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Original Article

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# Influence of Antiplatelet Therapy on Cardiovascular Disease Prevention among Type 2 Diabetic Patients in Thailand

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## ABSTRACT

**Introduction:** Cardiovascular Disease (CVD) is globally known as a common disease for diabetic patients. Antiplatelet therapy is a key pharmacological method to prevent and treat CVD. However, it has not been conclusive whether antiplatelet could significantly reduce the risk of CVD. An evaluating influence of antiplatelet therapy among Thai diabetics may be administered as a functional management in the future.

**Aim:** To investigate the effect of antiplatelet therapy for CVD prevention in type 2 diabetic patients in Thailand.

**Materials and Methods:** A cross-sectional study was investigated on 24,992 cases of Type 2 Diabetes (T2DM) and T2DM with Hypertension (HT) recorded under the program "An assessment on Quality of Care among Patients Diagnosed with T2DM and Hypertension Visiting Hospitals of the Ministry of Public Health and the Bangkok Metropolitan Administration, Thailand" in the year 2012. Among these cases, 10,799 participants were treated with antiplatelet drug whereas, 14,193 participants had no history of this treatment. Patients whose age over 30 years and attended a hospital for their treatments more than one year were recruited. CVD incidence was investigated in both who were treated with antiplatelet drug during one year preceding the data collection and those who were not treated. However, other factors, such as sex, age, period of having the disease, Body Mass Index (BMI), HbA1c level, cholesterol (total, LDL-C, HDL-C), systolic blood pressure and diastolic blood pressure were also recorded. Descriptive statistics with multiple logistic regression and 95% CI were used for analysis.

**Results:** Total of 24,992 cases of T2DM and T2DM with HT were recruited for analysis. The final model of the multiple logistic regression observed that T2DM who did not obtain antiplatelet therapy had a significantly higher risk of CVD ($OR_{adj}$=4.35, 95% CI=3.89 to 4.87, p-value <0.001). Other significant co-variates were found including duration of disease ≥10 yrs ($OR_{adj}$=1.30 95% CI 1.16 to1.44 p-value <0.001), serum creatinine >1.2 mg/dL ($OR_{adj}$=1.45, 95% CI=1.31 to 1.61, p-value <0.001) and latest systolic blood pressure >120 mmHg ($OR_{adj}$=1.38, 95% CI 1.23 to 1.55, p-value <0.001) and had HDL-C <40 mg/dL ($OR_{adj}$=1.25, 95% CI=1.12 to 1.40, p-value <0.001).

**Conclusion:** Low-dose antiplatelet therapy was significantly associated with decreasing the incidence of CVD. Whereas the duration of disease, serum creatinine, systolic blood pressure and HDL-C were found to be risk factors of CVD.


**Keywords:** Aspirin, Blood pressure, Cholesterol, Duration of disease, Serum creatinine

## INTRODUCTION

The number of people who live with T2DM has been rapidly rising up worldwide. The International Diabetes Federation (IDF) reported the increasing global trend of T2DM among people aged 18-99-year-old, of which approximately 451 million were affected in 2017 and would likely to reach 693 million in 2045 [1]. The estimation of T2DM in adult aged between 20 to 79 years was 8.8%. Male showed slightly higher prevalence than female (9.1%:8.4% in 2017 and may increase to 10.0%: 9.7% in 2045. Older adults (≥65 years), with lower income, low education, and have higher BMI were at risk of T2DM. Mortality rate was 4.0 million and global rate cause of death among 20-70 years was 10.7% [1-3].

T2DM as well as co-existing conditions and complication including hypoglycaemic and hyperglycaemic crisis, HT, renal failure, foot conditions, periodontal disease, blindness or Diabetic Eye Disease (DED) are identified as risk factors of CVD. T2DM patients had higher risk of CVD than non-diabetes.

T2DM as well as co-existing conditions and complications, hypoglycaemic and hyperglycaemic crisis, periodontal disease and HT are found as common complications [4]. Moreover, incidence of renal failure, foot conditions and DED are highly reported [5-8]. Focused on CVD, diabetic patients have high risk to a stroke event [9-12]. CVD mortality rate of T2DM was close to 41%, 1.7 times higher than non-T2DM, with a specific death rate of 50%. T2DM patients have been suffered from both microvascular diseases (27.2%) and macrovascular complications (53.5%). However, vascular factors in T2DM were identified as both risk and protective factors. Vascular risk factors included age, BMI, duration of disease, LDL-C and SBP whereas the vascular protective factors were High Density Lipoprotein Cholesterol (HDL-C), Haemoglobin A1C (HbA1C) and Fasting Plasma Glucose (FPG) [11,13,14].

