

## Results of Two Strategies for Peer-Support in Patients with Recently Diagnosed Type 2 Diabetes

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### ABSTRACT

**Objective:** To investigate whether a peer-support (PS) program at-distance (PSAD) helps maintain metabolic and mental health in patients with a recent diagnosis of type 2 diabetes (T2DM) after a multidisciplinary intervention.

**Methods:** Patients were randomized in PSAD and PS face-to-face groups (PSFF). Leaders were selected if they accomplished the eligibility criteria such as metabolic control and mental health department approval.

**Results:** We included 133 patients divided into three groups, at-distance (n=62), face-to-face (n=59), and leaders (n=12). Patients in the PSFF had higher odds of reaching glycemic targets at three months than PSAD (OR 2.52 95%CI 1.18-5.38, p=0.01) and improved scores in Diabetes Quality of Life Measure (DQoL) and empowerment.

**Conclusion:** PS increases long-term empowerment and decreases problem areas in T2DM, which increases the likelihood of achieving HbA1c target goals, LDL-C control, and promotes weight loss.

### Keywords

Type 2 diabetes, peer-support, metabolic control, mental health, at-distance intervention, face-to-face intervention.

### Introduction

Over the last decade, type 2 diabetes (T2DM) has been recognized as a global health problem of epidemic proportions. The latest National Survey of Health in Mexico (2018) revealed an increase in the prevalence of 10.3% in T2DM (9.2% in 2012) [1].

T2DM self-control is emotionally and physically exhausting and demands a lifelong commitment to lifestyle modification and medication adherence. One of the health system's biggest challenges is to offer sufficient care to patients when staff is

limited. On many occasions, the follow-up consultations are so prolonged, and the patient may feel abandoned and unprotected, which jeopardizes the control of the disease [2].

Peer support (PS) is defined as the support provided by the person who has knowledge from his own experiences with a chronic condition or is affected by the chronic disease. This allows patients to connect to others who have had similar experiences to solve the problems caused by the lack of time for the health professional to answer all patients' questions and provide sufficient support for self-management [3,4].

Previous studies have examined the effects of PS on self-efficacy and quality of life (QoL) in adults with T2DM, but the results have not been conclusive [5]. PS offers an increasingly

considered approach [5], due to the transfer of experiential knowledge of specific behavior between groups of people who share characteristics [6]. PS has been recommended as a strategy to improve long-term self-management [7].

We designed two PS programs held between annual evaluations to maintain metabolic control and learned behaviors, one of them with a program of scheduled face-to-face sessions and another group of messages in group chat. We aim to compare the effects in the at-distance program and the traditional face-to-face program to maintaining metabolic and mental health in patients with a recent diagnosis of T2DM after a multidisciplinary intervention.

## Material and Methods

The study was conducted at the CAIPaDi (term in Spanish for *Center of Comprehensive Care for the patient with Diabetes*). The CAIPaDi model is described elsewhere [8,9]. In short, this is a multidisciplinary program consisting of sessions held by 9 specialists (diabetes educators, nutritionists, foot care specialists, physical activity specialists, dentists, ophthalmologist/optometrist, psychologists, psychiatrists, and endocrinologists). The program comprises 2 stages. The first stage consists of four monthly visits. Then, patients continue their treatment with their treating physician. In the second stage, patients return to CAIPaDi for annual evaluations with the nine specialists. For every visit, health professionals follow specific protocols for individualized interventions. The CAIPaDi model and the PS programs were approved by the Institutional Ethics and Research Committees (ref 1198 and 1853) and registered in ClinicalTrials.gov (NCT02836808 and NCT03294265). All patients signed an informed consent form. We conducted a randomized, open, controlled interventional study based on the patients attending a PS program. Patients and leaders were randomized by random numbers by excel.

## Study population

**Leader selection:** Group leaders were selected if they completed 1 or 2 years of follow-up (second phase) in the CAIPaDi program, maintained adequate metabolic control (HbA1c <6.5%, BP <130/80mmHg, LDL <100mg/dl), had good health-literacy (in T2DM) with good interpersonal skills (group management skills) and demonstrated self-motivation, flexibility and good problem-

solving skills. They were given an informed consent form before a seven-week training to enhance knowledge and group management skills. The topics were grief and motivation stages, nutritional program, exercise program, self-care activities, and the knowledge of metabolic parameters (Table 1).

