

# Feasibility of Risk Assessment for Type 2 Diabetes in Community Pharmacies Using Two Different Approaches: A Pilot Study in Thailand

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**Abstract**—Aims: To evaluate the application of non-invasive diabetes risk assessment tool in community pharmacy setting. Methods: Thai diabetes risk score was applied to assess individuals at risk of developing type 2 diabetes. Interactive computer-based risk screening (IT) and paper-based risk screening (PT) tools were applied. Participants aged over 25 years with no known diabetes were recruited in six participating pharmacies. Results: A total of 187 clients, mean aged (+SD) was 48.6 (+10.9) years. 35% were at high risk. The mean value of willingness-to-pay for the service fee in IT group was significantly higher than PT group ( $p=0.013$ ). No significant difference observed for the satisfaction between groups. Conclusions: Non-invasive risk assessment tool, whether paper-based or computerized-based can be applied in community pharmacy to support the enhancing role of pharmacists in chronic disease management. Long term follow up is needed to determine the impact of its application in clinical, humanistic and economic outcomes.

**Keywords**—Community pharmacy, intervention, prevention, risk assessment, type 2 diabetes.

## I. INTRODUCTION

THE prevalence of Type 2 diabetes (T2DM) has reached epidemic proportion and the incidence rate is expected to escalate in coming years. It is projected that around 400 million people worldwide will suffer from this disease by 2030 [1]. The greatest increase is projected in economically developing countries such as Thailand where the prevalence is projected to increase almost threefold over this time period [2]. From the public health perspective, strategies to dampen the increasing rate of T2DM are urgently needed.

Apart from genetic factors, T2DM can be considered as a 'life-style' disease with considerable potential for the individuals when supported by healthcare professional advices to reduce the risk of developing the disease and limiting its progression [3]. However, being asymptomatic initially, T2DM can remain undiagnosed for many years until complications occur. To complicate the matter, many people seem to be unaware of the health risk associated with T2DM [4]. To confirm diagnosis, a fasting blood glucose test is recommended for those who exhibit symptoms or signs of

T2DM [5]. However, in order to dampen the advance of the diabetic epidemic, early identification of individuals at high risk (for example, people with impaired glucose tolerance or pre-diabetes) should be prioritized and promoted. In fact, a number of non-invasive risk screening tools have been developed to identify individuals at risk of developing T2DM for opportunistic screening by healthcare providers [6]. In Thailand, a Thai diabetes risk score was developed to predict the risk of developing T2DM in the next 12 years in individuals over 35 years old. The risk score comprises of 6 questions based on a set of variables not requiring laboratory test namely; age, gender, body mass index (BMI), waist circumference, history of high blood pressure and history of diabetes in parents or siblings. The total score can range between 0 and 17, and classified into 3 categories based on the scores [low risk (score  $\leq 5$ ), intermediate risk (score 6-8), and high risk (score  $\geq 9$ )]. This tool was recommended to be used for primary prevention of diabetes by the Thai Diabetes Management Guideline established by a cooperation of Diabetes Association of Thailand, the Endocrine Society of Thailand and the National Health Security of Thailand in 2008 [7].

Implementing diabetes management and diabetes screening in community pharmacy have been evaluated in various studies [8]-[10], with several studies actually applied diabetes risk scoring system in the diabetes screening service [11]-[13]. So far, there is a limited number of studies applying the Thai diabetes risk score in the clinical setting. One such study using the paper-based Thai diabetes risk score in pharmacy setting did report that almost 50% of participants were found to be at high risk of developing T2DM [13]. However, other information relevant to a more formal assessment such as individuals' clinical outcomes, and satisfaction of the pharmacy service were not measured in this study. Hence, the impact of diabetes risk screening at community pharmacy would require further assessment.

