

# Children Diabetes and Nutrition Clinic (CDNC) Initiative in Phra Nakhon Sri Ayutthaya Hospital

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**Objective:** To provide one-stop services of health care model of children with nutritional problems such as childhood obesity, diabetes mellitus, and failure to thrive at a regional general hospital setting. Additionally, to establish the Children Diabetes and Nutrition Clinic (CDNC) as a conceptual model staffed by a multidisciplinary teamwork at the regional setting that will help to improve the disease outcomes and efficiency of care and management.

**Materials and Methods:** The present study was an action research, conducted at Diabetic Mellitus and Nutrition Clinic in Phra Nakhon Sri Ayutthaya Hospital. The present study enrolled all children younger than 15 years old who attended the outpatient department (OPD) with malnutrition problems (childhood obesity, failure to thrive, and diabetic mellitus). The line of care was divided into three groups based on disease categories or problems. The one stop services with a multidisciplinary team, consisting of pediatricians, general practitioners, dietitians, pharmacists, and nurses, was engaged to educate, manage, care, and follow-up the patients, and compare the clinical outcomes and successful rate of treatment at baseline, 6 months, and 12 months after the treatment.

**Results:** The gradual reduction rate of obese children, with improvement of weight for height (W/H) at 6 and 12 months after going through the CDNC model, were 20%, 40% of reduction, respectively ( $p < 0.05$ ). Patients with persistent progressive weight gain were admitted in the "Weight reduction camp" and closely followed up by the multidisciplinary team. They also used "line" group-application to enhance compliances and adherence during the follow-up period. The diabetic patients were adjusted to receive standard insulin protocol correctly. They also changed to basal bolus and modified the basal bolus regimens if the conventional regimen did not work. Patients were follow-up and screened to micro and macro-vascular complications and appropriated referred to endocrinologists if needed. The causes of the diseases of the patients that failed to thrive were explored and the appropriate care, treatment, and followed up were provided.

**Conclusion:** Children with nutritional problems, especially obesity, are increasing. Additionally, there is a lack of appropriate care because of the lack of sub-specialty and resources in sub-urban and rural setting. A multidisciplinary teamwork that includes pediatric nutritionist, pediatric endocrinologist, nurse, and dietitian, as well as long-term follow-up plan are needed. The authors demonstrated the CDNC model of care and management of these patients by a multidisciplinary team at a regional general hospital setting. The improvement and success of the CDNC model is recommended to establish good clinical outcomes and parameters.

**Keywords:** Nutrition clinic, Obesity clinic, Multidisciplinary team, Obese children, Obesity

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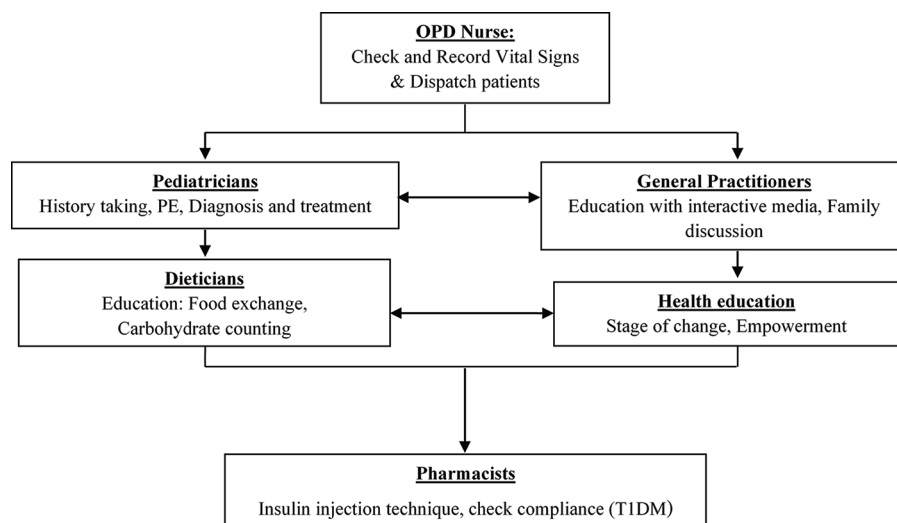
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Nowadays, non-communicable diseases (NCD) are some of the global disease burdens. About 15 million people died from the NCD between the ages of 30 and 69 years, and more than 85% of premature deaths happened in low- and middle-income countries. The NCD problem is comparable to that of the current communicable diseases<sup>(1-3)</sup>. As with the global trend, a five years statistical report by Ayutthaya Hospital found that the number of pediatric out-patient units is significantly increasing<sup>(4-6)</sup>. This correlated well with the recent national finding suggesting that children's nutrition status mostly depends on the environment,