In Thailand, the number of T2DM patients was increased from 500,347 in 2007 to 802,017 in 2017. The number of death was 14,487 (22.01 per 100,000) in 2016 and 14,322 (21.96 per 100,000) in 2017 [15,16]. Kidney condition was reported as a primary complication (33.63%) followed by diabetic retinopathy 21.75%, diabetic neuropathy 17.19% and vascular disease was found in 12.62% [17]. To decrease diabetes complication especially CVD, glucose lowering drugs, antihypertensive, statins and antiplatelet therapy have been recommended. A low dose of aspirin (75-162 mg/day) is the most common drug of choice for CVD prevention in diabetic patients who have had DM for longer than 10 years [7,8], especially among male patients aged 50 years or older as well as female aged 60 years or older who have had at least one additional risk factors such as, family history of CVD, HT, smoking, dyslipidaemia and albuminuria [18,19]. However, studies indicated that a low dose of aspirin had no effect on CVD prevention, but might benefit patients with no previous history of Gastro-intestinal Bleeding (GI bleeding) and older than 50 years [5]. It is not recommended for those with low risk of CVD [20-24]. However, a follow-up study for 7.4 years presented that a number of serious vascular events in aspirin group were significantly lower

than the placebo group, but still a major cause of GI bleeding [25]. After adjusting concerning age and other CVD risk factors, aspirin was found meaningfully associated [26]. Although both negative and positive effects of aspirin therapy were illustrated, some trials have been in progress [27].

Even though there was inconclusive recommendation of antiplatelet therapy among T2DM [5,20-25], the investigation on the effectiveness of antiplatelet therapy among Thai people who live with T2DM is essential. Therefore this study aimed to determine the effectiveness of antiplatelet drug administration for prevention of CVD complications in T2DM while controlling the other covariate factors including personal characteristics, clinical indicators, laboratory results, and other diabetic complications.

## MATERIALS AND METHODS

### Study Design

A cross-sectional study investigated the effect of antiplatelet therapy for CVD prevention among T2DM and T2DM with HT who were recorded under a national survey program "An Assessment on Quality of Care among Patients Diagnosed with T2DM and T2DM with Hypertension Visiting Hospitals of the Ministry of Public Health and the Bangkok Metropolitan Administration in Thailand". This program is the corporation between Thai National Health Security Office and Thai medical schools consortium. Information of diabetic patients and hypertensive patients who attended hospital for treatments was recorded. Data of T2DM and T2DM with HT outpatients were collected from multicenter across Thailand. There were 600 hospitals from 771 hospitals (77.82%) which participated in this program. Informed consents were obtained before patients took part the project. Approvals for utilisation of the DMHT dataset were submitted and approved by the Medical Research Foundation, Thailand (DAMUS) before conducting the analysis. Faculty of Public Health Khon Kaen University is one of the organisations that get permission to use this dataset (No. of permission=Med Res Net 2560/088, 3rd July 2017).

### Ethical Considerations

This study was approved by the Ethical Review Committee for Human Research, Khon Kaen University, Thailand (HE602236).

### Sample Size and Sampling Procedure

The inclusion criteria for the respondents in this study were T2DM patients and T2DM patients with HT who received care and treatment in a participating hospital from January 2012 to December 2012 and aged 30 years or older. Participants were excluded if they had HT only or had incomplete information for the outcomes or study effects. There were 24,992 T2DM and T2DM with HT patients who met the inclusion criteria and were included for analysis. Among them, 10,799 participants were treated with antiplatelet drug whereas the rest 14,193 did not receive.

### Data Collection

Structured questionnaires of the national survey program were distributed to 600 hospitals across Thailand. T2DM patients and T2DM patients with HT who attended diabetic clinic and HT clinic were asked to take part in the project. Patients who sign a consent were recorded. This national dataset were managed and complied by the Medical Research Foundation, Thailand (DAMUS).