On a slightly different note, the success of using a diabetes risk assessment at the community pharmacy would require a user-friendly instrument as well as posing lesser burden (in terms of time commitment etc.) on the pharmacist. The employment of IT technology would contribute to this objective as there are studies reporting that individuals prefer the presentation of information in an interactive format or animation [14], [15]. As such, a number of the risk score system has been converted into interactive web-based

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documents [16]-[18]. Thus, it would be worthwhile to evaluate if computerized interactive risk assessment tool will increase client's level on risk awareness and improve health-seeking decision making. Moreover, identification of a suitable model of intervention for screening service in community pharmacy would assist national health organization to plan implementation strategies effectively. We therefore conducted this study to determine the outcomes of two different modes of diabetes risk assessment tools on the level of risk perception among the assessed clients in community pharmacy setting.

## II. METHODS

### A. Settings and Participants

A convenience sample of six community pharmacies in Bangkok, Samutprakan, and Nakorn-pathom, Thailand participated in this study. Simple randomization was applied to assign participating pharmacies into 2 groups: Interactive computer-based risk screening group (IT) and paper-based risk screening group (PT).

Using effect size of 0.5,  $\alpha$  of 0.05 and power of 0.80, a sample size of 64 participants in each group was calculated. Participants were recruited into the study either by pharmacist invitation or by self-selection. Inclusion criteria for the participants included; age > 35years and able to read or understand Thai. Exclusion criteria included: currently or previously diagnosed of diabetes (type 1 or type 2), gestational diabetes and current use of anti-diabetic medications. All participants read the project information sheet and signed a consent form before undertaking the service. The study was approved by the Institutional Review Board at Silpakorn University, Nakorn-Pathom, Thailand.

### B. Instruments and data collection

Data collection was conducted among participating pharmacies during August- October 2012. To determine the risk of developing T2DM, paper-based Thai diabetes risk score was used in the PT group, and the computerized interactive diabetes risk score (iPad-II application) was used in the IT group. The computerized interactive risk score is structured in the same way as the paper-based format which consists of 6 questions: age, gender, BMI, waist circumference, history of high blood pressure, and history of diabetes in parents or siblings. The content of risk scoring system in the iPad version is similar to the web-based Thai diabetes risk assessment instrument. However, the iPad version was developed to be more user friendly, more interactive and can be accessed without internet connection. A sliding bar scales was used that allow the participant to slide the bar scales to select the numbers for age, weight and height (with BMI automatically calculated by the device) and waist circumference (Fig. 1).

In both groups, a generic instrument, EuroQol-5 dimensions-5 level (EQ-5D-5L) was used to measure participants' quality of life (QoL) and utility values. A five

point Likert scale self-reported questionnaire was applied to determine client's perception and satisfaction of risk assessment service. Furthermore, the willingness to pay for the risk assessment service was elicited by an open-ended question: "Assuming the risk screening service can improve your quality of life and delay or prevent type 2 diabetes, how much would you be willing to pay for the service to gain this benefit?"

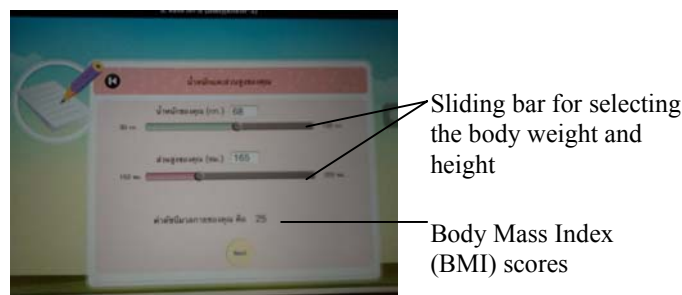


Fig. 1 Example page of the computerized interactive diabetes risk score on iPad

### C. Outcomes

Primary endpoints included in this study were (i) Percentage of individuals identified at high risk of developing T2DM. (ii) Humanistic outcomes in terms of QoL and satisfaction of risk assessment service. The willingness to pay was used to reflect the perceived value of the service by the participants.

### D. Data Analysis

Cronbach's  $\alpha$  statistic was used to test the reliability of the questionnaire. Descriptive statistics (mean, standard deviation, range) was generated for the continuous and numerical responses. Chi-squared test was used to determine differences between IT and PT groups for demographic characteristics. Independent sample t-test was used to compare the satisfaction of risk assessment service between IT and PT groups. Statistical comparisons across risk groups were performed using analysis of variance (ANOVA) with Scheffe post-hoc testing. All statistical analyses were performed using IBM SPSS statistic v.19 and the level of significance for all statistical tests was set at 0.05.

