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Integrated Behavioral Healthcare in Thailand: A Case Study from Chiang Mai

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Competing interests
The authors declare that they have no conflicts of interest.
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Abbreviations
NCDs, Noncommunicable diseases; T2DM, Type 2 diabetes; HT, Hypertension; PIP, Practice Integration Profile; FBS, Fasting blood sugar; HRA, Health risk assessment; MOHR, My Own Health Report; VAS, Visual analog scale; SSS, Somatic Symptom Scale; OLS, Ordinary Least Squares; PHQ-9, Patient Health Questionnaire-9; PTSD, Post-traumatic stress disorder; BHC, Behavioral health consultant.
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Abstract
Purpose: This study aims to examine the level of behavioral health integration in primary care clinics among patients with hypertension and type 2 diabetes in Chiang Mai, Thailand. It also aims to explore the provider perceived prevalence of behavioral problems and need for an expert behavioral health consultant on the primary care team and the risk and protective factors of the patients' psychological and cardio-metabolic health outcomes.
Methodology: Using survey data between 2017 and 2018 regarding the level of integration as measured by a Practice Integration Profile, provider ratings of prevalence and need based on a Provider Survey, and patient lifestyle and behavioral problems with a Health Risk Assessment in six primary health care settings in Chiang Mai, Thailand (n =335). We conducted ordinary least squares regressions to explore the relationship between each of the patient psychological and cardio-metabolic health outcomes and physical, mental health and substance abuse variables while controlling for the demographics.
Results: The results showed overall high levels of integration, but significant variability across clinics. Providers rated prevalence of health risk and need for a Behavioral Health Consultant as moderate. Results of the patient health risk assessment were variable, with some problems high severity, others low.
Conclusion: The results reflect a need for integrated behavioral health into the health care system in Thailand especially for those who are in the chronic illness condition. Recommendations for future study include an evaluation of the translation quality and validity and reliability of the study measures under the Thai context. This study fills the research gap of lacking research on the level of integrated care in clinics in Thailand.

Keywords: Integrated Behavioral Health, Integrated healthcare, Noncommunicable diseases, Hypertension, Diabetes, Patient health risk

Introduction

Noncommunicable diseases (NCDs) are a global epidemic, accounting for 82% of chronic condition-related deaths in low- and middle-income countries [1]. Major NCDs are primarily caused by four behavioral health risk factors: physical inactivity, poor nutrition, tobacco use, and excessive alcohol use [2]. Hypertension and diabetes are NCDs that are rising in prevalence in Thailand [3]. In Thailand the prevalence of type 2 diabetes (T2DM) has increased from 7.7% in 2004 to 9.9% in 2014 [3]. The prevalence of hypertension (HT) for Thai adults increased from 21% in 2003 to 24% in 2014 [4]. In addition, patient awareness of diagnosis and control of T2DM and HT in Thailand is poor [4]. Pharmacotherapy alone for T2DM does not address the lifestyle problems underlying NCD's, showing the need for integrate behavioral interventions in medical settings [5].

Integrated behavioral healthcare, a team-based, coordinated primary care-based treatment of medical, lifestyle, and behavioral conditions and problems in medical settings such as hospitals and primary care or community clinics, is viewed as an urgent necessity in Asia [5]. There is a proven relationship between integrated care and reduced hospital admissions and read missions, decreased hospital length of stay, improved patient treatment adherence, improved quality of life, and reduced healthcare costs [6]. However, there is a lack of standardized approaches to defining and measuring the level of integrated healthcare, which also contributes to a lack of consensus among stakeholders on implementation and funding of integrated care globally. This is mirrored in Thailand; a lack of studies fail to show the level of integrated care in clinics. Therefore, to address this research gap, this study will use the first-hand data from City of Chiang Mai, to examine the level of integration, provider ratings of prevalence and need, and the correlates of the patient lifestyle and behavioral problems in Thailand.

Hypertension and diabetes risk factors in Thailand

In Asia, including Thailand, the rapid economic transitions resulted in a change from low calorie, high carbohydrate and high fiber foods to processed foods high in fat, salt, and sugar [7]. Fruits and vegetables are consumed at about half the recommended rate [7]. In addition, technological developments have resulted in decreased physical labor, which in turn contributes to decreasing levels of physical activity [8]. Only 42.2% of the Thai adults have been able to regularly meet the physical activity guidelines set forth by WHO [9]. Unhealthy nutrition and low physical activity levels are the major reasons for increased prevalence of NCD's in Thailand [7]. Thailand has one of the highest incidences of overweight in Southeast Asia and patients with diabetes or hypertension experienced a markedly increased prevalence of obesity [10]. Obesity in Thailand more than doubled during the period 1991-2014, largely attributed to poor nutrition and lack of physical activity [7,11].

