

EFFECTIVENESS OF SCHOOL NETWORK FOR CHILDHOOD OBESITY PREVENTION (SNOCOP) IN PRIMARY SCHOOLS OF SARABURI PROVINCE, THAILAND

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Abstract. This research was designed to test the effectiveness of a school network for childhood obesity prevention (SNOCOP) in primary schools; a program that aimed to improve student behavior in terms of knowledge, attitude, intention towards obesity prevention, and their food consumption behavior. A quasi-experimental pretest-posttest time series study was conducted. By 2-stage stratified sampling selection 180 students from 6 schools were assigned to the intervention group and 195 students from 6 schools to the control group at Saraburi Province, Thailand in 2006- 2007. In addition, thirty-one participants being school administrators, teachers, parents, and community members from six schools formed the social network initiating the intervention. The schoolchildren in the intervention group improved their eating behavior, knowledge, attitude, intention towards obesity preventive behavior. The six schools of the intervention group changed school policies and school activities aiming to reduce the proportion of obesity among their student. No such activities could be observed in the control group. These findings suggest that the School-Social Network of Childhood Obesity Prevention program is an effective means to prevent childhood obesity.

INTRODUCTION

The prevalence of obesity and being overweight among schoolchildren is increasing rapidly in child populations throughout

the world (Summerbell *et al*, 2005). In Thailand, the prevalence of obesity in primary schools rose from 12.2% to 15.6% in just two years (WHO, 2003). Other investigations estimated the overall prevalence of child obesity to be about 17%, with a remarkable increase in the urban areas (National Health Foundation, 2006). From clinical investigations, it is known that a high proportion of overweight children had abnormally high levels of cholesterol and triglyceride as well as abnormal levels of insulin (Ministry of Public Health, 2001; WHO, 2003). Childhood

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overweight and obesity also are linked to cardiovascular diseases. In the US population, overweight youth are 2.4 times as likely to have high cholesterol levels and 43.5 times as likely to have three cardiovascular risk factors when compared to youth of normal weight (Nicklas *et al*, 2001). In 2005, a cohort study (Jirapinyo *et al*, 2005) indicated that the prevalence of obesity and being overweight in the first grade in Bangkok, Saraburi, and Sakon Nakhon were 16%, 23%, and 4%, respectively. When these children were in the sixth grade, the prevalence of obesity increased to 31%, 30%, and 9%, respectively. The problem of childhood obesity appears to have expanded into larger urban areas, and Thailand can expect to see an increase in chronic diseases in adulthood, as these children grow older. To address this problem, prevention is more effective than "cure." The prevention of weight gain is less expensive and more effective than treating obesity after it has fully developed. This is because health damages caused by obesity in childhood could increase the prevalence of cardiovascular diseases and diabetes in adulthood and that finally will tremendously increase costs for treatment and expenditures of the health delivery system in the long term (National Heart Lung and Blood Institute, 2007).

Food patterns and dietary intake of Thai children is affected by children's lifestyle. Energy expenditure of obese children is higher than for non-obese children because of their greater body weight. Moreover, junk food consumption by children in city areas is encouraged by guardians and marketing promotion (Klunklin *et al*, 2001). Schoolchildren have an improper behavior as far as food consumption is concerned and hardly exercise regularly (Silpasuwan *et al*, 2002).

Usually Thai children have lunch at schools. School lunch programs for children of poor families and children who are un-

derweight are free of charge, but parents have to pay if they can afford to. Dishes offered to children contain a high amount of fat and less vegetables and fruits. Schools confronted with problems of students' food choices (western snacks and fast food) and lack of parental control (Kai, *et al*, 2008). In addition, sweets and carbonated drinks are offered to the children from food stalls at the entrance of the schools and sometimes within the schools for a minimal amount of cash. Recommendation to improve the quality of food offered to the children is lacking and the governmental policy only assures the provision of meals regardless of the quality

Internationally it has been recognized that there is a need for health promotion in schools (WHO, 1986, 2009). The general features of the Charter include a change of policy towards health, change to a 'healthier' environment, and the empowerment of people to care for their health by strengthening community action as well as developing personal skills. Realizing that the percentage of obese children increased from 10.2% in 2002 to 13.4% in 2005 (National Health Foundation, 2006), officials at the National Health Foundation, the Department of Health, Ministry of Public Health, the Thailand Research Foundation, and Thai Health Promotion Foundation became increasingly concerned. As the result, the 9th Health Plan of the Ministry of Public Health and the National of Economic and Social Development Plan of Thailand (2002-2006) aimed to promote a minimum of 60% participation rate in sports and exercise programs.

The global strategy to improve dietary intake and increase physical activity has recently focused on a health policy that should be "...sustainable, comprehensive, and actively engages all sectors..." including obesity prevention (WHO, 2004). Social networks

are powerful tools to link persons in the network in communicating, interacting, participating, and providing social support in decision making aiming towards a common goal. Previous school-based social network interventions have resulted in a reduction of problems in adolescent behavior (Glanz *et al*, 2002). Such a network, for example, was an effective tool for smoking prevention (Valente *et al*, 2003), drug abuse and drop out (Eggert *et al*, 1994), and contraceptive behavior (Kincaid, 2000). A social network approach is an effective strategy to introduce health policies, reduce health problems, and manage health programs (Haythornthwaite, 1996; Wohlstetter *et al*, 2003; Krueathep *et al*, 2008). School network also had been applied as the administrative intervention to introduce policy to solve problems and promote quality of life.