**Figure 1.** Work flow chart in one-stop service management in Pediatric Diabetes and Nutrition Clinic (CDNC) at Pranakhorn Sri Ayutthaya Hospital.

eating behaviors, and parent nourishment<sup>(7)</sup>. Obesity in children is commonly caused by inappropriate diet intake such as fast food and junk food, which is convenient for both seller and consumer and deemed suitable for a hectic society. The other additional causes are a sedentary lifestyle and spending more time in front of a screen<sup>(8)</sup>. Therefore, the authors can find obesity in school-age children more frequently, and it is becoming a significant national problem.

Regarding these problems, obesity, metabolic syndrome, diabetes mellitus (DM), and failure to thrive (FTT) can occur due to malnutrition, inappropriate intake (less or more), and influence from genetic inheritance. Pediatricians, researchers, and a working team began seeking out many solutions and campaigns to solve the problem in practical ways. This began the initiation of a proper nutrition care clinic in Phra Nakhon Sri Ayutthaya Hospital. Many obese children need to be managed in the out-patient unit. These patients need optimized treatment with holistic health care approaches, such as medications, an appropriate insulin protocol treatment, nutrition therapy, and nutrition knowledge. These mixed types of patient were enrolled in the Children Diabetes and Nutrition Clinic (CDNC) to provide continuity and well-rounded care.

## Materials and Methods

The present study has enrolled all the children who attended the Diabetic Mellitus and Nutrition Clinic in Phra Nakhon Sri Ayutthaya Hospital between October 2015 and 2016. The clinic main objectives

were to care for the three main groups of patients, obese, DM, and FTT patient. This was done by a multidisciplinary team. The authors designed the clinical record form (CRF) that included the clinical parameters, medications, advices and patient's habits, clinical follow-up information of patients, and outcomes of treatment.

The multidisciplinary team included trained pediatricians, interns or general practitioners (GP), nurses, dieticians, pharmacists, and health education nurses. The design protocol of the CDNC model followed these steps (Figure 1):

1) Trained OPD nurses took patient history, measurement of vital signs, and physical components (weight, height, BMI, and waist circumference) then categorized the patients into one of three groups based on three main-groups of care as a triage point.

2) Trained pediatricians managed the first room. The pediatricians were precisely taking the patient's history and physical examination. Then, they evaluated the patient's lifestyle and prescribed proper medication if they needed.

3) The second room was the GP room. The general doctors or intern focused on patient group discussion and their education about medical problems and comorbidities.

4) The third room was for the dietitians and health education nurses. The dietitians educated and advised about the proper diet and food challenges for their diseases such as caloric counting, food exchange program for diabetic patients, and low glycemic index food for obese patients. The health education nurse

