ORIGINAL ARTICLE

Effect of peer education on self-management and psychological status in type 2 diabetes patients with emotional disorders

Yan Liu[1], Ying Han[1], Jieli Shi[1], Ruixia Li[1], Sufen Li[1], Nana Jin[1], Yong Gu[2], Honglei Guo[2,3]*

[1]General Hospital of Dagang Oilfield, [3]Key Laboratory of Hormones, Tianjin Medical University, Tianjin, and [2]The Fifth People's Hospital Of Shanghai, Fudan University, Shanghai, China

ABSTRACT

Aims/Introduction: The purpose of the present study was to assess the effect of peer education in type 2 diabetes patients with emotional disorders on the metabolic index and psychological status.

Materials and Methods: Educators use psychological scales to screen type 2 diabetes patients with emotional disorders. Participants were divided into usual and peer education groups. Both groups received usual diabetes education. Peer leaders were recruited to provide support with the peer education group for 6 months. The metabolic index, diabetes knowledge, self-management, diabetes-related distress, emotional status and quality of life were compared at the end of the study.

Results: A total of 127 patients participated in the study. There were 20 peer leaders engaged in the study as volunteers for peer education. All participants completed the study and fulfilled the scales. Improvements in the peer education group were significant compared with the usual education group with respect to anxiety (49.0 ± 9.65 vs 54.0 ± 8.48), depression (51.3 ± 7.97 vs 55.8 ± 7.52), diabetes knowledge (18.8 ± 2.46 vs 16.3 ± 2.08), distress (2.67 ± 0.55 vs 3.02 ± 0.56), self-management (66.5 ± 4.26 vs 62.4 ± 5.88) and quality of life (−1.98 ± 0.82 vs −2.50 ± 0.71), whereas no significant difference existed with respect to the metabolic index.

Conclusions: Peer education, providing more attention to diabetes patients with emotional disorders, is a preferred model for delivering care.

INTRODUCTION

Individuals with diabetes have a larger prevalence (40%) of mood disorders, especially related to depression and anxiety, compared with the population without diabetes[1]. These psychological barriers weaken the positive degree of self-management, self well-being and blood glucose adjustment[2]. Type 2 diabetes patients with depression have increased mortality, complications of diabetes and medical costs, as well as a reduced quality of life[3,4]. Previous studies[5–7] have shown that anxiety is adversely affected in diabetes patients, such as functional impairment, increased pain, diminished adherence to exercise and diet regimens, greater disability, worsened glycemic control, increased complications, low self-efficacy, and reduced quality of life. Patients are prone to neglect these mild affective disorders,

because there are no biomedical measures available to diagnose psychological barriers. In addition, patients prefer not to visit general practitioners for psychological issues, even if diagnosed with dysthymic depression or anxiety, and diabetologists in China cannot easily refer patients with emotional disorders to a psychologist when required.

Usual diabetes education (UDE) plays a significant role in glycemic control, thus preventing the risk of long-term complications[8]. The literature related to UDE has emphasized psychological support as an important strategy to improve clinical outcomes, while these studies have focused on the effectiveness of biomedical measures rather than psychological and emotional improvement. Peer education support (PES) can be implemented to complement diabetes education approaches in managing emotional disorders. PES provides emotional understanding, assessment tools and information from peer leaders

with similar conditions in relation to sharing experiential responses to various problems. This strategy can complement, supplement and extend formal diabetes education, and be instituted with non-hierarchical, reciprocal relationships[9]. Peer leaders can provide relevant and meaningful information, and assist in planning diabetes management for peer education receivers in daily life, including goal-setting, role playing and problem solving. Peer leaders can also provide social assistance, emotional support, positive encouragement and optimistic opinions. This flexible and proactive strategy is available as ongoing support[10]. Riddell *et al.*[11] reported that PES can heighten medical adherence and motivation, and improve the psychological status and quality of life compared with UDE; however, a unique design of PES is absent in populations with emotional disorders, and there are no special purposes studies relative to the effectiveness of PES in psychological and emotional profiles.

The aim of the present study was to develop a feasible and effective strategy to overcome these challenges and maintain behavioral health changes, and to implement and assess the effectiveness of PES compared to UDE in patients with diabetes and mild affective disorders.

MATERIALS AND METHODS
Study Design
All patients gave informed consent. Patients could withdraw at any time during the study. All personal information reviewed by the educators was strictly confidential.