However, a study of 107 primary schools in Saraburi Province indicated that networking was not effective (Banchonhattakit, unpublished data from a preliminary survey, 2006). According to school administrators, only 42% of schools were inked in some way to a social network. From those connected to a network, almost 60% did not utilize them effectively. Usually, only formal meetings with a top-down approach by the education officials had been organized. The networks were not innovative and had few close relationships with other schools. Forty percent carried out activities, such as educational meetings and annual sport competitions, within their own schools. Therefore, these school networks had not created more social contacts or social ties with other schools, nor had they supported each other.

However, schools in particular have the potential to play a pivotal role in the prevention of childhood obesity, but the absence of effective strategies in the school network approach, including taking advantage of environmental conditions and parental co-

operation, could limit effectiveness (Story, 1999; Summerbell *et al*, 2005). Moreover, social network members may influence decision makers, using the network to increase information and providing social support (Glanz *et al*, 2002). Social support can be defined as the functional content of relationships and can be measured by a number of variables that are supportive behaviors: emotional support, instrumental support, informational support, and appraisal support (House, 1981). Therefore, this study included in the school network the co-operation of school administrators, teachers, parents, and community leaders and added social support to prevent obesity in primary schools. The conceptual framework of this study is presented in Fig 1.

Aspects of internationally considered health promotion in schools were adopted such as introducing a healthy diet, enhance physical activities, and improve school lunch programs. Special attention had been given to the empowerment of people so that they established a school network and supported it. We hypothesized that, if the school network on childhood obesity prevention (SNOCOP) is implemented effectively, then student behavior in terms of knowledge, attitude, intention towards obesity preventive behavior, and their food consumption behavior will improve. Thus, the overall objective of the present study was to test the effectiveness of a school network to improve student's behavior in term of knowledge, attitudes, and intentions towards obesity prevention and food consumption behaviors.

MATERIAL AND METHODS

A quasi-experimental pretest-posttest time series design was chosen for this study. The results achieved with the children from the intervention group were compared with

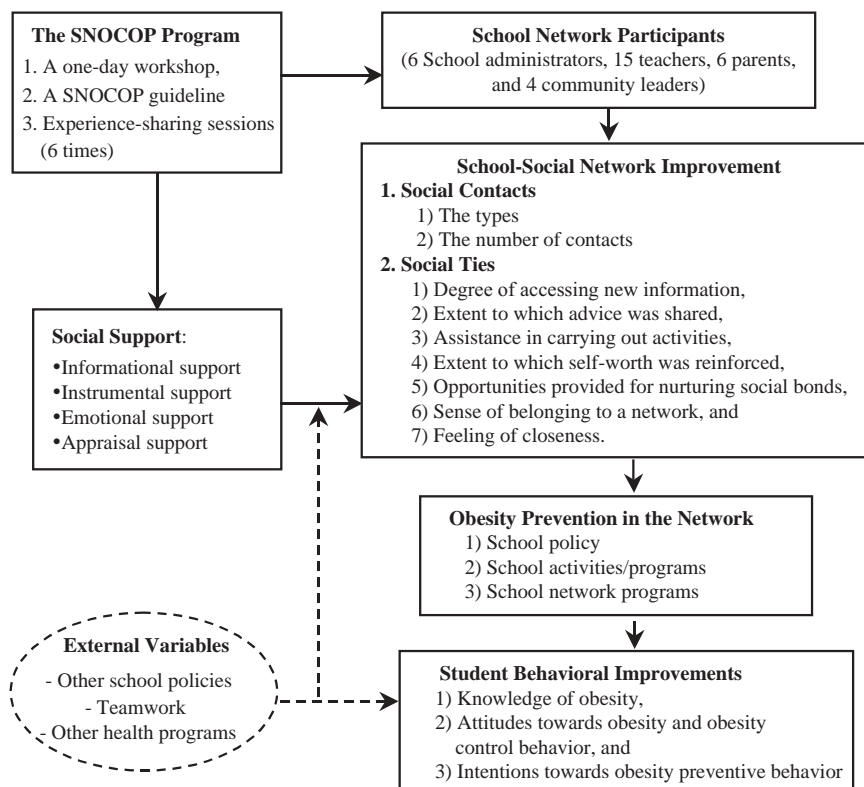


Fig 1-SNOCOP conceptual framework.

a control group. Saraburi Province was selected because its high prevalence of overweight primary school children (Ministry of Public Health, 2001). This research was approved by the Committee on Human Rights Related to Human Experimentation of Mahidol University, Bangkok (No. MU2006-236).

Sampling

A stratified sample technique was applied, based on the 313 primary schools from 13 districts of Saraburi Province. All primary schools were divided into two educational area categories. The first category identified schools located in an urban area, and a sample was drawn from this category. The same method was used in the second category, namely schools in the rural area. A two-stage sampling was applied to 133

schools in 8 districts. Five districts met the criteria of having schools of three different sizes, although one district was eliminated because it was too far away from the other districts. From these 4 districts, 2 were chosen by random sampling. Each of these districts had 6 schools, 3 of which were designated as control groups and 3 as intervention groups. From the remaining 22 schools, 12 schools were selected for participation in the project based on the following criteria: the prevalence of overweight children in each school had to be more than 10%, the location had to be convenient, and volunteers had to be willing to cooperate with the SNOCOP program.

