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Full Length Research Paper

Cost-effectiveness of a healthcare professional-led self-management support program for type 2 diabetic patients in Bangkok public health centers, Thailand

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Abstract

This study aimed to evaluate the cost-effectiveness of a healthcare professional-led type 2 diabetes mellitus self-management support program (DM-SMS) for a period of 6 months in public health centers in Bangkok, Thailand. Cost and cost-utility analyses were performed in the context of clinical trials that aimed to examine the effectiveness of the healthcare professional-led DM-SMS program compared with usual type 2 diabetes care. One hundred and seventy-six type 2 diabetic patients within a set criteria (i.e., aged > 20 years old, glycated hemoglobin or HbA1c > 7%, and seeking healthcare at a Bangkok public health center) participated in this study. Eighty-six patients received the DM-SMS program and 88 patients received the usual care. Data regarding costs focusing on the intervention and treatment for the physician-appointed visit were collected alongside the clinical trial. Outcomes such as quality of life were estimated. These economic analyses were done from both the healthcare provider's and societal perspectives. The findings revealed that the cost of the program was 1,960 baht per person. The total cost with respect to diabetes patients from the two different perspectives were 8,550 (health provider's perspective) and 12,098 (societal perspective) baht per person . The quality of life of patients in the intervention group as compared with those in the usual care group increased (0.02). The cost-utility results were 34,400 and 96,350 baht per QALY gain from the healthcare provider's and societal perspectives, respectively. According to the sensitivity analysis, the cost affected the incremental cost utility ratio (ICUR) to a high degree. In summary, the healthcare professional-led DM-SMS program requires only a small investment at startup and moderate implementation costs associated with patients. These investment costs with a small return in the improvement of quality of life would be perhaps mitigated by investment in a long term and sustainable DM-SMS program.

Keywords: Cost-effectiveness, self-management and support program, type 2 diabetes.

INTRODUCTION

Type 2 diabetes is on the increase in Asian and global populations. In Thailand, it has been documented that the numbers of diabetes patients and individuals with chronic diseases, including diabetes (Etzwiler, 1980 ; Etzwiler, 1986 ; Hiss, 1986). This is evident from impaired glucose tolerance were about three and one million in 2007, respectively. In 2025, these figures are projected to double to four million diabetes and two million impaired glucose tolerance cases (Chan et al., 2009 ; Ligaray et al., 2009). Over the past 30 years, a self-management support program has been considered to be a critical factor for the care of research which

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suggests that patients who had never received diabetes self-management education had a remarkable four-fold increased risk for major diabetes complications compared with patients who received some form of diabetes self-management education (Niccoluci et al., 1996). The benefits associated with education on self-management and lifestyle modification are positive and outweigh the costs associated with the intervention. Moreover, it was also associated with cost saving, cost-effectiveness, or positive return on investment (Boren et al., 2009).

There are many ways to deliver diabetes knowledge, such as web-based interventions, individual counseling, group programs, group medical visits, community-based classes, and telephone follow-up (Fisher et al., 2005; Jordan et al., 2006). One successful form is the chronic disease self-management program by Professor Kate Lorig (Naomi et al., 2007). The program provides a total of six weeks of small group sessions led by non-healthcare professionals in the community. Recent reviews suggest that the program can improve outcomes for diabetes patients and individuals with impaired glucose tolerance. The six-session, healthcare professional-led self-management support program has been applied in Thailand in recent years, but much remains to be learned about the relative cost-effectiveness of the program. This study therefore aimed to evaluate whether the program benefits patients in public health centers in terms of its cost effectiveness over a six-month period. Specifically, the following analyses were performed. First, the cost and cost-effectiveness of the program compared with usual care was analyzed. Second, the cost and cost-effectiveness of the program from the healthcare provider's perspective compared with the societal perspective were studied. Finally, sensitivity analysis was conducted in order to determine the influence of variables (between cost and quality of life) to the incremental cost-utility ratio (ICUR).

MATERIAL AND METHOD

This study was conducted on the prospective alongside clinical trial to test effectiveness of the healthcare professional-led DM-SMS program. In the clinical trial, 176 type 2 diabetic patients who met a set of inclusion criteria: their age over 20 years old, diagnosed as type 2 diabetes with no longer than 10 years, HbA1c >7% within the last 24 weeks, and body mass index (BMI) > 25 kg/m^2. Randomization was undertaken independently at public health centers of the Bangkok Metropolitan Administration (BMA). At each health centers, data such as costs, glycemic control (HbA1c), body mass index (BMI), and behavioral outcomes (self-efficacy and self- care) of the patients were monitored at baseline, 3 and 6 months.

