Development of a Capacity Building Program for Village Health Volunteers to Support Self-Management in a High Risk Population for Diabetes in a Rural Community in Northeast Thailand

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Abstract

Similar to other parts of the world, the prevalence of type 2 diabetes mellitus (T2DM) in the Asia-Pacific Region has rapidly increased during the last few decades. The purposes of this pilot study were to determine the feasibility and the effects of a capacity building program for Village Health Volunteers (VHVs) to support self-management in a T2DM high risk population from a rural subdistrict in Northeast Thailand. Both quantitative and qualitative data were collected using surveys, focus group discussions, and in-depth interviews. Data were analyzed and used to develop a 12-week capacity building program for VHVs. This program was then implemented on 60 subjects at high risk of T2DM in the selected community.

According to the paired *t*-test and Wilcoxon-signed rank test, VHVs had higher scores on knowledge and self-efficacy of T2DM prevention after a 12 week intervention ($p = .03$ and $p = .02$, respectively). Study participants at risk for T2DM also had a significant increase in T2DM knowledge and self-management ($p < .001$). Implementation of the capacity building program for VHVs in Northeast Thailand was feasible. The key successes were strong community bonding, community empowerment, and support from family and public health nurses. Effects of the program should be examined with those in other Asia-Pacific countries.

Keywords: pre-diabetes, self-efficacy, self-management, Village Health Volunteers, high risk population, action research

The global prevalence of type 2 diabetes mellitus (T2DM) has been increasing worldwide, particularly in South-East Asia. According to the International Diabetes Federation, more than 382 million adults aged 20 to 79 years had T2DM in 2013 with a sharp increase both in urban and rural areas (Guariguata et al., 2013). Estimated prevalence rates of T2DM and impaired glucose tolerance are high for all South-East Asia countries and are expected to continuously increase over the next two decades (International Diabetes Federation, 2013). By 2035, more than 72 million adults are estimated to have diabetes and 24.3 million to have impaired glucose tolerance (Guariguata et al., 2013). Impacts of T2DM have been recognized in terms of health deterioration, socio-economic burden, and quality of life. Diabetic patients have nearly 2.5 times greater medical expenditures than those in the same age group without T2DM (Srivanichakorn, 2007). Costs related to T2DM include outpatient costs, hospitalization, pharmaceutical costs, and length of stay (Henriksson et al., 2000). Thus, the optimal strategy to reduce the burden of T2DM is reorganized as early prevention, aiming to tackle worsening glucose intolerance before harmful effects of hyperglycemia become permanent.

Aekplakorn (2010) reported that the risk of developing metabolic syndrome increases for individuals who are obese, have impaired fasting glucose, or

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are prediabetic with a fasting blood sugar of 100-125 mg/dl. Approximately 10.7% of patients with metabolic syndrome are diagnosed at advanced age. A United Kingdom (1995) study found that at the time clinical T2DM was diagnosed, the pancreatic beta-cell capacity had been reduced 50 to 60% for 10 years during T2DM progression. Plasma fasting glucose, a recognized diagnosis test, is preferred in clinical settings (American Diabetes Association, 2002) and the Diabetes Risk Score (DRS) has been recommended as an early self-reported screening for T2DM in community settings (Aekplakorn et al., 2006).

Several studies have shown that lifestyle behavior change is the most effective way to prevent T2DM in high risk populations (Balagopal, Kamalamma, Patel, & Misra, 2008; Giroux et al., 2015; Habros et al., 2013; Juul, Andersen, Arnoldsen, & Maindal, 2016; Katula et al., 2011; Lindström, Absetz, Hemiö, Peltomäki, & Peltonen, 2010; Oba, McCaffrey, Choonhapran, Chutug, & Rueangram, 2011; Phanpinij, 2007; Ram et al., 2014; Rungsiriwat, Picayapinyo, & Lagampan, 2013), which can reduce the onset of T2DM by 50% among high risk individuals. In Thailand, a dramatic increase in the number of people with T2DM has been recognized, particularly in the Northeast region, accounting for the highest mortality rate (19.2 per 100,000 in the population; MOPH, 2009). From verbal screenings of T2DM in Mahasarakham Province, Northeast Thailand, about 40.3% of high risk populations had more than one risk factor, such as a family history of T2DM (53.3 %), body mass index $\geq$ 25 kg/m^2 (41.3 %), or a family history of hypertension (32 %; Tatoom Primary Care Unit, 2007).