Twelve schools (6 schools were the intervention group, 6 schools were the control group) met the inclusion criteria and were

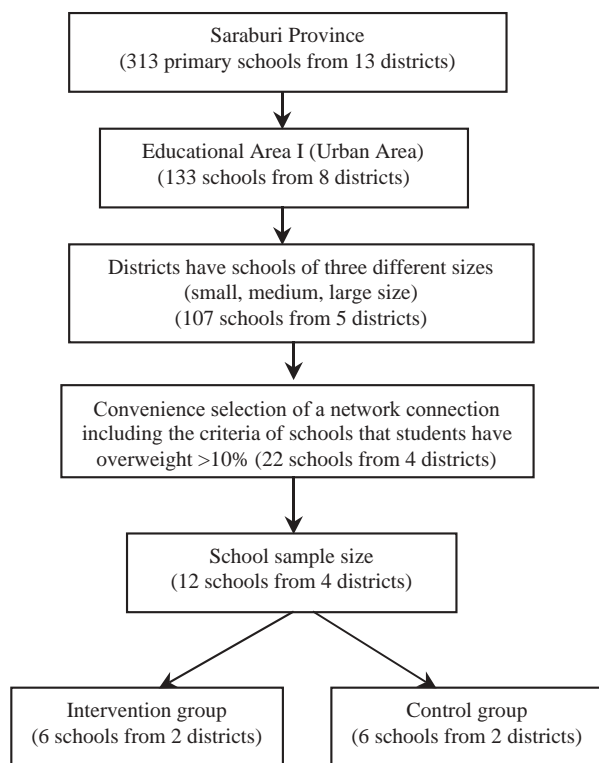


Fig 2—Steps of sample selection.

selected by simple random sampling. These 12 schools were then assigned to either the intervention or the control groups consisting of six schools in each of the 2 districts. Each group was composed of four small schools, a medium school, and a large school. Finally, by 2-stage stratified sampling selection, 375 students of the fifth grade constituted the final sample as follows: 180 students from 6 schools were the intervention group and 195 students from 6 schools were the control group in Saraburi Province (Fig 2).

Quantitative methods

The data collection instruments included questionnaires designed specifically for respective groups of respondents (*ie*, students, parents, teachers and school administrators, and community leaders), guide-

lines for in-depth interviews for network participants (teachers and administrators, parents, and community leaders), and anthropometric instruments (body weight and height used for a diagnostic method for the evaluation of overweight and obesity in Thai school children and used medical scales (RGT-200, Suheng[®], China) for weight and height measures.

The student questionnaire consisted of four parts: socio-demographic data (*eg*, sex, age, birth order, proportion of obese person in the family, meal preparation at home, pocket money for school, etc), knowledge (*eg*, healthy eating, unhealthy snack and food selection, exercise, and physical activities), attitude (*eg*, eating habit, and exercise), and intention towards obesity preventive behavior (*eg*, diet, fast food consumption, drinking carbonated beverages). Content validity of the student questionnaire and the school network participant questionnaires was approved by eight specialists: four specialists were experienced in health education and behavioral sciences, three specialists were nutritionists, and one specialist was a biostatistician.

The design of the school-network participant questionnaires were based on suitable variables found through a search of the literature (House, 1981, 1988; Berkman, 1984; Magliano *et al*, 2006). The participant questionnaires were divided into three groups for school administrators and teachers, parents, and community leaders (*eg*, village head, health personnel, school-education committee members). The overall content of the participant questionnaires included socio-demographic data, knowledge about childhood obesity prevention and school-social network development, school policy, school program/activities of childhood obesity prevention, social contacts, and social ties. Then the content experts on health education and behavioral sciences as well as the expert on

nutrition approved the content validity.

The extent of bonding among participants that occurred in the school network was measured by a questionnaire in terms of the following: 1) degree of access to new information, 2) extent to which advice was shared, 3) assistance in carrying out activities, 4) extent to which self-worth was reinforced, 5) opportunities provided for nurturing social bonds, 6) sense of belonging to a network, and 7) feeling of closeness (Berkman, 1984; Tausig, 1992; Magliano *et al*, 2006; Springer *et al*, 2006). The result of bonding was that social contact and social ties led to social support within the network. In this study, "social support" was measured by a questionnaire (Likert scale) and an in-depth interview with four variables: informational, instrumental, emotional, and appraisal support (House, 1981).

School-health-teachers reported height and weight of students by using the medical scales. Then the researcher used the growth chart interpreted weight-for-height for interpretation to nutritional status. The growth chart was used by the Department of Health, Ministry of Health, Thailand in 1999 (the BMI cutoff points that were adopted by the International Obesity Task Force were used to compare prevalence estimates of overweight and obesity in the growth chart). The weight-for-height was classified in six categories: obese (more than +3 SD), overweight (+2 SD to 3 SD), slightly overweight (+1.5 SD to +2 SD), normal (-1.5 SD to +1.5 SD), slightly underweight (-2 SD to -1.5 SD), and thin or underweight (less than -2 SD).

The reliability of the student questionnaire was tested with 85 students at a school in Saraburi Province that was not included in this research project. Responses were analyzed for Cronbach's Alpha coefficient. The results for internal consistency were 0.8694

for knowledge, 0.8416 for attitude, and 0.8354 for intention.

Qualitative methods

Focus group discussions and in-depth interviews were used to collect qualitative data about the school network process. These methods were appropriate to explain the processes of social interventions such as the SNOCOP program. Combined with quantitative data, these mixed methods can reinforce the evidence of changes in student behaviors, such as food intake and physical activities that occur during school-based activities (Johnson and Turner, 2003). Focus group discussions were organized into four groups of SNOCOP participants: six groups of student, six groups of teachers, six groups of parents, and six groups of community leaders. The focus group respondents in each group were selected by purposive sample ($n = 4-8$ for each group of respondents). All individuals included in the focus groups were key participants in the SNOCOP program. Together with the focus groups, in-depth interviews were conducted in five SNOCOP participant groups: school administrators, teachers, parents, community leaders, and students.