Adults diagnosed with T2DM and hypertension have increased risk for mental health disorders such as depression and anxiety. The comorbidity of depression and T2DM in Thailand is between 14% and 28% [12]. Research found that heavy alcohol consumption of four or more glasses per occasion is comorbid with hypertension in Thai patients [13]. Thanaeerat et al. (2009) showed that approximately 65% percent of adult diabetic patients at an outpatient endocrinology clinic in Bangkok had comorbid substance use, specifically alcohol and cigarette use [12]. In addition, studies show poor medication adherence for T2DM and HT patients in Thailand [14].

The Diabetes Association and Endocrine Associations of Thailand (2008) published national guidelines that emphasize medical treatment and patient self-management [15]. A Thailand healthy lifestyle strategic plan is focused on improved nutrition, physical activity and management of stress, but there is no national screening program or standardized measures for reporting T2DM complications and lifestyle metric [16]. There is a need for increased screening, data monitoring, focus on factors related to poor treatment outcomes, and healthy lifestyle promotion [16].

The present study

Behavioral factors such as poor nutrition, lack of physical activity, tobacco smoking, alcohol abuse, untreated co-morbid psychiatric disorders and poor medication adherence largely account for the increase of T2DM and HT in Thailand. Screening for the behavioral risk factors is poor, and integrated health care research is lacking. The current study is designed to address this gap by the following three research questions: a) What is the level of behavioral health integration in primary care clinics in Chiang Mai, Thailand? b) What is the provider perceived prevalence of behavioral problems and need for an expert behavioral health consultant on the primary care team? and; c) What are the risk and protective factors of the patients' psychological and cardio-metabolic health outcomes?

Methods

Sample

This project was conducted during the exchange program of a university from the United States (Blind for review) supported by the USAID Global Development Research (GDR) Scholar grant program in 2017 and 2018 in partnership with a university nursing program in Chiang Mai, Thailand (Blind for review). Chiang Mai is largest city in northern Thailand and the third largest city in Thailand, with a network of hospitals and health centers serving urban and rural patients. Subjects included healthcare providers (e.g., physicians and nurses), hospital leaders (e.g., departmental heads), and patients with diagnoses of hypertension and/or T2DM who receive service at the NCD clinic of the hospital and community health centers located at the urban area in the northern region of Thailand. These included one hospital and 5 sub-districts health promoting hospitals. This was a convenience sample based on administering patient surveys to patients scheduled for clinic appointments and provider surveys to available clinicians in each clinic. The Institutional Review Board (IRB) from C University (IRB ID:167-2017, by 10/27/2017) and A University (IRB ID: STUDY00006532, renewed by 9/25/2019) both approved this study.

Measures

Provider surveys. This study conducted two surveys to yield a better understanding of the integration status at the hospital level. The Practice Integration Profile (PIP) is a 30-item, 6-point Likert, validated measure of the degree of behavioral health integration in primary care [17]. The PIP is completed by managers or clinicians, providing an overall score and 6 domain scores that reflect definitions from the Lexicon definition of integrated health care [18]. The domain scores are workflow, services, workspace, integration, need, and engagement. A validation study concluded that the PIP has utility, face, content, and internal validity, and distinguishes practices with known variation in integration [19]. The PIP was reviewed by international partners in Thailand who agreed the items appeared face valid and applicable to primary care in Asia. The Provider Survey is a list of 23 behavioral health problems (e.g., headache, depression) rated by clinicians for the prevalence of each symptom in practice, and how often they would request consultation with a behavioral health clinician [20].

Medical record data. Patient physiological health was measured using fasting blood sugar (FBS) with fasting for 8-10 hours prior to being tested, and cardio-metabolic health risk measures, which included both the systolic and diastolic blood pressure. Patients demographic data was collected including gender (1 = female; 0 = male), age, marriage status (1 = married; 0 = others), household size, whether had national health insurance coverage (1 = yes; 0 = others), education levels, which was recoded as 3 dummy variables: primary school or less (1/0; as reference group), secondary school, and some college or higher educational levels.