The present study was a prospective controlled study of 6 months duration. Diabetes patients with mental disorders were enrolled in the General Hospital of Dagang Oilfield, Tianjin, China, and potential patients were screened with the Self-rating Depression Scale (SDS) and Self-rating Anxiety Scale (SAS). Participants were randomly divided into the peer education group (PEG) and usual education group (UEG). Randomization was carried out by an external agency using a computerized random number generator. According to the guidelines for diabetes control[12], the PEG received UDE and PES, whereas the UEG only received UDE, which was provided by educators who had attained the Certificate of Workshop Completion, a joint effort by Peers for Progress and Division of Diabetes Education and Management of Chinese Diabetes Society, and organized through Zhongda Hospital affiliated with Southeast University. The peer leaders matched the PEG to provide PES based on age, hobbies, residence zone and other factors. At the end of the study, participants in both groups were evaluated with respect to glycosylated hemoglobin (HbA1c), body mass index (BMI), blood pressure, diabetes knowledge, psychological status, self-management, distress and quality of life.

Recruitment
Participant Sample
All of the participants and peer leaders were residents of the Dagang Oilfield Community, and aged ≥45 years. Inclusion criteria included a diagnosis of type 2 diabetes, mild-to-moderate depression or anxiety according to SDS and SAS criteria, respectively, and signed informed consent. Patients were excluded for the following reasons: diagnosed with a severe psychiatric disorder; treatment with an antipsychotic; undergoing current psychosocial treatment; experienced a recent negative life event (within <3 months); known to have severe complications of diabetes; serious communication obstacles; and bedridden status.

Peer Leader Sample
Peer leaders met the following criteria: no psychological barriers; a >5-year history of type 2 diabetes; a HbA1c level <7.0% during the past 3 months; higher than senior middle school cultural level; enthusiastically participating in public activities; good interpersonal communication and organizational skills; willingness to bear the responsibility of peer education; and priority to the user of insulin.

Diabetes Education Program
The educators provided both groups with four diabetes health education lectures and relevant health knowledge materials. Peer leaders had to undergo six training sessions (2 h per training session) delivered by educators. Training methods included lectures and individual counseling. The training content focused on the relationship between blood glucose and diet, exercise, psychological status, emotions, and self-management. Peer leaders were trained to grasp organizational skills, be active listeners, develop non-judgmental communication skills, show expressive power and project charm. The educators used the Diabetes Knowledge Test (DKT) and Diabetes Self-care Scale (DSCS) to evaluate the knowledge of diabetes and self-management of the leaders, respectively. Peer leaders who passed written and oral examinations during the training were recruited as candidates.

During the study, peer leaders provided the patients in the PEG with diabetes self-care skills, emotional support, encouragement for lifestyle changes, and medication understanding and adherence. In addition, peer leaders exercised with peer members at least 150 min per week. Arrangements were made to share experience sessions; that is, group discussions on diabetes diet, medications, psychological adjustment, regular life and homemade recipes at least once per month. Peer leaders used indefinite media (telephone, SMS, e-mail and meetings) with the recipient once every 2 weeks to share experiences and lessons, focusing on providing psychological counseling and support, positive cues, communication with a pleasant interpersonal environment, and reminders of behavioral changes and regular healthy lifestyles. Peer leaders recorded the progress of each event, and could contact educators when problems occurred. The participants were encouraged to return their records to the educators monthly, who in turn reviewed the records on receipt and provided standardized feedback.

Data Collection

The educators carried out an interview to record the basic characteristics of the participants when consent was obtained. Laboratory measurements consisted of BMI, blood pressure, lipid profiles and HbA1c levels, and were collected through clinical information systems. Participants in both groups completed the DKT, DSCS, short-form Diabetes-related Distress Scale (DDS) and Audit of Diabetes Dependent Quality of Life (ADDQoL) before the intervention. At the end of the trial, participants provided the data, including the metabolic index, and questionnaire responses to the abilities for self-management, mentation and quality of life.

Measurements

SDS

The SDS[13] is a 20-item, self-reported questionnaire that is widely used clinically. Each item is scored on a scale of 1–4, with higher values corresponding to more frequent symptoms. The total score multiplied by 1.25 ranges from 25 to 100. The SDS has good validity. The internal consistency is 0.832 and the reliability coefficient of Chinese SDS is 0.898[14]. The cut-off point was set at 52, defined as negative depression; depression was divided into minimal-to-mild depression (53–62 points), moderate-to-marked depression (63–72 points) and severe-to-extreme depression (≥73 points).

SAS

The SAS was developed to assess the presence and degree of anxiety in adults with 20 items. Each item is scored from 1 to 4, corresponding to never or occasionally, sometimes, often and most of the time, respectively. A higher score represents more severe anxiety. The final score ranges from 25 to 100 with adjustment, weighted by 1.25. A score ≤49 is considered as negative anxiety, 50–59 reflects mild anxiety, 60–69 is classified as moderate anxiety and ≥70 is defined as severe anxiety. The SAS has been extensively validated, and psychometric evaluation has been carried out in the general Chinese population[15].

