

# Health Literacy and Complementary and Alternative Medicine Use among Type 2 Diabetes Mellitus Patients in the Northeast of Thailand

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## ABSTRACT

### Background

Globally, type 2 Diabetes Mellitus is in increasing trend. With its chronic and incurable natures, type 2 diabetes patients have been increasingly seeking various regiments to relieve their sufferings. However, magnitude and influencing factors are still unclear.

### Objective

To identify prevalence of complementary and alternative medicine among type 2 diabetes patients and the association between health literacy and its use in the Northeast region of Thailand.

### Method

This cross-sectional study aimed to determine the prevalence of Complementary and Alternative Medicine use and the roles of health literacy on its use among type 2 diabetes patients in the Northeast Region of Thailand. A total of 1,012 type 2 diabetes mellitus patients were systematic randomly selected to response to a structured questionnaire interview. The generalized linear mixed model was applied to identify factors associated with it.

### Result

There were 30.89% (95% CI: 28.25 to 33.67) of type 2 diabetes patients used complementary and alternative medicine. Majority of these patients (52.23%, 95% CI: 49.30 to 55.15) had sufficient level of health literacy related to complementary and alternative medicine. Type 2 diabetes patients who had sufficient to excellent levels of health literacy had 2.64 times higher Odds of complementary and alternative medicine use (95% CI: 1.91 to 3.65) when compared with those who had inadequate to problematic levels of health literacy. Others covariates that were also associated with complementary and alternative medicine use were had adequate income (OR<sub>adj.</sub> = 2.52; 95% CI: 1.81 to 3.52), had HbA1C < 7 (OR<sub>adj.</sub> = 2.50; 95%CI: 1.86 to 3.37) and had comorbidity (OR<sub>adj.</sub> = 2.07; 95%CI: 1.57 to 2.73).

### Conclusion

About thirty percent of type 2 diabetes patients used complementary and alternative medicine. Health literacy, economic status, comorbidity and diabetic control had strong influence on complementary and alternative medicine use.

## KEY WORDS

*Health literacy, Diabetes Mellitus, Northeast of Thailand*

## INTRODUCTION

Diabetes is a serious, chronic metabolic disease caused by either insufficient production of insulin, or ineffectively utilization of the produced insulin by the body.<sup>1</sup> The global prevalence (age-standardized) of diabetes has nearly doubled since 1980 which is increasing from 4.7 to 8.5% in the adult population and it is expected that this number will be twofold by 2025.<sup>2-5</sup> Diabetes Mellitus (DM) is not only ranked as the eighth leading cause of death among both sexes but also was the fifth leading cause of death in women.<sup>2</sup>

DM is a common metabolic disorder that is increasing health burden in Thailand as well as increased DM-related deaths by almost 21.1% between 2012 and 2014.<sup>6-8</sup> The estimated prevalence of DM in Thailand was approximately 8.3% (95% CI; 7.7 to 8.9) among adult >15 years with a higher prevalence in females 9.6% (95% CI; 8.9 to 10.4) than in males 6.5% (95% CI; 5.6 to 7.4), in 2003.<sup>6-10</sup> The prevalence of type 2 DM was 10.4% among adults in the Northeast, the highest among all regions, of which it was 9% among males and 11.7% among females.<sup>11</sup>

Nowadays, there are broad varieties of health services in Thailand, ranges from self-caring, over the counter drugs, traditional treatments, folk treatments, private clinics, public hospitals and private hospital.<sup>9,12</sup> Complementary and Alternative Medicine (CAM) is board range of treatments that are used in addition to, complementary, or instead of, alternative, standard or conventional western medical treatments. CAM may include herbs, dietary supplements, mega dose vitamins, herbal preparations, special teas, acupuncture, massage therapy, magnet therapy, spiritual healing, and meditation.<sup>13,14</sup>

Thai traditional medicine and alternative medicine have included in the National Health Service development plan (No. 10) indicated that "Every hospital must provide Thai traditional medicine that people can rely on it."<sup>15,16</sup> People with poor health literacy, often lack knowledge or have misinformation about nature and causes of disease of which they may not understand the relationship between health determinants and health outcomes.<sup>12,17</sup> The Northeast is the largest but poorest region of the country with the highest number of type 2 DM patients. Therefore, this study aimed to identify prevalence of CAM use among type 2 DM patients and the association between health literacy and CAM use in the Northeast region of Thailand. The results could be used as evident for health and other relevant sectors to set appropriate plans for appropriate use of CAM.