Patient health risk assessment. The study Health Risk Assessment (HRA) is comprised in part on items from the My Own Health Report (MOHR) [21]. The MOHR is comprised of short versions of validated measures of health behaviors relevant to primary care. The MOHR domains included for this study are: nutrition, 4 items from starting the conversation screen [22]; physical activity, 2-items screen from the exercise vital sign [23]; risky alcohol use 1-item screen [24]; smoking/tobacco use, 3-items from the Tobacco Use Screener [25]; anxiety and depression as measured by the PHQ-4 [26] and the full-version Patient Health Questionnaire-9 (PHQ-9) was validated in Thailand [27]; psychosocial stress, using the 1-item Distress Thermometer [28] also validated in Thailand [29], and; sleep (3-items from the BRFSS). The MOHR items were selected from validated measures by expert consensus to screen for the most common symptom presentations in primary care [30].

In addition, the following screening measures are included: The medication adherence visual analog scale (VAS), self-report measure of adherence, has been validated against prescription medication refills for chronic disease patients [31]. It's endorsed by the World Health Organization [32] and has been used in Asia [33]. It was selected given the high rates of medication nonadherence in Asia. The Somatic Symptom Scale (SSS) is a validated, 8-item version of the PHQ-15 designed to measure somatic symptom disorder [34] and used in Asia [35]. It was selected due to the high prevalence of somatic symptoms in primary care patients in Asia. The abbreviated Post-traumatic stress disorder (PTSD) Civilian Checklist is a validated, 2-item version of the PTSD Checklist that has been validated in the United States [36] and the full version was used in Thailand [37]. It was selected due to the high prevalence of trauma in Asia. A Green Health exposure screen developed by the PI was included based on research that greater exposure to green places (e.g., parks, gardens) is associated with improved cardio-metabolic and psychological health status [38] (Table 2).

Data analysis

First, descriptive analysis was conducted to describe the sample statistics on all the variables and the primary care survey measures. In

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addition, the Provider Survey was analyzed utilizing Chi-Square tests with Monte Carlo simulations (n = 10,000 simulations) in cases where there were cell counts less than five. Then Little's MCAR test was conducted to test whether the missing data were missing at random. However, the results showed a significant Chi-square distance ($\chi 2 = 1180$; df = 684; $P < 0.001$), indicating a systematic missing. Therefore, a decision was made to use listwise deletion rather than multiple imputation to deal with the missing data. This reduced our sample from 335 to 144 for FBS and 131 for the systolic and diastolic blood pressure outcomes. Last, with controlling for the demographic variables, Ordinary Least Squares (OLS) regressions were run to explore the physical and mental health as well as substance abuse factors that were associated with patient psychological and cardio-metabolic health outcomes. The OLS assumptions such as the testing the multicollinearity using variance inflation factor (e.g., VIF all <10) were tested, and no harmful assumptions were revealed.

Results

Levels of integrated care

A review of the PIP subscale scores by site shows variability among 5 sites in average level of integration and by each domain. The total PIP scores show that on average, site 1 was the highest at 81%, site 2 at 70%, site 4 at 62%, site 3 at 56%, and site 5 was lowest at 44%. The domain scores were generally high for all sites in the workspace and workflow, and low in integration (Figure 1). Figure 1 also includes the median scores for the PIP in the United States, showing that most of the Vietnam clinics report similar or greater levels of integration on all domains except for integration.

Clinician ratings of prevalence of behavioral conditions and need for a behavioral health consultant (BHC)

The top five behavioral health concerns for providers were a) unhealthy alcohol use, b) medication non-adherence, c) mental health disorders, d) difficulties coping with stress, and e) over utilization of healthcare services. The Provider Survey reported prevalence of symptoms responses ranged from one to four, with a mean of 2.42 overall, 2.30 for mental health symptoms, and 2.55 for health behavior symptoms (Table 1). The Provider Survey reported need for a BHC was similar, with a mean of 2.35 overall, 2.31 for mental health symptoms, and 2.39 for health behavior symptoms. Comparison of the mean scores for mental health and health behaviors for both ratings of symptom or problem prevalence and need for a BHC were not significant (Table 1).

Sample statistics

The average medical record biometrics of FBS value was 120.39, whereas systolic (Mean = 128.30) and diastolic (Mean = 69.98) blood pressures were both within normal range (See Table 2). A total of 335 patients participated in the study, with a mean age of 63 and predominantly female (59.7%). The majority were married (61.9%), had national health insurance coverage (79.5%), and secondary school education (50.15%), and had national health insurance coverage. The average household size was about 3 persons (Table 2).