DKT

The DKT is a reliable and valid instrument, and consists of 23 questions[16,17]. The test consent is related to diet, exercise, self-monitoring, foot care, diabetes complications and insulin use. Each item is given one point. A total score >20 is defined as good, 15–20 is satisfactory and <15 is poor. The reliability of the DKT is 0.78, and Cronbach's alpha is 0.89 in China[18].

DSCS

The DSCS is used to evaluate the ability of self-management of patients. The scale consists of six dimensions and 26 items, including self-management on exercise, diet, medication adherence, self-monitoring, foot care and response to hyper- or hypoglycemics. Each item uses a five-point scale to measure how often the subject develops self-management. To analyze the

results, the test score is switched to a standard score, according to the following formula:

$$\text{Standard score} = \frac{\text{the test score}}{\text{the highest score}} \times 100$$

Wang et al.[19] reported that the Cronbach's α was 0.82, and the test–retest reliability was 0.95. According to the standard score, ≥80 points is good, 60–79 is satisfactory and <60 is poor.

Diabetes Distress Scale

Polonsky et al.[20] developed the 17-item DDS with four dimensions, including emotional burden (five items), physician-related distress (four items), regimen-related distress (five items) and interpersonal distress (three items). The responses to each item are scored on a six-point frequency scale from 'not a problem' to 'a very serious problem.' Moderate distress (≥3) reflects a need for clinical attention. The content validity method was used to validate the scale, and the internal reliability of the scale and its four subscales are adequate (α = 0.77)[21].

ADDQoL

The ADDQoL is a diabetes-specific instrument comprised of 19 domain items. The participants were asked to rate how their lives would be if they were not affected by diabetes. The participants scored the impact on life, ranging from greatest negative impact (−3) to 0 (no impact) to positive impact (+1), and importance ranging from not at all important (0) to very important (+3)[22]. The impact of diabetes on each domain was then weighted by the importance of the domain. The sum of the raw scores was averaged across all applicable domains to generate a final average weighted impact score. A single final ADDQoL average weighted impact score ranged from −9 to +3. More negative scores reflect a more negative impact of quality of life on participants. Pre-studies[23,24] showed that the ADDQoL has good reliability and construct validity.

Statistical Analysis

Two-tailed tests and an α of 0.05 were used for two-group comparisons. The study design was a two-factor repeated measures design. Descriptive statistics were used to assess the demographic and diabetes care-related characteristics of the sample. Independent t-tests were used for continuous variables, and χ^2-tests were used for categorical variables to compare baseline characteristics and diabetes knowledge, self-management, and psychology at the 6-month follow up, indicating improvements by bar graphs compared with baseline. Measurement items, such as metabolic indexes and self-reported scores, were compared between two groups and two time-points. Statistical methods, such as repeated-measures ANOVA, were used before post-hoc comparisons. The degree of engagement with each intervention was reported, as measured by the percentage of attendance in the group education curriculum and peer activities.

RESULTS

Characteristics of the Samples

A total of 536 outpatients were screened using special psychological self-assessment scales. There were 187 eligible patients, 42 of whom were excluded because of the inclusion and/or exclusion criteria. A total of 18 patients declined to participate in the trial, thus leaving 127 patients for enrolment. The patients were randomly distributed into two groups (PEG, $n = 63$; UEG, $n = 64$). A total of 20 peer leaders participated in the study as volunteers for peer support. The basic characteristics of the participants are shown in Table 1.

Outcomes Analysis

All participants completed the study. During the study, two peer leaders were withdrawn, one who was hospitalized for an acute myocardial infarction and one who had migrated. Two replacement peer leaders were recruited. The PEG had higher attendance in group education (85%) than the UEG (74%), whereas the mean number of attendances did not differ between the two groups. There were no significant differences in metabolic indicators and self-reported scales, such as SDS, SAS, DKT, DSCS, DDS and ADDQoL, between the PEG and UEG at baseline. At the end, differences in all self-reported scales were significant between pretest and post-test in the PEG ($P < 0.05$), whereas no differences were found in the UEG, shown in Table 2.

Comparison of Metabolic Indicators

There were no significant differences in HbA1c levels, BMI, lipid profiles and blood pressures between the groups after 6 months. Both groups had a slight decline in the HbA1c level, without a significant decline compared with baseline data ($P > 0.05$); however, in stratified analyses of the population with a high baseline HbA1c level (>8.0%), patients in the PEG had a mean decrease of 0.67% at the post-test compared with 0.21% among patients in the UEG (between-group difference at the post-test, 0.54%; $P < 0.05$). Finally, 31 (49%) patients had a reduction in HbA1c levels compared with baseline in the PEG.