**Patient selection:** Patients were invited to participate after completing the first phase of the CAIPaDi program, regardless of whether they had good or poor metabolic control. They were given an informed consent form before the randomization in control and intervention groups.

## Peer support interventions

### Maneuver

- Control group, peer-support face-to-face groups (PSFF): It was designed with two leaders and eight patients in each group. Group sessions were delivered at the CAIPaDi every two months, in which the topics were the same as during the team leader training. These sessions were directed by team leaders and were observed by only one of the CAIPaDi staff to guarantee that all the information was clear. Besides, nutrition and exercise workshops were given every three months (interchangeable between exercise and nutrition). To obtain information, in every session, a questionnaire was applied to analyze evolution through the sessions. The sessions were completed in nine months. In every visit, leaders and patients in the PSFF group had blood samples, anthropometric evaluations, and mental health surveys.

- Intervention group, peer-support program at-distance (PSAD): It was designed with ten patients in each WhatsApp group chat in which a weekly text was sent concerning T2DM care and self-care activities. In these groups, a member of the CAIPaDi staff was included to keep the information related to the chat's main topics. To collect data, we designed an online questionnaire in which we could get information about their evolution. Every three months, electronic surveys were sent for evaluation. Patients were asked to send their blood sample results, anthropometric evaluations, and blood pressure (BP).

### Biochemical tests and questionnaires

Blood samples included fasting concentrations of glucose, lipids (low-density lipoprotein cholesterol [LDL-c]), and glycosylated

**Table 1:** Topics in the training course for leaders and during PS sessions.

Training course topic	PS sessions	PS messages
Grief and motivation stages	Grief and motivation stages	"Identify your weakest area in your self-care, put your mind to it and make it better"
Adherence to the nutritional program	Adherence to the nutritional program	"When making snacks, mix two different groups of food like: carbohydrates and protein"
Adherence to the exercise program	Adherence to the exercise program	"Achieve 10,000 steps per day or more to increase your level of physical activity"
Maintaining self-care activities	Maintaining self-care activities	"¿What have you done to take care of your feet today? There is plenty to do to keep your feet healthy"
Knowledge of metabolic parameters	Knowledge of metabolic parameters	"Remember: your HbA1c must be below 6.5% to be in control"
Workshop 1. How to manage group sessions	Workshops (every 4 months) • Exercise routines for home or office • Healthy recipes for easy/quick cooking	"Do not change your medical prescription without consulting your physician" "In winter season apply the seasonal flu vaccine"

**Abbreviations:** PS: *peer-support*

hemoglobin (HbA1c) (Bio-Rad Variant II Turbo HbA1c Kit 2, with HPLC method; the laboratory is certified by ISO 90001:2015 and the College of American Pathologists). Anthropometry was assessed by bioimpedance (Body composition analyzer JAWON medical ioi353). Validated questionnaires were applied in visits to the Center, and also via electronic survey for: empowerment (The Diabetes Empowerment Scale-Short Form [DES-SF]) [10], anxiety and depression symptoms (Hospital Anxiety and Depression Scale [HADS] (considering abnormal eight or more points) [11,12], QoL (Diabetes Quality of Life Measure [DQoL]) [13,14], and diabetes-specific emotional distress (Problem Areas in Diabetes Questionnaire [PAID]) [15].

### Main outcome measures

Achievement of treatment goals defined as: HbA1c <6.5%, LDL-c <100mg/dl, triglycerides <150 mg/dl, and BP <130/80mmHg), obtain lower scores in HADS, PAID, DQoL and DES-SF instruments.

### Statistical analysis

Frequency distribution of categorical variables are reported as frequencies and percentages and was compared between groups using chi-squared tests. To evaluate inter-group differences in sociodemographic and biochemical measures, we used one-way ANOVA with Fisher's LSD post-hoc test to correct for multiple comparisons or Kruskal-Wallis with post-hoc Dunn's test with Bonferroni correction, where appropriate. We used Student's paired t-test and Wilcoxon's rank-sign tests for measurements in follow-up studies, where applicable. Logarithmic transformations were applied to approximate normality in those variables showing a non-parametric distribution. Data are presented as mean ± SD or as median and interquartile range.