## METHODS

This cross-sectional study aimed to determine the prevalence of CAM use among type 2 DM patients and identify the association between health literacy and CAM

use. The study population were type 2 diabetes mellitus patients aged 18 years and older, who were diagnosed by the physician in respective health institutions in the Northeast region. The sample size was calculated by using the sample size estimation formula for multivariable regression analysis to identify the association between independent variables and categorical data outcome of with the sample size of 1,113. The sample size was then adjusted to control the over-fitting, using the rho ( $\rho$ ) of 0.06 and variance inflation factor (VIF) equal to 2.50. Therefore, the total samples was 1,120. A Multi stage random sampling was used to select the samples from 4 sub-districts, among 4 districts of 4 provinces.

The research tool was a structured questionnaire which was developed according to the research questions and relevant literatures. The questionnaire consists of the demographic and socioeconomics characteristics, knowledge on type 2 DM and CAM, attitude on CAM, health literacy, health behaviors, CAM use, health status and clinical outcomes. The questionnaire was tested by 5 experts for the content validity. The reliability test was conducted among 30 types 2 patients was tested in others provinces. The Cronbach's alpha coefficient of this questionnaire was  $\geq 0.7$ . The information was collected using a questionnaire interview by trained interviewers.

Demographic and socioeconomic characteristics: age was categorized into 2 age groups; 1) younger 60 yrs., and 2) 60 yrs. and older; occupation as 1) agriculturist 2) beside agriculturist including government/state enterprise/employees/trade/ business; household average monthly income as 1) < 5,000 baht and 2)  $\geq 5,000$  baht. Health behaviors was classified into 1) poor to average levels of behaviors and 2) good behaviors. Knowledge was classified as; low level (score 0-59%, average level (score 60-79%), high level (score  $\geq 80$ %). Attitude towards CAM was classified as poor attitude (score < 29.34), average attitude (score 29.34-47.66) and good attitude (score  $\geq 47.67$ ). Health literacy on DM and CAM was classified into inadequate to problematic score > 64 and 50-64), and sufficient to excellence (score 35-49, and 20-34), BMI was classified into 3 groups of normal and underweight: BMI < 23 kg/m<sup>2</sup>, overweight (BMI: 23-24.9 kg/m<sup>2</sup>) and obesity (BMI  $\geq 25$  kg/m<sup>2</sup>, Latest blood glucose levels were classified as 1) > 130 mg/dl and 2)  $\leq 130$  mg/dl. Glycated hemoglobin (HbA1C) was divided into 1) > 7 mg% and 2)  $\leq 7$  mg%.

The categorical variables were analyzed and described as frequency and percentage whereas presented mean, standard deviation and median for continuous variables. Crude odds ratios and their 95% confidence intervals (CI) and p-value were calculated by using simple logistic regression. The dependent variables which had  $p < 0.25$  were processed to multivariable analysis using the generalized linear mixed model (GLMM) analysis to estimate the association between health literacy and CAM use among type 2 DM patients and when controlled other

covariates. Backward elimination was used as the method for variable selection to obtain the final model. The p-value less than 0.05 was considered as statistically significant.

The written informed consent was taken from all the individuals after explaining the study objectives. The Ethical Committee of Khon Kaen University approved this study (reference no. HE 612105).