Changes in Diabetes Knowledge

Diabetes knowledge was statistically different between the UEG (16.3 ± 2.08) and PEG (18.8 ± 2.46) at the end-point ($P < 0.05$). A total of 42 (66.7%) and 20 (31.3%) patients achieved a good level in the PEG and UEG, respectively. There

Table 1 | Characteristics of participants at baseline

Characteristics	All participants	UEG	PEG	t/χ^2	P
n	127	64	63		
Sex (male)	63	36	27	2.28	0.13
Mean age (years)	63.3 ± 5.74	64.1 ± 4.73	62.6 ± 6.33	1.37	0.17
Duration of diabetes (years)	10.1 ± 6.48	10.5 ± 6.36	9.8 ± 6.57	0.67	0.50
Smoking	49	23	26	0.38	0.54
>High school education	45	24	21	0.24	0.62
Insurance	116	60	56	0.95	0.33

PEG, peer education group; UEG, usual education group.

Table 2 | Comparison of metabolic indexes, emotion and quality of life

Index	UEG ($n = 64$)	PEG ($n = 63$)
HbA1c (%)		
Baseline	7.39 ± 1.07	7.34 ± 1.15
Follow up	7.26 ± 0.87	7.28 ± 0.97
ΔHbA1c (%)†	0.20 (0.98)	0.10 (0.80)
BMI (kg/m^2)		
Baseline	24.7 ± 2.69	24.5 ± 2.72
Follow up	24.8 ± 2.67	24.5 ± 2.60
Cholesterol (mmol/L)		
Baseline	5.03 ± 0.82	5.01 ± 1.01
Follow up	5.01 ± 0.93	4.95 ± 1.00
Triglycerides (mmol/L)		
Baseline	1.55 ± 0.01	1.44 ± 0.48
Follow up	1.50 ± 0.50	1.39 ± 0.45
SBP (mmHg)		
Baseline	133 ± 12.2	137 ± 15.8
Follow up	137 ± 12.7	138 ± 17.8
DBP (mmHg)		
Baseline	79 ± 6.52	80 ± 8.78
Follow up	77 ± 5.90	76 ± 10.81
SAS		
Baseline	55.7 ± 5.03	54.2 ± 5.54‡
Follow up	54.0 ± 8.48	49.0 ± 9.65§
SDS		
Baseline	57.8 ± 4.25	57.7 ± 3.87‡
Follow up	55.8 ± 7.52	51.3 ± 7.97§
DKT		
Baseline	15.0 ± 3.48	14.8 ± 3.41‡
Follow up	16.3 ± 2.08	18.8 ± 2.46§
DDS		
Baseline	3.14 ± 0.89	3.18 ± 0.19‡
Follow up	3.02 ± 0.56	2.67 ± 0.55§
ADDQoL		
Baseline	-2.52 ± 0.90	-2.53 ± 0.78‡
Follow up	-2.50 ± 0.71	-1.98 ± 0.82§

ADDQoL, Audit of Diabetes-dependent Quality of Life; BMI, body mass index; DBP, diastolic blood pressure; DDS, Diabetes Distress Scale; DKT, Diabetes Knowledge Test; HbA1c, glycated hemoglobin; SAS, Self-rating Anxiety Scale; SBP, systolic blood pressure; SDS, Self-rating Depression Scale. Data presented as mean ± standard deviation. †Median (interquartile range); Wilcoxon rank sum test was used for heterogeneity of variance (z). ‡Significant change at baseline compared with follow-up in the peer education group (PEG; $P < 0.05$). §Significant change in the usual education group (UEG) compared to the PEG at follow-up ($P < 0.05$).

were six (9.5%) and 13 (20.3%) patients with diabetes knowledge scores <15, which was considered to be a poor level, at the end-point in the PEG and UEG, respectively. Patients in both groups had lower scores (accuracy rate <50%) in several items related to diet, including sugar-free foods, low-glycemic index foods and fat-free foods.

Difference in Self-Management

The total score of self-management between the UEG and PEG was statistically different in the end. The difference between baseline and follow up in the PEG is shown in Table 3. The self-management of patients identified as good was 12 (18.8%) and 25 (39.7%) in the UEG and PEG, respectively. Most patients had general self-management capacity (53.1 and 46.0%, respectively). In these six dimensions, medicine adherence had the highest standard score (76.7) in the UEG, whereas patients in the PEG had the best self-care on exercise (standard score 84.4). The minimum standard score in the self-monitoring dimension was regarded as poor (49 and 50.5, respectively). The comparison between the PEG and UEG was statistically different in the dietary dimension and the managing hyper- or hypoglycemics dimension ($P < 0.05$). In contrast, participants in the PEG reported improvements in the exercise dimension relative to the UEG ($P < 0.01$) because of the frequency of activities organized by peer leaders. Both groups showed similar outcomes in the dimension of self-monitoring and medicine adherence with no significant differences. Patients in both groups had limited improvement on the foot care dimension, and were still considered as poor, although the PEG had significant changes compared with the UEG ($P < 0.01$).