To evaluate the impact of PS in metabolic parameters and control, we calculated delta (Δ) values to assess longitudinal changes in metabolic and psychologic parameters. Furthermore, we performed linear regression analysis for continuous variables (eg HbA1c,

LDL-c, Body Mass Index [BMI]) and logistic regression analysis for dichotomized variables assessing the effect of PS on defined outcomes (eg HbA1C <6.5%, LDL-C <100mg/dL). Finally, to evaluate longitudinal transitions between BMI phenotypes across groups, we assessed the outcomes using McNemar's test. Statistical analyses were performed using the Statistical Package for Social Sciences software (SPSS, version 21.0) and Graph Pad Prism version 6.0.

## Results

### Study subjects

We analyzed the characteristics of 133 patients divided into three groups, PSAD (n=62), PSFF (n=59), and leaders (n=12). There were no significant differences concerning age, sex, blood test results, or anthropometric parameters at baseline between groups (Table 2). There were also no significant differences concerning baseline DQoL, DES-SF, HADS, and PAID scores. Forty-seven patients responded to at least one of the tri-monthly questionnaires sent electronically. If patients did not answer any of the questionnaires, data were obtained from their next annual visit. When comparing response rates between groups, we observed a higher rate in leaders (58.3%), followed by PSFF (49.2%) and PSAD (29.0%) groups. We observed a significantly higher response rate in leaders and patients in PSFF compared with PSAD (p=0.03), but no significant differences between leaders and patients in PSFF (p=0.56). Of the patients in the PSFF group, 80.7% completed the face-to-face program sessions. They were more likely to send their tri-monthly metabolic parameters and psychological well-being reports than the PSAD group (OR 2.36 95%CI 1.18-5.00, p=0.02).

### Comparison of biochemical and changes across visits

We did not observe significant differences in crude comparisons when comparing changes in blood test results and anthropometric parameters between groups. After two years, individuals in the PSFF group experienced more stable changes in biochemical parameters, with no significant differences between groups (Table 3). Patients in the PSFF group had higher odds of reaching glycemic

**Table 2:** Comparison between groups for body measurements and metabolic parameters.

Variable	PSAD (n=62)	PSFF (n=59)	Leaders (n=12)
Female sex (%)	40 (64.5)	41 (69.5)	3 (25)
Age (years), (mean ± SD)	53.10 ± 8.83	53.42 ± 10.68	54.42 ± 6.49
Time since diagnosis (years) (median-interquartile range)	1.5 (0.0-3.0)	1.0 (0.0-3.0)	1.0 (0.0-2.0)
Glucose (mg/dl)	103 ± 21	99 ± 27	112.17 ± 18.82
HbA1c (%)	6.4 ± 0.74	6.2 ± 0.78	6.59 ± 1.32
BMI (kg/m <sup>2</sup> )	29.4 ± 4.3	27.6 ± 4.9	28.56 ± 4.86
SBP (mmHg)	119 ± 11	116 ± 10	130.58 ± 16.65
DBP (mmHg)	74 ± 7	72 ± 5.3	77.42 ± 9.80
Triglycerides (mg/dl)	108 (81-144)	117 (97-143)	122.5 (87.5-176.7)
Total cholesterol (mg/dl)	141 ± 24	147 ± 29	170.83 ± 31.37
HDL-c (mg/dl)	46 ± 10	47 ± 11	42.08 ± 12.21
LDL-c (mg/dl)	81 ± 22	84 ± 22	110.92 ± 24.27
Albumin-creatinine ratio (median-interquartile range)	6.92 (4.23-10.17)	7.26 (3.73-21.05)	5.37 (1.92-12.27)

**Abbreviations:** BMI: body mass index; DBP: diastolic blood pressure; HbA1c: glycosylated hemoglobin; HDL-c: high-density lipoprotein cholesterol; LDL-c: low-density lipoprotein cholesterol; PSAD: peer-support program at-distance; PSFF: peer-support face-to-face; SBP: systolic blood pressure; SD: standard deviation.\* p<0.005.

**Table 3:** Changes ( $\Delta$ ) between visits in each group: body measurements, metabolic control, and psychological parameters.