The researcher, who has had extensive experience as a focus group moderator, served as the focus group moderator. The focus groups were conducted using a Focus Group Interview Protocol (FGIP), developed by the researcher and based on thorough literature review related to school-based obesity prevention programs (FGIP and in-depth interview questions in Table 7). To insure that all information from the focus groups was recorded, an assistant researcher, who was trained by the primary researcher, operated a digital voice recorder and took extensive written notes. All participants in both the focus groups and in-depth interviews were asked questions on four main

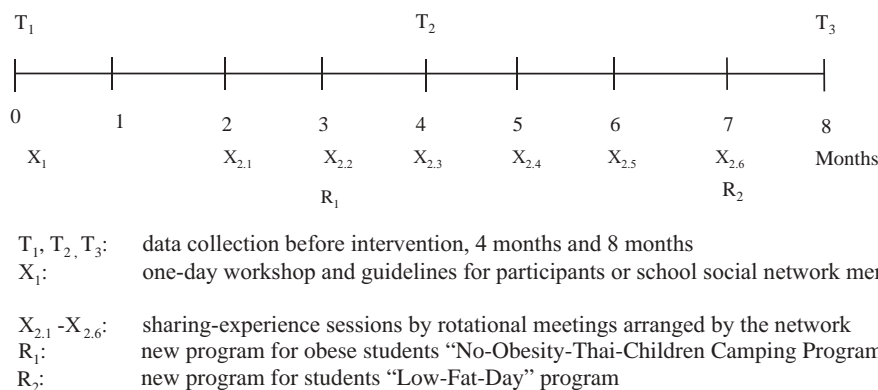


Fig 3—Time line of the network and research activities.

SNOCOP topic areas: school network programs/activities, school lunch program, food intake of students, and student physical activity improvement at 4 months and 8 months. All focus groups and in-depth interviews were conducted at the six intervention schools.

Qualitative methods were also used for the assessment of program progress and project evaluation. These included in-depth interview of school network members and focus group discussion of students moderated by the researcher. Information obtained from the in-depth interviews was used to explore the process obtained and difficulties faced in improving the function of the school network. The focus group discussions with the students served to assess the process progress of the project. The qualitative approach was adopted to augment the conclusions drawn from questionnaires and to give deeper insights into how the students perceived the various attempts to improve their understanding and attitude towards obesity prevention.

Procedure

The SNOCOP program was implemented for a period of eight months. The first session began in Month 1. After program initiation, the second session occurred in Month

3, and monthly meetings (6 meetings) were subsequently held for social network participants to exchange their experiences.

The social network was comprised of 31 participants, including 6 school administrators, 15 teachers, 6 parents, and 4 community leaders. The network-building process was crucial for the implementation of the SNOCOP program and consisted of two sessions. The first session was a one-day workshop, School-Social Network of Childhood Obesity Prevention in Primary Schools. This workshop used techniques (such as lecture with PowerPoint presentation, printing media, group discussion, participatory action plan writing, presentation, answer-the-question, and group consensus) intended to increase knowledge, empower school network participants, and form networks by encouraging them to recognize childhood obesity as a problem, appreciate the necessity of exercise and healthy eating habits, and draft effective school policies to prevent students from becoming obese. Participants were given SNOCOP guidelines (*ie*, emphasis on the roles of the school network participants separated by group; situation and childhood obesity problems; childhood obesity prevention activities, such as physical activity, and nutrition education; school food service; parental involvement; the development of

school-social networks; and implementation and follow-up plan) to improve school-social networking and to implement obesity prevention activities in the schools. The same format and procedures were used for all six meetings that focused on obesity prevention in school networks.

Two months after the first session, a second session was held to allow participants to share their experiences with each other. The experience gained while conducting the project was analyzed continuously by the social network members, and activities were adjusted accordingly. The collected experience that showed creative thinking included improvements of the school lunch program, such as reducing sugar in school cooking, changing junk food to fruits; and introducing new methods for physical activity, such as hula-hoop exercise and Thai boxing exercise. The experience-sharing sessions were intended to strengthen social contacts, social ties, and social support among participants in the network. The school-social network in this study focused on the types, number of the contacts, and extent of bonding by members of the school network of the SNOCOP program.

Data were collected on three occasions: at pre-intervention (Time 1), in November 2006; four months post-intervention (Time 2), in March 2007; and eight months post-intervention, in September 2007 (Time 3) (Note: Thai primary schools close for approximately two months during April and May). The various activities of the network and research are illustrated on a time line (Fig 3).

Quantitative data analysis

Data were analyzed using SPSS™ (version 11.5). Other than common descriptive statistics, analysis of variance was used to assess repeated measures (RMANOVA). Variables about knowledge, attitude, and

intention (KAI) towards obesity preventive behavior; social contacts; and social ties, including participants' knowledge and social support over three test periods (pre-intervention, Month 4, and Month 8) of the SNOCOP program were assessed. Multiple comparisons of the three means at each specific time were tested for significance by post-hoc tests [Bonferroni and the least significant difference test (LSD)]. Cochran's Q was used to test the schools' policy.

Qualitative data analysis

All digital recordings were transcribed as full dialogs. When the transcriptions were completed, the researcher reviewed the written manuscripts of the focus group data and the in-depth interview data for relevant themes and story lines regarding the four SNOCOP topic areas in the six intervention schools. These analyses were done by hand, not using any computer-based qualitative software. Such themes and story lines can be combined with the quantitative data to provide a more explanatory discussion of the SNOCOP program (Flick, 2006).