Table 3 | Score of three groups on self-management

Dimension	Time	UEG ($n = 64$)	PEG ($n = 63$)
Self-care Score	Baseline	62.0 ± 6.04	62.6 ± 7.39
	Follow up	62.4 ± 5.88	66.5 ± 4.26
Exercise	Baseline	75.7 ± 6.65	76.0 ± 9.46†
	Follow up	74.5 ± 6.90	84.0 ± 5.60‡
Dietary	Baseline	62.0 ± 7.95	61.9 ± 7.60†
	Follow up	62.7 ± 4.93	65.7 ± 4.07‡
Medicine adherence	Baseline	76.1 ± 8.47	76.6 ± 6.97
	Follow up	76.7 ± 8.40	78.0 ± 9.00
Self-monitoring	Baseline	48.8 ± 7.71	49.6 ± 6.49
	Follow up	49.0 ± 9.01	50.5 ± 5.40
Foot care	Baseline	51.38 ± 6.01	51.9 ± 7.88†
	Follow up	51.2 ± 7.24	69.0 ± 6.40‡
Care on hyper- or hypoglycemics	Baseline	64.8 ± 5.72	65.5 ± 4.84†
	Follow up	66.5 ± 11.3	71.5 ± 6.95‡

Data presented as mean ± standard deviation. †Significant change at baseline compared to follow-up in the peer education group (PEG; $P < 0.05$). ‡Significant change in the usual education group (UEG) compared with the PEG at follow up ($P < 0.05$).

Improvement in Psychological Status, Distress and QoL at Follow Up

The total SAS and SDS scores had improved outcomes in both groups. The percentage of negative anxiety and depression was 15.6% vs 36.5%, and 9.3% vs 27.0%, in the UEG and PEG, respectively. The remaining belonged to more than mild anxiety or depression. In addition, the PEG had a statistically significant improvement in negative anxiety ($\chi^2 = 6.64$, $P < 0.05$) and depression ($\chi^2 = 7.20$, $P < 0.05$) compared with the UEG. The PEG reported improvements in SAS and SDS relative to the baseline visit and the UEG ($P < 0.05$).

A significant change in DDS was observed in the PEG compared with the baseline visit and the UEG ($P < 0.05$). There was a significant reduction in emotional burden for the PEG compared with the UEG ($P < 0.01$); a similar reduction was observed in regimen-related distress. Interpersonal and physician-related distress decreased in both groups compared with the baseline visit, but did not reach a significant difference between the groups ($P > 0.05$). Improvement was found in the PEG compared with the baseline visit. The PEG maintained a positive effect on the quality of life with a significant difference compared with the UEG ($P < 0.05$). Figure 1 shows the improvements in scores at the 6-month follow up relative to baseline.

DISCUSSION

The current study focused on the effectiveness of peer education in diabetes patients with emotional disorders. This study showed that PES could improve self-management, affect and the quality of life in diabetes patients with emotional disorders.