The healthcare professional-led DM-SMS program was based on Chronic Disease Self-Management Program (Naomi et al.,, 2007). One course during six months consisted of the six sessions of two-weekly small group activity which were arranged and facilitated by healthcare professional in the healthcare facility. Each session lasted two hours, and the whole program was three months duration. Topics covered included: (1) an introduction to the program and basic knowledge about type 2 diabetes; (2) physical activity; (3) healthy diet; (4) diabetes medication; (5) coping with stress, and; (6) monitoring type 2 diabetes complications and developing the life-long problem solving skill. Two phone calls were performed in the latest three months. The control or "usual care" group is commonly given the basic diabetes knowledge performed in hospitals.

Cost analysis with respect to the healthcare provider's and societal perspectives considered 2 parts ; (1) direct medical cost and (2) direct non medical cost. Direct medical cost as healthcare provider's cost consist of intervention cost and healthcare service regarding refill medicine according to appointment . This research focus on intervention cost that informed the difference between two groups. Education and tracking activities were the core of intervention. Costs at start-up which covered training and material cost was allocated to these two activities. Ongoing implementation costs which were associated with personnel , material, phone call were also divided into education and tracking activities. Health care service which was identified as medicines, medical supplies and laboratory test originated from the database of healthcare setting and was calculated by using reference price. Direct non medical cost regarding transportation and time lost of patients as opportunity cost were collected from questionnaire. Summation of cost may be a little overestimate when including overhead cost (fixed cost that hospital must expend every month such as labor cost, public utilities, which do not vary according to quantity of patients) because the educator's labor cost overlaps with the overhead cost.

The main outcome was quality-adjusted life-years (QALYs) which is a measure of health outcome that measured quality and quantity of life into a common metric on a scale that ranges from 0 to 1, where 0 corresponds to death and 1 corresponds to perfect health. It derived from EQ5D questionnaire which consist of 5 domains (mobility, self-care, usual activity, pain/discomfort and anxiety/depression) and was adjusted by model-based coefficients from the time trade off (TTO) on a random sample of the adult UK population (Dolan et al.1995,1996b). QALYs of the health professional led DM-SMS compared with usual

care was considered at the sixth month. The improved outcome as glycemic control was considered for estimating cost-effectiveness.

Statistical analysis was carried out by intention to treat. First, cost analysis of the health professional led DM-SMS programs compared with the usual care were performed. The purpose of this part was to deriving the cost and incremental cost. This comparison emphasized only on the cost relating to the implementation (process of intervention) in the healthcare provider's and societal perspectives. This was due to these costs were quite different in the DM-SMS program, while the other costs were quite similar for all patient and did not affect the overall cost. The time span for cost comparison was 6 months and the type 2 diabetes complications were not taken into account as the time span may be too short for the occurrence of long term complications. Second, cost-utility analysis was the incremental cost-utility ratio (ICUR) which contained 2 sections; monetary and utility (QALYs) units. The numerator as the difference of the overall 6-month duration cost and the denominator as the difference of QALYs at the sixth month in the health professional led DM-SMS programs compared with the usual care. It indicated cost(baht) per 1 QALY gain regarding the healthcare professional-led DM-SMS program. Calculation formula was as followed:

$$ICUR = \frac{\text{cost of (DM-SMS – usual care)}}{\text{QALYs of (DM-SMS – usual care)}}$$

Finally, one-way sensitivity analysis was used for examining the impact of change of cost and QALYs (ranging from the minimum to maximum possible values) on the estimate of the incremental utility ratio(ICUR).The results were shown in tornado diagram (figure 1), where long or short bar represents large or small effect, respectively, to the ICUR.

RESULTS

The demographic characteristics of the patients are shown in Table 1. There were 174 type 2 diabetic patients (86 in the healthcare professional-led DM-SMS group and 88 in the usual care group). The groups were not significantly different except for the diastolic blood pressure. The two patients' groups were mostly female, with the mean age of between 61.8 (SD 8.6) and 62.9 (SD10.4) years old. Most of them had an education lower than a bachelor's degree, worked as a housewife, and had a monthly income of lower than 5,000 baht. The duration of their diabetes ranged from 7 to 9.5 years, with 80 % prevalence of co-morbidity, and the majority used an oral anti-diabetic agent only. Their HbA1c levels were 7.8 % on average, and the systolic blood pressure ranged from 137.4 to 139.0 mmHg, with an average body mass index of 26 kg/m^2.