## RESULTS

Majority of the respondents were women (69.77%) with the average age of 60.50 ± 11.26 years old. Most of them were married (78.93%), finished primary education (79.46%) and were agriculturists (74.11%). Almost half lived in a family with 4-5 members (50.71%). About one-third had family monthly income of 5,000-9,999 baht (33.04%), 54.82% had debt. Only 16.70% had active social role. Almost all were in the Universal Health Coverage Scheme (UC) of which they pay a copayment of 30 Baht per visit for curative care at the health facilities they registered (table 1).

**Table 1. Personal and socioeconomic factors of type 2 diabetes in Northeast Region (n=1,120)**

Demographic and socioeconomic characteristics	Number	%
<b>Gender</b>		
Male	347	30.98
Female	773	69.02
<b>Age (Years)</b>		
< 50	191	17.05
50-59	299	26.70
60-69	419	37.41
≥ 70	211	18.84
Average: 60.50 years old, SD: 11.26, Median = 61 Min: 25, Max: 98		
<b>Marital status</b>		
Single	29	2.59
Marriage	884	78.93
Divorce/Widow/Separated	207	18.48
<b>Educational attainment</b>		
No formal education	39	3.48
Primary school	890	79.46
Secondary school	92	8.21
High school	74	6.61
Bachelor degree or higher	25	2.24
<b>Occupation</b>		
Farmer	830	74.11
Government officer/State enterprise	19	1.70
Employee	4	0.36
Worker	83	7.41
Merchant	81	7.23
Unemployment	103	9.20
<b>Family size (Person)</b>		

1	13	1.17
2-3	261	23.30
4-5	568	50.71
≥ 6	278	24.82
<b>Status in family</b>		
Head of family	444	39.64
Family member	676	60.36
<b>Average monthly household income (Baht)</b>		
<5,000	75	6.70
5,000-9,999	370	33.04
10,000-19,999	448	40.00
≥20,000	227	20.26
Mean: 14,156.88, SD: 13,495.46, Median: 10,000 Min: 3,000, Max: 150,000		
<b>Average monthly household expenditure</b>		
<5,000	152	13.57
5,000-9,999	434	38.75
10,000-19,999	385	34.38
≥20,000	149	13.30
Mean: 11,697.77, SD: 10,942.00, Median: 9,000 Min: 2,500, Max: 150,000		
<b>Debt</b>		
No	450	40.18
Yes	670	59.82
<b>Adequacy of income</b>		
Not enough without debt	31	2.77
Not enough with debt	398	35.54
Enough without saving	511	511
Enough with saving	180	16.07
<b>Role in society</b>		
No	933	83.30
Yes	187	16.70
Community Leader	26	2.32
Village health volunteer	111	9.91
Fund manager/Committee	50	4.46
<b>Health insurance</b>		
No Health insurance	20	1.79
Universal Coverage Scheme	1,036	92.50
Government or State Enterprise Officer	36	3.21
Social Security Scheme	28	2.50

About one third (35.54%) of the DM patients were obese (BMI: 25 to 29.9 kg/m<sup>2</sup>). Almost half of the respondents (49.38%) had poor control of plasma glucose of which their latest plasma glucose level was higher than 130 mg/dl, 38.03% of these patients had HbA1C ≥ 7 mg%. Moreover, 48.12% of them were suffered from the congenital disease more than diabetes. In addition, 66.52% of them were taken one medicines a day for the treatments of DM and average expenditure per month was less than 5,000 baht (88.12%) However, most of them don't had complication with eye, kidney, foot or paralysis (table 2).