## III. RESULTS

First and foremost, the reliability of the questionnaire was tested. The scale measuring clients' satisfaction and perception of risk assessment service was found to be reliable with Cronbach's coefficient alpha of 0.783 [19].

A total of 187 clients participated in this study; with 99 participants in the IT group and 88 participants in the PT group. Approximately 58% was women; mean age ( $\pm$ SD) of all participants was 48.6 + 10.9 years, approximately 35% of total participants were determined having high risk of developing T2DM and 37% of participants in high risk group age < 45 years. A comparison of risk factors characteristics based on Thai diabetes risk score indicated no significant

difference between participants in IT and PT groups (Table I).

The proportion of participants reporting problems on each dimensions of EQ-5D-5L is shown in Fig. 2. More participants in high risk group reported problems on all 5 dimensions than the participants in low risk and intermediate risk groups, but the difference did not reach statistical significance ( $p>0.05$ ). Likewise, the degree of satisfaction (1= the least satisfaction, 5= the most satisfaction) of diabetes risk

assessment service among risk groups and between IT and PT groups showed no significant difference ( $p>0.05$ ) (Table II). However, the WTP value for the service fee ranges from Bht 2-59 (US\$0.07-2), and Bht 0-44 (US\$0-1.5) in the IT group and the PT group respectively. Nevertheless, the mean value of WTP for the service fee in the IT group was significantly higher than the PT group (Bht 24 vs. 19 (US\$ 0.8 vs. 0.63),  $p=0.013$ ) (Exchange rate: 1 baht = US\$ 0.03).

TABLE I  
DEMOGRAPHIC CHARACTERISTICS AND RISK FACTORS BASED ON THAI DIABETES RISK SCORES OF 187 PARTICIPANTS

Characteristics	Mode of services		Risk group			Total (N=187)
	IT (N=99)	PT (N=88)	Low (n=82)	Intermediate (n=40)	High (n=65)	
Age (mean±SD), years	48.62 ±10.74	48.65 ± 11.24	45.5±10.1	51.4±11.6	50.8±10.7	48.63 ± 10.9
Age category, number (%)						
25-35	6 (6.0%)	6 (6.8%)	6(3.2%)	21(1.1%)	4(2.6%)	12 (6.4%)
36-45	40 (40.4%)	35 (39.8%)	45(24.1%)	10(5.3%)	20(10.7%)	75 (41.2%)
46-55	29 (29.3%)	29 (32.9%)	21(11.2%)	17(9.1%)	20(10.7%)	58 (31.0%)
56-65	16 (16.2%)	13 (14.8%)	7(3.7%)	7(3.7%)	15(8%)	29 (15.5%)
>65	8 (8.1%)	5 (5.7%)	3(1.6%)	4(2.6%)	6(3.2%)	13 (6.9%)
Gender, number (%)						
Male	37 (37.4%)	41 (46.6%)	25(13.4%)	17(9.1%)	36(19.2%)	78 (41.7%)
Female	62 (62.6%)	47 (53.4%)	56(29.9%)	24(12.8%)	29(15.5%)	109 (58.3%)
BMI <sup>a</sup> , number (%)						
< 23	42 (42.4%)	35 (39.8%)	58(31%)	14(7.5%)	6(3.2%)	77 (41.2%)
23-27.49	42 (42.4%)	32 (36.4%)	23(12.3%)	20(10.7%)	31(16.6%)	74 (39.6%)
≥27.5	15 (15.2%)	21 (23.8%)	0(0%)	7(3.7%)	28(15%)	36 (19.2%)
Waist circumference, number (%)						
<90 cm. in men or <80 cm. in women	50 (50.5%)	46 (52.3%)	62(33.2%)	19(10.2%)	14(7.5%)	96 (51.3%)
≥90 cm. in men or ≥80 cm. in women	49 (49.5%)	42 (47.7%)	19(10.2%)	22(11.8%)	51(27.3%)	91 (48.7%)
Hypertension <sup>b</sup> , number (%)						
Yes	17 (17.2%)	19 (21.6%)	2(1.1%)	8(4.3%)	26(13.9%)	36 (19.3%)
No	82 (82.8%)	69 (78.4%)	79(42.2%)	33(17.6%)	39(20.8%)	151 (80.7%)
History of diabetes in parents or siblings, number (%)						
Yes	37* (37.4%)	20* (22.7%)	8(4.3%)	11(5.9%)	38(20.3%)	57 (30.5%)
No	62 (62.6%)	68 (77.3%)	73(39%)	30(16%)	27(14.4%)	130 (69.5%)
Risk category, number (%)						
Low (total score <5)	42 (42.4%)	39 (44.3%)	-	-	-	81 (43.3%)
Intermediate (total score 5-8)	22 (22.2%)	18 (20.5%)	-	-	-	40 (21.4%)
High (total score ≥9)	35 (35.4%)	31 (35.2%)	-	-	-	66 (35.3%)

