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Brief communication (Original)

Assessment of 5-year system-wide type 2 diabetes control measures in a Southeast Asian metropolis

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Background: Sparse information exists regarding the progress of the chronic care model (CCM) implementation for type 2 diabetes, at system-wide level for developing countries including Thailand.

Objective: We assessed the extent to which type 2 diabetes patients in Bangkok, Thailand report having received CCM-based services by using the Patient Assessment of Chronic Illness Care (PACIC).

Methods: One thousand type 2 diabetes patients from 64 healthcare facilities throughout Bangkok were randomly selected, data about the extent they have received CCM-based services, their dietary, physical activity, medication-taking behaviors, body mass index (BMI), and blood sugar control status were collected by a set of structured questionnaires and medical record abstraction.

Results: PACIC and self-management scores for patients receiving care from public hospitals and health centers were significantly higher than those from private hospitals. Being the primary care unit (PCU)—where the CCM implementation has been enforced since 2008 was significantly associated with higher PACIC scores for public hospitals. This was not the case for private hospitals. PCU status was significantly associated with better self-management scores for patients in both public and private hospitals. However, variations in PACIC and self-management scores did not reflect to BMI or glycemic control outcomes of the patients.

Conclusion: There is encouraging evidence of progress of CCM implementation for type 2 diabetes patients in Bangkok, Thailand. This had also resulted in improved self-management, but not physiological or metabolic outcomes.

Keywords: Patient assessment of chronic illness care, quality of care, type 2 diabetes

Improving the management of type 2 diabetes is needed worldwide. The present response of health care system to this issue is inadequate [1]. This is particularly imperative for developing countries where the disease burden is greater than in developed countries [2]. The chronic care model (CCM) is one of the most popular models that have been implemented internationally to improve the care for chronic illness including type 2 diabetes [3, 4]. It emphasizes shifting medical care that is reactive and event-driven to care that is proactive and planned. However, there is concern that many constraints might hinder the application of the CCM in developing countries [5, 6]. Present data addressing this concern is sparse and based only on individual or small group providers [7-9].

In response to a rising burden and poor quality of healthcare for chronic conditions—particularly type 2 diabetes, Thailand has been introduced the CCM into her healthcare system in 2007 [10, 11]. In that year, Thailand Ministry of Public Health (MOPH) had launched the "Thailand Healthy Lifestyle Strategic Plan for 2550–2559 BE (2007–2016 CE)" aiming at

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reducing the public health threat from chronic lifestyle related condition [12]. In parallel with this, the National Health Security Office (NHSO) of Thailand had initiated "the comprehensive care management project for type 2 diabetes and related conditions" to improve the diabetes care throughout the country [11]. The CCM was used as the major framework in this project, as suggested by the World Health Organization (WHO) [13].

The NHSO drives this project via the Universal Coverage (UC) health insurance scheme. It covered 46.7 million or 74.8% of the Thai population [11, 14]. The top-up money was offered to the contracted primary care units (PCUs) for activities such as; (a) the diabetes education for high-risk group (pre-diabetes individuals); (b) self-management support for type 2 diabetes patients, and; (c) regular monitoring and follow-up of glycemic control status, mouth hygiene, and diabetes complications. Participation in the UC health insurance scheme was, however, not uniform for different types of healthcare facilities. While almost all public hospitals (903 out of 994 or 90.9%) participated in this scheme, few private hospitals did (49 out of 321 or 18.7%) [11]. The NHSO's project was consequently expected to have higher impact in the improvement of type 2 diabetes care in public than private health facilities. Nonetheless, there is still no data to verify this supposition yet.

The objective of present study was to assess the progress of CCM implementation on system-wide to improve type 2 diabetes care in a developing county. Specifically, this study aims at surveying the extent to which type 2 diabetes patients report having received CCM-based services in different types of healthcare facilities throughout Bangkok.