Since 1978, the Village Health Volunteers (VHVs) have had an important role in Thailand's primary health care system. They function as a link between the community and health care providers. VHVs serve four key roles: (a) assist with daily management, (b) provide social and emotional support, (c) serve as a link to clinical care, and (d) manage community resources (Kowitt & Emmerling, 2012). Currently, Thailand has at least one million active VHVs who have received ~15 days of training, serve 5-15 households, and provide support to their communities. They also serve as a peer-support group and are key mobilization for primary health care for all in Thailand. They work with various populations ranging from maternal and child health, infectious diseases, mental health problems, people with disabilities, chronic diseases, elderly care, and so forth (Sanguanprasit, Leelaphan, Techaboonsermsak, & Jongsuwat, 2011). In addition, Thai VHVs are endorsed by public health officers every year.

Preventive intervention for the pre-T2DM group in the Thai context has been inadequately researched, which could lead to higher incidence and burden of T2DM. The National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes recommended goals and strategies involving community health workers for T2DM care. These included building strong support and integrating that support within T2DM health care teams and programs for people at risk for T2DM (Ministry of Public Health, 2008). In addition, most existing programs focus on patients with T2DM. However, the mechanisms and means to promote lifestyle behavior change are lacking. A previous study indicated that the obstacles to volunteering in the community were less of a health concern (27%), there was a lack of motivation, (26%), and a lack of self-care skills (21%; Achimangkul, 2006). Thus, this study aimed to examine the feasibility and effect of a 12-week capacity building program on VHV's knowledge and self-efficacy as well as to improve T2DM knowledge and self-management skills for diabetes prevention and control in a high risk group.

Methods

A rural community in Mahasarakham Province was selected as the study site because of having the highest prevalence of T2DM. In Thailand, leisurely lifestyle, strong family bonding, and cultural related activities can be observed throughout the country. This lifestyle is particularly true in rural communities of the Northeast where agriculture is considered the major occupation – most people are farmers (Pila, Boonrung, & Cheaplamdee, 2016). With limited resources and low socio-economic status, their lifestyle and health practices are closely related to their culture and belief system, particularly agricultural work. "Hitsbsong-Kongsibsee" is a typical culturally rich activity organized monthly by the community to promote the value of rice and to strengthen community bonds and health.

Participants

Two groups of participants were recruited from those who lived in the selected village in Northeast Thailand and those registered at the primary health center for at least six months. VHVs and T2DM high risk individuals who were aged 35 years and older, independent, competent in writing, reading, and communicating in Thai, and agreed to remain for the duration of the research were recruited. In addition, individuals with high T2DM risk were determined by a score of 9 or greater on the DRS developed for the Thai population (Aekplakorn et al., 2006). Those who had a diagnosis of T2DM or indicated being unable to complete at least 80% of activities were excluded. Sixteen VHVs were willing to participate in the capacity program. Accord-

ing to the previous study, an effect size of 3.43 will provide a power of 0.80 to determine the number of T2DM high risk subjects needed (Phanpinij, 2007). A total of 60 T2DM high risk subjects were accepted and volunteered to participate in the program.

Ethical Considerations

This study was approved by the Committee for the Protection of Human Subjects of the Faculty of Public Health, Mahidol University. Participants who met inclusion criteria were invited to participate in this study by poster. They were then informed about the purpose and benefits of the study, their involvement, anonymity, and confidentiality issues; their names would not be released or disclosed to anyone. The data would be presented as a whole and only the study team could access the data. With consents, a total of 60 high risk T2DM subjects met eligibility.