a= Body Mass Index (kg/m<sup>2</sup>), b= Blood pressure ≥ 140/90 or currently taking blood-pressure-lowering agents or treatments. \* $p=0.038$  (Chi-squared test, significant level 0.05), IT=interactive computer-based, PT=paper based.

TABLE II  
DEGREE OF SATISFACTION OF DIABETES RISK ASSESSMENT SERVICE AMONG RISK GROUPS (LOW, INTERMEDIATE, HIGH), INTERACTIVE COMPUTERIZED-BASED GROUP AND PAPER-BASED GROUP (N=187)

Items	Risk groups**				Interventions***		
	Low Mean (SD)*	Intermediate Mean (SD)*	High Mean (SD)*	p-value	IT Mean (SD)*	PT Mean (SD)*	P-value
Advertisement of diabetes risk assessment service in community pharmacy	4.11 (0.93)	4.23 (1.01)	3.84 (0.93)	0.095	4.29 (1.33)	4.14 (1.26)	0.412
Interesting of diabetes risk assessment service in community pharmacy	4.34 (0.77)	4.31 (0.77)	4.22 (0.83)	0.643	4.42 (1.22)	4.44 (1.19)	0.915
Knowledge gained from receiving diabetes risk assessment service	4.39 (0.75)	4.56 (0.68)	4.44 (0.73)	0.472	4.51 (1.24)	4.63 (1.10)	0.487
Benefit gained worth the time spent in receiving diabetes risk assessment service	4.45 (0.75)	4.56 (0.68)	4.44 (0.73)	0.405	4.51 (1.21)	4.65 (1.08)	0.398
Overall satisfaction of diabetes risk assessment service in community pharmacy.	4.41 (0.83)	4.62 (0.63)	4.41 (0.71)	0.321	4.60 (1.17)	4.67 (1.10)	0.655

\*degree of satisfaction range from 1-5 in each item (1=the least satisfaction, 5=the most satisfaction). \*\* Analysis of variance (ANOVA) was performed to compare mean between risk groups, significance level 0.05. \*\*\*Independent samples t-test was performed to compare mean between groups (interactive computerized-based and paper-based group), significance level 0.05

IT=interactive computerized-based group, PT=paper-based group.

The results for the individuals' perception on diabetes risk screening showed that the individuals in the IT group had a higher level of worrying of developing T2DM than the PT group ( $p < 0.05$ ). However, the level of motivation in changing lifestyle, the willingness to seek further information about the disease and the level of understandable of the content in diabetes risk assessment tool showed no significant statistic difference between IT and PT group ( $p = 0.32, p = 0.17, p = 0.66$  respectively)

#### IV. UNITS

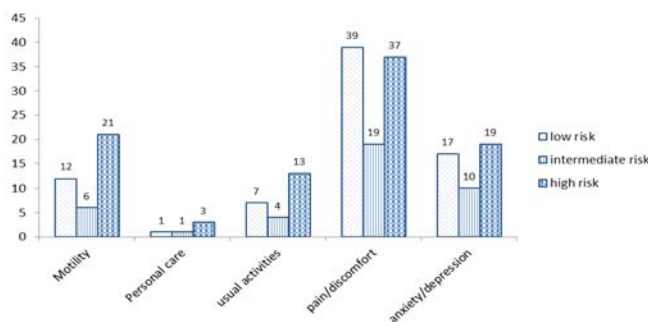


Fig. 2 Proportion of participants reporting problems on each EQ-5D dimension, by risk groups