Materials and methods

Study population

Detail of the study design and method has been described elsewhere [15]. Briefly, this cross-sectional survey was conducted in 64 healthcare facilities that were randomly selected based on the size of facilities throughout Bangkok. These were 14 public hospitals, 10 private hospitals, and 40 public health service centers under the jurisdiction of the Department of Health of Bangkok Metropolitan Administration (BMA). In total, 1,000 type 2 diabetes patients, who were ≥20 years old, were randomly selected from those who sought diabetes care on the diabetes clinic day of each participating healthcare facility. The study was approved by the relevant Ethical Committees and the data were collected between January 2011 and January 2012 upon each patient's consent.

Participating health care facilities were classified into; (a) public hospitals, (b) public health centers, and (c) private hospitals. They were also further classified into those that were and were not the PCUs of the NHSO. Study participants who received diabetes care from healthcare facilities that were also the PCUs exposed to the CCM-based diabetes care, which was enforced by the NHSO, while the others were not.

Data collecting instrument

An interview questionnaire was utilized for data collection and composed of 3 parts. The first part included 20 items asking about personal demographics, family health history, and personal type 2 diabetes related data (duration of illness, comorbidity and complication, treatment received). The second part was the Thai version of the 20-item Patient Assessment of Chronic Illness Care (PACIC) which was translated and culturally adapted from the original English version. This part measured the extent to which type 2 diabetes patients self-reported having received CCM-based services during the past 6 months. It was composed of five predefined domains including patient activation, delivery system/practice design, goal setting/tailoring, problem solving/contextual, follow-up/coordination. Possible response scale ranged from 1 = 'almost never' to 5 = 'almost always', with higher scores reflecting more frequent presence of structured chronic care. Aggregated mean scores for five domains and for the total instrument were calculated as described in previous research [16]. In addition, PACIC scores of ≥3.5 were further considered to represent "implemented" components of the CCM as suggested in recent study [17].

The third part had 14-items, which emphasize the 3 major self-management behaviors during the past 7 days that directly related to glycemic control status. Namely dietary, physical activity, and medication-taking behaviors. These were adapted from the Thai version of the summary of diabetes self-care activities (SDSCA) [18]. Possible score for each item ranged from 0 (none) to 7 (everyday), with higher scores indicated better self-management behavior. Each domain was scored by averaging items completed within the domain and the overall SDSCA score is an average across all 14 items. Furthermore, the SDSCA

scores were also classified according to Shaw et al. into "adequate" or "inadequate" levels of self-management behavior for the scores of ≥4.0 or otherwise [19].

In addition, patient's body weight and height were measured during the data collection, while his/her latest fasting plasma glucose (FPG) (not older than 1 month) and glycated hemoglobin (HbA1c) levels (not older than 12 months) were obtained from patient's medical record. However, the HbA1c results were available only for 216 patients and included in the analysis.

Body mass index (BMI) was calculated as (weight in kg)/(height in meters)^2. Those with BMIs of <23 and ≥23 kg/m^{2}were classified as "healthy" weight and "overweight" respectively [5], while FPG of ≤130 mg/dl and HbA1c of ≤7 percent were considered as "well controlled" and the otherwise as "poor controlled diabetes.

Statistical analysis

Participants' characteristics for each group (namely public hospitals, public health centers, and private hospitals) were summarized and presented by frequency and percentage (categorical variables), mean and standard deviation or SD (continuous variables with normal distribution), or median and interquartile range or IQR (continuous variables with skewed distribution). A Chi-square test and one-way ANOVA were then conducted to assess the difference between patient groups. For skew distributed variables, log transform data was used in the ANOVA. The PACIC and self-management scores, BMI, FPG, and HbA1c were analyzed by mean and SD, and group comparisons were then conducted by ANOVA. Their corresponding categorical forms were also analyzed by frequency and percentage, and group comparisons were then conducted by Chi-square tests.

Furthermore, the relationship between the type of healthcare facilities (e.g. public hospitals, public health centers, or private hospitals; and being the PCUs or not) and the probability of having adequate PACIC and self-management scores were further examined by the odds ratio (OR) calculations. The "private hospital" and "non-PCU" categories were treated as baseline in the analyses. In these analyses, variables that were significantly associated with the outcomes of interest in the univariate analysis were considered as potential confounders and included in the multivariate analyses. These were: for PACIC outcome, age, number of family members, and monthly income (in quartiles); for self-management outcomes, age, and monthly income (in quartiles). As suggested by stratify analytical result, the significance of the interaction between type of hospital (private versus public) and primary care unit or PCU status (no versus yes) was also examined for PACIC outcome.

