 points, covering knowledge about managing the disease. To show an improvement in knowledge about the disease, the patient needs to get at least eight points. The ATT-19 has 19 items that describe emotional responses to the disease, with closed questions. Each statement is replied to with the help of a 5-point Likert scale, starting with "Strongly disagree" to "Strongly agree", and points that range from 19 to 95 for a positive attitude to the disease. On this scale the patient needs to get a minimum score of 70 points. The ESM test has a total score of eight points. To show that the patient has achieved a change in behavior he/she must obtain a minimum score of five points. Quality of life is evaluated using the SF-36 and includes the individual's well-being measurement. The responses to each statement followed the Likert scale model. The following eight items represent the concept of health: physical, social, and emotional functioning, mental health, energy and fatigue, pain and general health perceptions.

The patients took on average 20 to 30 minutes to complete each questionnaire, for a total of two hours.

The clinical indicators of metabolic control were: an examination of glycated hemoglobin (HbA1c), which reflects the average blood glucose level over a period of three months,¹ and anthropometric measurements (weight, height and BMI). Weight and height were measured with the outpatient clinic's digital scales (Model PL150, Filizzola Ltda, Brasil).

To evaluate the results of the A1c hemoglobin and the BMI of the patients with type 2 DM, we used the parameters recommended by the Latin American Diabetes Association.¹ The normal values of these parameters are: A1c hemoglobin between 35% and 7.5%, and BMI ≤ 27 kg/m² for men and ≤ 26 kg/m² for women.

At each stage in the group education process (T0, T3 and T6 months) there were three meetings and patients were only allowed to miss just one of them to be included in the study evaluation. In the individual process, there was just one meeting at each of the moments; one absence already excluded the patient from the study.

The statistical analyses of the data were carried out using the SPSS V.16 and Minitab programs, with double-input processing of the data in order to avoid possible errors. In characterizing the sample, the comparison between the groups was done using the *t*-Student test, after the data normality assumption had been confirmed by means of the Kolmogorov-Smirnov test. Evaluation of the effect of time on each of the variables analyzed was carried out using generalized linear models (GLM) for balanced data, with the Bonferroni test being used to make multiple comparisons. In the case of comparisons between proportions, the chi-squared (χ^2) test was used. For all analyses a significance level of 5% was considered.

For the total sample of 57 patients (31 monitored in groups and 26 monitored individually) who took part at all three moments in time (T0, T3 and T6 months), the power of the test drops from 90% (beta = 0.1) to approximately 65% (beta = 0.35).

The project was approved by the Research Ethics Committee of the *Universidade Federal de Minas Gerais*.

RESULTS

Of the 104 patients who started the study, 76 (73.1%) participated in the program for up to three months and 57 (54.8%) completed the 6-month educational process, of whom 31 (57.4%) were in group sessions and 26 (52.0%) in the individual education process. The

² Torres HC. Avaliação de um programa educativo em diabetes mellitus com indivíduos portadores de diabetes tipo 2 em Belo Horizonte, MG [doctoral thesis]. Rio de Janeiro: Escola Nacional de Saúde Pública da Fiocruz; 2004.