Research Instruments

Research instruments were classified into three categories:

1. Data collection tools:
   - 1.1 T2DM prevention knowledge questionnaire (15 items). The 15-item questionnaire on T2DM prevention knowledge was developed by the researcher based on practice guidelines of the Diabetes Association of Thailand (Ministry of Public Health, 2008). This true-false questionnaire consisted of four components, including signs and symptoms, risk factors, severity and complications, and T2DM prevention. Examples were "being frequently hungry, weight loss, presenting polyurine, frequently thirsty are early symptoms of T2DM"; and "a person with a family history of T2DM has higher risk than that without a family history of T2DM." The total score ranged from 0-15; the higher the score the higher the knowledge. A content validity index of 0.80 and Kuder-Richardson Formula 20 reliability coefficient of 0.79 was reported.
   - 2.1 Self-efficacy to advise high risk population questionnaires (20 items). The 20-item self-efficacy questionnaire was developed by the researcher based on the self-efficacy theory and the practice guidelines for T2DM care from the Diabetes Association of Thailand (Ministry of Public Health, 2008). The content on advice focused on appropriate eating behaviors, exercise or physical activity, and stress management for T2DM among high risk individuals. All VHVs were asked to rate their level of confidence to advise high risk subjects under their responsibility – 4 indicated very much and 1 indicated least confident. Examples of the items included (a) how much confidence you have to suggest appropriate food, and (b) how much confidence you have to encourage the high risk group to exercise more. Scores ranged from 20-80 points; the higher the score, the higher the confidence. Content validity index of 0.80 and Cronbach's alpha coefficient of 0.73 were reported.
   - 3.1 Record of home visits by VHVs. The frequency of activities that VHVs suggested to the high risk population to modify their health behaviors was prepared. All VHVs were asked to record their performance during home visits.
   - 4.1 Intervention tools for the high risk population comprised four parts: (a) general characteristics; (b) data of health status; (c) knowledge of T2DM and T2DM prevention (15 items); and (d) data of physical examination and anthropometric measurements such as weight, body mass index, waist circumference, and blood pressure.
   - 5.1 Self-management record for the high risk population. All VHVs were asked to record their health behaviors by themselves every day. Health behaviors related to modified risk factors totaled 10 behaviors.
2. Intervention tools referred to the health education program and monitoring, prepared by the researcher, including healthy foods, exercise, and stress management.
3. Screening tool: DRS was developed by Aekplakorn (2006) as a useful and appropriate tool for early screening and monitoring of those at high risk of T2DM at the primary care setting in Thailand. The six components of DRS included age, sex, body mass index, waist circumference, a diagnosis of hypertension, and a family history of T2DM. Total score of DRS ranged from 0-17 with a cut-off point score of > 8 indicating being at high risk. It had predictive validity indicating a relationship between level of risk and opportunity to develop T2DM within 12 years. For example, DRS $\geq$ 9 was considered "high risk of T2DM" indicating about > 20 % could develop T2DM within 12 years.

Research Procedure

This study consisted of four phases. Phase 1 was conducted to assess the situation of T2DM by surveys, in-depth interviews, and focus group discussions with stakeholders, high risk populations, and VHVs. Phase 2 aimed to set the intervention based on data from

situation analysis and the capacity building intervention program for VHVs. The capacity building program included small group health education and practice for selecting a healthy diet, selecting an appropriate exercise, increased exercise or physical activities, and activities for stress management. Phase 3 was to implement the program for the high risk population. Activities in each group included health education and behavior practice, such as selecting a healthy diet (low carbohydrates, complex carbohydrates, low fat, fruits, and vegetables) and appropriate exercise or physical activities and learning to use plastic pipes for exercise and stretching and stress management (relaxation and meditation). The T2DM prevention education program also involved a series of goals, plans, and skills evaluation. VHVs were trained to build self-efficacy for self-management support on diet management, exercise, stress management, unhealthy behavior modification, and to record health behaviors. Active participatory learning was applied and consisted of role playing, brainstorming, group discussions, and demonstrating how to communicate with high risk participants and their family members to maintain healthy behaviors to delay the onset of T2DM. Phase 4 was to perform the outcome evaluation, assessing changes of knowledge and self-management related to T2DM prevention in the high risk population.