RESULTS

The socio-demographic characteristics of the fifth grade students of the intervention and control group did not differ before the intervention in terms of the proportion of males and females in the classes, birth order, proportion of students still living with their parents, proportion of obese persons in the family meal preparation at home, pocket money for the school, allowance for food and snacks, and transportation time between home and school ($p > 0.05$). The average age of the intervention group was 10.54 years (SD = 0.58) and the control group was 10.71 years (SD = 0.54). Therefore, the characteristics of the two sample groups were similar (Table 1).

Most of the school-network adult par-

Table 1
 Socio-demographic characteristics of the two groups.

Socio-demographic characteristic	Intervention group (n = 180)		Control group (n = 195)	
	No.	%	No.	%
Sex				
Male	88	48.9	94	48.2
Female	92	51.1	101	51.8
	$\chi^2 = 0.018, df = 1, p = 0.895$			
Age (years old)				
10	87	48.3	64	32.8
11	90	50.0	125	64.1
12	2	1.1	5	2.6
≥13	1	0.6	1	0.5
$\bar{x} \pm SD$	10.54 ± 0.58		10.71 ± 0.54	
	$t = -2.820, df = 373, p = 0.005$			
Birth order				
First	86	47.8	96	49.2
Second	68	37.8	69	35.4
Third	17	9.4	21	10.8
Forth	7	3.9	6	3.1
Fifth and more	2	1.1	3	1.5
	$\chi^2 = 2.459, df = 5, p = 0.783$			
Proportion of obese persons in the family				
Mother	47	26.1	48	24.6
Father	27	15.0	32	16.4
Mother and father	18	10.0	21	10.8
Grand mother/father	16	8.9	20	10.3
Sister or brother	14	7.8	11	5.6
Nothing	58	32.2	63	32.3
	$\chi^2 = 1.078, df = 5, p = 0.956$			
Meal preparation at home				
Purchasing at food shop	28	15.6	26	13.3
Cooking at home	152	84.4	163	83.6
Others	-	-	6	3.1
	$\chi^2 = 1.894, df = 2, p = 0.388$			
Pocket money for school (THB)	Min = 5, Max = 100		Min = 3, Max = 100	
$\bar{x} \pm SD$	23.33 ± 11.23		22.23 ± 11.27	
	$t = 0.953, df = 373, p = 0.341$			
Allowance for food and snacks (THB)	Min = 2, Max = 35		Min = 0, Max = 40	
$\bar{x} \pm SD$	14.74 ± 5.52		14.31 ± 6.36	
	$t = 0.691, df = 373, p = 0.490$			
Transportation Time(Minutes)	Min = 1, Max = 60		Min = 1, Max = 75	
$\bar{x} \pm SD$	12.44 ± 9.137		14.37 ± 11.226	

$t = -1.817, df = 373, p = 0.07$

Table 2
The mean scores of social network improvement in term of social contacts.

Time	$\bar{x} \pm SD$
T ₁	2.000 ± 0.000
T ₂	28.226 ± 7.247
T ₃	27.968 ± 7.364

$F = 233.288$, $df = 2, 60$, $p < 0.001$

ticipants (administrators, teachers, parents, and community leaders) were female (71.0%). Half of the participants were 51-60 year-olds, and the average age was 47.48 years ($SD = 9.32$). Most of them graduated with a bachelor's degree, had a personal monthly income higher than THB 30,000 (approximately USD 860), and were married (80.6%).

Social network improvement

School policies and activities. School policies and activities were described in an official school network document, prepared by the school network participants, who focused on five areas: 1) advice on food consumption; 2) exercise/physical activity; 3) teaching and learning; 4) school lunch program; and 5) the social environment, and family and community involvement. Concerning food consumption, advice concentrated on not eating unhealthy snacks and reducing sweet drinks at school. At the same time, students and school personnel exercised for 30 minutes every day, as specified by Thailand's health promotion policy. Students were educated in healthy eating, and personnel responsible for the school lunch program reduced sugar and fat content in school meals. Meetings were held with the purpose of motivating parents to work against childhood obesity and to participate in childhood-obesity prevention programs within their communities, particularly in school programs. The Cochran's Q test for school

samples ($n = 12$) was used to analyze school policy on obesity prevention of the two sample groups. The result showed that school policy was significantly different among the twelve items in the experimental group at Time 2 ($Q = 46.444$, $df = 11$, $p < 0.001$), and also was significantly different among the twelve items in the same group at Time 3 ($Q = 32.205$, $df = 11$, $p = 0.001$). Most of the items addressed were successfully altered for the intervention group with the exception of taking high sugar drinks at school.

Social contacts. After intervention, 83.95% of participants attained a high level of contact, peaking at 4 months, and this level of contact was maintained at 8 months post-intervention by 67.2% of participants. Approximately one-third (35%) of the participants contacted others in the meetings; nearly 25% of them contacted others by written correspondence, and nearly 25% had telephone contact. Moreover, half of the school network participants reported that their role was both giving and taking assistance within the network. For social contacts in the network over the three time periods, there was significant effectiveness of the SNOCOP intervention, indicated by increased mean scores at Time 2 (T₂), but slightly decreased mean score at Time 3 (T₃). The frequency of social contacts between participants in the preceding 3 months was 2.0, 28.226, and 27.968, at pre-intervention (Time 1), 4 months post-intervention (Time 2), and 8 months post-intervention (Time 3), respectively. The time spent in these social contacts was significantly different at the three time points ($F = 233.288$, $df = 2, 60$, $p < 0.001$) (Table 2).