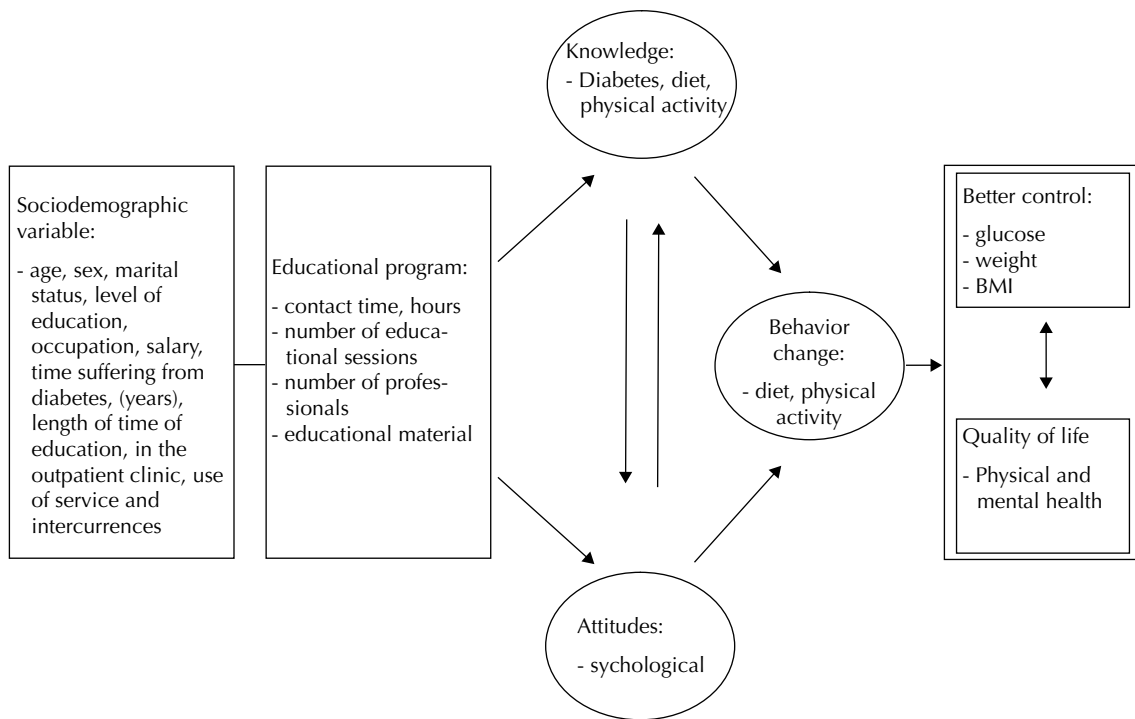


Figure. Conceptual framework of the evaluation structure of the group and individual diabetes education programs.

drop-out rate after six months was approximately 45%. In the group education process 40.4% of the patients dropped out and 50% of the patients in the individual education process. Most of the reasons given were of an economic or institutional order. These losses did not affect the randomness of the study. By comparing the patients with diabetes who were monitored for up to six months (who did not drop out) and the patients who interrupted the program, divided by the type of monitoring (individual or in group), no statistically significant difference was detected ($p > 0.05$), except for the level of schooling of the patients on the group educational program, where the ratio of individuals who dropped out was lower among those who had an elementary education level or under (65.2 vs. 93.5%; $p = 0.022$).

The characteristics of the patients included in the study are presented in Table 1. Weight, BMI and time of diagnosis differed between patients in the group and individual education program ($p < 0.05$).

Table 2 shows the results of the weight, BMI, glycated hemoglobin and questionnaires about behavior change – self-management of diabetes care; knowledge about diabetes; psychological attitudes and quality of life – for those patients who were participating in the education program at the three intervention moments. There was a statistically significant reduction in glycated hemoglobin after six months ($p = 0.002$). Despite not reaching the ideal figure (7.5%), the glycated hemoglobin of patients who completed the six month monitoring period reduced on average by 1.5%.

Table 1. Initial study sample. City of Belo Horizonte, Southeastern Brazil, 2006.

Variable	Educational program			p
	General (n = 104)	Individual (n = 50)	Group (n = 54)	
Age (years)	60.6 ± 10.5	59.4 ± 10.4	61.7 ± 10.5	0.264
Gender (% women)	75.0	74	75.9	0.821
Schooling (% elementary education or below)	78.8	76.0	81.5	0.494
Diagnosis time (years)	17.3 ± 9.9	15.2 ± 8.4	19.3 ± 10.8	0.036
Weight (kg)	75.4 ± 14.7	78.9 ± 14.3	72.0 ± 14.5	0.016
Height (m)	1.60 ± 0.1	1.60 ± 0.1	1.60 ± 0.1	0.806
BMI (kg/m ²)	30.1 ± 5.9	31.5 ± 5.7	28.9 ± 5.8	0.025
Glycated hemoglobin – HbA1c (%)	9.5 ± 2.4	9.4 ± 2.4	9.6 ± 2.5	0.607

Average data +/- standard deviation, or in %

Also in Table 2, with regard to the knowledge questionnaire (DKN-A), after six months monitoring patient knowledge about managing the disease increased in a statistically significant way ($p = 0.017$). Despite initial knowledge already having a score higher than the minimum eight points (9.2 ± 2.8), this score increased to 10.6 ± 2.3 , approximately 76% of the total 14-point score available in the knowledge test. When the two groups were compared the increase was greater in the group education process (1.6 vs. 1.3), but the differences were not statistically significant (Table 3 and 4).