**Table 2. Health Status of type 2 diabetes in North-East Region (n=1,120)**

Health Status	Number	Percentage
<b>Body mass index (kg/m<sup>2</sup>)</b>		
Underweight (<18.5)	44	3.93
Normal (18.5 to 22.9)	320	28.57
Overweight (23 to 24.9)	267	23.84
Obesity (≥25)	489	43.67
<b>Years of diagnosed with diabetes (years)</b>		
<5	229	20.45
≥ 5	891	79.55
<b>Latest fasting plasma glucose (mg/dl)</b>		
≥130	657	58.66
70-129	462	41.25
<70	1	0.09
<b>Blood sugar level before the latest</b>		
>130	553	49.38
70-130	567	50.63
<b>HbA1C</b>		
<7	694	61.96
7 - 8	333	29.73
≥9	93	8.31
<b>Complications</b>		
<b>Eye complication</b>		
No	1,052	93.93
Yes	68	6.07
<b>Kidney degenerative/Dialysis</b>		
No	1,073	95.80
Yes	47	4.20
<b>Foot Complication</b>		
No	1,092	97.50
Yes	28	2.50
<b>Paralysis</b>		
No	1,111	99.20
Yes	9	0.80
<b>Ischemic heart disease</b>		
No	1,111	99.20
Yes	9	0.80
<b>Others</b>		
No	1,097	97.95
Yes	23	2.05
<b>Comorbidity of DM</b>		
No	581	51.88
Yes	539	48.12
Hypertension	506	45.18
Others	70	6.25
<b>Diabetes Treatment Regimens</b>		
Oral Medicine only	1,046	93.39
1 Tablet	745	66.52
2 Tablet	301	26.88

Injection only	24	2.14
Both Oral medicine and Injection	50	4.46
<b>Average Health Expenditure (Baht per month)</b>		
< 500	987	88.13
500-999	72	6.42
≥ 1,000	61	5.45

Average: 258.88, SD: 1,141.21, Median: 50 Min: 0, Max: 30,000

Most of the type 2 DM patients had average level of knowledge on health 72.77% (95%CI: 70.08 to 75.03) and 25.45% (95%CI: 22.98 to 28.08) had high level of knowledge (table 3).

**Table 3. Level of knowledge on DM and CAM of type 2 diabetes in the Northeast Region (n=1,120)**

Knowledge Level	Number	Percentage	95% CI
<b>Low level (Score 0-59%)</b>	20	1.79	1.15 to 2.75
Average level (Score 60-79%)	815	72.77	70.08 to 75.30
High level (Score ≥80%)	285	25.45	22.98 to 28.08

Average: 16.97, SD: 2.17, Median: 17 Min: 6, Max: 20

Table 4 indicate the attitude toward CAM of type 2 diabetes in Northeast Region. Almost 2- thirds of the respondents had poor on CAM (61.96%: 95%CI: 59.08 to 64.78) whereas 37.23% (95%CI: 34.44 to 40.11) had average level of attitude.

**Table 4. Attitude towards CAM of type 2 diabetes in Northeast Region (n=1,120)**

Attitude Level	Number	Percentage	95% CI
Poor attitude (score < 29.34)	694	61.96	59.08 to 64.76
Average attitude (score 29.34 – 47.66)	417	37.23	34.44 to 40.11
Good attitude (score ≥47.67)	9	0.80	0.41 to 1.15

Average: 34.29, S7.D: 6.31, Median: 33 Min: 11, Max: 55

Health literacy in this study assess the level of difficulty that the respondent encountered in accessing, understanding, appraising health information and making decision on health practices. It was found that more than half of the DM patients had sufficient level of health literacy (52.68%, 95%CI: 49.72 to 60.59) and 34.29% (95% CI: 31.56 to 37.12) had problematic level of health literacy (table 5).

**Table 5. Health Literacy (Difficulty in accessing to health information, understanding, appraising and making decision) of type 2 diabetes in the Northeast Region (n=1,120)**

Health literacy level	Number	Percentage	95% CI
Inadequate (> 64 points)	73	6.52	0.21 to 8.12
Problematic (50 - 64 points)	384	34.29	31.56 to 37.12
Sufficient (35 - 49 points)	585	52.23	49.30 to 55.15
Excellent (20 - 34 points)	78	6.96	5.61 to 8.615
Average: 47.98, SD: 11.33, Median: 45 Min: 20, Max: 80			

The prevalence of CAM use during the past one year among type 2 DM was 30.89% (95% CI: 28.25 to 33.67). Among the users, massage and herbal medicine were the most popular type of CAM with 16.96% and 15.63%, respectively. The other types such as naturopathy, acupressure and supplementary food were used among few CAM users (table 6).

