THE EFFECTIVENESS OF A DIABETES SELF-MANAGEMENT PROGRAM FOR DIABETES PATIENTS IN TAIWAN

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ABSTRACT

The purpose of the study was to test the effectiveness of a diabetes self-management program in controlling blood glucose, HbA1C, blood pressure, cholesterol, triglycerides, LDL, HDL, and saliva cortisol as well as regularity of exercise, improving diabetes self-efficacy, exercise self-efficacy and outcome expectations, and diabetes self-knowledge. This study was a single group, pre and post test research design. All subjects received an exercise and diabetes self-management handbook, Walk Daily for Better Control of Diabetes, via a trained diabetes educator. Then, subjects’ behavior changes were monitored via telephone calls by a trained diabetes educator once/week for 8 weeks. Results showed that the self-efficacy for diabetes, outcome expectations for exercise, and health-care climate scores have improved, but only the health-care climate score revealed statistically significant changes (p < 0.05). Results also showed abdominal circumference and salvia cortisol level presented statistically significant changes. Hence, the baseline HbA1C and exercise period per day were significant predictors of HbA1C levels among diabetes patients. With diabetes self-management education, and counseling interventions, diabetes patient have better self-health management of their diseases, and mitigate the detrimental changes. To encourage diabetes patients to continue exercising regularly, clinical nurses must support patients by playing the roles of educator and counselor.

Key words: Patient Education, Type II Diabetes, Self-Management, Taiwanese, Exercise

1. INTRODUCTION

Diabetes has been recognized as a global health problem (King, Aubert and Herman, 1998). According to the World Health Organization (2012), 347 million people have been diagnosed with diabetes. Although more than 80% of people with diabetes live in low- and middle-income countries, approximately 8.3% of the population in the United States of America (USA) has been diagnosed with diabetes. In the USA, Diabetes ranks sixth as a major cause of death, and the annual healthcare costs for diabetes treatment was 132 million in 2007 (Centers for Disease Control and Prevention; CDC, 2011). In Taiwan, diabetes was the fourth leading cause of death in the year 2011. The annual treatment of diabetes accounted for 11.5% of all medical costs, with the cost for treating diabetes patients reaching 4.3 times that for non-diabetes patients (Lin, Chou, Lai, Tsai and Tsai, 2001). These statistics indicate a high mortality rate for diabetes, and economic burden for health care systems.

Patients with diabetes face a lot of health problems and challenges. Evidence indicates that diabetes is the leading a cause of lower-limb amputation, kidney disease, blindness and eyes problems, nervous system diseases, hypertension, heart attacks and strokes (CDC, 2011). Thus, to reduce diabetes-related mortality and mobility rates, patients with diabetes must incorporate a complicated regime of life style changes, such as taking medication, diet, physical exercise, monitoring blood glucose, and foot care (CDS, 2011; Rapley and Fruin, 1999). Diabetes self-
management has become a critical issue and challenge for diabetes patients.

Diabetes self-management (DSM) is a time-consuming task, and it requires considerable self-discipline. DSM in this study is defined as a set of skilled behaviors engaged to manage diabetes. To improve self-management behaviors of diabetes patients, patient education is supported as an effectiveness strategy to change patients’ knowledge and attitudes through information transfer instruction (Viviene, Courtney, Edwards, McDowell, Shortridge-Baggett and Chang, 2007; Glasgow and Osteen, 1992). For example, Pariser and Demeuro (2010) designed an Active Steps for Diabetes program for type 2 diabetes patients with comorbidities and mobility impairments. The Active Steps for Diabetes program is a 45-minute group exercise class followed by 30 minutes of diabetes education. Each session of class includes: 5-minute warm-up, 5-minute balance and posture exercise, and 30-minute aerobic resistance training, and 5-minute cool-down. Results have showed that the subjects increased daily physical activity, 6-minute walking distance, and knowledge of diabetes-specific exercise guidelines. Atak and colleagues (2008) conducted a randomized single blind control study to assess the effectiveness of an education program for diabetes patients. The diabetes education program was delivered to 7-12 patients/group in two sections of 45 minutes one week apart. The information provided included diabetes specific information and self-management behaviors, such as blood glucose self-monitoring, hypo and hyper-glycaemia, exercise, diet, weight control complications, foot care and the importance of adherence with medical care. Results showed that subjects improved in talking regular walks, recognizing nutrients with high caloric content, following recommended daily fat distribution, regulating blood glucose levels to avoid complications, and in diabetes self-efficacy. Thus, diabetes education programs or interventions have proven successful in contributing to the self-management of diabetes patients.