Results

Participants' characteristics

Participants in the three types of healthcare facilities were quite different in many ways. Participants in private hospitals had higher educational and monthly income levels and lower prevalence of comorbidities than those in public healthcare facilities (**Table 1**). The majority were self-pay or holding private health insurance (59.0%). On the other hand, participants in public health centers had the lowest monthly income level, and a higher proportion held the UCS (79.8%). Most of them were treated by antidiabetic drugs only (93.5%). Details about gender, marital status, and number of family member for these subgroups are shown in **Table 1**.

PACIC scores and Type 2 diabetes care outcomes

The overall PACIC scores were significantly highest for public hospitals and significantly lowest for private hospitals (**Table 2**). The proportions of patients indicating that their diabetes care experience is in line with the CCM (as measured by overall PACIC score ≥3.5) were significantly different among types of healthcare facilities, with the highest and lowest proportions for those in public and private hospitals (58.5% and 30.3%) respectively. Detailed analyses showed that these differences were pronounced for almost all subscales, especially for the "follow-up/coordination" subscale where the score of private hospital was very low compared with the other subgroups. The exception was for the "delivery system/practice design" subscale where statistically significant differences were not achieved.

Stratified analysis was conducted to examine the influence of being a PCU or Non-PCU on the PACIC and self-management behaviors among the participants in public and private hospitals. As all public health centers were PCUs, participants in these facilities were thereby excluded. Results showed that, among participants in public hospitals, being patients in the PCUs had significantly or almost significantly higher PACIC scores and higher proportion of

Table 1. Characteristics of type 2 diabetic patients, by type of healthcare facilities

Characteristics	Public hospitals		Public health centers		Private hospitals	
	n	(%)	n	(%)	n	(%)
Sample size	219	(21.9)	659	(65.9)	122	(12.2)
Females	148	(67.6)	492	(74.7)[a]	79	(64.8)[b]
Age (Years)*	60.8	(12.9)	62.2	(10.0)	63.4	(12.6)
Education						
Primary (1–6 y)	141	(64.4)	455	(69.0)	56	(45.9)[a,b]
Secondary (7–12 y)	28	(12.8)	86	(13.1)	26	(21.3)
Higher (>13 y)	50	(22.8)	118	(17.9)	40	(32.8)
Marital status						
Single	21	(9.6)	66	(10.0)	13	(10.7)
Married	148	(67.6)	434	(65.9)	87	(71.3)
Widow/divorce/separate	50	(22.9)	159	(24.1)	22	(18.1)
Family size (Persons)	3	(3)	3	(3)	4	(4)[a]
Income (Baht/month)	6,000	(7,500)	3,000	(7,000)[a]	15,000	(31,000)[a,b]
Health insurance						
CSMBS	71	(32.4)	70	(10.6)[a]	5	(4.1)[a,b]
SSS	31	(14.2)	18	(2.7)	10	(8.2)
UCS	84	(38.4)	526	(79.8)	35	(28.7)
Self-pay or other	33	(15.1)	45	(6.8)	72	(59.0)
Years of diabetes	9	(8)	6	(7)[a]	8	(12)b
Comorbidity						
Hypertension	163	(78.0)	398	(68.9)[a]	59	(49.2)[a,b]
Dyslipidemia	93	(44.5)	252	(43.6)	55	(45.8)
Diabetes complication						
Microvascular	52	(23.7)	97	(14.7)[a]	25	(20.5)[b]
Macrovascular	24	(11.0)	35	(5.3)[a]	16	(13.1)[b]
Treatment						
Lifestyle	0	(0.0)	7	(1.1)[a]	3	(2.5)[b]
Drug	158	(72.2)	616	(93.5)	87	(71.3)
Insulin	13	(5.9)	12	(1.8)	11	(9.0)
Drug & insulin	48	(21.9)	24	(3.6)	21	(17.2)