**Table 6. CAM use among type 2 diabetes in the Northeast Region (n=1,120)**

CAM use	Number	Percentage	95% CI
Did not use	774	69.11	66.33 to 71.75
Use	346	30.89	28.25 to 33.67
Massage	190	16.96	14.87 to 19.28
Herbal	175	15.63	13.61 to 17.87
Acupressure	1	0.09	0.01 to 0.63
Supplementary food	1	0.09	0.01 to 0.63
Naturopathy	2	0.18	0.04 to 0.71

In the bivariate analysis using simple logistic regression, the individual factors that were statistically significant with CAM use of type 2 diabetes patients in Northeast Region, Thailand with statistical significant (p-value ≤ 0.25) were age ≥ 60 years (OR=1.17), was family member (OR=1.36), had adequate of income (OR=1.78), body mass index ≥ 23 (OR=1.78), latest of fasting plasma glucose level<130 (OR=1.46), HbA1c <7 mg% (OR=1.79), had comorbidity (OR=2.16), had high knowledge level (OR=1.77) and had sufficient to excellent levels of health literacy (OR=3.37). All these factors were processed into the final multiple logistic model by using GLMN with backward elimination with statistically significant at p-value <0.05 (table 7).

**Table 7. The factor associated with CAM use of type 2 diabetes in the Northeast Region (n=1,120)**

Factors	N	%	Crude OR	95% CI	P-Value
<b>Gender</b>					<b>0.801</b>
Male	347	31.41	1		
Female	773	30.66	0.97	0.73 to 1.27	
<b>Age</b>					<b>0.221</b>
<60	490	28.98	1		
≥60	630	32.38	1.17	0.91 to 1.52	
<b>Educational attainment</b>					<b>0.863</b>
No formal education/Primary school	929	31.00	1		
Secondary school/High school school/Bachelor degree or higher	191	30.37	0.97	0.69 to 1.36	
<b>Status in Family</b>					<b>0.019</b>
Head of family	676	28.25	1		
Family member	444	34.91	1.36	1.05 to 1.76	

<b>Average Monthly Household Income (Baht per Month)</b>					<b>0.550</b>
<10,000	445	31.91	1		
≥10,000	675	30.22	0.92	0.71 to 1.20	
<b>Average Monthly Household Expenditure (Baht per Month)</b>					<b>0.367</b>
<10,000	586	32.08	1		
≥10,000	534	29.59	0.89	0.69 to 1.15	
<b>Adequacy of income</b>					<b>&lt;0.001</b>
Enough with saving/ Enough with no saving	429	17.72	1		
Not enough without debt/ Not enough with debt	691	39.07	2.98	2.23 to 3.99	
<b>Body Mass Index (kg/m<sup>2</sup>)</b>					<b>0.242</b>
<23	364	28.57	1		
≥23	756	32.01	1.78	0.89 to 1.55	
<b>Latest fasting plasma glucose level (mg/dl)</b>					<b>0.004</b>
≥130	657	27.55	1		
<130	463	35.64	1.46	1.13 to 1.88	
<b>HbA1C (%)</b>					<b>&lt;0.001</b>
≥7	426	23.47	1		
<7	694	35.45	1.79	1.36 to 2.35	
<b>Comorbidity of DM</b>					<b>&lt;0.001</b>
No	581	23.06	1		
Yes	539	39.33	2.16	1.67 to 2.80	
<b>Knowledge level</b>					<b>&lt;0.001</b>
Low – average	835	27.66	1		
High	285	40.35	1.77	1.34 to 2.34	
<b>Attitude level</b>					<b>0.310</b>
Poor	694	31.99	1		
Average – good	426	29.11	0.87	0.67 to 1.34	
<b>Health literacy level</b>					<b>&lt;0.001</b>
Inadequate – Problematic	457	16.85	1		
Sufficient – Excellent	663	40.57	3.37	2.52 to 4.50	