## STATISTICAL ANALYSIS

Descriptive statistics such as number and percentage were used to describe categorical variables whereas maximum, minimum, median, mean and standard deviations were used to illustrate continuous variables. A multiple logistic regression was used to identify the association between antiplatelet drug and CVD while controlling the effect of covariate factors, presenting the magnitude of association as an adjusted odd ratio, p-value and 95% confident interval (95% CI). SPSS version 19 was used for statistical analysis.

## RESULTS

### Characteristics of the Study Participants

Most of the T2DM and T2DM with HT were female (69.79%), with the average age of 59.99±10.59-year-old, the highest proportion aged group was between 60 and 69-year-old (n=7,970: 31.89%). Almost all (87.08%) were Buddhist, the most common occupation was agriculturist (40.91%). Only 3.91% were smokers.

Most of the respondents (70.21%) had T2DM with HT whereas the rest had only T2DM, 74.66% had the disease for less than 10 years. In terms of clinical outcome, 71.72% had HbA1C higher than 6.5% (average of 7.95±1.86%), 85.17% had total cholesterol ≤200 mg/dL. Serum BUN >20 mg/dL was found among 55.81% of the patient; however, most of the respondents (71.42%) had serum creatinine ≤1.3 mg/dL. Considering lipid, 81.91% had LDL-C less than 190 mg/dL, 74.64% had HDL-C more than 40 mg/dL. Considering the HT, 67.87% had latest systolic blood pressure higher than 120 mmHg, and 94.94% had latest diastolic blood pressure less than 90 mmHg. The primary outcome of this study, the prevalence of CVD among these T2DM and T2DM with HT was 6.92%, (95% CI: 6.62 to 7.24) of which 43.21% (95% CI: 42.59 to 43.83) received antiplatelet therapy [Table/Fig-1,2].

| Demographic characteristics | Number | Percent |
|---|---|---|
| **Sex** | | |
| Male | 7,551 | 30.21 |
| Female | 17,441 | 69.79 |
| **Age (years)** | | |
| 30-39 | 620 | 2.48 |
| 40-49 | 3,541 | 14.17 |
| 50-59 | 7,922 | 31.70 |
| 60-69 | 7,970 | 31.89 |
| 70-79 | 4,158 | 16.64 |
| ≥80 | 781 | 3.13 |
| Mean±SD (59.99±10.59); Median 60 (Min: Max, 31:97) | | |
| **Occupation** | | |
| Agriculturalist | 10,225 | 40.91 |
| Personal business | 8,577 | 34.32 |
| Civil servant | 1,501 | 6.01 |
| Private sector employee and others | 4,689 | 18.76 |
| **Religion** | | |
| Buddhism | 21,764 | 87.08 |
| Others | 3,228 | 12.92 |

**[Table/Fig-1]:** Demographic characteristics of study population (n=24,992).

### Factors Associated with CVD Complication among T2DM and T2DM with HT in Thailand: A Bivariate Analysis

A bivariate analysis demonstrated six factors that had statistically significant association with CVD. These factors were: did not received antiplatelet drugs (OR=4.26, 95% CI: 3.81 to 4.77, p-value <0.001), the T2DM with HT when compared with the T2DM (OR=1.15, 95% CI: 1.04 to 1.24, p-value <0.010), has been diagnosed with T2DM for ≥10 years (OR=1.26: 95% CI: 1.13 to 1.40, p-value <0.001, had latest systolic blood pressure >120 mmHg (OR=1.36, 95% CI: 1.22. to 1.52, p-value <0.001) and had serum creatinine >1.2 mg/dL (OR=1.46: 95% CI=1.32. to 1.62, p-value <0.001). HDL-C <40 mg/dL was found as risk factor (OR=1.21: 95% CI=1.08 to 1.34, p-value <0.001) [Table/Fig-3].