Table 3 shows the results of the clinical aspects and the questionnaires for the 31 (54.7%) patients included in the group education program who took part in the three evaluation moments in time.

For those patients who took part in group sessions, there was only a statistically significant difference after monitoring for glycated hemoglobin ($p=0.016$), with the final values of the study coming close to the ideal of 7.5% ($7.6 \pm 1.4\%$).

Table 4 shows the results of the clinical aspects and questionnaires for the 26 (52%) patients in the individual education program who took part in the three evaluations.

The average weight, BMI and hemoglobin figures reduced in those who were individually monitored. There was also an increase in the average number of points in the attitude and knowledge questionnaires. However, such changes cannot be considered statistically significant over the three moments in time for any of the variables analyzed ($p>0.05$).

It was also possible to observe that the patients who took part in the group sessions did not differ significantly from those who took part in the individual monitoring program, as far as concerns clinical aspects and replies to the questionnaires, with the exception of glycemic control.

DISCUSSION

The change in eating behavior and the practice of physical activities in patients with type 2 DM as a result of the evaluation of the group and individual diabetes education program is conditioned by improvements in their knowledge and a modification in their attitude towards the disease. The objective of the whole process is to control glycemia and improve the physical and mental condition of the individuals.

Some authors^{4,5} state that the increase in knowledge and change in attitudes are not sufficient to improve glycemia and reduce weight; it is necessary to adhere to the diet and the practice of physical activities. Furthermore, individuals must understand their disease and be encouraged to follow educational guidance. Education combined with behavior therapy may be of great benefit to diabetic individuals, strengthening and encouraging their decision to sustain the therapeutic regime.³

Education, health promotion and access to information from health professionals was used in an attempt to bring about behavior change for the self-management of care in the group program. The dynamics used in the group education sessions provided a strong incentive

Table 2. Clinical aspects and results of the questionnaires for the patients who completed six months of the diabetes education program in three different moments ($n=57$). City of Belo Horizonte, Southeastern Brazil, 2006.

Variable	Beginning (n = 57)	3 months (n = 57)	6 months (n = 57)	P
Weight (kg)	74.7 ± 15.7	74.1 ± 13.7	74.5 ± 13.4	0,938
BMI (kg/m ²)	30.0 ± 6.4	29.8 ± 6.0	29.9 ± 6.0	0,956
Glycated hemoglobin (%)	9.3 ± 2.4 ^a	8.7 ± 2.6	7.8 ± 1.5 ^a	0,002
Self-care management	3.8 ± 0.8	3.7 ± 0.6	3.6 ± 0.6	0,641
Attitudes	66.8 ± 9.7	68.5 ± 9.6	69.8 ± 9.8	0,182
Knowledge of diabetes	9.2 ± 2.8 ^b	9.8 ± 2.7	10.6 ± 2.3 ^b	0,017
Quality of life	109.5 ± 18.4	111.4 ± 18.1	110.0 ± 18.1	0,825
Functional capacity	65.4 ± 23.9	68.6 ± 23.0	67.8 ± 24.4	0,721
Physical aspects	55.4 ± 40.9	49.6 ± 42.2	53.9 ± 41.4	0,853
Pain	55.2 ± 20.8	54.4 ± 22.0	57.4 ± 22.7	0,709
General state of health	66.9 ± 20.0	71.6 ± 20.8	65.2 ± 20.8	0,231
Vitality	56.0 ± 22.5	59.9 ± 22.7	58.4 ± 23.6	0,620
Social aspects	74.1 ± 25.0	67.9 ± 24.8	69.7 ± 29.3	0,421
Emotional aspects	63.7 ± 42.8	51.8 ± 43.1	53.2 ± 43.6	0,411
Mental health	65.1 ± 20.9	66.9 ± 22.8	67.6 ± 22.7	0,808

^{a,b} Statistically different groups ($p < 0.05$)

Table 3. Clinical aspects and results of the questionnaires for the patients being monitored in groups who completed six months of the program in three different moments (n=31). City of Belo Horizonte, Southeastern Brazil, 2006.