Indictors of health for diabetes patients include blood glucose, glycosylated hemoglobin (HbA1C) levels, blood pressure, cholesterol and weight/BMI, triglycerides, low density lipoprotein (LDL), high density lipoprotein (HDL), as well as behaviors related to regularity of physical exercise, foot care and taking medication as prescribed (American Association of Diabetes Educators; AADE, 2009; Stetson, Schlundt, Peyrot, Ciechanowski, Austin and Young-Hyman et al., 2011). Although diabetes education has contributed to effective outcomes for improving diabetes self-management, many studies have shown that adherence with self-management education for diabetes is often far from optimal (Bean, Cundy, & Petrie, 2007; Gramer, 2004). Previous studies have indicated psychological factors, such as diabetes self-efficacy, exercise self-efficacy and outcome expectation as being associated with diabetes self-management (Atak et al., 2008; Bean et al., 2007; Viviene et al., 2007). To improve diabetes self-management behaviors, Bandura’s social cognitive theory was used as the framework to guide this research study, and promote behavior changes for diabetes patients in Taiwan. This study aimed to test the effectiveness of a diabetes self-management program in controlling blood glucose, glycosolated hemoglobin (HbA1C), blood pressure, cholesterol, triglycerides, low density lipoprotein (LDL), high density lipoprotein (HDL), and saliva cortisol as well as regularity of exercise, improving diabetes self-efficacy, exercise self-efficacy and outcome expectations, and diabetes self-knowledge.

2. METHODS

This study employed a single group, pre and post test research design. Subjects were recruited from an out-patient department in a community-teaching hospital located in southern Taiwan. They were: 1) diagnosed with type 2 diabetes by a medical physician; 2) able to walk; 3) able to speak Mandarin or Taiwanese; 4) willing to participate the study. All subjects received an exercise and diabetes self-management comic handbook via a trained diabetes educator at an out-patient department. Then, subjects’ behavior changes were monitored via telephone calls by a trained diabetes educator once/week for 8 weeks. The study was approved by the Human Subjects Protection Program at Tainan Hospital.

2.1 Intervention

All subjects participating in the study received a handbook, called Walk Daily for Better Control of Diabetes. This handbook was developed by Dr. Angela, Yee Man Leung, who aimed to encourage exercise and disease self-management in diabetes patients. Using comic story telling methods, the benefits of exercise and strategies of foot care for
diabetes patients are introduced in the handbook. Hence, self-recording sheets for foot care, daily walking, practicing tai-chi, swimming, healthy diet, adherence with medication, and exercise supporters were received by each diabetes patient daily-week for 8 weeks.

The trained diabetes educator was a registered nurse in Taiwan. She used Walk Daily for Better Control of Diabetes to educate diabetes patients in an out-patient department (OPD) in southern Taiwan. Diabetes self-management education was provided face-to-face, and one-by one for each subject in a private area located in outside of the OPD during clinic waiting time. To ensure diabetes patients followed the diabetes self-management instructions within the Walk Daily for Better Control of Diabetes handbook, the diabetes educator made telephone calls to provide counseling twice/week for 8 weeks.

According to Bandura’s Social Cognitive Theory (1997), strategies to improve self-management behaviors include performance accomplishment and verbal persuasion. When performance accomplishment is carried out by diabetes educator, subjects achieve enhanced self-confidence in performing diabetes self-management. In this study, the diabetes educator taught each subject how to use the self-recording sheet in the handbook, and then, reviewed their daily records via telephone calls. When the strategy of verbal persuasion is provided by diabetes educators, subjects receive verbal encouragement for their efforts to carry out diabetes self-management behaviors. In this study, the diabetes educator provided positive encouragement verbally via telephone calls if subjects performed exercise regularly, and/or used the self-recording sheet to record their daily diabetes self-management behaviors. In addition, the diabetes educator assisted subjects in dealing with problems or questions regarding diabetes self-management during telephone conversations with the subjects.

2.2 Instruments

Self-efficacy for Diabetes (SED) was developed by the Stanford Patient Education Research Center (2013). It is an 8-item scale used to measure self-efficacy for diabetes management. The score for each item ranges from 1 (not at all confident) to 10 (totally confident). The internal consistency reliability is .828. A higher score indicates more confidence in dealing with diabetes.

The Health Care Climate Questionnaire (HCCQ) was developed to measure patients’ perceptions of degrees of autonomy, supportiveness or control by their health care providers, such as physicians, nurses, diabetes educators, and dieticians in diabetes centers. It contains 15-item arranged on a 7-point Likert scale. The scores range from 1 (strongly disagree) to 7 (strongly agree). A higher score represents a higher level of perceived autonomy and support. The internal consistency was examined, revealing a Cronbach α of .92 to .96. The content and face validities were examined (Williams, Freedman and Deci, 1998).