| Health behaviour and health status | Number (%) | 95%CI |
|---|---|---|
| **Smoking** | | |
| Yes | 978 (3.91) | 3.77 to 4.16 |
| No | 24,014 (96.09) | 95.84 to 96.32 |
| **Disease** | | |
| T2DM | 7,446 (29.79) | 29.22 to 30.36 |
| T2DM and HT | 17,546 (70.21) | 69.63 to 70.73 |
| **Duration of disease (Years)** | | |
| <10 | 18,658 (74.66) | 74.11 to 75.19 |
| ≥10 | 6,334 (25.34) | 24.81 to 25.89 |
| Mean±S.D. (6.75±4.59) median 6 (Min: Max <1:54) | | |
| **HbA1C (%)** | | |
| ≤7 | 7,067 (28.28) | 27.72 to 28.84 |
| >7 | 17,925 (71.72) | 71.16 to 72.28 |
| Mean±SD (7.95±1.86) median 7.6 (Min: Max 4:14) | | |
| **Treating with antiplatelet drug (mg/dL)** | | |
| Yes | 10,799 (43.21) | 42.59 to 43.83 |
| No | 14,193 (56.79) | 56.17 to 57.41 |
| **Having CVD** | | |
| No | 23,263 (93.08) | 92.76 to 93.39 |
| Yes | 1,729 (6.92) | 6.62 to 7.24 |
| **BMI (kg/m$^2$)** | | |
| <18.5 | 789 (3.16) | 2.94 to 3.38 |
| ≥18.5 to <23 | 10,553 (42.23) | 41.61 to 42.84 |
| ≥23 to <25 | 5,066 (20.27) | 19.77 to 20.74 |
| ≥25 | 8,584 (34.35) | 33.76 to 34.94 |
| Mean±SD (25.54±4.42) median 25.11 (Min: Max 12.95:73.98) | | |
| **Total cholesterol (mg/dL)** | | |
| ≤200 | 21,285 (85.17) | 84.72 to 85.61 |
| >200 | 3,707 (14.83) | 14.39 to 15.28 |
| Mean±SD (188.55±43.03) median 183 (Min: Max 110:390) | | |
| **LDL-C (mg/dL)** | | |
| <190 | 20,471 (81.91) | 81.43 to 82.39 |
| ≥190 | 4,521 (18.09) | 17.61 to 18.57 |
| Mean±SD (109.61±37.33) median 105 (Min: Max 10:300) | | |
| **HDL-C (mg/dL)** | | |
| ≥40 | 18,654 (74.64) | 74.10 to 75.18 |
| <40 | 6,338 (25.36) | 24.82 to 25.90 |
| Mean±SD (45.87±12.95) median 44 (Min: Max 10:145) | | |
| **Serum BUN (mg/dL)** | | |
| ≤20 | 11,043 (44.19) | 43.37 to 44.80 |
| >20 | 13,949 (55.81) | 55.20 to 56.43 |
| Mean±SD (15.23±5.30) median 14 (Min: Max5:30) | | |
| **Serum creatinine (mg/dL)** | | |
| ≤1.2 | 17,850 (71.42) | 70.86 to71.98 |
| >1.2 | 7,142 (28.58) | 28.02 to 29.14 |
| Mean±SD (1.03±0.33) median 1 (Min: Max 1:2) | | |
| **Systolic blood pressure (Latest) (mmHg)** | | |
| ≤120 | 8,030 (32.13) | 31.55 to 32.71 |
| >120 | 16,962 (67.87) | 67.29 to 68.45 |
| Mean±SD (129.92±16.47) median 130 (Min: Max 70:200) | | |
| **Diastolic blood pressure (Latest) (mmHg)** | | |
| ≤90 | 23,728 (94.94) | 94.66 to 95.21 |
| >90 | 1,264 (5.06) | 4.79 to 5.34 |
| Mean±SD (74.96±10.34) median 75 (Min: Max 40:125) | | |