Delta ( $\Delta$ )	PSAD (n=62)	PSFF (n=59)	Leaders (n=12)
BMI (kg/m <sup>2</sup> )	0.60 (0.0 – 1.40)	0.80 (-0.67 – 1.30)	0.15 (-1.20 – 1.00)
HbA1c (%)	0.40 (0.00 – 0.70)	0.40 (0.10 – 1.07)	0.00 (-0.07 – 0.37)
SBP (mmHg)	6.0 (-3.0 – 8.0)	3.0 (-5.5 – 11.5)	7.0 (-6.25 – 11.5)
LDL-C (mg/dl)	34.0 (6.0 – 61.0)	16.5 (-16.25 – 36.35)*	8.50 (-13.25 – 30.25)
Quality of Life (points)	2.00 (-2.00 – 9.00)	2.00 (-10.00 – 8.00)	-2.50 (-7.75 – 3.00)
Empowerment (points)	-3.12 (-9.37 – 3.13)	0.00 (-12.51 – 10.00) *	0.00 (-11.09 – 9.37)

**Abbreviations:** BMI: body mass index; HbA1c: glycosylated hemoglobin; LDL-c: low-density lipoprotein cholesterol; PSAD: peer-support program at-distance; PSFF: peer-support face-to-face; SBP: systolic blood pressure.

\* p<0.05

**Table 3:** 8 or more points in the HADS questionnaire

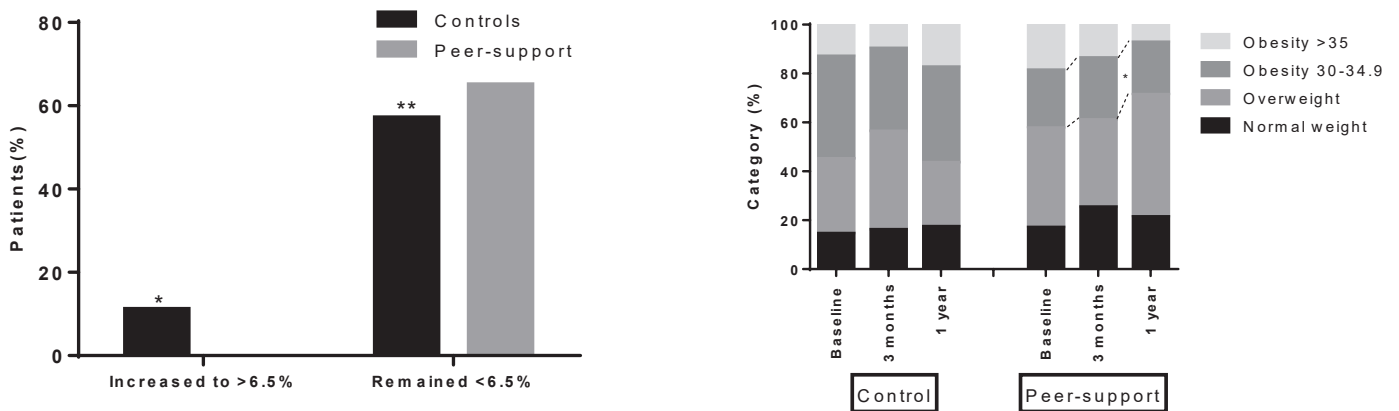
	Depression symptoms (%)			Anxiety symptoms (% patients) ^		
	Baseline	1 year	2 years	Baseline	1 year	2 years
PSAD (n=62)	11.5	17.9	12.5	14.8	17.4	12.5
PSFF (n=59)	6.8	4.3	10	10.2	17.9	20

**Abbreviations:** PS: peer-support; PSAD: peer-support program at-distance; PSFF: peer-support face-to-face.

Of the patients in the PSAD group, 11.5% had symptoms of depression compared with 6.8% of the patients of the PSFF group 1 (p = 0.37). At one year of follow-up, 4.3% of patients in the PSAD group continued with depression, compared with 17.9% of patients in PSFF group 1 (p = 0.13). In the 2-year follow-up, the percentage of patients with depressive symptoms increased to 12.5% in the PSAD group and decreased to 10% in PSFF group 1 (p = 0.86).

Regarding anxiety, 14.8% of patients in the PSAD group had anxiety symptoms at the start of the PS program, and 10.2% of patients in PSFF group 1 (p = 0.44). The percentage increased to 17.4% at 1 year in PSAD group and 17.9% in PSFF group (p = 0.97). In the 2-year follow-up, group PSAD had 12.5% of patients with anxiety symptoms, and the PSFF group had 20% (p = 0.67).