**Table 1.** Healthcare providers functional model in Child Diabetes Mellitus and Nutrition Clinic (CDNC)

Staffs	CDNC	
	Diabetic clinic	Nutrition clinic
OPD nurse	<ul style="list-style-type: none"> <li>• Screening history and measure vital signs, body weight, height, BMI and waist circumference</li> <li>• Triage care point to dispatch patients into 3 group's rooms</li> <li>• Advice and remind the patient and their family about hypoglycemia and hyperglycemia symptoms, and self-monitoring</li> <li>• Recheck routine annual laboratory screening such as screening diabetic retinopathy, Urine micro-albumin and HbA1C</li> </ul>	<ul style="list-style-type: none"> <li>• Advice and remind patient and family about appropriate food program, dietary exchanges and exercise</li> </ul>
Pediatricians	<ul style="list-style-type: none"> <li>• Exhaustive history taking, physical examination and send appropriate laboratory investigation for new patients (reference from Thai Clinical Practice Guideline)</li> <li>• Finding comorbidities and complications for old registered patients</li> <li>• Give patient education for their diseases</li> <li>• Follow up until disease improved or until age 15 years old</li> </ul>	<ul style="list-style-type: none"> <li>• Follow up at least 1 year for obesity group and at least 6 months in failure to thrive group</li> </ul>
Interns (general practitioner)	<ul style="list-style-type: none"> <li>• Family group discussion for each disease</li> <li>• Patient education about diseases and their complications by VTR and other programs of presentation such as PowerPoint presentations</li> </ul>	
Pharmacists	<ul style="list-style-type: none"> <li>• Demonstrate and remind recapitulate insulin injection technique and give counseling with patient about usage problems</li> </ul>	<ul style="list-style-type: none"> <li>• Counseling with the patient about drugs used problems consists of related oral medications</li> </ul>
Dietitians	<ul style="list-style-type: none"> <li>• Nutritional education about appropriate food for diabetic patients</li> </ul>	
Health education nurses	<ul style="list-style-type: none"> <li>• Counseling and stage of change assessment for patient and family</li> <li>• Advice on the reminder of adherence about medication and exercise</li> <li>• Adjust improper behaviors to good health behaviors</li> </ul>	

CDNC=Child Diabetes Mellitus and Nutrition Clinic; OPD=outpatient department; VTR=video tape recorder

evaluated the stage of change of the patient and the family, and provided empowerment, and advice.

5) Finally, the pharmacists demonstrated and recapitulated the insulin injection technique, and counseled with the patient about drugs used problems.

All the enrolled patients will follow the programs in the three rooms in separate session, then return to the OPD nurse for an appointment for the next visit. New patients or patients who cannot control their diseases received monthly appointments. Patients that have been in the program for at least three months and are controlling they diseases were given follow-up appointments that were two to three months apart. Please see Table 1 for details.

### Children obesity's care

Children with obesity were screened from four types of clinics. The first group of patients were enrolled from the pediatric out-patient unit by the pediatrician and GP, who worked five days a week, Monday to Friday (9 a.m. to 12 a.m.). The second group of patients were enrolled at the extended

general out-patient unit that is working from Monday to Friday (5 p.m. to 8.30 p.m.). The third group of patients were enrolled from the community hospital and extended primary care unit in Phra Nakhon Sri Ayutthaya province. The fourth group of patients were from any ward or clinic who have detected patients with a weight for height ratio (W/H) of more than 140% that needed treatment to reduce and control the weight. All of the children were assigned to the CDNC on every Tuesday between 1.00 p.m. and 4.00 p.m.

The new patients had history taking and physical examination. Additionally, the causes of the obesity were explored. The present study also assessed the metabolic syndrome risks and behaviors. Patients who had their W/H greater than 200%, had a positive family history of metabolic syndrome, or had rapid weight increase, and had their fasting blood sugar (FBS) when screening DM of more than 126 mg/dl were evaluated about pancreatic autoantibody AntiGAD, antiIA2 for differentiating DM type I (type IA or type IB) or type II, lipid profile, serum cholesterol, triglyceride, high-density lipoprotein

(HDL) and low-density lipoprotein (LDL) for hyperlipidemia, and alanine transaminase (ALT) for fatty liver.

The multidisciplinary care team from the CDNC intervened and provided continuing care with a holistic approach by the pediatricians with small group discussion by the GP or intern who was responsible for each session. The team gave important essential information about the causes of the diseases and provided knowledge of self-health care at home by teaching and demonstrating with a Power Point presentation and short video information or VTR. The present study randomly picked three to four patients and their families into one large group and gave information, experiences, self-health care, and knowledge to share within the group.

Dieticians gave useful information about appropriate food for their diseases. They explain how to exchange food for better selection and programs to help them. They made a follow up appointment for the patients and their families to re-evaluate the patient. The dietician informed the patient about the disease condition. They empower the patients by providing related content, and associated information, health education, and self-care. The nurse evaluated the patients and their families about the stage of change such as attitude and thinking, perception about their problems, and power to change lifestyles, providing re-empowerment to the patients.