**[Table/Fig-2]:** Health behaviours and health status of study population (n=24,992).

| Factors | Number | % CVD | OR | 95% CI | p-value |
|---|---|---|---|---|---|
| **Treating with antiplatelet drug (mg/dL)** | | | | | |
| Yes | 14,193 | 3.09 | 1 | | |
| No | 10,799 | 11.95 | 4.26 | 3.81 to 4.77 | <0.001* |
| **Sex** | | | | | |
| Male | 7,551 | 6.91 | 1 | | |
| Female | 17,441 | 6.92 | 1.00 | 0.90 to 1.11 | 0.98 |
| **Age** | | | | | |
| Male | | | | | |
| <60 | 12,083 | 6.65 | 1 | | |
| ≥60 | 12,909 | 7.17 | 1.09 | 0.98 to 1.20 | <0.100 |
| **Occupation** | | | | | |
| Farmer or farm worker | 10,255 | 6.47 | 1 | | |
| Personal business | 8,577 | 7.54 | 1.18 | 1.05 to 13.2 | 0.004 |
| Civil servant | 1,501 | 6.26 | 0.97 | 0.77 to 1.21 | 0.755 |
| Private corporation officer and others | 4,689 | 6.65 | 1.08 | 0.94 to 1.23 | 0.276 |
| **Smoking** | | | | | |
| Yes | 978 | 7.57 | 1 | | |
| No | 24,014 | 6.87 | 0.90 | 0.71 to 1.15 | 0.421 |
| **Chronic disease** | | | | | |
| T2DM | 7,446 | 6.29 | 1 | | |
| T2DM and HT | 17,546 | 7.19 | 1.15 | 1.04 to1.24 | <0.010* |
| **BMI (kg/m$^2$)** | | | | | |
| ≥23 | 18,381 | 6.88 | 1 | | |
| <23 | 6,611 | 7.03 | 1.02 | 0.92 to 1.14 | 0.667 |
| **Duration of disease (Years)** | | | | | |
| <10 | 18,658 | 6.53 | 1 | | |
| ≥10 | 6,334 | 8.07 | 1.26 | 1.13 to 1.40 | <0.001* |
| **HbA1C (%)** | | | | | |
| ≤7 | 7,067 | 6.71 | 1 | | |
| >7 | 17,925 | 7.00 | 1.05 | 0.94 to 1.17 | 0.408 |
| **Total cholesterol (mg/dL)** | | | | | |
| ≤200 | 21,285 | 7.00 | 1 | | |
| >200 | 3,707 | 6.42 | 0.91 | 0.79 to 1.05 | 0.191 |
| **Serum BUN (mg/dL)** | | | | | |
| ≤20 | 11,043 | 6.67 | 1 | | |
| >20 | 13,949 | 7.11 | 1.07 | 0.97 to 1.18 | 0.175 |
| **Serum creatinine (mg/dL)** | | | | | |
| ≤1.2 | 17,850 | 6.18 | 1 | | |
| >1.2 | 7,142 | 8.77 | 1.46 | 1.32 to 1.62 | <0.001* |
| **LDL-C (mg/dL)** | | | | | |
| <190 | 20,471 | 7.05 | 1 | | |
| ≥190 | 4,521 | 6.33 | 0.89 | 0.78 to 1.02 | 0.078 |
| **HDL-C (mg/dL)** | | | | | |
| ≥40 | 18,654 | 6.60 | 1 | | |
| <40 | 6,388 | 7.86 | 1.21 | 1.08 to 1.34 | <0.001* |
| **Systolic blood pressure (Latest) mmHg** | | | | | |
| ≤120 | 8,030 | 5.63 | 1 | | |
| >120 | 16,962 | 7.53 | 1.36 | 1.22 to 1.52 | <0.001* |
| **Diastolic blood pressure (Latest) mmHg** | | | | | |
| ≤90 | 23,728 | 6.89 | 1 | | |
| >90 | 1,264 | 7.36 | 1.07 | 0.86 to 1.33 | 0.531 |

**[Table/Fig-3]:** Factors associated with cardiovascular disease complication among T2DM and T2DM with HT in Thailand: A bivariate analysis (n=24,992).

### Influence of Antiplatelet Drugs on CVD among T2DM and T2DM with HT in Thailand: A Multivariable Analysis

The final model of the multiple logistic regression after adjusting for covariates indicated a strong association between antiplatelet drugs and CVD, of which the T2DM patients who had not been treated with antiplatelet drug had 4.35 times higher risk of CVD ($OR_{adj}$=4.35, 95% CI: 3.89 to 4.87, p-value <0.001). Other significant covariate were duration of disease for 10 years or higher ($OR_{adj}$=1.30, 95% CI: 1.16 to 1.44, p-value <0.001), had serum creatinine more than 1.2 mg/dL ($OR_{adj}$=1.45, 95% CI: 1.31 to 1.61, p-value <0.001), and had systolic blood pressure >120 mmHg ($OR_{adj}$=1.38, 95% CI: 1.23 to 1.55, p-value <0.001). HDL-C <40 mg/dL remained a risk factor ($OR_{adj}$=1.25, 95% CI=1.12 to 1.4, p-value <0.001) [Table/Fig-4].