We think that the network helped us provide programs cooperatively that one school could not do well, particularly small schools. Our school is a big school and we can support the network (School administrator, 52-years-old).

Table 3
The mean scores of social network improvement in term of social ties.

Time	$\bar{x} \pm SD$	SE
1	8.000 \pm 0.000	0.000
2	28.871 \pm 5.566	0.999
3	32.258 \pm 7.762	1.378

$F = 208.595$, $df = 2, 60$, $p < 0.001$

Social ties. The results of social ties among the school network participants showed that 16.8% of them accessed new information, 16.1% of the respondents participated in the meetings, 15.4% of them accessed communication, 15.4% of them expressed or exchanged experience, 14.0% of them made new friends, and 8.4 % of them became a leader in the network by Time 2. The results by Time 3 indicated that 16.6% of the respondents participated in the network meeting, 16% of them accessed new information, 15.4% of them accessed communication in the network, 13.0% of them made new friends, 13.0% of them expressed/exchanged experiences, 11.8% of them accessed creative programs/activities, and 10.7% of them became a network leader. In addition, the average number of new friends (cases) was 9.77 in Time 2 and increased to 11.77 in Time 3. The average number of new information (topics) was 3.26 in Time 2 and increased to 4.19 in Time 3. The average frequency of communication (times) was 2.84 in Time 2 and increased to 4.55 in Time 3. The average number of exchange experiences (times) was 1.58 in Time 2 and increased to 3.13 in Time 3. The average of the number of creative program/activity of obesity prevention (items) was 1.45 in Time 2 and increased to 2.45 in Time 3. The number of self-identified leadership activities was 6 in Time 2 and increased to 8 in Time 3.

Taking turn leaderships in the sharing ex-

perience sessions is a very good participation in the network meeting. It means the network have sharing roles, sharing places, and sharing sense of network belonging (School administrator, 53-years-old).

At 8 months (Time 3), 58.1% of the participants in the network demonstrated increased knowledge and having a sense of belonging in the network. Approximately one half (54.8%) provided advice to others in the network; 51.6% were reassured of their self-worth and had feelings for others in the network; 48.4% reported sharing experiences in the network; and 38.7% made new contacts, and exchanged resources such as food, locations, and staff through the network. The mean score of social ties of the participants increased over the three time-periods ($F = 208.595$, $df = 2, 60$, $p < 0.001$) (Table 3).

Ultimately, the participants in the SNOCOP program initiated the obesity-prevention policies for all the schools in the network. Then, due to school contacts and social ties, school administrators and other school network participants organized internal activities and created network programs within and among schools-a "No-Obese-Thai-Children Camping Program" (a one-day activity in the first semester for 109 overweight and obese children and 58 of their parents) and a "Low-Fat-Day Program" (a one-day activity in the second semester for 180 fifth grade students was expanded to include 377 fourth and sixth grade students (including 103 students from three schools outside the network).

Everything that we do; we do for our students; we do not do for the network, but the network helps us to do the program well. A small school has no power to provide the obesity prevention program alone, because of the small number of teachers and the limitations of the budget. The network can sup-

Table 4
Analysis of variance of knowledge, attitude, and intention towards obesity preventive behavior by groups and times.

Source of variance	df	F	p-value
Knowledge			
Between subjects	374		
Group	1	50.913	<0.001 ^b
Within group (error)	373		
Within subjects	750		
Time	2	68.517	<0.001 ^b
Group x Time	2	48.683	<0.001 ^b
Within subject error	746		
Attitude			
Between subjects	374		
Group	1	4.426	0.036 ^a
Within group (error)	373		
Within subjects	750		
Time	2	24.799	<0.001 ^b
Group x Time	2	26.371	<0.001 ^b
Within subject error	746		
Intention towards obesity preventive behavior			
Between subjects	374		
Group	1	28.438	<0.001 ^b
Within group (error)	373		
Within subjects	750		
Time	2	63.029	<0.001 ^b
Group x Time	2	45.071	<0.001 ^b
Within subject error	746		

^a $p = 0.05$, ^b $p = 0.001$

port schools to provide the school activity in the program, such as personnel, place, and material. Then the small school can take part in the programs (Teacher, 53-years-old).

The investigators served as the coordinators and facilitators in the network and provided information if requested by the network. The outcome of the SNO COP program improved student behavior in term of knowledge, attitude, and intention towards obesity preventive behavior.

Student behavior improvement

Knowledge, attitude, and intention (KAI) towards obesity preventive behavior

were analyzed: the intervention group performed better on these measures than the control group at the three measuring points (Table 4).

Food consumption. In school network meetings, school network participants exchanged obesity prevention strategies for integrating educational activities in schools, such as regular morning talks before classroom everyday by teachers, online lunch talks by student leaders, and school lunch service improvement in schools. Because of school network efforts, schoolchildren altered food consumption, emphasizing on the reduction

Table 5
The average mean scores for fast food eating behavior of the samples, T₁, T₂, T₃.

Fast food eating	Experimental group (n = 180)		Control group (n = 195)	
	$\bar{x} \pm SD$	SE	$\bar{x} \pm SD$	SE
T ₁	29.033 ± 2.956	0.220	28.456 ± 2.957	0.212
T ₂	30.017 ± 3.403	0.254	28.780 ± 2.982	0.214
T ₃	29.633 ± 3.628	0.270	28.995 ± 3.208	0.230

F = 11.770, df = 1, 373, p = 0.001

Table 6
Nutritional status, experimental and control groups, T₁, T₂, T₃.