Glycemic control can be improved through lifestyle changes; for example, the release of psychological stress and raised self-management skills. Previous studies[25–28] have shown that a high level of HbA1c at baseline (HbA1c >8.0%) reduced eligible participants because of the exclusion criteria. Heisler et al.[27] reported that a higher HbA1c level contributed to a more significant reduction. The outcomes of glycemic control are consistent with those of other studies issued on peer education for diabetes patients without mood disorders, which have also failed to show a significant difference in glycemic control[29–33]. Those studies examining peer education have targeted patients with a HbA1c <7.5%, and such patients would not benefit from peer education intervention, although they had improved lifestyle changes. Philis-Tsimikas et al.[34] even showed that populations with a higher risk for developing diabetes had a small, but statistically significant, increase (0.09%) in HbA1c after peer education. In stratified analyses of patients with high baseline HbA1c levels (>8.0%), patients in the PEG had a significant reduction compared with the UEG, showing that PES could be mainly effective in improving glycemic control if targeted to populations with higher HbA1c levels (>8.0%). There was also no effect on the BMI, triglyceride and cholesterol levels, and blood pressure in the PEG compared with the UEG, but this
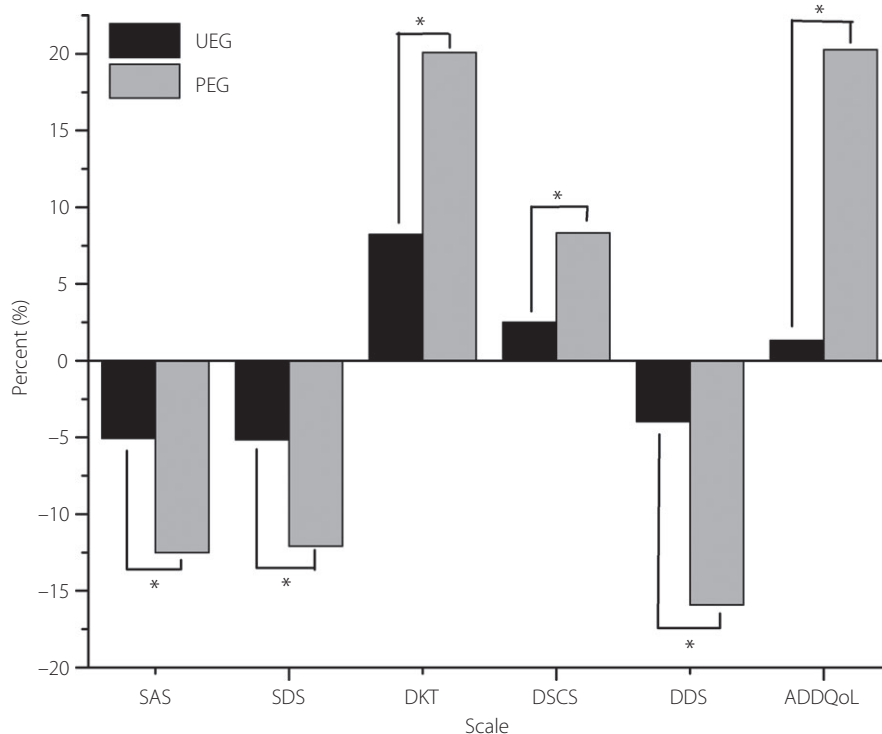
Figure 1 | The improvements of percentage change at follow up relative to baseline (*$P < 0.05$). ADDQoL, Audit of Diabetes Dependent Quality of Life; DDS, Diabetes-related Distress Scale; DKT, Diabetes Knowledge Test; DSCS, Diabetes Self-care Scale; PEG, peer education group; SAS, Self-rating Anxiety Scale; SDS, Self-rating Depression Scale; UEG, usual education group.

might be attributed to a 'floor effect,' with an average mean in normal range at the baseline visit, there was little room left for improvement. Another explanation attributed to the negative outcomes of the metabolic index could be associated with the seasons (autumn and winter), in which the research was implemented, with diverse Chinese traditional festivals and feasts, filled with delicious sweets, greasy foods and wine. The freedom to enjoy nutritional supplements in winter plays a significant role in the quality of life in the Chinese traditional culture[35,36], which serves as a barrier to preventing patients from carrying out self-management of diet. The feedback, reflecting higher blood glucose levels in those particular periods, corresponded to this phenomenon. Self-management was ascertained by self-report; those patients might actually have poorer behavioral change than their reports. Previous studies[30,31,37] have found improvements in depression and psychological well-being similar to the improvement noted in diabetes patients with emotional disorders in the current study. These results might be credited to a relaxed, pleasant environment provided by peer leaders, which increased patient safety, stability and a sense of belonging. Patients were enthusiastic about participating in the self-management of diabetes, which is beneficial in facilitating adherence to the lifestyle changes and mental adjustment recommended as part of their medical regimen. Peer leaders provided positive feedback, actively exchanging and sharing with the patients, listening to the patients, and strengthening communication, all of which were conducive to the patients emerging from a depressed mood and mental instability. Peer leaders also improve the psychological adjustment capability, and a psychological intervention delivered to diabetes patients leads to psychological improvement[38]. Patients involved in activities and collective motion were likely to vent their negative emotions, and to divert their attention rather than focusing on diabetes itself. Patients would positively face reality, take the initiative to participate in glycemic control and self-management, expand communication, and make life more fun.

PES prompted patients to learn the successful experience and skills of self-management, and promoted patients with low positive horizontal phase transition to a high level[31]. The peer education recipients would emulate effective self-management from providers to participate in formulation and self-monitoring, and diet and exercise plan activities, so as to improve self-confidence. The emotional foundation commiserated between the patients helped the recipients who were more vulnerable to receive comfort, positive feedback, establish role models and receive emotional support from supporters, thereby enhancing self-efficacy[35,39]. With a pleasant companion and an educational environment, the opportunity existed for the patient to talk about pain, trouble, feelings and more emotional communication, so that patients felt a sense of belonging and identity, which was conducive to cultivating a good attitude and a positive psychological state.