The team made a comprehensive brochure that contains the main information about caring for themselves at home such as the self-management of hypoglycemia or hyperglycemia for diabetic patients, tip and trick for good health for obese patient, and proper food and nutrient for patients with weight gain problems. During the follow-up period, new patients or patients who cannot control their diseases received monthly appointments. Patients that have been in the program for at least three months and are controlling they diseases were given appointments that were two to three months apart. Please see Table 1 for details. Furthermore, poorly controlled patients and rapid weight gain in obese patients were offered to go to the “Weight reduction camp” in October and April (summer and vacation for student) for seven days to give exhaustively detail about ways to control weight, causes of obesity, risk and morbid-mortality. At the camp, they learned about carbohydrate and caloric counting from a dietician, appropriate exercise for obese children from a physical therapist, and proper activities for weight control from a health education nurse. The benefit of this camp was knowledge

retention for long-term care for being good health. Every 3 to 6 months, staff in CDNC set a meeting to share the problems about working in this clinic and solutions and solved problems together.

An extra-activity in this clinic are giving out presents like positive reinforcement for all patients every new year. The authors gave the three special gifts for three ranks of rewards to children who are the best patient to reduce and control their weight.

The authors made the “Line groups” via “Line” application, which consisted of the multidisciplinary team members and the patients and their families after the weight reduction camp. The purpose of this intervention was to share important news, give announcement, follow up, and motivate patients and families. The team will discharge a patient when the diseases are well controlled and the patient got a normal percent W/H for at least three consecutive months. This is to make sure that both the patient and the family truly understand about proper food and exercise for their diseases or health condition.

#### **Type I and type II diabetic mellitus care in children**

Both types of diabetic mellitus children (type I and II) were confirmed and registered in the clinic. The team did the history review, physical examination, and sent the samples to the proper laboratory for tests and confirm when needed. Patients and families were evaluated on basic knowledge, medical care, and comorbidities. This clinic included patients with comorbidities such as hyperthyroidism, and HIV infection.

A previous treatment for type I diabetic children included in the present study was premix insulin (conventional regimen), however, they could not maintain their good blood sugar level to achieve the goal of the treatment. Another group was patients who had high HbA1C before being enrolled into the CDNC. After being enrolled into the CDNC, their regimen was changed from conventional regimen to basal bolus regimen or modified conventional regimen that used an appropriate regimen for children and adolescent. Another action taken for the poor control DM patients was to adjust the insulin regimen to control the blood sugar level or change the insulin regimen to a more appropriate regimen. Furthermore, positive reinforcement was given through a health education program. For the follow-up protocol, uncontrolled patients (HbA1C greater than 8%) would be seen monthly and the insulin regimen would be adjusted. Furthermore, screening for short- and long-term complication was done, and a diabetic

**Table 2.** Protocol of follow-up short-term and long-term complications for diabetic patient in CDNC

Short-term complications	Treatment and caring protocols
Hypoglycemia and hyperglycemia	<ul style="list-style-type: none"> <li>• Education about symptoms and self-treatment and symptoms that must come to hospital at first visit</li> <li>• Give brochure about self-care about common problem in diabetic mellitus for patient and family</li> <li>• Review of knowledge about self-care every outpatient visit</li> <li>• Initiate Line group “Child Diabetic Mellitus in Ayutthaya” for giving information and primary self-care by pediatrician</li> </ul>
Long-term complications	Treatment and caring protocols
Diabetic retinopathy	• Screening at first visit then every 1 to 2 years
Diabetic nephropathy	• Blood test for blood urea nitrogen (BUN), creatinine (Cr) and urine micro-albumin at first visit then annually. If abnormal blood test, they will be assess for causes and treatment for diabetic nephropathy protocol.
Diabetic neuropathy	• Preparing to order microfilament and will screen diabetic neuropathy annually
Hyperlipidemia	• Blood test for cholesterol (Chol), triglyceride (TG), low-density lipoprotein (LDL), and high-density lipoprotein (HDL) at first visit then annually. If abnormal blood test, they will be assess for causes and treatment for dyslipidemia protocol.
Hyperthyroidism	• Blood test for thyroid stimulating hormone (TSH) and free T4 at first visit. If abnormal blood test, they will treat for autoimmune thyroiditis protocol.

education was performed at the end of the semester, see Table 2.