The cost analysis of the healthcare professional-led DM-SMS programs compared with the usual care revealed the following results:

1. The total cost of the healthcare professional-led DM-SMS program for 86 patients for a period of 6 months comprised both the startup costs (25,872 baht) and ongoing implementation costs (142,726 baht). The training educator (11,124 baht) and developing the curriculum (14,748 baht) were the main startup costs. The ongoing implementation costs were education (30,410 baht), tracking by phone (5,762 baht), and opportunity and transportation costs of patients (106,554 baht). The totals for program cost and cost per case were 168,598 and 1,960 baht, respectively (Table 2).
2. During the usual care (88 persons), patients received education including common diabetes knowledge while waiting for the physicians. The cost consisted of the labor cost of the nurse (2,020 baht), the printing cost of the pamphlet (880 baht), as well as opportunity and transportation costs of patients (22,792 baht). The total cost was 25,692 baht, with the cost per case of 292 baht (Table 2).
3. Intervention costs of the healthcare professional-led DM-SMS program and the usual care were 1,960 and 292 baht per person, respectively. From the healthcare provider's perspective during 6 months, the costs related to intervention, overhead, and health care service were 8,550 (healthcare professional-led DM-SMS) and 7,862 (usual care) baht per person. When including direct non-medical costs with direct medical costs from the societal perspective, the cost of the DM-SMS program was 12,098 baht per case while that of the usual care was 10,171 baht per case (Table 3).

With regard to the comparison of costs from the healthcare provider's and societal perspectives, the cost-utility analysis focused on two variables: incremental cost and incremental QALYs of the healthcare professional-led DM-SMS program compared with usual care. The incremental costs were 688 and 1,927 baht (healthcare provider's and societal perspectives, respectively). The incremental QALY was 0.02. When considering cost-utility analysis, the healthcare professional-led DM-SMS program used 34,400 baht per QALY gained from the healthcare provider's perspective and used 96,350 baht per QALY gained from the societal perspective (Table 3).

The tornado diagram in Figure 1 shows that changes of costs ranging between the minimum and maximum affect the base-case ICUR from -475 to 7,264%. On the contrary, the change of QALYs affects the base-case ICUR only from -121.74 to -75%. In other words, cost has a large effect while QALYs has a small effect on the ICUR.

DISCUSSION

While a number of studies had investigated the effective-

Table 1. Characteristics of patients

Characteristics	DM-SMS (n = 86)	Usualcare (n = 88)	p Value
Female, %	76.7	72.7	0.66
Age, year, mean(SD)	62.9(10.4)	61.8(8.6)	0.30
Maried, %	58.1	69.3	0.19
Education, %			
Primary school	68.6	81.8	0.09
Secondary school	17.4	12.5	
> Secondary school	14	5.7	
Occupation, %			
Vendor/merchant	24.4	27.3	0.64
Employee	10.5	14.7	
Housewife	54.6	45.5	
No job	10.5	12.5	
Income/month(bath), %			
<5,000	55.8	58	0.83
5,001 - 10,000	30.2	30.6	
10,001 - 15,000	4.7	5.7	
>15,000	9.3	5.7	
Diabetes duration , year			
median(IQR)	9.5(11)	7(11)	0.13
Co-morbidity , %	80.3	81.8	0.31
Diabetes treatment regimen, %			
Lifestyle modification	1.2	1.1	
Oral agents only	86	80.7	
Insulin only	11.6	15.9	
Insulin and oral agents	1.2	2.3	
HbA1c ,% , median(IQR)	7.8(1.3)	7.9(1.5)	0.39
Blood pressure ,mm Hg ,mean(SD)			
Systolic	137.4(15.2)	139.0(18.7)	0.54
Diastolic	75.5(9.2)	79.9(14.8)	0.02
Body mass index, kg/m^2,mean(SD)	26.6(4.1)	26.8(4.3)	0.46

Table 2. Costs of health professional-led DM-SMS program and usual care (24weeks)

Item	DM-SMS program(n = 86)				Usual care(n=88)			
	Unit	Unit cost (baht)	Time (mins)	Total cost (baht)	Unit	Unit cost (baht)	Time (mins)	Total cost (baht)
Starting costs								
Training educator								
Training cost				4,000				
Trainee time		153/hr	2,400	6,124				
Trainee transportation				1,000				
Curriculum development								
Educator time		153/hr	9,600	12,248				
Manual and hand-outs				2,500				