Self-efficacy for Exercise (SEE) was developed by Resnick and Jenkins (2000). SEE is used to measure elders’ beliefs concerning their ability to perform physical activity. It includes nine questions. All questions are numbered from 0 (not confident) to 10 (very confident). The validity of the SEE is supported by statistically significant Lambda estimates, which range from .61 to .87. The internal consistency was established with an alpha coefficient of .92 in a previous study.

The Outcome Expectations for Exercise Scale (OEES) was developed by Dr. Resnick and colleagues (2000). This scale is used to measure older adults’ perceptions of the consequences of their exercise behaviors. It includes 9-items. OEES is arranged on a 5-point Likert scale with ranges from strongly agree to strongly disagree. The criteria-related validity, construct validity, and internal consistency have been tested (Resnick, Zimmerman, Orwig, Furstenberg and Magaziner, 2000). In this study, one more item, “exercise helps me feel less tired”, was added. There were ten questions on this questionnaire. Since elders like to respond to simple and easy questions, all responses were organized on a scale from 0 (disagree) to 10 (agree). The scale was scored by summing the numerical ratings for each response.

Tracking for Diabetes Self-management was applied to understand individual’s self-management for diabetes via physiological indicators. The measured indicators included: blood glucose, glycosylated hemoglobin (HbA1C) levels, blood pressure, cholesterol and weight/BMI, triglycerides, low
density lipoprotein (LDL), high density lipoprotein (HDL), and abdominal circumference.

A Saliva Sample was collected to examine the cortisol level. Previous studies have shown that cortisol is positively correlated to blood glucose, urinary glucose, and blood pressure (Oltmanns, Dodit, Schultes, Raspe, Schweiger and Born, 2006). This study collected saliva cortisol in order to support self-management for diabetes.

2.3 Data analysis

The statistical software package used in this survey was SPSS 16.0 for Windows. The level of significance was set as an alpha of .05. Descriptive statistics were employed to obtain demographic information. An independent t test was applied to understand psychological, physical, and biological changes regarding self-management for diabetes patients. Multiple regression was also used to understand predictors of HbA1C level.

3. Results

51 type-2 diabetes patients participated in this study. Their ages ranged from 34.79 to 85.22 years old. The number of months diagnosed ranged from 11 to 367 months. The majority of subjects were male, married, and received 12 or less years of education. Table 1 summarizes the demographic information.

3.1 Changes in psychological, physical and biological data

Although the self-efficacy for diabetes, outcome expectations for exercise, and health-care climate scores showed improvement, only the health-care climate score revealed statistically significant changes (p < .05). As for physical and biological, we found declines in abdominal circumference, cholesterol level, triglycerides, HbA1C, and saliva cortisol level, but only abdominal circumference and saliva cortisol level showed statistically significant changes. Table 2 and Table 3 summarize the changes in diabetes self-management among psychological, physical and biological data.

3.2 Exercise behaviors affect HbA1c

In this study, 25 subjects regularly recorded walking steps. Figures 1 and 2 showed subjects’ self-records of their exercise period per day, and walking steps per week. The results also present no statistical changes after about 8 weeks of recording walking steps (χ² = .489, p > .05).

To understand predictors of post-intervention HbA1C levels among diabetes patients, multiple stepwise regression was performed. Results showed the baseline HbA1C and exercise period per day were significant predictors of HbA1C levels among diabetes patients. The model accounted for 69.6% of the variation (R² = .70; Adjusted R² = .67) in the post-intervention HbA1C levels.

4. DISCUSSION

4.1 Changes in Psychological, Physical and Biological Data

Illness perceptions are linked to self-care in diabetes patients (Bean et al., 2007). Although self-efficacy for diabetes and outcome expectations for exercise showed improved, and the self-efficacy for exercise score actually declined, these changes were not statistically significant. Results also presented that the health-care climate score showed statistically significant decline, which suggests that diabetes patients have less control of their conditions. According to several previous studies, if patients believe their conditions are more controllable, they have better self-care in the areas of diet and exercise (Skinner and Hampson, 2001; Skinner, Hampson and Fife-Schaw, 2002). Seong and Lee (2011) conducted a study to examine the relationships among illness perception, self-efficacy and self-care among pulmonary tuberculosis patients. Their results showed a statistically significant positive correlation between illness perception and self-care, and between self-efficacy and self-care. Subjects with better perceived control of their diseases showed better self-efficacy and self-care. Similarly, Chen and colleagues (2011) examined the relationships between illness perception and adherence to therapeutic regimens among patients with hypertension. Three hundred and fifty-five subjects were recruited from cardiovascular clinics in three teaching hospitals in Taiwan. Results showed that control of the disease exhibited direct effects on adherence to therapeutic regimens. By encouraging a sense of controllability, adherence to therapeutic regimens may be enhanced.
The results of this study also showed that abdominal circumference and salivary cortisol level had statistically significant declines. For example, Shi and colleagues (2010) conducted a randomized controlled trial study to examine the effect of a hospital-based clinic intervention on glycaemic control self-efficacy and glycaemic control behavior among Chinese patients with type 2 diabetes. One hundred and fifty-one subjects participated in the study. Results showed that subjects’ beliefs in treatment effectiveness and self-efficacy for diabetes were proximate factors influencing diabetes self-management.