The new case patients, the type I DM patients, and the old case patients who did not know or were not confident to care for themselves were referred to the pediatric endocrinologist at the University Hospital (Siriraj Hospital). These patients were admitted in the hospital for two weeks and provided learning classes for diabetic education. During that time, their insulin dosage and regimens was adjusted. The goal of the authors’ team was to send most of type I diabetic children who cannot self-care to the self-education program at least one time. The self-education program was administered by the pediatric endocrinology department. The patients who cannot be admitted to Siriraj Hospital were admitted for the diabetic education program at Phra Nakhon Sri Ayutthaya Hospital for one week. This diabetic education program was managed by a multidisciplinary team consisting of pediatricians, pharmacists, pediatric nutritionists, and health education nurses. During their stay, the adjustment of the insulin regimen was done. In addition, pediatrician encouraged and educated the patients about important and emergent information such as how to detect hypoglycemia and hyperglycemia, and their symptoms, how to recognize warning signs and symptoms to prevent diabetic ketoacidosis. and how-to self-monitor properly. The pharmacist reviewed the insulin dosage and technique for patients and family. The pediatric nutritionist discussed topics such as carbohydrate counting, appropriate food for diabetic patients, parents and

cookers of the family. The health education nurse trained and initiated inspiration on how-to self-care for those chronic diseases.

After being discharged, the health care providers follow-up with the patients and the family using the “Line group” application “Child Diabetic in Ayutthaya” that consist of all the members of the team as well as both patients and care givers. The objectives of this group were to provide long-term communication between the provider’s team and the patients, and to consult in case that acute problems developed after discharge.

Patients were referred to the internal medicine doctors when their age were more than 15 years old.

#### **Failure to thrive care in these children**

All patients diagnosed FTT had their history taking and physical examination done. Then the causes of the problems were determined, as shown in Table 3. The patient with percent W/H below the 90 percentiles will have a blood examination that included complete blood count (CBC) to look for nutritional anemia such as iron deficiency anemia, megaloblastic anemia, or iron depletion. They were also checked for blood urea nitrogen (BUN), creatinine (Cr), electrolyte, and urinalysis (UA) for chronic kidney diseases and undetected renal diseases that can causes of patient stunting and poor weight gain.

After the authors found the causes of FTT, the team would directly treat the causes of illness, and follow up, based on the protocol in Table 3. If their

**Table 3.** Causes of failure to thrive and treatment and caring protocol in CDNC

Causes of Failure to thrive	Protocol management
Nutritional causes; e.g., <ul style="list-style-type: none"> <li>• Improper feeding</li> <li>• Feeding difficulty</li> <li>• Picky eater</li> </ul>	<ul style="list-style-type: none"> <li>• Nutritional counseling about technique for feeding and emphasized with proper complimentary food, adequate amount of food, Five groups of food and iron supplement or high iron component food.</li> <li>• If percent weight for height below 90, they were given medication if indicated for example multivitamin, zinc sulfate, iron supplement and high caloric milk (30 kcal/ounce)</li> <li>• They were found signs and symptoms of micronutrient and macronutrient deficiency and treatment</li> </ul>
Genetic diseases	<ul style="list-style-type: none"> <li>• History taking, physical examination and laboratory investigation for example chromosome study for finding cause of disease</li> <li>• If their comorbidities were developmental problems for example cerebral palsy or globally delayed development, patients were consulted with development and behavioral pediatrician (DBP) in development clinic in Phra Nakhon Sri Ayutthaya Hospital</li> <li>• If their problems were complicated, mainly genetic problems and need sub-specialty care, they were referred to medical school hospital</li> </ul>
Endocrine diseases	<ul style="list-style-type: none"> <li>• History taking, physical examination and laboratory investigation for example chromosome study for finding cause of disease</li> <li>• If their problems were complicated, mainly genetic problems and need subspecialty care, they were referred to medical school hospital</li> </ul>
Child rearing problem <ul style="list-style-type: none"> <li>• Neglect child</li> </ul>	<ul style="list-style-type: none"> <li>• Nutritional counseling and child rearing counseling</li> </ul>
Normal physiology <ul style="list-style-type: none"> <li>• Family short stature</li> <li>• Constitutional delayed growth and puberty</li> </ul>	<ul style="list-style-type: none"> <li>• Nutritional counseling about proper complimentary food, adequate amount of food, 5 groups of food and iron rich food</li> <li>• Reassurance, promote self-esteem to patient and support family</li> </ul>

causes were more complicated, for example genetic diseases and renal diseases, they were referred to a subspecialty doctor in the medical school hospital.