| Factors | Number | % CVD | OR | $OR_{Adj.}$ | 95% CI | p-value |
|---|---|---|---|---|---|---|
| **Treating with antiplatelet drug (mg/dL)** | | | | | | |
| Yes | 14,193 | 3.09 | 1 | 1 | | |
| No | 10,799 | 11.95 | 4.26 | 4.35 | 3.89 to 4.87 | <0.001* |
| **Duration of disease (Years)** | | | | | | |
| <10 | 18,658 | 6.53 | 1 | | | |
| ≥10 | 6,334 | 8.07 | 1.26 | 1.30 | 1.16 to 1.44 | <0.001* |
| **Serum creatinine (mg/dL)** | | | | | | |
| ≤1.2 | 17,850 | 6.18 | 1 | 1 | | |
| >1.2 | 7,142 | 8.77 | 1.46 | 1.45 | 1.31 to 1.61 | <0.001* |
| **Systolic blood pressure (Latest) mmHg** | | | | | | |
| ≤120 | 8,030 | 5.63 | 1 | 1 | | |
| >120 | 16,962 | 7.53 | 1.36 | 1.38 | 1.23 to 1.55 | <0.001* |
| **HDL-C (mg/dL)** | | | | | | |
| ≥40 | 18,654 | 6.60 | 1 | 1 | | |
| <40 | 6,388 | 7.86 | 1.21 | 1.25 | 1.12 to 1.40 | <0.001* |

**[Table/Fig-4]:** Influence of antiplatelet drugs with cardiovascular disease complication among T2DM and T2DM with HT in Thailand: A multivariate analysis.
*$OR_{adj}$ when controlled the effect of sex, age, occupation, smoking, BMI, HbA1C, total cholesterol, serum BUN, LDL-C and diastolic blood pressure

## DISCUSSION

This cross-sectional study aimed to determine the effect of antiplatelet therapy on CVD prevention among Thai T2DM patients. The study used the data of the MedResNet of T2DM and T2DM with HT across Thailand in 2012 Findings and were discussed according to the objective of the study as follows: This study found that 6.92% (95% CI: 6.60 to 7.23) of T2DM in Thailand had CVD, of which 43.21% (95% CI: 42.59 to 43.83) received antiplatelet therapy. This rate was slightly lower than 41% found in a study of epidemiology in DM and CVD in 2017 [8]. However, the current study was conducted among nationally representative samples with a large sample size; therefore, the results could be generalised to the Thai population. The multivariable analysis illustrated that antiplatelet therapy was successfully reduced CVD in T2DM in Thailand after adjusting the effect of sex, age, occupation, smoking, BMI, HbA1C, total cholesterol, serum BUN, LDL-C and diastolic blood pressure ($OR_{adj}$=4.35, 95% CI: 3.89 to 4.87, p-value <0.001). This current finding was similar to result of the study conducted by Bowman L et al., [25]. The investigation on effects of aspirin for primary prevention among DM patients reported that serious vascular conditions was significantly reduced in aspirin group more than the placebo group {658 participants (8.5%) vs. 743 (9.6%); rate ratio, 0.88; 95% CI, 0.79 to 0.97; P=0.001} [25]. Pignone M et al., found an aspirin influenced on the reduction of cardiovascular morbidity and mortality in diabetic patients [20]. In addition, Van't Hof JR et al., also indicated the effectiveness of aspirin therapy ($OR_{adj}$=2.6, 95% CI: 1.6-4.2) [26]. However, Saito Y et al., indicated that a low-dose aspirin did not decrease cardiovascular incidence in patients with T2DM [21]. This finding was similar to the result of Halvorsen S et al., study [22] and the study of Jung JH, et al., [23]. The current study observed that HDL-C lower that 40 mg/dL was a risk factor ($OR_{adj}$=1.25, 95% CI=1.12 to 1.40, p-value <0.001) which confirmed the report of IDF [3] but Litwak L et al., reported that higher HDL-C was negatively associated with micro and macrovascular diseases [13]. While aspirin and HDL-C were protective factors, others were risk factors including; duration of disease, this study observed that those who were diagnosed as having T2DM for longer than 10 years had higher risk of CVD ($OR_{adj}$=1.30, 95% CI: 1.16 to 1.44, p-value <0.001). This finding was supported by the guideline of DM treatments [2,12]. Other risk factors were high serum creatinine of >1.2 mg/dL ($OR_{adj}$=1.45, 95% CI: 1.31 to 1.61, p-value <0.001), systolic blood pressure of >120 mmHg ($OR_{adj}$=1.38, 95% CI: 1.23 to 1.55, p-value <0.001) of which consistent with the study of Leon Litwak L et al., and WHO [13,14].