The final model of multivariable analysis by using Generalized Linear Mixed Model (GLMM) with the backward elimination technique that controlled the clustering effect. The factors associated with CAM use of type 2 diabetes in Northeast of Thailand, when control other covariates were had sufficient to excellent levels of health literacy (OR<sub>adj.</sub> =2.64; 95% CI: 1.91 to 3.65; p-value <0.001). Other covariates that associated with CAM use were: had adequate income (OR<sub>adj.</sub> =2.52; 95% CI: 1.81 to 3.52; p-value <0.001), HbA1c <7 mg% (OR<sub>adj.</sub> =1.25; 95% CI: 1.86 to 3.37; p-value <0.001) and had comorbidity (OR<sub>adj.</sub> =2.07; 95% CI: 1.57 to 2.73; p-value = <0.001) (table 8).

**Table 8. Factors associated with CAM use of type 2 diabetes in the Northeast Region (n=1,120)**

Factors	N	%	Crude OR	OR Adj.	95% CI	P-Value
<b>Health Literacy level</b>						<0.001
Inadequate – Problematic	457	16.85	1	1		
Sufficient – Excellent	663	40.57	3.37	2.64	1.91 to 3.65	
<b>Adequacy of income</b>						<0.001
Inadequate	429	17.72	1	1		
Adequate	691	39.07	2.98	2.52	1.81 to 3.52	
<b>HbA1C (%)</b>						<0.001
≥7	426	23.47	1	1		
<7	694	35.45	1.79	2.50	1.86 to 3.37	
<b>Had comorbidity</b>						<0.001
No	581	23.06	1	1		
Yes	539	39.33	2.16	2.07	1.57 to 2.73	

## DISCUSSION

This present study observed that about 30% of the type 2 DM used CAM of which about half used massage services and another half used herbal medicines. This proportion was much lower than those found in a study among diabetes patients in 2005 in Ubon Ratchathani Province, Thailand which indicated prevalence of CAM use was 47.8%, and was also lower than studies in Taiwan (61 percent), South Korea (65 percent), and India (67.7 percent).<sup>18-21</sup> However, CAM use in our finding was higher than those in the United Kingdom (17 percent), and Australia (23.6 percent).<sup>22,23</sup> The possible reasons for lower prevalence of CAM use even when compared with those found in the Northeast of Thailand in 2005 might be the influence from campaigns to reduce or stop inappropriate use of medicines both modern and CAM to prevent chronic kidney disease (CKD) which is a common and severe complication of type 2 DM in Thailand. Our finding indicated about 40 percent of the respondent had average to good attitude on CAM, they might be those 30 percent that used CAM. In addition, about 17 percent used massages which related to occupational musculoskeletal disorders and another 16% used herbal medicines. It is expected that DM patients would use CAM with better understanding which relater with their health literacy that reflect their capacity to obtain, understand and process common health information to make appropriate decisions regarding health. This was supported by our findings that DM patients with sufficient to excellent levels of health literacy were more likely to use CAM (ORadj. = 2.64) when compared to those who did not use. Having access to health information and health service, communication skill, decision making skill, self-management skill also associated with alternative medical

usage of type 2 diabetes had been observed by previous studies as having association with complementary and alternative medicine use through influence of media and recommendations of health professional.<sup>24,25</sup> Easily access to information can lead to more complementary and alternative use in Jordan.<sup>26</sup> Simultaneously, people with higher education were more likely to use complementary and alternative medicine along with the conventional treatment.<sup>24,27</sup> In contrast, a study among type 2 diabetes in Eastern Mediterranean Region indicated no statistically significant association between education and CAM use in their multivariable analysis models, of which patients used CAM because of friend recommendations.<sup>28-30</sup>