Model	Parameter	B	OR	95%CI	p
1 R2=0.063	HbA1c <6.5% at 1 year	0.924	2.52	1.18-5.38	0.017



**Figure 1:** Logistic regression model for long-term achievement of HbA1c.

Model	Parameter	B	OR	95%CI	p
1 R2=0.140	Δ Empowerment at 1 year	--0.048	0.953	0.912-0.996	0.032

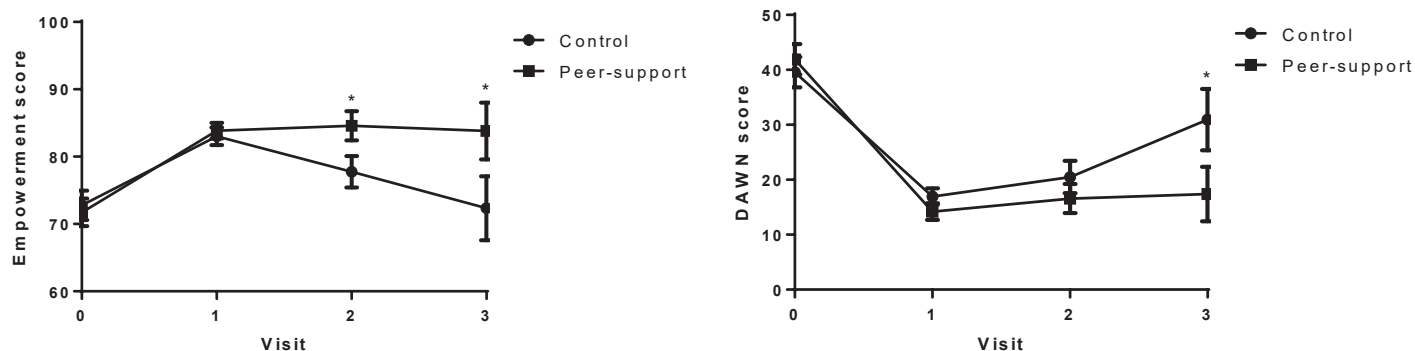


Figure 2: Logistic regression model for empowerment.

targets at three months compared to PSAD (OR 2.52 95% CI 1.18-5.38,  $p=0.01$ ). Patients in the PSFF group were more likely to reach HbA1c  $<6.5\%$  at one year than PSAD ( $p<0.05$ , Figure 1). About changes in BMI categories, we observed a sustained and significant decreasing trend in the rate of patients with BMI  $>35\text{kg/m}^2$  over time in the PSFF ( $p<0.05$ , Figure 1) but not in the PSAD group. In relation to LDL-c levels, patients in the PSFF group had better  $\Delta\text{LDL-c}$  values at one year, compared to PSAD, who also showed improved metabolic control.

### Comparison of psychological parameters changes over time

When evaluating changes across groups related to psychological parameters, we observed (in HADS score) a higher and sustained decrease in depressive symptoms scores for the PSFF group at 1 and 2 years ( $p<0.05$ , Table 3). With anxiety scores, the group of leaders had significantly lower anxiety symptom scores at baseline. Still, it did not decrease over time compared to patients in the PSFF and PSAD groups. We also observed sustained increases in DES-SF and PAID scores at one and two years in patients in the PSFF group compared to the PSAD group ( $p<0.05$ , Figure 2), similar to that observed in the group of leaders. Furthermore, patients in the PSFF group were less likely to have better DES-SF scores than the PSAD group at one year (OR 0.95, 95%CI 0.91-0.99,  $p=0.03$ ).

### Discussion

The success of PS can be attributed to various situations, in part to the non-hierarchical and reciprocal relationship created by sharing similar life experiences and psychosocial processes, including social support, knowledge of experience, and learning in society. On the other hand, the most influential perspective on peer-based social support assumes that support reduces the effects of stressful life events, improving the health of people with T2DM through the supportive actions of others. Support actions are believed to improve coping performance, perception, and subsequent self-care behavior [3,16]. Due to a worldwide increase in the T2DM population, the design of new strategies to maintain metabolic

control in patients is essential. Therefore, the rise in studies trying to relate the effect of PS to maintain self-care have shown differences.