Intervention

This 12-week training program consisted of five educational sessions, and home visit practices aimed to improve knowledge and self-efficacy of VHV. T2DM prevention education programs involved a series of goals, plans, and skills evaluation. VHVs were trained to build self-efficacy for self-management support on diet management, exercise, stress management, unhealthy behavior modification, and how to record health behaviors. Active participatory learning was applied. Each VHV was assigned to 3-4 T2DM high risk participants to practice home visits once a week to discuss problems and obstacles related to their self-management and how to record measured outcomes. Monitoring, feedback, and reflection on eating behaviors, exercise, and stress management was provided by the researcher during the VHVs' group meetings every two weeks.

Data Analysis

Data analysis first illustrated baseline characteristics of VHVs and participants with high T2DM risk. The changes in knowledge and self-efficacy in VHVs between pre-test and post-test were measured to evaluate their feasibility of the capacity building program. Changes in knowledge and self-management in the T2DM high risk group were also analyzed to evaluate the effect of the capacity building program. Paired *t*-test and Wilcoxon-signed rank test were used to examine differences between pre- and post-test. All statistical analyses were conducted using SPSS statistical analysis software. Significance level was set at 0.05.

Results

Characteristics of the VHVs

Sixteen VHVs initially participated in the program but only 11 completed it. The age of the subjects ranged from 43 to 68 years (M = 56 years, SD = 4.3). Among the 11 VHVs, six were women, seven had primary school education, seven lived with an extended family, eight were farmers, and 10 were married. These VHVs had served from 5 to 15 years (M = 7.7 years, SD = 3.3). Several VHVs had been diagnosed with health disorders: (a) four persons had hypertension, (b) two had diabetes, (c) two had osteoarthritis, and (d) one had allergies.

Characteristics of the High Risk Subjects

A total of 60 T2DM high risk subjects, presenting a DRS score > 8, were willing to participate in the program. Only 41 subjects completed the program and had complete health behavior records. The age of the 41 subjects ranged from 35 to 84 years (M = 57 years, SD = 6.3). One half of them were women (51.2%), most were married (85.4%), more than half were living with extended family (65.9%), had completed primary school education (73.2%), and were farmers (63.4%). Some reported having hypertension (39.0 %), consuming alcohol (41.5 %), and smoking (17.1%).

VHVs' Diabetes Prevention Knowledge and Self-Efficacy for T2DM Prevention

Eleven VHVs performed at home visits to the high risk population for 10 weeks with a minimum of 12 visits and a maximum of 39 visits. Each VHV was responsible for 1-6 high risk subjects with an average of three people. They provided advice on stress reduction (M = 6.7 times per case, SD = 5.3), exercise (M = 6.3 times per case, SD = 3.8), and healthy food (M = 6.1 times per case, SD = 3.7). In addition, the VHVs received high scores for the ability to advise types of fruits that are appropriate to eat and to advise types of vegetables that were low in calories (M = 3.8 and M = 3.6, respectively). Three items that VHVs received low scores on were the ability "to encourage the high risk population and family members to reduce risk factors" (M = 3.0), "to modify health behavior of the high risk population with family members" (M = 3.1), and "to

evaluate exercise behavior" (*M* = 3.1). Table 1 shows the mean score of VHVs' diabetes prevention knowledge. VHVs scored higher at post-test compared to pre-test (p = .03). The mean score of VHVs' self-efficacy to advise the high risk population at post-test was significantly higher than that at pre-test (p = .02).