CSMBS = Civil Servant Medical Benefit Scheme, SSS = Social Security Scheme, UCS = Universal Coverage Scheme, [a]significantly different from "Public hospitals", [b]significantly different from "Public health centers", [*]Mean (Standard deviation or SD), Median (Interquartile range or IQR)

"receiving care in line with the CCM or implemented CCM" than being patients in the Non-PCUs (**Table 3**). However, this was not the case for the participants in private hospitals, where there were no significant PACIC difference for being patients in a PCU versus Non-PCU. Further odds ratio analyses also showed consistent results with the above finding that the association of being PCUs and "implemented CCM" was stronger in public than private hospitals (**Tables 3 and 4**). However, being a patient in a public hospital was no longer significantly associated with the "implemented CCM", as compared with being a patient in a private hospital.

Concerning the diabetes care outcomes, self-management scores were also highest for the patients in public hospitals and lowest for those in private hospitals (**Table 2**). However, further analyses by controlling for potential confounding effects showed no significant association for being patients in public or private hospitals and "adequate self-management" (**Tables 3 and 4**). On the other hand, being a patient in a PCU was significantly associated with "adequate self-management". The association was on comparable magnitude for both public and private hospitals.

However, for other diabetes care outcomes such as BMI, FPG, and HbA1c, no significant variation was found for different types of hospitals (**Table 2**) or being a PCU or Non-PCU (detail not shown).

Table 2. PACIC and type 2 diabetes care outcomes, by type of healthcare facilities

Characteristics	Public hospitals		Public health centers		Private hospitals	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
PACIC (full score = 5)						
Overall	3.6	(0.7)	3.4	(0.8)[a]	3.2	(0.5)[a]
Patient activation	3.7	(0.7)	3.5	(0.8)[a]	3.5	(0.6)[a]
Delivery system/practice design	3.9	(0.7)	3.8	(0.8)	3.7	(0.6)
Goal setting/tailoring	3.5	(0.9)	3.2	(0.9)[a]	3.2	(0.7)[a]
Problem solving/contextual	3.7	(0.7)	3.6	(0.8)[a]	3.5	(0.6)[a]
Follow-up/coordination	3.3	(1.2)	3.0	(1.2)[a]	2.6	(0.9)[a,b]
"Implemented" CCM (≥3.5)*	128.0	(58.5)	323	(49.0)[a]	37	(30.3)[a,b]
Self management score (full score = 7)						
Diet	5.3	(0.8)	5.0	(0.8)[a]	5.0	(0.8)[a]
Physical activity	3.1	(1.8)	3.1	(2.0)	2.5	(1.8)[a,b]
Medication	6.9	(0.6)	6.8	(0.9)	6.5	(1.3)[a,b]
Overall	5.1	(0.8)	5.0	(0.9)	4.7	(0.9)[a,b]
Body Mass Index (kg/m^2)	25.7	(6.1)	26.0	(5.0)	26.4	(5.3)
Fasting plasma glucose (mg/dl)	153.9	(54.2)	149.4	(45.4)	152.9	(45.5)
Glycated hemoglobin (%)	7.3	(1.8)	7.7	(2.1)	7.3	(1.8)

[a]significantly different from "Public hospitals", [b]significantly different from "Public health centers", normal BMI range for Thai population is 20.0–22.9 kg./m^2, *n (%), Median (interquartile range or IQR)

Table 3. Patient assessment of chronic illness care (PACIC) and self-management behaviors, by type of healthcare facility and "PCU" status