There were several limitations to the present study. During the experiment, there was no comparison of peer leaders for biochemical and psychological assessments. The influence of members with depression or anxiety on peer leaders could not be ascertained, whereas peer leaders might learn more about diabetes and could serve as a peer to others[40,41]. Peer leaders were selected based on ability, and might be less convincing than leaders produced in the group, so as to affect the effect of activities. Depression and anxiety were not carried out in separate studies. The PEG could lead to different outcomes in anxiety and depression, and thus might confuse the results of the study, this requires further study.

A potential reason why PES was superior to UDE was related to the timing of the delivery of communications and encouragement, more attention, and a relaxed environment. More intensive follow up on patients would be beneficial. PES is the preferred model for delivering care for diabetes patients with emotional disorders to improve their mental status.

ACKNOWLEDGMENTS

REFERENCES
1. Weinger K, Lee J. Psychosocial and psychiatric challenges of diabetes mellitus. *Nurs Clin North Am* 2006; 41: 667–680.
2. Ciechanowski PS, Katon WJ, Russo JE. Depression and diabetes: impact of depressive symptoms on adherence, function, and costs. *Arch Intern Med* 2000; 160: 3278–3285.
3. Zhang X, Norris SL, Gregg EW, *et al.* Depressive symptoms and mortality among persons with and without diabetes. *Am J Epidemiol* 2005; 161: 652–660.
4. Simon GE, Katon WJ, Lin EH, *et al.* Diabetes complications and depression as predictors of health service costs. *Gen Hosp Psychiatry* 2005; 27: 344–351.
5. Grigsby AB, Anderson RJ, Freedland KE, *et al.* Prevalence of anxiety in adults with diabetes: a systematic review. *J Psychosom Res* 2002; 53: 1053–1060.
6. Gendelman N, Snell-Bergeon JK, McFann K, *et al.* Prevalence and correlates of depression in individuals with and without type 1 diabetes. *Diabetes Care* 2009; 32: 575–579.
7. Collins MM, Corcoran P, Perry IJ. Anxiety and depression symptoms in patients with diabetes. *Diabet Med* 2009; 26: 153–161.
8. Ellis SE, Speroff T, Dittus RS, *et al.* Diabetes patient education: a meta-analysis and meta-regression. *Patient Educ Couns* 2004; 52: 97–105.
9. Dennis CL. Peer support within a health care context: a concept analysis. *Int J Nurs Stud* 2003; 40: 321–332.
10. Fisher EB, Boothroyd RI, Coufal MM, *et al.* Peer support for self-management of diabetes improved outcomes in international settings. *Health Aff* 2012; 31: 1–139.
11. Riddell MA, Renwick C, Wolfe R, *et al.* Cluster randomized controlled trial of a peer support program for people with diabetes: study protocol for the Australasian peers for progress study. *BMC Public Health* 2012; 12: 843.
12. Chinese Medical Association. Chinese Type 2 Diabetes Prevention Guide 2010, 1st edn. Peking University Medical Press, Beijing, 2010 (Chinese).
13. Zung WW. A self-rating depression scale. *Arch Gen Psychiatry* 1965; 12: 63–70.
14. Yang J, Li SJ, Zheng YL. Predictors of depression in Chinese community-dwelling people with type 2 diabetes. *J Clin Nurs* 2009; 18: 1295–1304.
15. Kong LP, Cui Y, Qiu YF, *et al.* Anxiety and depression in parents of sick neonates: a hospital-based study. *J Clin Nurs* 2013; 22: 1163–1172.
16. Fitzgerald JT, Funnel MM, Hess GE, *et al.* The reliability and validity of a brief diabetes knowledge test. *Diabetes Care* 1998; 21: 706–710.
17. Chen AL, Zhang ZL, Liao ZH, *et al.* Self-management and quality of life in patients with diabetes mellitus. *Chin J Behav Med Sci* 2006; 5: 434–436. Chinese
18. Hu J, Gruber KJ, Liu H, *et al.* Diabetes knowledge among older adults with diabetes in Beijing, China. *J Clin Nurs* 2012; 22: 51–60.
19. Wang JS, Wang RH, Ling CC. Self-care behaviors and related factors in outpatients newly diagnosed with non-insulin-dependent diabetes mellitus. *J Nurs* 1998; 45: 60–75 (Taiwan).
20. Polonsky WH, Fisher L, Earles P, *et al.* Assessing psychosocial distress in diabetes: development of the diabetes distress scale. *Diabetes Care* 2005; 28: 626–631.
21. Ting RZ, Nan H, Yu MW, *et al.* Diabetes-related distress and physical and psychological health in chinese type 2 diabetic patients. *Diabetes Care* 2011; 34: 1094–1096.
22. Soon SS, Goh SY, Bee YM, *et al.* Audit of Diabetes-Dependent Quality of Life (ADDQoL) [Chinese Version for Singapore] questionnaire: reliability and validity among Singaporeans with type 2 diabetes mellitus. *Appl Health Econ Health Policy* 2010; 8: 239–249.
23. Bradley C, Todd C, Gorton T, *et al.* The development of an individualized questionnaire measure of perceived impact of diabetes on quality of life: the ADDQoL. *Qual Life Res* 1999; 8: 79–91.
24. Ashwell SG, Bradley C, Stephens JW, *et al.* Treatment satisfaction and quality of life with insulin glargine plus insulin lispro compared with NPH insulin plus unmodified human insulin in individuals with type 1diabetes. *Diabetes Care* 2008; 31: 1112–1117.
25. Moskowitz D, Thom DH, Hessler D, *et al.* Peer coaching to improve diabetes self-management: which patients benefit most? *J Gen Intern Med* 2013; 28: 938–942.
26. Philis-Tsimikas A, Fortmann A, Lleva-Ocana L, *et al.* Peer-led diabetes education programs in high-risk mexican