When considered their illness conditions such as having comorbidity, those who had commodity were more likely to use CAM. (ORadj. = 2.07) of which this study found that about 45% had hypertension. In addition, the good clinical outcome also associated with CAM that the DM patients who had good control of sugar level (Hb A1C < 7 mg%) use CAM more than (ORadj. = 2.50) the patients whose Hb A1C was ≥ 7 mg%. A study in Singapore indicated that blood sugar level was associated with alternative medicine used.<sup>31</sup> Our finding founded that about 16% used massage services with was similar with the alternative health report of Strategy and Plan Division, Ministry of Public Health (October 1997) indicated that the most popular alternative medical used was massage because it was well known among Thai people and believe in it. Income is also a main factor for using complementary and alternative medicine (ORadj. = 2.52). Since only some herbal medicines were covered be the universal coverage health insurance, the use were rather limited to those who could afford them. A study in Iran indicated that hospitalized patients who had higher income were more likely to use complementary medicine.<sup>32</sup> However, few study found that the usage of alternative medicine of chronic pain patient was not associated with income.<sup>33</sup>

The strengths of the present study include the regionally representative samples to determine the prevalence of CAM use among type 2 DM patients and identify the association between health literacy and its use among the Northeast DM population of Thailand and relay on the responses of the patients. Therefore, further qualitative study which represent all areas of Thailand will be great strength to conclude the findings in an effective manner.

## CONCLUSION

The study indicated that about 30 percent of type 2 DM patients used complementary and alternative medicine. Health literacy was highly associated with complementary and alternative medicine use when consider the influenced of their health status of having hypertension as hypertension, effectively control blood sugar level and income.