Characteristics	Public Hospitals				Private Hospitals			
	PCU (n = 189, f = 14)		Non-PCU (n = 30, f = 2)		PCU (n = 66, f = 6)		Non-PCU (n = 56, f = 4)	
	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)
PACIC Score (full score = 5)								
Patient activation	3.7	(0.7)	3.4	(0.6)[A]	3.5	(0.6)[a]	3.5	(0.7)
Delivery system/practice design	3.9	(0.7)	3.6	(0.6)[a]	3.7	(0.6)[a]	3.7	(0.6)
Goal setting/tailoring	3.6	(0.9)	2.8	(0.7)[A]	3.2	(0.8)[A]	3.3	(0.6)[a,b]
Problem solving/contextual	3.8	(0.7)	3.5	(0.6)[A]	3.5	(0.6)[A]	3.5	(0.6)[A]
Follow-up/coordination	3.5	(1.1)	2.3	(0.8)[A]	2.7	(1.0)[A]	2.5	(0.7)[A]
Overall	3.7	(0.7)	3.0	(0.5)[A]	3.3	(0.6)[A]	3.2	(0.4)[A]
"Implemented" CCM(≥3.5)*	123	(65.1)	5	(16.7)[A]	21	(31.8)[A]	16	(28.6)[A]
OR (95% CI)	9.32	(3.41–25.47)	$p < 0.000$		0.86	(0.39–1.87)	$p = 0.698$	
Self-management Score (full score = 7)								
Diet	5.3	(0.8)	5.3	(1.1)	5.1	(0.7)	4.8	(0.8)[A,b]
Physical activity	3.27	(1.8)	2.8	(1.8)	2.6	(1.7)	2.4	(2.0)[A]
Medication	6.9	(0.5)	6.6	(1.0)	6.6	(1.1)	6.4	(1.6)[A]
Overall	5.1	(0.8)	4.9	(1.0)	4.8	(0.8)[A]	4.5	(1.0)[A]
Adequate self-management*	176	(93.1)	24	(80)[A]	61	(92.4)[b]	44	(78.6)[A,C]
OR (95% CI)	3.39	(1.18–9.74)	*p = 0.024*		3.33	(1.09–10.13	*p = 0.034*	

A = Different from "Public hospitals and PCU" group at $p < 0.05$, [a] = Different from "Public hospitals and PCU" group" at $p < 0.10$, B = Different from "Public hospitals and Non-PCU" group at $p < 0.05$, [b] = Different from "Public hospitals and Non-PCU" group at $p < 0.10$, C = Different from "Private hospitals and PCU" group at $p < 0.05$, c = Different from "Private hospitals and Non-PCU" group at $p < 0.10$, *number (%), n = number of participants, f = number of facilities, Odds ratio(95% confidence interval) of having "Implemented" CCM(≥3.5)* for patients in "PCU" versus "Non-PCU" healthcare facilities, Odds ratio(95% confidence interval) of having "Adequate Self-management* for patients in "PCU" versus "Non-PCU" healthcare facilities

Table 4. Logistic regression analysis for the relationship of type of healthcare facility with the probabilities of having adequate PACIC and self-management

Characteristics	Adequate PACIC Score				Adequate Self-management			
	Crude		Adjusted		Crude		Adjusted‖	
	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)	OR	(95%CI)
Type of facility (reference = Private hospital)								
Public hospital	3.2	(2.0–5.2)***	0.5	(0.2–1.7)	1.7	(0.8–3.4)	1.6	(0.7–3.5)
Primary care unit (PCU) status (Reference="Non-PCU")								
PCU (overall)	4.0	(2.3–7.0)***			3.5	(1.7–7.1)**	2.1	(2.0–11.4)***
PCU (Private hospital)			1.0	(0.4–2.3)				
PCU (Public hospital)			9.3	(2.5–5.2)**				

*$p < 0.05$, **$p < 0.01$, ***$p < 0.005$, Overall Patient Assessment of Chronic Illness (PACIC) score >3.5
Overall self-management score >4.0, Independent variables included in the final model were: type of hospital (private versus public), primary care unit or PCU status (no versus yes), interaction term of type of hospital and PCU status, age, number of family member, and monthly income (in quartiles), ‖Independent variables included in the final model were: type of hospital (private versus public), primary care unit or PCU status (no versus yes), age, and monthly income (in quartiles).