Variable	Beginning	3 months	6 months	p
Weight (kg)	71.7 ± 16.5	72.0 ± 13.2	73.7 ± 12.8	0.959
BMI (kg/m ²)	29.1 ± 7.0	29.5 ± 5.7	29.8 ± 5.6	0.979
Glycated hemoglobin (%)	9.3 ± 2.2 ^a	9.0 ± 2.9	7.6 ± 1.4 ^a	0.016
Self-care management	3.7 ± 0.9	3.7 ± 0.6	3.7 ± 0.5	0.993
Attitudes	65.2 ± 8.8	67.6 ± 8.2	69.5 ± 10.2	0.141
Knowledge of diabetes	8.6 ± 2.8	9.3 ± 2.7	10.2 ± 2.0	0.063
Quality of life	107.0 ± 17.8	110.0 ± 18.2	107.6 ± 18.0	0.746
Functional capacity	63.7 ± 25.2	68.2 ± 24.1	66.9 ± 22.2	0.701
Physical aspects	46.8 ± 39.7	46.7 ± 41.4	54.0 ± 40.4	0.648
Pain	52.2 ± 20.4	53.6 ± 21.7	55.6 ± 22.5	0.747
General state of health	64.3 ± 18.8	70.8 ± 18.5	63.9 ± 22.2	0.308
Vitality	52.1 ± 21.5	58.3 ± 22.9	56.0 ± 22.6	0.492
Social aspects	67.3 ± 26.0	63.3 ± 29.0	64.9 ± 33.0	0.862
Emotional aspects	52.7 ± 43.7	48.9 ± 41.7	45.2 ± 43.5	0.882
Mental health	65.9 ± 21.0	64.9 ± 23.1	64.1 ± 23.6	0.951

^a Statistically different groups (p < 0.05)

for diabetes education, because they were interactive, valued the reporting of experiences by the participants themselves and allowed everyone to take part in an integrating process for therapeutically controlling the disease better. The health professionals' use of games and appropriate language in the educational process allowed the patients to plan their meals better and comply with time schedules, the eating regime and the practice of physical activities. According to literature, building up new knowledge leads to the acquisition of preventive behavior and encourages individuals to understand their

problems and choose the appropriate solution for managing care of the disease.⁶ This process was possible with the patients who received individual attention, a process that valued the dialogue with the health professionals and also generated positive results.

Although not statistically significant, it was observed that contact time (time/months), the number of professionals and the number of group and individual education sessions brought about an improvement in knowledge and attitudes, favoring a change in the behavior of

Table 4. Clinical aspects and results of the questionnaires for the patients being monitored individually who completed the program in three different moments (n=31). City of Belo Horizonte, Southeastern Brazil, 2006.

Variable	Beginning	3 months	6 months	p
Weight (kg)	78.3 ± 14.1	75.6 ± 14.4	75.4 ± 14.3	0.718
BMI (kg/m ²)	31.0 ± 5.6	30.1 ± 6.5	30.0 ± 6.5	0.815
Glycated hemoglobin (%)	9.3 ± 2.6	8.4 ± 2.2	7.9 ± 1.6	0.071
Self-care management	3.9 ± 0.8	3.7 ± 0.6	3.6 ± 0.7	0.397
Attitudes	68.8 ± 10.6	69.5 ± 11.1	70.2 ± 9.4	0.815
Knowledge of diabetes	9.8 ± 2.7	10.4 ± 2.6	11.1 ± 2.6	0.224
Quality of life	112.4 ± 19.0	113.0 ± 18.3	112.9 ± 18.1	0.994
Functional capacity	67.3 ± 22.5	69.0 ± 22.1	68.8 ± 27.2	0.960
Physical aspects	66.0 ± 40.7	52.9 ± 43.8	53.8 ± 43.4	0.549
Pain	58.9 ± 21.1	55.3 ± 22.6	59.4 ± 23.2	0.769
General state of health	70.1 ± 21.2	72.5 ± 23.6	66.7 ± 19.5	0.617
Vitality	60.6 ± 23.3	61.7 ± 22.8	61.3 ± 24.8	0.984
Social aspects	82.2 ± 21.6	73.1 ± 17.9	75.5 ± 23.6	0.278
Emotional aspects	77.3 ± 38.2	55.1 ± 45.2	62.8 ± 42.5	0.236
Mental health	64.0 ± 21.2	69.2 ± 22.6	71.8 ± 21.3	0.420

individuals towards adhering to the diet and engaging in physical activities. For the health professionals it was encouraging to notice how education makes a difference in therapeutic treatment, thus constituting an important tool in its practice.¹¹

Weight and BMI did not reduce after the three and six month monitoring periods in either group. These findings are consistent with literature,¹ because such measures generally only show any improvement after a more prolonged period of education. However, the results showed an improvement in glycemetic control, as evidenced by the reduction in the HbA1c values only after six months of the program, proving that monitoring for a period of just three months is inadequate for this type of evaluation. In HbA1c reduction group education performed better than individual education.