americans improve glycemic control compared with standard approaches. *Diabetes Care* 2011; 34: 1926–1931.

27. Heisler M, Vijan S, Makki F, *et al.* Diabetes control with reciprocal peer support versus nurse care management. *Ann Intern Med* 2010; 153: 507–515.

28. Rogers EA, Hessler DM, Bodenheimer TS, *et al.* Diabetes peer coaching: do 'better patients' make better coaches? *Diabetes Educ* 2014; 40: 107–115.

29. Cade JE, Kirk SF, Nelson P, *et al.* Can peer educators influence healthy eating in people with diabetes? Results of a randomized controlled trial. *Diabet Med* 2009; 26: 1048–1054.

30. Heisler M, Piette JD. 'I help you, and you help me': facilitated telephone peer support among patients with diabetes. *Diabetes Educ* 2005; 31: 869–879.

31. Lorig K, Ritter PL, Villa FJ, *et al.* Community-based peer-led diabetes self-management: a randomized trial. *Diabetes Educ* 2009; 35: 641–651.

32. Smith SM, Paul G, Kelly A, *et al.* Peer support for patients with type 2 diabetes: cluster randomised controlled trial. *BMJ* 2011; 342: d715.

33. Baksi AK, Al-Mrayat M, Hogan D, *et al.* Peer advisers compared with specialist health professionals in delivering a training programme on self-management to people with diabetes: a randomized controlled trial. *Diabet Med* 2008; 25: 1076–1082.

34. Philis-Tsimikas A, Fortmann AL, Dharkar-Surber S, *et al.* Dulce Mothers: an intervention to reduce diabetes and cardiovascular risk in Latinas after gestational diabetes. *Transl Behav Med* 2014; 4: 18–25.

35. Guo H, Tian X, Li R, *et al.* Reward-based, task-setting education strategy on glycemic control and self-management for low-income outpatients with type 2 diabetes. *J Diabetes Investig* 2014; 5: 410–417.

36. Yang W. Changing characteristics of the type 2 diabetes epidemic of China and other Asian countries. *J Diabetes Investig* 2013; 4: 223–224.

37. van der Wulp I, de Leeuw JR, Gorter KJ, *et al.* Effectiveness of peer-led self-management coaching for patients recently diagnosed with Type 2 diabetes mellitus in primary care: a randomized controlled trial. *Diabet Med* 2012; 29: e390–e397.

38. Ismail K, Maissi E, Thomas S, *et al.* A randomised controlled trial of cognitive behaviour therapy and motivational interviewing for people with type 1 diabetes mellitus with persistent sub-optimal glycaemic control: a Diabetes and Psychological Therapies (ADaPT) study. *Health Technol Assess* 2010; 14: 1–101.

39. Ghorob A, Vivas MM, De Vore D, *et al.* The effectiveness of peer health coaching in improving glycemic control among low-income patients with diabetes: protocol for a randomized controlled trial. *BMC Public Health* 2011; 11: 208.

40. Jiang YD, Shiu RS, Chuang LM, *et al.* Is the development of a diabetes care system important for quality care? An analysis in Taiwan. *J Diabetes Investig* 2011; 2: 79–81.

41. Paul G, Keogh K, D'Eath M, *et al.* Implementing a peer-support intervention for people with type 2 diabetes: a qualitative study. *Fam Prac* 2013; 30: 593–603.