Discussion

To our knowledge, there were six studies using PACIC in assessing the situation of CCM implementation for type 2 diabetes. Noted is that all of these studies were from developed countries [16, 17, 20-23]. Although there was one recent study in Mexico that assessed the system-wide implication of public health insurance on improved access to health care and blood glucose control among poor adults with diabetes [24], the CCM had not been of interest in this report nor the PACIC used in the assessment. Our study was therefore the first evidence evaluating the CCM implementation in system-wide basis from a developing country, where resources were more limited than in developed countries.

The present study revealed encouraging evidence about the application of the CCM framework in improving the quality of type 2 diabetic care in Thailand. This CCM framework was heavily enforced nation-wide via the PCUs--mainly in public healthcare facilities--during the past five years [14]. Our reported higher PACIC for the PCUs than non-PCUs might reflect some progress of this endeavor, particularly in public healthcare facilities. The finding of higher self-management scores for the patients in the PCUs than non-PCUs seemed also support this conclusion, although the evidence from BMI, FPG, and HbA1c was not so supportive.

The finding of stronger PCU and PACIC association in public than private hospitals might contradict the premise that private health-care plays a more prominent role in chronic disease care than the public sector in most developing countries [25]. However, this could be explained because, although the CCM may improve the quality of care, its implementation is expensive and may not be profitable [26]. It is therefore not interesting for most private healthcare sectors whose interest is financial gain. On the other hand, public healthcare sectors in Thailand were heavily encouraged and supported to implement the CCM by the MOPH and the NHSO [11, 12]. Nevertheless, higher PACIC for public hospitals than public healthcare centers might the result of greater resources by public hospitals for the better CCM implementation.

The reason that higher PACIC scores were not reflected in improved BMI and blood glucose control in our study might be because of the fact that these outcomes are influenced by many variables other than healthcare attributes [16, 27]. These include impact from intra-personal relationships, family and friends, neighborhood, workplace, community, and media and policy factors. A meta-analysis showed that intervention by healthcare personnel focusing only on individual patients did not result in a sustained improvement of glycemic control in type 2 diabetic patients [28]. It is suggested that, to effectively improve type 2 diabetes care outcomes, particularly in the long run, the holistic approach by taking into account factors at all levels of socio-ecological framework is necessary [27].

Patients in the various types of healthcare facilities might have responded differently to the questionnaire and differential level of social desirably bias might also

be the alternative explanation for the variation of PACIC score among them. Patients in these types of healthcare facilities differed significantly in socioeconomic status [29, 30]. Previous evidence showed that individuals from lower socioeconomic status tend to over-report socially desirable variables than those from higher socioeconomic status. This might therefore have resulted in higher reported PACIC score for public healthcare facilities, where patients were in lower SEC level compared with patients in private hospitals. However, after controlling for monthly income and educational levels, the result for PCU and PACIC association was not significantly altered in our analysis.

Furthermore, the relative ranks among PACIC subscales for all patient sub-groups in our study were also consistent with previous reports in other countries [16, 17, 20-23]. The "delivery system/practice design" and "problem-solving/contextual counseling" subscales ranked the highest, while "follow-up/coordination" subscale ranked the lowest in almost all--if not all--studies. This evidence further argues against the distorting effect of social desirably bias on study results.

Although our study included a large sample size with high heterogeneity--both in terms of patients and healthcare facilities--some limitations need to be mentioned. Firstly, single cross-sectional rather than pre- and post-test nature of the design limited the inference about the nation-wide CCM policy implementation and the resultant improved chronic care performance (as measured by the PACIC). Secondly, the sample size for participants in public and private hospitals was quite small, particularly the number of non-PCU public hospitals. However, even with this limitation our study was still able to demonstrate the stronger PCU and PACIC association in public than private hospitals. Lastly, covering only healthcare facilities in Bangkok might not be able to reflect the situation in the entire country. Patients in the countryside differ from those in the capital city in many ways including their availability and accessibility to healthcare [31]. Further study is therefore needed for this patient group.

Conclusion

Our results showed that nation-wide CCM implementation during the past 5 years may have produced some progress in improved type 2 diabetic care in the Bangkok Metropolitan region. However, the progress seemed to be more pronounced in the public rather than private healthcare sectors.

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