The multidisciplinary treatment in the CDNC consisted of the pediatrician finding the causes of FTT, informing the patient and the family about the appropriate food relevant with their diseases, and prescribing medication if indicated or prescribing multivitamin, zinc sulfate, folic acid, ferrous sulfate, and high caloric milk formula. The pediatric dietician informed the patient and the family about appropriate food for the age, common nutritional problem solution for the patient, the parent, and the one that was cooking for them. The health education nurse was empowering and supporting patients and their family with additional information as required.

The authors use multi-media to teach about important information and provided brochures that consist of basic knowledge about appropriate food for children, common problems about malnutrition, and treatment. For the first three months, or until the patient improved, the team would meet with the patient every month. When the patient improved, the team met with the patient every two to three months until the patient reached normal weight and had knowledge for long-term care.

The authors would discharge the patient from the clinic when they sustained normal growth for six months and had adequate knowledge for long-term care.

This research and comparative study and the CDNC model were created to improve malnutrition problems in children at the Diabetic Mellitus and Nutrition Clinic in Phra Nakhon Sri Ayutthaya Hospital. The present study was approved by the Ethical Clearance Committee on Human Rights Related to Researches Involving Human Subjects of Phra Nakhon Sri Ayutthaya Hospital (IRB no.010/61).

### Statistical analysis

The descriptive characteristics was presented using mean and standard deviation (SD) values for continuous data and percentages for categorical variables. The comparisons between successful rate of clinical outcomes between the three groups of interested outcome, childhood obesity, DM type I, and FTT, at 6- and 12-month after treatment with the baseline data were performed using chi-square or Fisher's exact tests for categorical variables. The Student's t-tests was used for continuous variables. All analyses were performed using Stata, version 14.0 (StataCorp LP, College Station, TX, USA). A p-value

**Table 4.** Demonstrate the group of patients separated by diseases in CDNC at 1<sup>st</sup> visit, 6<sup>th</sup> months, and 12<sup>th</sup> months

Type of patients	Number of patients at 1 <sup>st</sup> visit (person)	Number of patients at 6 <sup>th</sup> months (person)	Number of patients at 12 <sup>th</sup> months (person)
Obesity	50	20	5
Type I diabetes mellitus	8	8	8
Failure to thrive	40	25	10

**Table 5.** Outcome after patients and family finished weight reduction camp and follow-up with “Reduced the authors’ weight” line application program

Number of patients	Pretest (points)	Posttest (points)	Weight before activities (kg)	Weight after activities (kg)
1	9/15	12/15	46.5	46.3
2	6/15	8/15	54.5	54.4
3	4/15	6/15	70.6	68.3
4	9/15	13/15	91.6	90
Mean of improvement; n (%)	2.75 (18.33)		1.25 (1.90)	

of less than 0.05 was considered to be statistically significant.

## Results

Ninety-eight patients were enrolled in this study. Fifty cases (51.0%) were diagnosed as childhood obesity, eight cases were diagnosed as type I DM (insulin dependent) (8.2%), and forty cases were diagnosed FTT (40.8%). The present study measured the success rates of patient’s treatment at baseline (first visits), sixth months and twelfth months to see the effectiveness of the multidisciplinary treatment by CDNC in each group. The highest success rate was childhood obesity. The authors found the success rate at 60% at 6 months and 90% at 12 months with statistically significance ( $p < 0.05$ ). For FTT group, the success rate at 6 and 12 months were 37% and 75%, respectively ( $p < 0.05$ ). For type I DM, the number of patients was constant at eight cases as all treatment programs required long-term follow-up and there is no cure for the disease. The success rates are based on well controlled blood sugar after providing a comprehensive education program on food challenges and changes type or regimen of insulin control, as shown in Table 4.