## REFERENCES

- American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes care*. 2010;33(Supplement 1):S62-S9.
- Gadsby R. Epidemiology of diabetes. *Advanced drug delivery reviews*. 2002;54(9):1165-72.
- Lindström J, Neumann A, Sheppard K, Gilis-Januszewska A, Greaves C, Handke U, et al. Take action to prevent diabetes—the IMAGE toolkit for the prevention of type 2 diabetes in Europe. 2010;42(S 01):S37-S55.
- World Health Organization. Global status report on non communicable diseases 2014.[Online]. 2014. [Cited 2016 Dec 4]. Available from: <https://www.who.int/nmh/publications/ncd-status-report-2014/en/>.
- World Health Organization. Global report on diabetes. 2016.
- Aekplakorn W, Stolk RP, Neal B, Suriyawongpaisal P, Chongsuvivatwong V, Cheepudomwit S, et al. The prevalence and management of diabetes in Thai adults: the international collaborative study of cardiovascular disease in Asia. 2003;26(10):2758-63.
- Deerochanawong C, Ferrario AJG, Health. Diabetes management in Thailand: a literature review of the burden, costs, and outcomes. 2013;9(1):11.
- Aekplakorn W, Bunnag P, Woodward M, Sritara P, Cheepudomwit S, Yamwong S, et al. A risk score for predicting incident diabetes in the Thai population. 2006;29(8):1872-7.
- Ministry of Public Health Thailand. The survey results of Behavioral Risk Factor Surveillance System in 2015. In: Level R, editor. 2015.
- International Diabetes Federation. Western pacific: Thailand. [Online]2014. [Cited 2016 Dec 4]. Available from: <https://www.idf.org/our-network/regions-members/western-pacific/members/115-thailand.html>.
- Aekplakorn W. Thai National Health Examination Survey (NHES) V. Nonthaburi: Health System Research Institute; 2014.
- US Department of Health Human Services. Healthy people 2020: an opportunity to address societal determinants of health in the United States. 2010. 2015.
- Cancer Nlo. NCI Dictionary of Cancer Terms : Complementary and alternative medicine. [Online]2014. [Cited 2016 Dec 4]. Available from: <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/complementary-and-alternative-medicine>.
- Medicine UNLo. Collection Development Manual: Definition of Complementary and Alternative Medicine. [Online]2014. [Cited 2016 Dec 4]. Available from: <https://www.nlm.nih.gov/tsd/acquisitions/cdm/subjects24.html>.
- Ministry of Public Health. Health Situation Report 2016. 2016.
- Prasittivatechakool A. Alternative Health and Perspective to Select without Overlook. *Journal of The Royal Thai Army Nurses*. 2014;15(3).
- Ratzan S, Parker R, Selden C, Zorn M, Ratzan S, Parker RJBNIoH, US Department of Health, et al. Introduction in national library of medicine current bibliographies in medicine: health literacy. 2000.
- Sripa SJJMAT. Usage of and cost of complementary/alternative medicine in diabetic patients. 2005;88(11):1630-7.
- Chang H-yA, Wallis M, Tiralongo EJE-BC, Medicine A. Use of complementary and alternative medicine among people with type 2 diabetes in Taiwan: a cross-sectional survey. 2011;2011.
- Lee MS, Lee MS, Lim HJ, Moon SRJP, Safety D. Survey of the use of complementary and alternative medicine among Korean diabetes mellitus patients. 2004;13(3):167-71.
- Kumar D, Bajaj S, Mehrotra RJP. Knowledge, attitude and practice of complementary and alternative medicines for diabetes. 2006;120(8):705-11.
- Leese G, Gill G, Houghton GJPD. Prevalence of complementary medicine usage within a diabetes clinic. 1997;14(7):207-8.
- Clifford RM, Batty KT, Davis W, Davis TMJJoPP, Research. Prevalence and predictors of complementary medicine usage in diabetes: Fremantle Diabetes Study. 2003;33(4):260-4.
- Yeh M-L, Chiu W-L, Wang Y-J, Lo CJHnp. An investigation of the use of traditional chinese medicine and complementary and alternative medicine in stroke patients. 2017;31(6):400-7.
- Chang KH, Brodie R, Choong MA, Sweeney KJ, Kerin MJJBc. Complementary and alternative medicine use in oncology: a questionnaire survey of patients and health care professionals. 2011;11(1):196.
- Al Qudimat MR, Rozmus CL, Farhan NJJoan. Family strategies for managing childhood cancer: using complementary and alternative medicine in Jordan. 2011;67(3):591-7.
- Yarney J, Donkor A, Opoku SY, Yarney L, Agyeman-Duah I, Abakah AC, et al. Characteristics of users and implications for the use of complementary and alternative medicine in Ghanaian cancer patients undergoing radiotherapy and chemotherapy: a cross-sectional study. 2013;13(1):16.
- Weizman A, Ahn E, Thanabalan R, Leung W, Croitoru K, Silverberg M, et al. Characterisation of complementary and alternative medicine use and its impact on medication adherence in inflammatory bowel disease. 2012;35(3):342-9.
- Naja F, Mousa D, Alameddine M, Shoaib H, Itani L, Mourad YJBc, et al. Prevalence and correlates of complementary and alternative medicine use among diabetic patients in Beirut, Lebanon: a cross-sectional study. 2014;14(1):185.
- Ustundag S, Zencirci AD. Complementary and alternative medicine use among cancer patients and determination of affecting factors: a questionnaire study. *Holistic nursing practice*. 2015;29(6):357-69.
- Tan M, Win MT, Khan SAJAAMS. The use of complementary and alternative medicine in chronic pain patients in Singapore: a single-centre study. 2013;42(3):133-7.
- Khansari A, Mahmoudi GA, Almasi V, Lorzadeh N. The reasons for using and not using alternative medicine in Khorramabad women, west of Iran. 2009.
- Shorofi SAJCTicp. Complementary and alternative medicine (CAM) among hospitalised patients: reported use of CAM and reasons for use, CAM preferred during hospitalisation, and the socio-demographic determinants of CAM users. 2011;17(4):199-205.