Nutritional status	Experimental group		Control group	
	n = 180	%	n = 195	%
Before intervention (T ₁)				
Obese + Overweight	25	13.9	22	11.3
4 months (T ₂)				
Obese + Overweight	20	11.1	20	10.2
8 months (T ₃)				
Obese + Overweight	18	8.5	23	11.8

of 14 kinds of fast food with high calories, high fat, carbohydrate, and sugar contents. Examples of readily available foods included fried chicken, fried meatballs, fried sausage, French-fried potatoes, donuts, hamburgers, hotdogs, pizza, sandwiches, *roti* (fried unleavened bread), crepes, and packaged snacks. Most of the children in both the intervention group and the control group ate fast foods throughout the intervention period. More than 90% of students ate fried chicken 3-4 times per week, and more than 80% had eaten fried meatballs 3-4 times per week. The percentage of the frequency of fast food eating behavior decreased slightly between Time 1 and Time 2, and stabilized by Time 3. Repeated measures of ANOVA tested fast food eating behavior at the three

times. The results indicate that there was a significant difference between the experimental and control groups concerning their fast food eating behavior (F = 11.770, df = 1, 373, p = 0.001) (Table 5). Therefore, the students in the intervention group demonstrated practices about reducing fast food eating behavior, while the control group showed no change in their practices to reduce food items with high-fat content.

Physical activity. Before the intervention, students in both the control and intervention groups had the same amount of self-reported and observed physical activity (p = 0.245). The SNOCOP program provided 30 minutes of exercise for the students in the intervention group every day and promoted additional exercise during lunchtimes and after

school. The percentage of students in the intervention group that exercised at least 30 minutes every daily increased from 77.2% to 100%, while the control group indicated relatively stable exercise at Time 1 and Time 2 (82.1%; 87.2%) that did not change from its baseline values of 30 minutes exercise once a week.

Nutritional status of students. The result showed that there was a trend to reduce weight and improve the nutritional status of students when the categories “obese” and “overweight” were combined and compared over times T_1 , T_2 , and T_3 . The experimental group showed an improvement (13.9%, 11.1%, and 8.5%); while the control group showed no improvement (11.3, 10.2%, and 11.8%) (Table 6).

DISCUSSION

This study tested the feasibility of SNO COP to establish a social network for the prevention of obesity in primary schools. The SNO COP program resulted in a change at three levels of the school network: improved school policy towards reduction of obesity, established a closer school network that increased social contacts and social ties of school network participants at four months (T_2) and eight months (T_3), and improved student nutritional and health behavior. This confirms the potential of school networks to improve social contacts and social ties, and promote social capital, collaboration, sharing of experience, information, knowledge and innovative activities (Kahne *et al*, 2001; Smith and Wohlstetter, 2001).

School network participants developed their schools’ policies, and implemented the programs and school activities for obesity prevention for schoolchildren both internal and among schools in the network. At the SNO COP workshop, school administrators, teachers, parents, and community leaders

worked together to formulate suitable school policies on childhood obesity prevention through the network. The results were consistent with a previous study (Surakiat, 2005) that suggested that school policy is important for effectiveness in promoting students’ health (WHO, 2004). However, although schools in the network have a policy of “no sweet drinks in school (particularly, carbonated drinks),” one of the intervention schools was prevented from implementing this policy because it had a commitment to a soft drink supplier.

Additionally, the participants drafted an action plan to promote obesity prevention of schoolchildren and included community leaders in the activities. The school network also increased cooperation, communication, and collaboration, as was found in other studies (Armstrong and Rada, 1989; Slater, 1993; Meier and O’Toole, 2001). The participation of parents, however, was difficult to obtain because of the shortage of their time due to working hours.

Of particular importance are sessions in which the experience of the different groups could be exchanged. The experience-sharing sessions between schools increased network interactions and social support to the school program activities. It has been suggested that school networks increase cooperation, communication, and collaboration (Mullen and Kochan, 2000). Networking increases meaningful interactions among schools within a scheme in that important functions include the social relationships and the linkages between persons that provide social support (Glanz *et al*, 2002). In this study, meeting places, food, and materials were shared in the obesity prevention program. For example, the largest school in the network offered lunch for all of the students who participated in the program.

In this study, the school network

Table 7
Examples of Focus Group Questions.

For fifth-grade students

1. What do you think about your body image? 2. If you think you are obese. What do you do and how? 3. What did your school provide for obese students? How school did? Do you like that? 4. Please explain your school lunch program. What did food menu at school on Monday to Friday? What food is always cooked? What kind of food does you like the most? 5. Do you think that school lunch of this semester be different form last semester? 6. What did your parent provide food for you? What did you have for breakfast in this morning? 7. Please let me know your food menu on last holiday. 8. How did you exercise at school and at home? 9. How did you reduce sugar-high food, fat food, and carbonated drink?

For school administrators

1. What did school policy lead to practice well? How school did? 2. What are new programs or activities that come from the obese prevention policy? 3. How programs or activities are different from the last semester? 4. How school-social network of obese prevention effect on the students, especially obese students? 5. Please explain the strategies of obese prevention that you did. 6. Please explain resource for obese prevention of the SNOCOP that received for school network. (such as personnel. budget, tools, place) 7. What did community used to support your school in obese prevention programs? 8. How did you know your school programs be successful? 9. How about the participation of obese prevention of teacher, parent, community and cook, food seller? 10. How did you receive from the meeting of sharing experience? 11. What do you plan to do about obese prevention next semester?