### Result of caring childhood obesity in CDNC

The authors collected data and analyzed the obese patients for 14 months in the CDNC. The outcome of treatment showed a 20% of weight and W/H reduction in six months, and a 20% of weight reduction and 40% W/H reduction in 12 months. The research team created a long-term follow-up

program after the patients were discharged from the “Weight reduction camp”. The authors also used the “Line” tool with a group named “Reduced the authors’ weight” to increase the compliance and adherence among the follow-up patients. This “Line” group consisted of patients who need to follow up, their parents, and all the CDNC team. The strategy was to enhance and reinforce their will to reduce the patient’s weight and to self-care properly to improve their health status before their next appointment date. The present study included four cases of obesity that used the comprehensive “Reduced the authors’ weight” program via “Line” application. Pretest and posttest points of knowledge and attitudes were increase by an average of 2.75 points (18.33%), and the mean weight was reduced by an average of 1.25 kilogram (1.90%), as shown in Table 5.

### Result of caring childhood with DM (type I) in CDNC

The CDNC enrolled both type I and type II diabetic patient as shown in Table 6. The indicators of patient type I diabetic patients were the same as for the adult patients. It was mainly long-term complication screening and target HbA1C. The authors adapted the indicators referenced from the DM Clinic at Siriraj hospital. The eight cases diagnosed as DM type I, included three cases that were sent to Siriraj Hospital, Mahidol University based on the authors’ protocol. Five cases were admitted for adjustment of their insulin treatment for basal bolus regimen or to modify their conventional regimen. They were also provided education as an inpatient. The authors found that 62.5% were glycohemoglobin (HbA1C) with less

**Table 6.** Indicators of type I diabetic patients in CDNC

Indicators of caring patient type1 diabetes patient	No. of patients (cases) n (%)
Refer for diabetic education at Siriraj hospital	3/8 (37.5)
Admit for adjust insulin treatment for basal bolus regimens or modified conventional regimen and education in IPD	5/8 (62.5)
HbA1C ≤9	3/8 (37.5)
Screening complications	
Blood pressure measurement every visit	8/8 (100)
Eye exam for diabetic retinopathy annually	8/8 (100)
Lipid profile annually	8/8 (100)
Blood urea nitrogen, serum creatinine, urinalysis, and urine micro-albumin annually	8/8 (100)

than 9% indicated high blood sugar level and poor control. The eight patients had all the complication as shown in Table 6. All of treatment for DM type I in the authors' CDNC were changed from conventional treatment to basal bolus and modified basal bolus regimens, with the gold standard insulin therapy for diabetic mellitus type I. Children and their family had counselling and psychosocial support about chronic diseases. These were same standard protocol as in other countries<sup>(9-11)</sup>.

The present study created a “Line” group “Diabetic group in Ayutthaya” in “Line” application. This “Line” group consisted of all patients, their parents, and all the CDNC team. Other objectives were to send the proper information for their health and primary management for high risk of common problems such as hypoglycemia and hyperglycemia before their appointed date. It was useful to connect with patients and a convenient pathway to contact the health care providers if they had an emergency problem.

### Result of caring failure to thrive problem in CDNC

The FTT children were children who W/H was under the 90 percentiles. They were enrolled and be treated in the CDNC. The research team gave many useful information about proper complimentary food, high caloric density food, and iron rich food to the parent and caretakers. If the patients had more behavior problems, such as eating difficulty and picky eater, they were given proper information to solve these problems and follow-up. If they had nutritional deficiency or their W/H went under 80, they were given medication and follow-up until the causes were diagnosed and a cure provided.

Every FTT patient in the CDNC had blood taken to screen for serious causes of FTT such as chronic kidney diseases by BUN, serum Cr, and UA,

or other metabolic causes by checking for serum electrolytes, chronic infection, iron deficiency anemia by CBC, zinc deficiency, treatable micronutrient deficiency, and serum alkaline phosphatase at the first visit<sup>(12)</sup>. From the 40 cases of FTT, the study found that 25 cases (62.5%) were caused by improper feeding e.g., overfeeding milk, bottle feeding, and inadequate carbohydrate and protein intake. Seven cases (17.5%) of FTT were caused by difficult behavioral problems, feeding difficulty and picky eater. Four cases (10%) were caused from chronic diseases and conditions such as cerebral palsy. The other four cases (10%) were came from normal physiologic of children, constitutional delayed growth, and puberty or family short stature. For this group, the success rate of treatment and intervention at 6 and 12 months was 37.5% and 75.0%, respectively ( $p < 0.05$ ).