There is a wide range of PS intervention designs, such as telephone calls, church-based, and training patients. Our selection was similar to the Junmei Yin et al study, in which the leaders were selected if they accomplished the eligibility criteria [2]. On the other hand, in the former study, the PS interventions were given each six months in a less formal setting. Meanwhile, in our study, all sessions were each two months and delivered at the center. A systematic review (SR) of controlled interventional studies on the effect of social and PS in T2DM identified six randomized controlled trials (RCT) that all showed some beneficial effects [17], but further studies questioned these early positive results. Although some evidence for the effectiveness of ongoing PR on metabolic control has been presented, a SR found this evidence too limited to support firm recommendations and calls for further well-designed studies [18]. A combination of traditional disease management with ongoing PS may be a promising approach in diabetes care that deserves further evaluation [18].

The program's optimal development depends mainly on the knowledge and experience that peer leaders can share with the participants, so it is required that they receive training from health professionals and develop the communication skills that allow them to create a relationship of trust and empathy [19].

Other PS studies have shown no different results, which have failed in delivering significant glycemic control [20-22]. However, in our research, the PS group had higher odds of achieving metabolic control in the long term and improved psychological parameters through time.

Our study showed a significantly higher response rate in leaders and patients with PS than controls and no differences between

leaders and PS patients. This is consistent because leaders tend to participate more and motivate their patients in the PS groups. Also, leaders were more likely to answer the surveys during the study. Also, patients in the PS group were more likely to maintain more stable metabolic parameters and better mental health evaluation scores. At this point, leaders were more convincing and motivational for patients to keep healthy activities after a multidisciplinary approach.

The choice of peers is a complicated process. It even more so is the election of leaders, who must be enthusiastic, capable of leadership, and have characteristics within the main categories of social support: appraisal support (helping a person understand a stressful event better and what resources and coping strategies may be mastered to deal with it) or informational support (giving advice and information), emotional support (warmth and nurturance expressing commitment, reassuring the person that he or she is a valuable individual who is cared for, including approval or appreciation for the patient's behavior) and tangible assistance or practical-instrumental support (material or other practical help such as services) [5,17,19].

One RCT conducted by Peimani et al after six months, patients in the PS group experienced a significant decline in the mean HbA1c value ( $p=0.045$ ). Also, mean T2DM self-management scores, mean QoL scores and the mean self-efficacy scores significantly improved in the PS group compared to the control group ( $p<0.001$ ) [3]. With its use, patients have maintained self-care activities and diminished distress and metabolic control through long-term follow-up. However, patients drop-out remains the first problem through conducting PS [23]. A RCT by Johanson et al showed that at two-year follow-up, the adjusted analysis revealed a non-significant difference in HbA1c change of 0.14% (21.97 mmol/mol, 95%CI  $-0.08$  to  $0.36\%$ ,  $p=0.22$ ) in favor of the intervention. Baseline values were  $7.08 \pm 1.25\%$  in the control group and  $7.02 \pm 1.25\%$  in the intervention group. None of the secondary outcome measures showed significant differences except for the improved QoL (EQ-5D-VAS) in the control group. (4.3 points on a scale of 100, 95%CI  $0.08$  to  $8.53$ ,  $p=0.046$ ) compared to the intervention group.

## Conclusion

As an additional disease management, our PS intervention showed no significant effect on HbA1c and outcome measures [18].

The PS intervention's role in helping achieve target goals was also evaluated to assess the relation of psychological benefits of PS with blood test results. We observed a statistically significant interaction between PS with increased DES-SF scores, which was statistically significant and increased the odds of achieving HbA1c goals  $<6.5\%$  at three months ( $\beta=0.01$ ,  $p=0.03$ ). PS increases long-term DES-SF and decreases PAID scores, which increases the likelihood of achieving HbA1c target goals, LDL-C control, and promote weight loss.

## Abbreviations

BMI: Body Mass Index; BP: Blood pressure; CAIPaDi: Term in Spanish for *Comprehensive Attention Center for the patient with Diabetes*; DQoL: Diabetes Quality of Life Measure; DES-SF: The Diabetes Empowerment Scale-Short Form; HADS: Hospital Anxiety and Depression Scale; HbA1c: Glycosylated hemoglobin; LDL-c: Low-density lipoprotein cholesterol; PAID: Problem Areas in Diabetes Questionnaire; PS: Peer support; PSAD: Peer-support program at-distance; PSFF: Peer-support face-to-face groups; QoL: Quality of life; RCT: Randomized controlled trial; SR: Systematic review; T2DM: Type 2 Diabetes Mellitus.

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