Atak and colleagues (2008) also conducted a randomized single blind controlled study to assess the effect of education using a pre and post test design. Eighty patients with type 2 diabetes were recruited from an out-patient clinic in Turkey, and randomly assigned to the intervention and control groups. An educational program was delivered by the researcher. The program provided instruction for 90 minutes in a clinic at a teaching hospital at Xi’an Jiaotong University, and randomly divided into experimental or control groups. Subjects in the experimental group received one-month intervention, which was composed of 1 to 2-hour session/week for four weeks. The diabetes teaching packaged was delivered based on educational strategies and self-efficacy theory, which was originated from Social Cognitive theory by Alberta Bendura. The teaching strategies included video, power point presentations, reading materials, and small group discussion. Subjects in the experimental group were also trained to monitor their signs and symptoms of diabetes, and control their disease. During the four months following the end of the intervention, the researchers made at least two phone calls each week to participants, aimed at providing counseling and coaching to maintain glycaemic control. Subjects in the control group received care as usual. Results showed that subjects in the experimental group showed statistical improvements in glycaemic control self-efficacy and glycaemic control behavior immediately and four months after the intervention.

4.2 Exercise Behaviors Affect HbA1c

The results of this study found that the significant predictors of HbA1C level among diabetes patients were baseline line HbA1C level and exercise period per day. These results are consistent with previous studies (Walkker, O'Dea, Gomez, Girgis and Colagiuri, 2010; Moriyama, Nakano, Kuroe, Min, Niitan and Nakaya, 2009). For example, Moriyama and colleagues (2009) conducted a randomized controlled trial study to test the efficacy of a self-management education program for people with type 2 diabetes. Subjects in the experimental group (n = 25) received less than 30 min of monthly interviews based on the program’s textbook and biweekly telephone calls from a nurse educator throughout the 12 months. Subjects in the control group followed usual clinical practice. Results found that subjects in the experimental group showed significant differences in abdominal circumference, HbA1C and diastolic blood pressure. Similarly, Hansen and colleagues (2009) examined the effectiveness of continuous low- to moderate-intensity exercise training for type 2 diabetes patients. Fifty male subjects performed three supervised exercise sessions per week for 6 months. Results showed that blood HbA1C content decreased significantly following exercise training. Thus, exercising regularly can
affect blood HbA1C levels among type 2 diabetes patients.

4.3 Conclusion

People with type 2 diabetes often demonstrate low exercise tolerance. With diabetes self-management education, and counseling interventions, diabetes patient might show better self-management of their diseases, and mitigate the detrimental changes. However, to encourage diabetes patients to continue exercising regularly, clinical nurses must support patients by playing the roles of educator and counselor.

However, the research design was the limitation of the study. This study employed a single group, pre and post test design. The intervention period was only 8 weeks. Although the effectiveness of exercise resulted in declines in HbA1C, LDL cholesterol, body weight and body mass index at 8 weeks after implementing regular exercise, longer exercise training showed more significant effects on HbA1C, LDL cholesterol, triacylglycerols, body weight and body mass index. To evaluate the effectiveness of self-management among type 2 diabetes patients, a longitudinal, repeated-measures, experimental design would be a stronger design. The sample size and intervention should be longer. Further studies could be conducted for 6 to 12 months. Moreover, age and disease duration should be considered as covariance and controlled in further study.

4.4 Practice Implications

Based on Bandura’ Social Cognitive Theory, this study used the Walk Daily for Better Control of Diabetes handbook to instruct type 2 diabetes patients in self-management. The patient education and counseling was provided by a trained nurse educator regularly over an 8 week period. Although the results of the study showed improvement in abdominal circumference and salvia cortisol level, subjects showed no statistical changes in cholesterol level, triglycerides and HbA1C levels. Thus, the results provide important information for clinical nurses using the Walk Daily for Better Control of Diabetes handbook. In further study, combined with a 6 to 12 months of patient counseling, significant results might be achieved in encouraging physical and biological changes.