## STRENGTH

This study used the record of a national representative which was collected across all parts of Thailand. Therefore, the results could be generalised among Thai T2DM population. The influence of antiplatelet could be suggested for prevention of CVD in Thai T2DM.

## LIMITATION

This study used the secondary data of which some information such as family history of health was not included. It is recommended for the next version of recording form to include the family history as well.

## CONCLUSION

Results from this study can be concluded that low-dose antiplatelet therapy decreased the incidence of CVD in Thai diabetic patients. In consequence, antiplatelet drug should be put in a Clinical and Practice Guideline for Diabetes. However, the duration of diabetes, serum creatinine, systolic blood pressure and HDL-C level should be considered before prescribing antiplatelet drug because these factors influenced an increasing incidence of CVD. Although these results were investigated from a national data set, randomised control trial or clinical research must be explored in the future.

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## REFERENCES

[1] Centers for Disease Control and Prevention. National Diabetes Statistics Report: Estimates of Diabetes and Its Burden in the United States, 2014. Atlanta, GA: U.S. Department of Health and Human Services; 2014.
[2] Xu G, Liu B, Sun Y, Du Y, Snetselaar LG, Hu FB, et al. Prevalence of diagnosed type 1 and type 2 diabetes among US adults in 2016 and 2017: Population based study. BMJ. 2018;4(362):k1497.
[3] International Diabetes Federation. IDF Diabetes Atlas Eighth Edition 2017. [Internet]. Brussels: International Diabetes Federation; 2017 [update unknown; cited 2019 May 21]. Available from: www.diabetesatlas.org.
[4] International Diabetes Federation. Diabetes Complications [Internet] Brussels. International Diabetes Federation; 2016 [update unknown; cited 2019 May 21]. Available from: https://www.idf.org/aboutdiabetes/complications.html.
[5] Afkarian M, Katz R, Bansal N, Correa A, Kestenbaum B, Himmelfarb J, et al. Diabetes, kidney disease, and cardiovascular outcomes in the jackson heart study. Clinical Journal of the American Society of Nephrology. 2016 ;11(8):1384-91.
[6] Gregg EW, Hora I, Benoit SR. Resurgence in diabetes-related complications resurgence in diabetes-related complications resurgence in diabetes-related complications. JAMA. 2019;321(19):1867-68.
[7] Newman JD, Rockman CB, Kosiborod M, Guo Y, Zhong H, Weintraub HS, et al. Diabetes mellitus is a coronary heart disease risk equivalent for peripheral vascular disease. Am Heart J. 2017;184:114-20.