Table 1. *Mean Scores Between Pre-Test and Post-Test For VHVs' Diabetes Prevention Knowledge and Self-Efficacy for T2DM Prevention*

		N	Mean Rank	Sum of Ranks	*Z*	*p*-value
Pre-Post	**VHVs' Diabetes prevention knowledge**					
	Mean Pre-test = 11.7	*SD* = 2.3				
	Mean Post-test = 12.8	*SD* = 2.5				
	Negative Ranks	1[a]	3.00	3.00	-2.157[a]	.03
	Positive Ranks	7[b]	4.71	33.00		
	Ties	2[c]				
	Total	10				
Pre-Post	**VHVs' self-efficacy**					
	Mean Pre-test = 65.5	*SD* = 11.3				
	Mean Post-test = 87.3	*SD* = 10.8				
	Negative Ranks	0[a]	0.00	0.00		
	Positive Ranks	7[b]	4.00	28.00	-2.371[a]	.02
	Ties	1[c]				
	Total	8				

Note. By Wilcoxon Signed Rank Test. a = Negative Ranks; b = Positive Ranks; c = Ties

Changes in Knowledge of T2DM Prevention and Self-Management in T2DM High Risk Group

The effect of the capacity building program on the T2DM high risk group was evaluated by comparing changes in knowledge and self-management between pre- and post-test. Table 2 shows that the mean score of T2DM prevention knowledge in the 41 participants was approximately 2.0 points greater (p < .001). There were more participants with improved knowledge than with worsened knowledge (29 vs. 7 people).

Table 2. Mean Scores of the High Risk Population's T2DM Prevention Knowledge Between Pre- and Post-Test (*N* = 41).

M Pre-test	*M* Post-test	SD	*SE* of Mean	*T*	*p*-value
10.2 (*SD* = 3.2)	12.1 (*SD* = 2.5)	2.36	0.37	4.97	< .001

Note. Twenty nine participants improved, five worsened, and seven remained at the same knowledge level.

Ten activities demonstrating the efficacy of self-management in the participants were recorded for 10 weeks. Figure 1 shows that their diet behavior had a slight change in fish consumption. They had more than three portions of vegetables and had lean meat. The consumption of rice and sweet fruits peaked the 3rd and 5th week, respectively. Avoiding desert and fried food had a small change but avoiding desert was easier than having fried foods. Participants increased exercise in the beginning around week three and was maintained until week seven. Participants reported feeling increasing stress at 10 weeks, while the practice for stress reduction declined during week seven.