### Discussion

The nutritional problems are important and count as one of the five burden problems for childhood in many ASEAN countries as well as various under-developing, developing, and developed country. Most of the problems were childhood obesity, metabolic syndrome, DM (type I & II), and FTT. The caring of children with these problems, especially children with DM are complicated and need a multidisciplinary care team. In Thailand, the authors do not have adequate amount of pediatric nutritionist and pediatric endocrinologist in the hospital services in the suburban or urban area. Therefore, this problem is difficult to manage. Furthermore, it is difficult to provide care at the same level as in a general hospital. The present study, using a qualitative research, reveals on how to compose a one-stop services model for caring for patient nutritional based problems. The advantage of the one-stop services clinic is that by



recruiting multiple groups of patient with the same caring method in one day, it reduces time required and complete every aspect of care from the treatment by pediatricians, group discussion by GPs, nutritional counselling by nutritionist, and empowerment by health education nurses in one visit.

In sub-urban and rural hospital, the caring of these patients should have a focus goal and objectives of care based on standard treatment, investigation of short- and long-term care and follow-up. The present research aims to integrate the objectives of health care provider and hospital resources for proper care and management by a multidisciplinary team. In these concepts, the authors have standard objectives and achievement goal of micro-vascular and macro-vascular screening. This is to help with type I diabetic children and maintain normal growth and normal percent W/H for children with problems of obesity or FTT. The other objective is to increase compliance and adherence of treatment and follow-up of patient through an increase of proper knowledge of their diseases and their complication, improving the ability for long-term self-caring.

For patient with DM, it is difficult to administer treatment. The present study tries to give them with the standard conventional medications, or modified from conventional to the basal bolus regimens, and refer them for tertiary diabetic center to adapt their lifestyle as compliances and adherences to the medication treatment is important for their health. Children in the present study had multiple problems with childhood obesity, overweight, or FTT. The authors managed these three problems that are difficult to control and follow-up. Most of these problems were neglected or had an inappropriate level of care in the public hospitals because of crowding in the healthcare service<sup>(12-15)</sup>.

The outcome of treatment from the one-stop services in limited sources for healthcare likes a CDNC appeared to improve the quality of care and management when compared to the traditional way. In the future, this action qualitative research for quality improvement will be publicized to several groups of medical professions, including other pediatricians, family physicians, and GP. Primary school teachers will also be included as the authors are concerned about the increasing number of patients who have the nutritional problems especially childhood obesity, prediabetes condition, DM, metabolic syndrome, malnourished, or FTT. This should become of concern to everyone as an important premature condition of NCD in Thailand.

## Conclusion

Nutritional problems in children are important problems. It was difficult to manage and control of these diseases because the authors cannot uncover the causes of diseases, lacking a comprehensive team and resources. The present study shows the action taken by a quality research team to build up the comprehensive nutritional care clinic with a multidisciplinary team in a sub-urban and rural setting. This solution solves the infrastructure problem such as inadequate amount of pediatric nutritionist and pediatric endocrinologist in rural setting, and lack of protocol and teamwork. This CDNC model can set from the general pediatrician's perspective. It provides successful results such as reduce the rate of childhood obesity, improves the quality of diabetic care and reduces the complication, and discovers the causes of FTT and provide an effective treatment plan to this group of patients. The present study showed good outcomes and concept of long-term follow up via "Line" application by enhancing the healthcare efficiency and communication. This model increased the satisfactions for both patients and family and the CDNC team.

## What is already known on this topic?

Obesity is an important health problem with long-term sequelae in both children and adults. Many physicians, especially pediatricians and internist, are concerned about this burden problem. This problem is difficult to manage because it needs to be solved by a cooperation between the health care provider's team and by patient's inspiration and habits. In Thailand, there is inadequate health care provider's team and pediatric specialists. This reason may present unsatisfied outcomes for caring these patients.

## What this study adds?

This study shows how to initiate a system of care for nutritional problems in children in sub-urban and rural area that provides favorable outcomes. This CDNC model can used or adapted for another clinic that use multidisciplinary care teams. Current communication tool such as "Line group" in "Line" application or other mobile application can improve patient care and engagement for treatment and long-term follow-up. This application and mobile devices can aid the team to communicate better than could be done in the past. The initiative self-educational campaign, long-term of doctor-patient relationship, and communication are important keys of success to caring for these chronic diseases.

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## Conflicts of interest

The authors declare no conflict of interest.

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