In individual education it was seen that patients recognize diet and the regular practice of physical activities as important factors for controlling the disease, but they were not reported as habits that were practiced frequently by the majority. This was confirmed in the results of the average of the scores of the behavior change variable. Education and the transfer of knowledge is a difficult process, especially in the case of

DM, a disease that affects individuals of all ages, with different education levels and from different social and environmental backgrounds.⁶

The limitations of this study include the short monitoring period for evaluating the educational program, which should be longer than 12 months to better evaluate the effect of the intervention. However, if the monitoring period is increased, the number of drop-outs increases. These are generally limitations associated with the time of work and domestic chores.

Sample size may have been a limiting factor of this study, which prevented the detection of possible differences between the two educational strategies. Nevertheless, the proposed initiative, both in group and individually, is a potential alternative in the treatment of DM, which, when compared with conventional treatment, showed improvement and impact trends on HbA1c.

In conclusion, this study presents an evaluation structure of a DM education program that is useful for finding out its effects in the control of the disease and in managing self-care. Furthermore, it allows for discussion about the possible limits and improvement options in the health education process, associated with diabetes programs.

REFERENCES

1. American Diabetes Association. Diagnosis and classification of *diabetes mellitus*. *Diabetes Care*. 2007;30(Supl 1):S42-7.
2. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev*. 1977;84(2):191-215. DOI: 10.1037/0033-295X.84.2.191
3. Brown SA. Interventions to promote diabetes self- management: state of the science. *Diabetes Educ*. 1999;25:(Supl 6) 52-61 DOI:10.1177/014572179902500623
4. Campbell EM, Redman S, Moffitt PS, Sanson-Fisher RW. The relative effectiveness of education and behavioral instruction programs for patients with NIDDM: a randomized trial. *Diabetes Educ*. 1996;22(4):379-86. DOI: 10.1177/014572179602200412
5. Franz MJ, Warshaw H, Daly AE, Green-Pastors J, Arnold MS, Bantle J. Evolution of diabetes medical nutrition therapy. *Postgrad Med J*. 2003;79(927):30-5. DOI: 10.1136/pmj.79.927.30
6. Funnell MM, Anderson RM. Empowerment and self-management of diabetes. *Clin Diabetes*. 2004;22(3):123-7. DOI: 10.2337/diaclin.22.3.123
7. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med*. 2002;346(6):393-403. DOI: 10.1056/NEJMoa012512
8. Romero BB, Barceló A, Machado CA. Campanha nacional de detecção de casos suspeitos de *diabetes mellitus* no Brasil: relatório preliminar. *Rev Panam Salud Publica*. 2001;10(5):318-27. DOI: 10.1590/S1020-49892001001100005
9. Rosenstock IM. The health belief model: explaining health behavior through expectancies. In: Glanz K, Lewis FM, Rimer BK. Health behavior and health education: theory, research and practice. San Francisco: Jossey-Bass Publishers; 1990. p.39-62.
10. Torres HC, Hortale VA, Shall V. A experiência de jogos em grupos operativos na educação em saúde para diabéticos. *Cad Saude Publica*. 2003;19(4):1039-47. DOI: 10.1590/S0102-311X2003000400026
11. Torres HC, Hortale VA, Shall VT. Validação dos questionários de conhecimento (DKN-A) e atitude (ATT-19) de *Diabetes Mellitus*. *Rev Saude Publica*. 2005;39(6):906-11. DOI: 10.1590/S0034-89102005000600006
12. Ware JE, Kosinski M, Keller SD. SF-36 physical and mental health summary scales: a users manual. Boston: The Health Institute, New England Medical Center; 1994.
13. Welch G, Dunn, SM, Beeney LJ. The ATT39: a measure of psychosocial adjustment to diabetes. In: Bradley C, editor. Handbook of psychology and diabetes. Amsterdam: Harwood Academic Publishers; 2001. p.223-47.