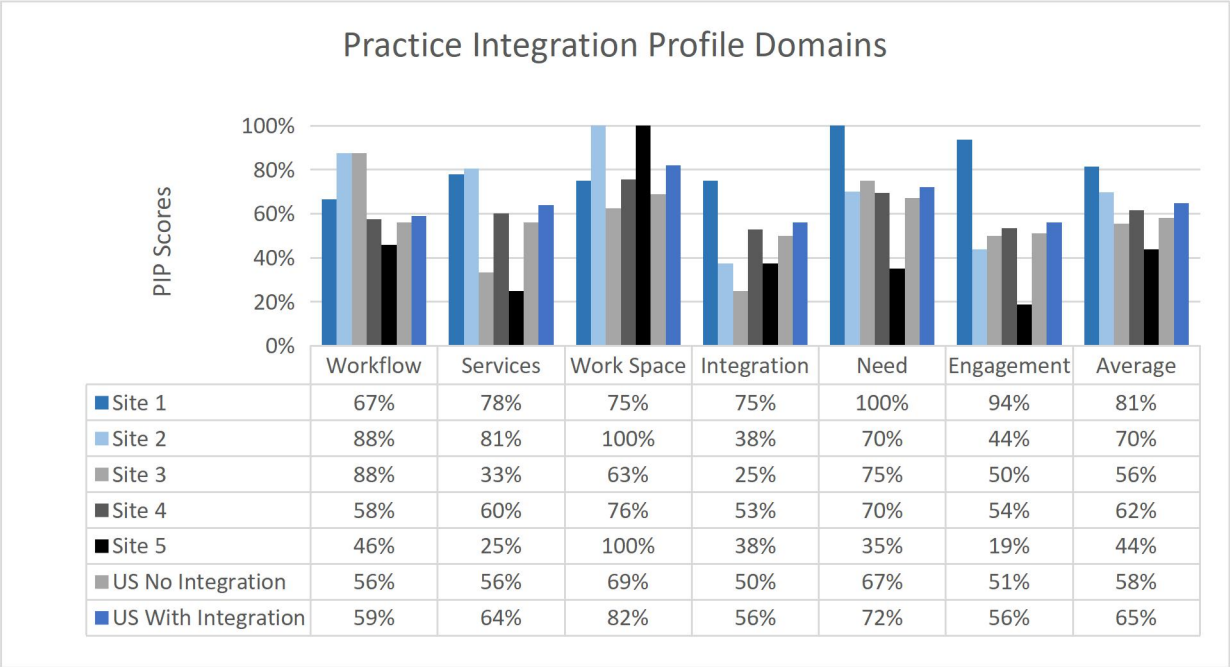

Figure 1. PIP Subscale Scores by Site

Table 1 Provider survey results *(N = 56)*

	Subscales	N	Mean (μ)	SD (σ)	*t*	*p*
Prevalence of Problems	Mental Health	12	2.30	0.90		
	Health Behaviors	11	2.55	0.95		
	Total	23	2.42	0.94	0.6481	0.5240
Need for a BHC	Mental Health	12	2.31	0.93		
	Health Behaviors	11	2.39	0.92		
	Total	23	2.35	0.94	0.2071	0.8379

Note. *Difference in means test:* $H_0: \mu_1 = \mu_2, H_A: \mu_1 \neq \mu_2$

Table 2. Sample Statistics *(n = 335)*

Variables	Mean/%	SD	Risk level
Medical record biometrics			
Fasting blood sugar	120.39	36.68	Normal = < 100 mg/dL
Systolic blood pressure	128.30	14.92	M: 130-139 stage 1; F:120-129 elevated
Diastolic blood pressure	69.98	14.95	<80 normal
Demographics			
Gender (1 = female; 0 = Male)	59.70%		
Age	63.07	11.20	
Married (1 = yes; 0 = others)	61.90%		
Household Size	3.48	1.58	
Had insurance (1 = yes; 0 = others)	79.51%		
Education level			
Secondary school or less	36.17%		
High school	50.15%		
Some college or higher	13.68%		
BMI	25.08	5.16	
Physical Health			
Sleep Apnea – Snoring (Average)	88%	0.33	High risk if responding yes
Daytime Sleepiness (Weekly Average)	1.86	1.44	Average 2 days per week
Somatic Symptoms (Average)	7.13	4.85	Low Risk on Scale (0 – 32)
Medication Adherence (%)	0.39	0.44	Mild Risk < 0.80 Considered Good
Weekly Fast Food intake (%)	22.22%		
Daily Fruit and Veggies intake (%)	54.46%		
Weekly Exercise (> 150 minutes)	62.96%		Low Risk (>150 min. recommended)
Green Space Days (Weekly Average)	5.70	2.24	Low Risk (Based on Days per Week)
Green Space Access (Average)	8.46	2.28	Low Risk on Scale (0 – 10)
Green Space Quality (Average)	8.15	2.27	Low Risk on Scale (0 – 10)
Comfort with Medical Forms (Average)	1.40	0.88	Low Literacy (> 2) on Scale 0 – 4
Mental Health			
PHQ-4 total	1.05	1.91	No Risk (≥4 cut-off)
Stress Level	1.87	2.48	Low Risk on Scale (0 – 10)
PTSD	1.29	1.94	No Risk (≥4 positive screen)
Substance Abuse			
Binge Drinking Risk	10.42%		High risk > 1 day per year
Smoking risk	4.19%		High risk if responding yes