#### V. DISCUSSIONS

The prevalence of diabetes is escalating worldwide particularly in the Asia-Pacific region including Thailand [20]. In fact, the prevalence of individuals with diabetes and impaired glucose in Thai population is sharply increased in individuals aged over 45 years [2]. Our study could be rated as moderately successful in reaching the targeted population as nearly 50% of total participants were aged < 45 years. However, it is rather alarming that high percentage of people in this age group was assessed as having high risk of developing T2DM. According to the cost of managing a patient with diabetes in Thailand was estimated at ~US\$880 in 2008 [21]. Assuming T2DM can be prevented in this population by risk screening, the cost saving to the health care system could be substantial.

Although there is no significant difference in degree of satisfaction of diabetes risk assessment service between risk groups and between modes of services, the satisfaction scores were consistently high (>4) among all groups, which implied that the participants perceived that diabetes risk screening service is useful and will be well accepted by consumers. In addition, our study showed a trend that people were willing to pay more for the services when an electronic device is used. In our study, the electronic device automatically calculates BMI and total risk scores, thus this would reduce times spent by pharmacists and would result in a cost saving. Moreover, greater level of worrying in developing T2DM was found in the individuals in IT group. This may implied that the computerized risk assessment tool have greater effect on individuals' risk perception, with may lead to the higher

motivation to initiate lifestyle changes to prevent the disease. The long-term follow up would be needed to confirm this hypothesis. Nevertheless, ours is the first developed model of risk assessment tool using numeracy to communicate health risks on an electronic device (iPad). It has been reported that using visual symbols or graph may provide better understanding in risk perception and in decision-making [22]. Hence, to fully utilize the potential of electronic device for personalized health message, facilitators and barriers to a successful risk assessment need to be further determined.

When coming to HRQoL, overall EQ-5D scores (whether VAS or index scores) were substantially higher in the low risk group. This finding is similar to other studies which found a decreasing HRQoL in diabetes patients and diabetes patients with complications compared to the general population [23], [24]. Hence, if reducing risk factors could lead to improve quality of life in individuals at risk of disease before the disease is diagnosed, it is more likely that individuals would take the service and follow the recommendations provided by the pharmacists to reduce the risk factors. However, long term follow-up is needed to measure changes in HRQoL to confirm this assumption.

Recently, there is a developing model for collaboration between community pharmacists and a government primary care unit (PCU) in carrying out a screening program for diabetes and hypertension in Thailand [25]. Therefore, the extension of this model to diabetes risk screening in community pharmacy setting would encourage community pharmacists to play more proactive role in providing the service. Together with suitable reimbursement and availability of an effective risk assessment tools (in terms of accuracy and time consumed), community pharmacists would be motivated to deliver more specialist diabetes services.

#### VI. LIMITATIONS

There are few limitations in this study. Firstly, there might be a selection bias in our study samples as one study had reported that 80% of Thai people was not interested in diabetes screening because they believed that they were healthy and did not need the screening [26]. It was therefore more likely that our participants were those who were interested in healthy life style or felt they were at risk of developing the disease. Secondly, findings from this study indicated diabetes risk assessment both paper-based and IT-based can be applied in community pharmacy setting but the long term impact of this intervention on clinical outcomes and humanistic outcomes were not performed. Lastly, the long term impact of education and intervention on health behavior of the participants were not measured in the present study.

#### VII. CONCLUSIONS

This study provided data on the feasibility of applying diabetes risk assessment tool to support health promotion role of community pharmacy in Thailand which can be applied to other countries where the risk assessment score are available.

Our results also indicated that an electronic device could be another option for community pharmacists to enhance individuals' risk awareness and increase perceived value of risk screening at community pharmacy. Based on our findings, when properly planned and implemented, performing risk screening in community pharmacy setting might be an appropriate and relatively cost-effective approach to address the growing of diabetes burden in Thailand and internationally.

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