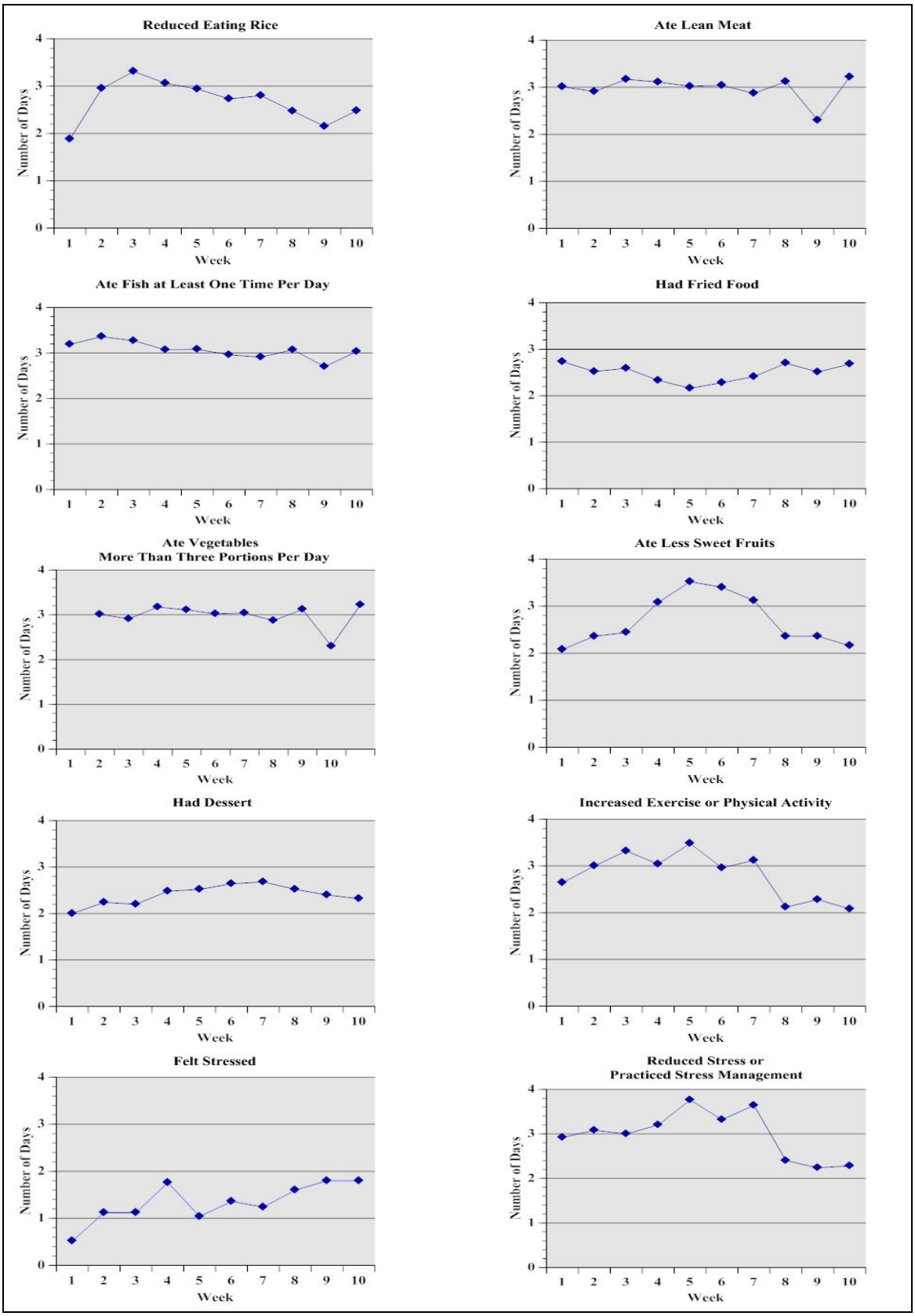

Figure 1. Self-management reported by the high risk population over 10 weeks.

Discussion

Feasibility of the Capacity Building Program for T2DM Prevention in the High Risk Population

In this study, feasibility of the capacity building program was supported in terms of changes in ability and self-efficacy of VHVs to support health behavior modification among populations at risk and their families about diabetes prevention. The key factors of the program included a supportive environment (i.e., flexible time), active participatory learning, and small group discussions with feedback. Small group discussions gave an opportunity to share ideas and experiences of working in different situations. The VHVs group was strengthened and the head of the VHVs could capably manage the team. In addition, informal relationships were very important for group dynamics. VHVs suggested that they wanted to cooperate with the group every two weeks to refresh their knowledge and to learn special techniques every six months with a health care personnel.

This program expanded roles and responsebilities of VHVs to support self-management for high risk populations. Community participation was a key component of this capacity building program. Activities primarily involved early screenings and database management for high risk populations. Thus, the feasibility of the program was supported.

Effect of the Capacity Building Program: Changes in Knowledge of T2DM Prevention and Self-Management of T2DM High Risk Group

The mean score of T2DM prevention knowledge in the high risk population for pre- and post-test was significant ($p < .05$). Similarly, small group health education and participatory learning processes have shown an increase in knowledge (Phanpinij, 2007; Srikurdum, Lapvongwatana, & Chansatitporn, 2013; Wang, Li, Zhang, Zhou, & Zhang, 2015). The intervention was first planned to improve self-regulation among a high risk population, but it was found that most of the high risk population were older adults and they did not cook by themselves. Although most family members were those who prepared food for the high risk population, family involvement was not intervened successfully. Relapse periods were another weakness that was found in the present study. We found a reduction in the number of recorded self-care activities by weeks eight and nine. Thus, a reboot session on dose should be added during week seven of the intervention. In addition, limited time was another factor that might have influenced the outcome evaluation, such as the evaluation of body weight; the greatest difference was noted at least six months after an intensive lifestyle intervention (Juul et al., 2016; Lindström et al., 2010; True et al., 2015).