Patient health risk assessment

For physical health, the majority (88%) of the patients reported snoring, and each week had about 1.86 days of sleepiness. The somatic symptoms were moderate, with a mean value of 7.13 (SD = 4.85). Medication adherence rate was 79.75%. Daily fruit and vegetable intake rate was 54.46%, whereas the weekly fast food intake rate was 22.22%. About two thirds (62.96%) of participants did on average more than 150 minutes of exercise weekly. Weekly average days in green space was 5.7, the average Green Space Access score was 8.46, and the average Green Space Quality score was 8.15. The score for average comfort with medical forms, or health literacy, was low at 2.6, greater than the cut-off of 2.0 indicating poor health literacy.

For mental health indicators, the average depression score was 1.05 (SD = 1.91), the Stress Level mean score was 1.87 (SD = 2.48), and the average PTSD score was 1.29 (SD = 1.94). For the substance abuse measures, 10.42% reported binge drinking risk, whereas only 4.19% showed smoking or tobacco use risk.

Regression results of cardio-metabolic health on health risk factors

FBS. Table 3 shows the regression results of patients' FBS (Column 1) and systolic and diastolic BP (Column 2 and 3, respectively) health outcomes on patients' physical and mental health, and substance abuse factors, when controlling for the demographic variables. Column 1 shows that other things being equal, patients who reported snoring had significant higher FBS score by 16.56 ($P < 0.05$). However, those who did an average minute of weekly exercise more than 150 minutes and had higher scores of green space access had significant lower FBS score by 22.07 ($P < 0.01$) and 5.69 units ($P < 0.05$), respectively, when compare to their counterparts. In addition, Column 1 shows that women had significantly higher FBS score than men by 16.56. Compared to patients with education level as primary school or less, those with secondary school or some college or higher had significantly higher FBS scores by 35.35 and 36.75 ($P < 0.05$), respectively. Results did not show any significant mental health and substance abuse predictors of FBS scores.

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Table 3 Regression results of psychological and cardio-metabolic health on health risk factors