REFERENCES


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Management Education and Training (DSME/T)


[23] T. Skinner, S.E. Hampson, and C. Fife-Schaw, “Personality, Personal Model Beliefs, and Self-Care in Adolescents and Young Adults with Type 1 Diabetes”, Health Psychology, Vol. 216, 2002, pp. 61-70.


### TABLES/FIGURES

#### Table 1. Demographic Information

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number (%)</th>
<th>Mean (S.D.)</th>
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<tbody>
<tr>
<td>Age</td>
<td></td>
<td>69.93 (8.9)</td>
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<tr>
<td>Marital status</td>
<td></td>
<td>117.39 (91.36)</td>
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<tr>
<td>Gender</td>
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<tr>
<td>Male</td>
<td>28 (68.3%)</td>
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<tr>
<td>Female</td>
<td>13 (31.7%)</td>
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<tr>
<td>Education level</td>
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<td></td>
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<tr>
<td>Not Educated</td>
<td>3 (7.3%)</td>
<td></td>
</tr>
<tr>
<td>≤ 12 years</td>
<td>28 (68.3%)</td>
<td></td>
</tr>
<tr>
<td>&gt; 12 years</td>
<td>10 (24.4%)</td>
<td></td>
</tr>
<tr>
<td>Number of months diagnosed with diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>1 (2.4%)</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>39 (95.1%)</td>
<td></td>
</tr>
<tr>
<td>Devoice</td>
<td>1 (2.4%)</td>
<td></td>
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</tbody>
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#### Table 2. Diabetes Self-Management Psychological Changes

<table>
<thead>
<tr>
<th>Variables</th>
<th>Time 1 Mean (S.D.)</th>
<th>Time 2 Mean (S.D.)</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy for diabetes</td>
<td>7.48 (1.96)</td>
<td>7.65 (1.78)</td>
<td>.565</td>
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<tr>
<td>Self-efficacy for exercise</td>
<td>5.80 (2.24)</td>
<td>5.53 (2.32)</td>
<td>.543</td>
</tr>
<tr>
<td>Outcome expectation for exercise</td>
<td>8.46 (1.81)</td>
<td>8.59 (1.88)</td>
<td>.396</td>
</tr>
<tr>
<td>Health-Care Climate score</td>
<td>6.06 (0.72)</td>
<td>5.67 (0.64)</td>
<td>3.065**</td>
</tr>
</tbody>
</table>
Table 3. Diabetes Self-Management Physical And Biological Changes

<table>
<thead>
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<th>Variables</th>
<th>Time 1</th>
<th>Time 2</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal circumference</td>
<td>89.49 (9.76)</td>
<td>88.17 (9.04)</td>
<td>2.58*</td>
</tr>
<tr>
<td>Pulse (times/min)</td>
<td>74.78 (11.22)</td>
<td>75.20 (10.34)</td>
<td>.381</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>126.68 (13.89)</td>
<td>127.15 (15.97)</td>
<td>.205</td>
</tr>
<tr>
<td>Diastolic BP</td>
<td>77.17 (9.7)</td>
<td>75.85 (8.89)</td>
<td>1.284</td>
</tr>
<tr>
<td>Ac blood sugar</td>
<td>132.2 (19.56)</td>
<td>134.4 (27.37)</td>
<td>.434</td>
</tr>
<tr>
<td>Pc blood sugar</td>
<td>156.38 (88.78)</td>
<td>165.89 (64.15)</td>
<td>.496</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>187.05 (34.05)</td>
<td>189.20 (35.69)</td>
<td>.677</td>
</tr>
<tr>
<td>LDL</td>
<td>119.17 (30.11)</td>
<td>124.23 (32.89)</td>
<td>1.575</td>
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<tr>
<td>Triglycerides</td>
<td>218.95 (160.42)</td>
<td>186.62 (105.66)</td>
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<tr>
<td>HDL</td>
<td>50.06 (9.99)</td>
<td>48.94 (8.99)</td>
<td>1.306</td>
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<tr>
<td>HbA1C</td>
<td>7.11 (.97)</td>
<td>7.05 (.93)</td>
<td>.732</td>
</tr>
<tr>
<td>Saliva cortisol</td>
<td>.185 (.10)</td>
<td>.147 (.08)</td>
<td>2.040*</td>
</tr>
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</table>

Figure 1. The Numbers Of People Performed Self-Record About Exercise Period/Per Time

Figure 2. The Numbers Of Steps Recorded About Walking Steps/Per Week