Activities of the program affected communication among families. In case of complex health problems, family members perceived their roles and responsibilities to prevent or delay T2DM especially in older high risk subjects. Subjects in the high risk population said "I talked about level of blood sugar to my family member after blood screening," and "When I talked about level of blood sugar to family members, we discussed and planed for preparing food and modified health behavior to control or decrease the level of blood sugar." These activities stimulated participants to share and provide T2DM care in the family. In addition, the researcher encouraged the high risk population to share experiences with group members. Then, each high risk participant was reviewed for their screening result. Every other week, the head of the VHVs made a list of the high risk population who needed an advanced home visit. In the case of those with hypertension or heart disease, they assisted them to make appointments for a health team visit.

Thirty six subjects in the high risk population participated in T2DM screening and six people that had a capillary blood sugar level more than 126 mg/dl was confirmed with the fasting blood sugar level. It was found that a few VHVs showed low scores of self-confidence to advise and encourage the high risk population. During home visits, some VHVs needed additional support from the researcher when they had to take care of those with multiple risk factors and complicated problems such as having low education, low income, and multiple comorbidities. At the end of the program, one of the VHVs shared her work experience with the high risk population on the importance of reducing the consumption of carbohydrates and desserts and increasing fruits and vegetables. The VHVs suggested that engaging in group exercise may not be appropriate and is difficult to maintain. So, individual or home-based exercise could be appropriate in future interventions.

During the early phases of the intervention, some VHVs requested to be accompanied by a researcher for the home visit with participants who had been diagnosed with hypertension or had a stroke. They found participants had gained knowledge at post-test, but their T2DM prevention behaviors, such as eating less sweet fruits and avoiding desserts had not changed within the first eight weeks of the intervention. It could be explained that some participants had less perceived severity of the T2DM, especially among men. In addition, some participants perceived that having diabetes was normal. Participants mentioned that "When people got T2DM, some felt fear, but some

felt fearless because they did not experience any serious signs and symptoms"; "The people do not fear of T2DM because most diabetic patients died from other complications, such as renal failure; they did not die from T2DM"; and "Diabetic problems are normal because there are plenty of diabetic patients in the community."

Implications

This study contributed new knowledge on the effect of a capacity building program conducted in a rural community prevalent with T2DM patients. Our findings reinforce the need for more research exploring why the current intervention was ineffective and how it could be improved. Since VHVs received more than the usual training for pre-diabetic care, a longer intervention period might be essential to promote behaveioral changes among the high risk populations. Recording their diet and exercise is recommended. VHVs should also perform more follow-up visits to verify and encourage the recording of food intake and physical activity levels. In addition, follow-up booster sessions between assessment intervals are also recommended to increase the attainment and maintenance of behavioral changes. Based on this, booster interventions should be provided at weeks four, five, six, and seven to remind the participants about the consumption of sugar, fruits and vegetables, and exercising.

The program for VHVs should be modified to have greater community self-management support and to enhance skills of risk communication and risk management. Lastly, the study sample size was too small to yield statistical significance. Thus, a larger sample size may be needed to reflect a true change in diet and exercise.

Recommendations

The feasibility and the effectiveness of a 12 week capacity building program deserves an evaluation. Knowledge and self-efficacy in VHVs and participants with high T2DM risk significantly improved. These findings can benefit community health development for other populations such as Pacific Islanders, and can be applied in primary health care. The proposed capacity building program should be expanded from an individual centered intervention to family centered care with community empowerment for the high risk population. Data from community mapping with a combination of family folders can be used to provide early screening and monitoring in the T2DM surveillance for the high risk community.

DRS was useful and appropriate for screening and monitoring at the primary care setting to classify people at high risk of developing T2DM. Furthermore, level of T2DM risk can help develop an appropriate intervention for a specific high risk population. DRS can also be used to set up a T2DM surveillance system for high risk populations.

Moreover, strategies for lifestyle modifycation among high risk populations should be taught to nurses, particularly to those who work in the primary care setting. The content of risk management and risk communication should be added to the public health nursing curriculum, continuing education, and short course trainings. Lastly, future interventions should concentrate attention on community awareness of T2DM prevention, perceptions of T2DM prevention, and methods to increase T2DM screening, particularly for men.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publiccation of this article.

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