Variables	(1)FBS	(2)SYS_BP	(3)DIA_BP
	Coef. [95% CI]	Coef. [95% CI]	Coef. [95% CI]
Demographic variables			
Gender (1 = female; 0 = male)	16.56*	-3.20	4.13
	[3.46 - 29.66]	[-9.39 - 2.99]	[-2.52 - 10.79]
Age	0.10	0.14	0.01
	[-0.48 - 0.69]	[-0.13 - 0.41]	[-0.29 - 0.30]
Marriage status (1 = Married; 0 = others)	6.13	0.57	3.38
	[-5.16 - 17.42]	[-4.89 - 6.04]	[-2.50 - 9.25]
Household size	0.31	-0.18	0.15
	[-3.01 - 3.62]	[-1.75 - 1.39]	[-1.53 - 1.84]
Having health insurance (1 = Yes; 0 = others)	-11.48	-14.71 +	-26.37**
	[-44.34 - 21.38]	[-31.35 - 1.93]	[-44.26 - -8.49]
Education level (Ref. = Secondary school or less)			
High school	35.35*	-1.66	3.03
	[4.15 - 66.56]	[-15.84 - 12.52]	[-12.21 - 18.27]
Some college or higher	36.75*	-6.73	5.76
	[1.23 - 72.26]	[-22.58 - 9.12]	[-11.27 - 22.79]
BMI	0.56	0.07	0.53*
	[-0.39 - 1.52]	[-0.39 - 0.53]	[0.03 - 1.02]
Physical Health			
Sleep Apnea – Snoring	19.48*	-18.89**	-0.37
	[0.84 - 38.12]	[-31.09 - -6.70]	[-13.48 - 12.74]
Daytime Sleepiness (Weekly Average)	-0.10	-0.73	-2.01*
	[-3.83 - 3.62]	[-2.52 - 1.06]	[-3.94 - -0.08]
Somatic Symptoms (Average)	-1.02	-0.35	-0.22
	[-2.50 - 0.46]	[-1.09 - 0.40]	[-1.02 - 0.58]
Medication Adherence (%)	26.66	-12.41	-34.13**
	[-13.26 - 66.59]	[-31.18 - 6.37]	[-54.31 - -13.95]
Weekly Fast Food (Average Servings)	-15.99	3.12	-0.50
	[-40.83 - 8.86]	[-9.63 - 15.87]	[-14.21 - 13.20]
Daily Fruit and Veggies (Average Servings)	-12.49	7.20	2.47
	[-33.72 - 8.73]	[-3.64 - 18.05]	[-9.18 - 14.13]
Weekly Exercise (> 150 minutes)	-22.07**	0.08	-6.31 +
	[-35.95 - -8.19]	[-6.61 - 6.77]	[-13.50 - 0.89]
Green Space Days (Weekly Average)	-2.14	1.06	1.37
	[-6.89 - 2.60]	[-1.34 - 3.46]	[-1.21 - 3.95]
Green Space Access (Average)	-5.69*	0.56	-0.95
	[-10.70 - -0.69]	[-1.74 - 2.86]	[-3.42 - 1.52]
Green Space Quality (Average)	-2.66	-1.18	-0.07
	[-7.59 - 2.26]	[-3.92 - 1.56]	[-3.01 - 2.87]
Comfort with Medical Forms (Average)	-5.57	-5.13	-1.06
	[-21.95 - 10.82]	[-13.34 - 3.08]	[-9.88 - 7.77]
Mental Health			
PHQ-4 total	2.90	0.45	0.40
	[-5.30 - 11.10]	[-3.75 - 4.64]	[-4.11 - 4.91]
Stress Level	-2.05	0.40	2.77*
	[-6.66 - 2.57]	[-1.80 - 2.61]	[0.40 - 5.14]
PTSD	1.65	-3.08	-0.70
	[-10.99 - 14.28]	[-9.40 - 3.25]	[-7.50 - 6.10]
Substance Abuse			
Binge Drinking Risk	13.02	10.60+	13.67*
	[-10.73 - 36.77]	[-1.42 - 22.61]	[0.76 - 26.59]
Smoking risk	-10.57	-16.31+	-8.03
	[-48.24 - 27.09]	[-34.04 - 1.42]	[-27.08 - 11.03]
Constant	157.94**	161.33***	81.89**
	[64.04 - 251.83]	[112.38 - 210.27]	[29.28 - 134.50]
Observations	144	131	131
R-squared	0.34	0.30	0.31

Note: 95% confidence interval in brackets *** $P<0.001$, ** $P<0.01$, * $P<0.05$, + $P<0.1$

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Table 4 Correlations among key independent variables

		Physical Health											Mental Health			Substance Abuse	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.BMI	1.00																
2.Sleep Apnea – Snoring	-0.04	1.00															
3.Daytime Sleepiness	0.17*	0.06	1.00														
4.Somatic Symptoms	0.03	-0.14	0.08	1.00													
5.Medication Adherence	0.07	0.11	0.36*	-0.01	1.00												
6.Weekly Fast Food	-0.05	-0.08	-0.05	0.16**	0.43***	1.00											
7.Daily Fruit and Veggies	0.05	-0.27***	-0.07	0.24***	0.63***	0.45***	1.00										
8.Weekly Exercise	-0.09	0.31***	-0.02	-0.13	-0.21	-0.33***	-0.58***	1.00									
9.Green Space Days	-0.14*	0.29***	0.03	-0.18**	-0.18	-0.17**	-0.46***	0.56***	1.00								
10.Green Space Access	-0.07	0.10	-0.16*	-0.14**	-0.14	-0.07	-0.14*	0.22**	0.33***	1.00							
11.Green Space Quality	-0.06	0.20**	-0.16*	-0.19***	-0.29*	-0.17**	-0.29***	0.30***	0.33***	0.70***	1.00						
12.Comfort Med Forms	0.03	-0.14*	0.16*	0.13*	0.14	0.14*	0.15**	-0.12	-0.30***	-0.24***	-0.17**	1.00					
13.PHQ-4	0.001	-0.46***	-0.02	0.36***	0.37***	0.19***	0.42***	-0.28***	-0.35***	-0.24***	-0.21***	0.20***	1.00				
14.Stress	0.03	-0.17*	0.13	0.32***	0.38***	0.25***	0.31***	-0.32***	-0.24***	-0.28***	-0.29***	0.25***	0.46***	1.00			
15.PTSD	-0.03	-0.22**	0.01	0.34***	0.59***	0.32***	0.54***	-0.23**	-0.28***	-0.11	-0.14**	0.35***	0.58***	0.44***	1.00		
16.Binge Drinking	-0.06	0.01	0.02	0.02	0.04	0.06	0.04	-0.10	-0.04	0.02	-0.04	0.03	0.06	0.02	0.09	1.00	
17.Smoking	-0.03	-0.03	0.08	0.10	0.003	0.04	0.100	-0.08	-0.18**	-0.10	-0.11	-0.03	0.17	0.02	0.09	0.17**	1