Table 2. Continue

Ongoing implementation costs								
Education								
Educator time		153/hr	6,192	15,790				
Nurse time						153/hr	792	2,020
Recording notebook	86	20		1,720				
Pamphlet&brochure					88	10		880
Refreshment	516	25		12,900				
Tracking by phone call								
Educator time		153/hr	1,720	4,386				
Phone call cost		0.8/min		1,376				
Patient/participant time		27/hr	125,560	56,502		27/hr	31,680	14,256
Patient/participant transportation	516	97		50,052	88	97		8,536
Total cost				168,598				25,692
Cost per case				1,960				292

Table 3. Cost-utility analysis of the health professional led during 6 months

Item	Health provider perspective		Societal perspective	
	usual care	DM-SMS	usual care	DM-SMS
Direct medical cost				
1. Intervening cost				
Educational cost	33	589	33	589
Tracking cost	0	132	0	132
2. Overhead cost	2,326	2,326	2,326	2,326
3. Health care service	5,503	5,503	5,503	5,503
Direct non-medical cost				
1. Appointment of OPD			2,309	2,309
2. Attend to educational group			0	1,239
Cost (Bath/patient)	7,862	8,550	10,171	12,098
QALYs	0.42	0.44	0.42	0.44
Incremental cost-utility ratio (Bath/QALYs)		34,400		96,350

ness of DM-SMS programs in the Thai context, no health/economic studies exist for such interventions. This study is the first to provide economic information on a healthcare professional-led DM-SMS program in Thailand. In this study, the findings revealed that the total cost of the DM-SMS program at 168,598 baht was quite high compared to that of the usual care at 25,692 baht. As well, the per-patient cost of the DM-SMS program relative to usual care during the 6 months was incremental. The percentage of incremental costs of the DM-SMS program compared with usual care was 9% (688 baht) and 19% (1,927 baht) from the healthcare provider and societal perspectives, respectively. Incremental costs from the health provider's perspective originated from training, educator's time, and refreshments. Participant's time and transportation were the main components of increasing costs from the societal perspective. In addition, when comparing the two perspectives, it was found that the percentage of incremental costs per case from the societal perspective was twice as high as from the healthcare provider's perspective. The

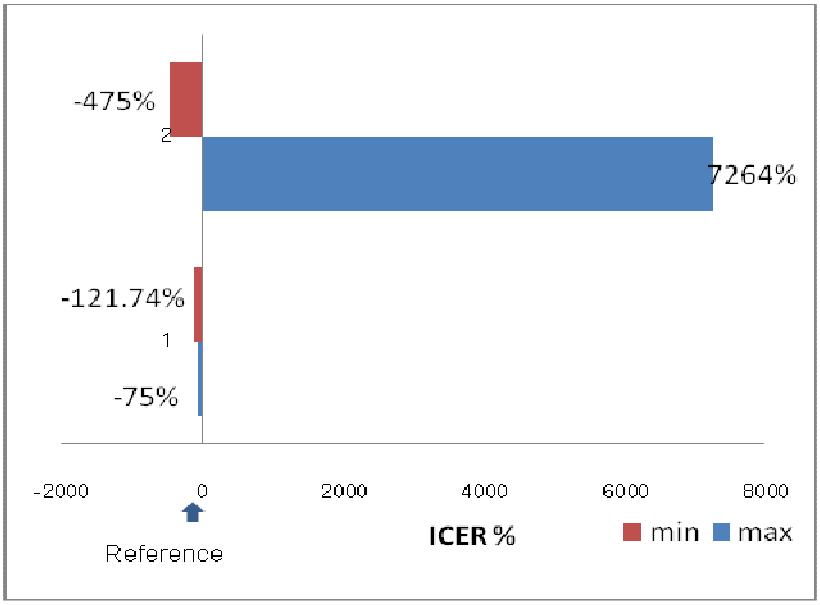

Figure 1. Sensitivity analysis

ICER% = Percentage of change incremental cost effectiveness ratio ; QALY = Quality adjusted life year

costs of patients (such as opportunity and transportation costs) accounted for a large portion of the DM-SMS program budget. It is important to note that the costs of the DM-SMS program in this study accrued in the context of a randomized trial may not reflect full-scale implementation costs. In the trial, the fixed cost for training and program development was distributed across less than 100 patients. When applying this intervention across a much larger population, the cost for full-scale implementation would be considerably lower per patient than in this trial.