For teachers

1. What is your role in this school? 2. Please explain programs or activities about obese prevention that school did? What did you do and how? 3. How your school provide school lunch? How did it change after SNOCOP involved in school? 4. How did persons cooperate in programs/activities of obese prevention? (persons such as other teachers, students, parents, caretaker, cook, and community members) 5. How did you follow-up obese student to change behavior of obese prevention? (such as carbonated drink, fat food, snack, and sugar-high food including exercise, physical activity and TV watching) 6. How did you evaluate output/outcome of obese prevention program? 7. Did you have a chance to report or consult about obese prevention in the school meeting? 8. What did you report the result of SNOCOP in school meeting? 8. What did you do in the SNOCOP network? How? 9. What problems did you find in the SNOCOP network when you participate in the network? 10. How did you solve the problem? Please explain more detail.

For parents

1. What did you think about obese children? 2. What did you do when your child look obese? 3. What did you participate in the school program of obese prevention for student? 4. What did you support your child about obese prevention? How? 5. Please explain your cooking for your child. 6. What did you do when your child want to eat high calories food and sugar-high snack? 7. Do you think about obese child should be controlled weight? Why do you think that? 8. What did you advise about exercise for you child? How? 9. What did school do for obese prevention or weight control? 10. Did you participate in obese clamping? What did you do after lamping for your child? 11. What did you change? (such as cooking, advising, child weight control)

For community members

1. What is you role in community? 2. What did you support obese prevention in school? How? 3. What do you think about obese children should be controlled weight? Why? 4. What did you suggest school to create some program for obese prevention? 5. What do you plan to do for obese prevention in community? How?
-

involved building rapport among six different schools in two different districts. It was not always easy to cooperate with other schools, although the schools might have the same goal to prevent obesity. However, it may be possible to integrate school networks for various purposes, not only for obesity prevention, but also for other health prevention and health promotion programs (eg, healthful school living, life skills, tobacco prevention) (Valente *et al*, 2003). Studies support the observation that social networking is a slow process of trust development during long periods of interaction (Krackhardt, 1992). Network connections need to flow through social support in the network. Therefore, an experience-sharing session is an important strategy of the SNO COP program to achieve this goal. Friedkin and Johnsen (1997) suggested that participants who share experiences, information, and interpretation by communicating are influenced by each other because of their positions in the social network. The SNO COP program results indicated that the school network participants exchanged or shared experience on obesity prevention in the network meeting. The average of number of communication events in the network was three times within a four-month period. During the meetings, sharing of experiences was achieved during school activities that focused on childhood obesity prevention, such as exercise programs, school lunch program, and creating two new programs for obesity prevention.

RMANOVA analyses indicated that, after the implementation of the SNO COP program, student behavior on knowledge, attitude, intention towards obesity preventive behavior and food consumption behavior, measured over three time periods, suggested that there were positive improvements. Therefore, the SNO COP program demonstrated the potential to improve student be-

havior effectively due to school network participation through social contacts, social ties, and social support. However, the nutritional status of the intervention and the control groups was not significantly different because of the limited duration of the program.

This study had design and methodological limitations. First, the SNO COP program was implemented for a short duration (two semesters/8 months), and no reductions in weight or an improved nutritional status could be measured. A systematic review from 1985 to 1999 found that short-term interventions (>3 months and <1 year) have little effect in reducing the prevalence of obesity (Campbell *et al*, 2001). An intervention of at least 18 months duration might show some reduction in weight because of a combination of physical activity/exercise and food control intervention. The "Pathways Program," undertaken as a three-year school-based intervention program for American Indian school children, resulted in changes in classroom curricula, food service, physical activity and exercise, and family involvement, but found no significant reductions in the percentage of body fat, but improved knowledge, attitude, and practice (Caballero *et al*, 2003). However, most of the effective prevention interventions that included at least a dietary and a physical activity aspect suggested that most interventions were able to reduce dietary fat intake, increase physical activity during school time, and reduce television viewing time (Perry *et al*, 1990).

Another limitation of this study was the finding that few parents found the time to attend the meetings of the network. The influence of parents would have been needed to motivate children to change their eating habits. A school-social network should therefore make every effort to educate parents to reduce television-viewing time and

prevent the consumption of unhealthy snacks. Some parents, perhaps for cultural reasons, still have a positive attitude about obese children and consider them especially healthy. Community-wide efforts are also needed to increase awareness and promote an environment that encourages physical activity and healthy nutrition (Sothorn, 2004). In addition, this study overlooked psychosocial aspects of childhood obesity.

Methodological limitations to this study include the purposive sampling of the districts, which render it non-representative on a national level. However, randomized assignment of the sample to control and intervention schools mitigated the potential bias of the initial sampling strategy. The second methodological limitation might have been the lack of a blinded assessment of outcomes, particularly for the nutritional status component. However, blinded assessment is not done in most nutritional studies.

A school policy that related to obesity prevention was functioning due to school network effectiveness through the SNO COP program. Participants gained more social contacts and social ties from the experience-sharing sessions: the establishment of a social network for preventing obesity in primary schools proved feasible through the SNO COP method. In the intervention schools, the effectiveness of SNO COP program improved student behavior in terms of knowledge, attitude, and intentions related to obesity prevention, including reducing fast-food eating behavior when compared to control schools. Therefore, the SNO COP program is possibly a feasible program for school-based obesity prevention at the primary school level.

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