Note: $*P < 0.05$, $**P < 0.01$, $***P < 0.001$

Systolic blood pressure. Table 3 (Column 2) shows that patients who reported snoring had significant lower systolic blood pressure scores by 18.89 ($P < 0.01$), compared to their counterparts. In addition, patients who had national health insurance coverage had lower systolic blood pressure scores by 14.71, and patients who had smoking or tobacco use risk had lower systolic blood pressure scores by 16.31. However, these two indicators were only showed a marginal significance at 90% level ($P < 0.1$).

Diastolic blood pressure. Table 3 (Column 3) shows that every 10 percentile of patients' medication adherence increase significantly decreases the diastolic blood pressure scores by 34.13 ($P < 0.01$), and for every unit increases in daytime sleepiness scores, the diastolic blood pressure score decreases by 2.01 ($P < 0.05$). Those who did on average more than 150 minutes of weekly exercise had marginal significant lower diastolic blood pressure scores by 6.31 ($P < 0.1$). However, for every unit increases in stress scores, the diastolic blood pressure score increases by 2.77 ($P < 0.05$). Patients who had binge drinking risk had significant higher diastolic blood pressure scores by 13.67 ($P < 0.05$). In addition, every unit of patients' BMI score increases significantly increases the diastolic blood pressure scores by 0.53 ($P < 0.05$), whereas patients who had national health insurance coverage had lower diastolic blood pressure scores by 26.37 ($P < 0.01$), compared to their counterparts.

Significant correlation results

Green space days exposure, access and quality (higher numbers are positive) were all negatively correlated with somatic symptoms and fruit and vegetable intake and positively with exercise, and green space days and quality positively associated with snoring and negatively with fast food. Green space access and quality were negatively associated with daytime sleepiness and green space quality negatively with medication adherence, and green space days was negatively associated with BMI (Table 4). Health literacy was positively associated with daytime sleepiness, somatic symptoms, fast food, fruit/vegetables, and negatively associated with snoring, green space days and access. The mental health variables PHQ-4, stress and PTSD were negatively associated with all of the green space measures except access, indicating that greater green space exposure is associated with improved mental health (Table 4). All mental health variables with positively correlated with somatic symptoms, medication adherence, fast food, fruits/vegetables, and health literacy, and negatively correlated with snoring and exercise. The majority of mental health items were positively correlated (PHQ-4, physical symptoms, stress, PTSD) (Table 4).

Discussions

It was found that the level of behavioral health integration in Thailand by site was variable, with two sites reporting higher levels of integration than the others overall, and one site much lower than the others. However, the domain and total scores were generally higher than PIP scores in other countries (Cambodia, China, Vietnam) in our unpublished research, and were comparable to levels of integration seen in community health centers with a BHC on site based on US PIP data [39] (See Figure 1). This may be due to the high utilization of nurses and especially community health workers in Chiang Mai, with approximately 100 community health workers assigned to each clinic (personal communication).

The Provider Survey self-reported prevalence of behavioral problems/conditions and the need for a behavioral health consultant to assist in treatment was moderate. Most ratings for prevalence and need for BHC ranged between "rarely" (2) and "sometimes" (3). The top five conditions are consistent with other research showing that unhealthy alcohol use [13], mental health disorders [40], and medication adherence [41] are significant problems in the Thai population [4, 5, 9, 11]. The concern for overutilization of health services is consistent with concern that the Thailand universal health insurance results in overutilization of healthcare services that may reflect negligence in managing personal health and dependency on the health care system [42] and contributes to rising healthcare costs [43].