The estimated gain of 0.02 QALY with the DM-SMS program was a relatively small increment when compared with usual care. However, it had no effect on the glycaemic improvement for the short duration between the end of the program and the final follow-up. The relevant results of Norris and Sarkisian' s research indicated that glycaemic control was not sustained in the short term (< 6 months from follow-up) for immediate post intervention (Norris et al., 2002, Sarkisian et al., 2003). Although participants in this program had improved knowledge, the results of glycaemic level were contrary. Relevantly, Norris et al.,. also reported previously that although this type of program improved patients' knowledge, it did not have an impact on good HbA1c control, which was similar to the results of this research (Norris et al., 2001).

According to the cost-effectiveness analysis, when using QALY as the outcome for estimation, the result of QALY gain for diabetes self-management support (DM-SMS) programs did not recommend a threshold of adoption. This research revealed that the cost per QALY of DM-SMS from the societal perspective (96,350 baht/QALY) was three times as high as that of the DM-SMS from the healthcare provider's perspective (34,400 baht/QALY). The sensitivity analysis showed that the influence of cost caused a large change to the ICUR. This was probably due to the wide variation of healthcare service costs in different healthcare facilities.

This study had several limitations. First, there was no variation in the demographic data of participants. Consequently, the findings provide insight into only a specific group (e.g., female, elderly, below bachelor's degree, housewife, low income, > 5 years duration of diabetes). Future research should emphasize testing the program's effectiveness in the context of a more heterogeneous patient group. Second, this trial was implemented for a short period of only 6 months, which was too short for HbA1c improvement. As well, patients suffered from other complications (e.g., foot ulcers, blindness, etc.) which are expensive to treat.

In conclusion, this healthcare professional-led DM-SMS program improved the knowledge of the participants, but glycaemic control may be delayed. The DM-SMS program demonstrates a low investment at start-up and moderate implementation costs associated with patients. Although this program should be provided due to its benefit to all diabetes patients, a long-term and sustainable DM-SMS program is required for minimizing costs and maximizing returns.

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REFERENCES

Boren SA, Fitzner KA, Panhalkar PS, Specker JE (2009). Costs and benefits associated with diabetes education: a review of the literature. Diabetes Educ. 35(1):72-96.

Edwin B Fisher, Carol A Brownson (2005). Ecological Approaches to Self-Management: The Case of Diabetes. Public Health Matters 95(9): 1523-1535.

Etzwiler DD (1980). Teaching allied health professionals about self-management. Diabetes Care. 3 :121-123.

Etzwiler DD (1986). Diabetes management. The importance of patient education and participation. Postgrad Med. 80:67-72.

Hiss RG (1986). The activated patient: a force for change in diabetes health care and education. Diabetes Educ. 12:600-602

Jordan EJ, Osborne RH (2006). chronic disease self-management education programs: challenges ahead (view point). eMJA Rapid Online Publication.

Juliana CN, Chan Vasanti Malik, Weiping Jia (2009). Diabetes in Asia: Epidimeology, Risk factors, and Pathophysiology. JAMA 301(20) : 2129 – 2140.

Kenneth Patrick L Ligaray, Wiliam L Isley (2009). Diabetes mellitus, Type 2. 1998-2009 Mayo Foundation for Medical Education and Research (MFMER).

Naomi Kubina, Jill Kelly, Fiona Symington (2007). Navigating self-management : A practical approach to implementation for Australian health care agencies. Whitehorse division of general practice with the assistance of the Australian Government Department of Health and Ageing.

Niccoluci A, Cavaliere D, Scorpiglione N, Carinci F, Capani F, Tognoni G, Benedetti MM (1996). A comprehensive assessment of the avoidability of long-term complications of diabetes: a case control study. Diabetes Care. 19: 927-933.

Norris SL, Engelgau MM, Narayan KM (2001). Effectiveness of self-management training in type 2 diabetes: a systematic review of randomized controlled trials.Diabetes Care 24:561-587.

Norris SL, Nichols PJ, Caspersen CJ, Glasgow RE, Engelgau MM, Jack JrL, Isham G, Snyder SR, Carande-Kulis VG, Garfield S, Briss P, MaCulloch D and the Task Force (2002). The effectiveness of disease and case management for people with diabetes: a systematic review. Am J Prev Med. 22(suppl):15-38.

Norris SL, Lau J, Smith SJ, Schmid CH, Engelgau MM (2002). Self-management education for adults with type 2 diabetes: a meta-analysis of the effect on glycemic control. Diabetes Care. 25:1159-1171.

Sarkisian CA, Brown AF, Norris KC, Wintz RL, Mangione CM (2003). A systematic review of diabetes self-care interventions for older, African American, or Latino adults, Diabetes Educ. 29(3):467-479.