[8] Fan W. Epidemiology in diabetes mellitus and cardiovascular disease. Cardiovascular Endocrinology & Metabolism. 2017;6(1):08-16.
[9] Bloomgarden ZT. Diabetes and cardiovascular disease. Diabetes Care. 2011;34(3):e24-30.
[10] Ergul A, Kelly-Cobbs A, Abdalla M, Fagan SC. Cerebrovascular complications of diabetes: Focus on stroke. Endocrine, Metabolic & Immune Disorders Drug Targets. 2012;12(2):148-58.
[11] Fox CS, Golden SH, Anderson C, Bray GA, Burke LE, de Boer IH, et al. Update on prevention of cardiovascular disease in adults with type 2 diabetes mellitus in light of recent evidence. A Scientific Statement from the American Heart Association and the American Diabetes Association. 2015;132(8):691-718.
[12] Gori M, Gupta DK, Claggett B, Selvin E, Folsom AR, Matsushita K, et al. Natriuretic peptide and high-sensitivity troponin for cardiovascular risk prediction in diabetes: The Atherosclerosis Risk in Communities (ARIC) study. Diabetes Care. 2016;39(5):677-85.
[13] Litwak L, Goh S-Y, Hussein Z, Malek R, Prusty V, Khamseh ME. Prevalence of diabetes complications in people with type 2 diabetes mellitus and its association with baseline characteristics in the multinational A1chieve study. Diabetology & Metabolic Syndrome. 2013;5(1):01-10.
[14] World Health Organisation (WHO). Global Report on Diabetes. [Internet]. France. World Health Organisation (WHO); 2016; [update unknown; cited 2019 May 21]; Available from: http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257_eng.pdf?ua=1.
[15] Bureau of Non Communicable Disease. Number and Morbidity of Diabetes Mellitus. [Internet]. Nontaburi. Bureau of Non Communicable Disease; 2016 [update 2019 April 19; cited 2019 May 21]; Available from: http://www.thaincd.com/2016/mission/documents.php?tid=32&gid=1-020.
[16] Bureau of Non Communicable Disease. Number and motility rate of non-communicable disease 2016 and 2017[Internet]. Nontaburi. Bureau of Non Communicable Disease, 2019, [update 2019 April 19; cited 2019 May 21]; Available from: http://www.thaincd.com/2016/mission3.
[17] Bureau of Epidemiology. Annual Epidemiological Surviellance Report. [Internet]. Nonthaburi: Bureau of Epidemiology; 2019 [update unknown; cited 2019 May 21]; Available from: http://www.boe.moph.go.th/Annual/AESR2015/aesr2558/Part%201/11/diabetes.pdf.
[18] American Diabetes Association. Aspirin. [Internet]. USA: American Diabetes Association; 2014 [update 2014 May 13; cited 2016 January29]; Available from: http://www.diabetes.org/living-with-diabetes/treatment-and-care/medication/other-treatments/aspirin.html?referrer=https://www.google.co.th/#sthash.Gv0rFBt2.dpuf
[19] Diabetes Association of Thailand under The Patronage of Her Royal Highness princess MahaChakriSirindhorn. Clinical and Practice Guideline for Diabetes 2017. Pathumthani: Romyen Media Co, Ltd,; 2017.
[20] Pignone M, Alberts MJ, Colwell JA, Cushman M, Inzucchi SE, Mukherjee D, et al. Antiplatelet for primary prevention of cardiovascular events in people with diabetes. A position statement of the American Diabetes Association, a scientific statement of the American Heart Association, and an expert consensus document of the American College of Cardiology Foundation. 2010;121(24):2694-701.
[21] Saito Y, Okada S, Ogawa H, Soejima H, Sakuma M, Nakayama M, et al. Low-dose aspirin for primary prevention of cardiovascular events in patients with type 2 diabetes: 10-year follow-up of a randomized controlled trial. Circulation. 2017;135(7):659-70.
[22] Halvorsen S, Andreotti F, Ten Berg JM, Cattaneo M, Coccheri S, Marchioli R, et al. Aspirin therapy in primary cardiovascular disease prevention: a position paper of the European Society of Cardiology working group on thrombosis. J Am Coll Cardiol. 2014;64(3):319-27.
[23] Jung JH, Gurbel PA, Jeong YH. Current antiplatelet therapy strategy in patients with diabetes mellitus. Diabetes Metab J. 2015;39(2):95-113: https://doi.org/10.4093/dmj.2015.4039.4092.4095.
[24] Okada S, Morimoto T, Ogawa H, Sakuma M, Soejima H, Nakayama M, et al. Is long-term low-dose aspirin therapy associated with renal dysfunction in patients with type 2 diabetes? JPAD2 Cohort Study. PLoS ONE. 2016;11(1):e0147635.
[25] Bowman L, Mafham M, Wallendszus K, Stevens W, Buck G, Barton J, et al. Effects of antiplatelet for primary prevention in persons with diabetes mellitus. N Engl J Med. 2018;379(16):1529-39.
[26] Van't Hof JR, Misialek J, Oldenburg N, Duval S, Hirsch AT, Luepker RV. Abstract P334: Primary Prevention Aspirin Use in an African American Population: The impact of health beliefs and social norms. Circulation. 2017;135(Suppl 1):AP334-AP.
[27] Korytkowski MT, Forman DE. Management of atherosclerotic cardiovascular disease risk factors in the older adult patient with diabetes. Diabetes Care. 2017;40(4):476-84.

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