The Provider Survey results showed moderate but not the expected high ratings of prevalence and need for a BHC, with the average around 2.3—2.4 on a 4-point Likert scale ranging from Never (0) to Often (4). One explanation is that clinicians do not recognize behavioral conditions in practice. Studies in Asia consistently show that behavioral conditions are under diagnosed and that clinicians fail to recognize conditions such as depression and anxiety [44]. Another explanation may be that the role of BHC is filled by nurses and community health workers in Thailand who are well-prepared in health counselling and can bridge the gap. However, this might be not be true in other clinics that lack psychiatric nurses and should be further investigated to depict the relevant factors. Further research is needed to evaluate perceived prevalence and need for a BHC for behavioral conditions in Thailand in order to determine if it reflects a lack of clinician awareness or simply low need because nurses and community health workers fill this role.

Medication adherence was 74%, which is slightly lower than the generally accepted cut-off of 80% to categorize as good adherence [46]. Adherence was a top five concern in this study, even at 75%. Health literacy was poor, consistent with research that health literacy is a risk factor for poor medication adherence [41]. The significant positive correlations between medication adherence and the mental health variables (PHQ-4, stress and PTSD) implies that better adherence is related to better mental health status, whereas the positive correlations with fast food, fruits and vegetables implies that adherence is associated with greater intake of fast foods and fruits/vegetables. These results have implications to behavioral health education and intervention in Thailand that increase the health literacy can be helpful to improve the medication adherence.

Self-reported nutrition showed low consumption of fruit and vegetables, consistent with research on poor nutrition in Thailand [7]. The average self-reported weekly rigorous physical activity of 130 minutes was less than recommended levels (150 minutes/week), also consistent with research on decreased physical activity in Thailand, and the significant correlations between physical activity and most other self-report HRA measures suggest that increased exercise is associated with better behavioral health [9]. These findings are consistent with a study of diabetes clinic patients that found only 31.7% and 54.3% reported adherence to physical exercise and diet recommendations, respectively [41]. The very low scores on the mental health measures of anxiety, depression, and trauma were surprising based on other research finding higher prevalence of these problems in Thailand [37,47]. Risky alcohol use was significant for males for most sites (range 21% to 54%) with lower rates in two sites (16-17%). Tobacco use was lower than expected for men. Anecdotal reports form community health workers who administered and reviewed the patient HRA indicated that the workforce had not used these types of screening measures and found them valuable and has implication both for identification of behavioral issues and as a point of discussion with patients.

Patient that suffered from sleep apnea showed significantly higher levels of FBS and systolic BP, which suggests that sleep disruption has metabolic implications. While green space access seems to have a significant reductive impact on FBS in the regression model, all green space measures showed significance on PHQ-4 and stress levels. The green space significant negative correlations with all of the mental health variables, somatic symptoms implies that greater green space exposure is related to better mental health status and fewer physical symptoms. Other green space correlations were mixed, with some in the expected direction and others not. This is consistent with research showing that exposure to green spaces is associated with improved physical and mental health, and points to the need for greater research on the relationship between green space and health [38]. Interestingly, the regression model did find that those with lower health literacy also had much higher systolic blood pressure, indicating that there is a poor understanding of physical health overall. Poor health literacy may indicate that there is a failure to

understand healthcare information provided by their doctors and makes them unable to take responsibility for their own health, leading to poor heart health.

Limitations

There are several limitations to this study. First, the PIP, Provider Survey, and some of the HRA screening measures have not yet been validated in Thailand. However, a formal validation study was not in scope for this study. Anecdotal reports from participants indicate that some of the PIP questions contain terms that are not commonly used in Thailand, and some of the question on the HRA, such as how to define a "portion" of fruits or vegetables, were unclear to patients. Plans for this research include a validation study of the PIP in 2021 and plans to validate the HRA in future research. Lastly, this study was based on a convenience sample which self-selection bias is the main issue therefore, it may not be able to generalize the results to the whole population.

Conclusion

This appears to be the first study to utilize a multidimensional approach to measure integrated care in Thailand. The results of this study reflect a need for integrated behavior health into the health care system in Thailand to improve the prevention and management of NCD's. There is a need for a brief, validated HRA feasible for use in busy clinics that will increase clinician recognition of behavioral problems in their patients. It is likely that as clinicians are more aware of the prevalence of these behavioral risk factors they will report greater prevalence and need for a BHC to address these problems. The PIP measure of integration is needed so that clinic leadership may evaluate the relationship between level of integration, provision of integrated health services, and clinical outcomes. Recommendations for future study include an evaluation of the translation quality and validity and reliability of the study measures under Thai context. This research team has active studies in progress in Cambodia, India, Thailand and Vietnam to address these gaps in the research.

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