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## Factors Associated with CKD among Middle Age and Elderly Populations with T2DM and Hypertension in Thailand

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**Abstract:** This study analyzed the risk factors of chronic kidney disease (CKD) among middle-age and elderly populations with Type 2 Diabetes Mellitus (T2DM) and hypertension and its associated factors in Thailand. The cross-sectional study used the data from the records of 43 standard healthcare folders of the Health Data Center (HDC) of the Ministry of Public Health (MoPH) with population of 19,342,297. The inclusion criteria included people aged > 45 with complete comorbidity data. 3,957,040 respondents passed the requirements and had processed for analysis. The multivariable analysis was used to analyze the factors associated with CKD when controlling for the effect of other covariates. The prevalence of CKD among middle-age and elderly populations with comorbidities was 4.97%. The multivariable analysis in the adjusted model indicated that factors that were associated with CKD included age  $\geq 80$  years (OR<sub>adj</sub>: 9.40, 95% CI: 8.51–10.38), being female (1.03, 1.01–1.07), and being comorbidity (6.69, 6.47–6.92). There is an urgent need for screening attempts to avoid early detection and improved practice for managing T2DM, hypertension, and CKD in the T2DM population in Thailand.

**Keywords:** chronic kidney disease, type 2 diabetes mellitus, hypertension.

### 泰国中老年 2 型糖尿病合并高血压人群慢性肾病的相关因素

**摘要：**本研究分析了泰国中老年 2 型糖尿病和高血压人群慢性肾脏病的危险因素及其相关因素。横断面研究采用卫生部卫生数据中心 43 个标准健康档案记录，人口 19342297 人。纳入标准包括 45 岁以上且有完整合并症数据的人。3,957,040 名受访者通过了要求并进行了分析处理。在控制其他协变量的影响时，使用多变量分析来分析慢性肾病相关的因素。有合并症的中老年人群慢性肾脏病患病率为 4.97%。调整后模型中的多变量分析表明，与慢性肾脏病相关的因素包括年龄  $\geq 80$  岁（调整后优势比：9.40，95% CI：8.51-10.38）、女性（1.03，1.01-1.07）和合并症（6.69，6.47-6.92）。迫切需要进行筛查尝试，以避免在泰国 2 型糖尿病人群中早期发现和改进行管理 2 型糖尿病、高血压和慢性肾病的实践。

**关键词：**慢性肾病、2 型糖尿病、高血压。

## 1. Introduction

Chronic kidney disease (CKD) has decreased the function of nephrons, consequently losing their ability to filter blood and maintain homeostasis [1]. The coexistence of T2DM and hypertension (HT), mainly when not adequately controlled, considerably increases CKD risk with mortality, morbidity rate, and progression [2]. Although current curative options may slow the progression of diabetic-hypertensive nephropathy, some of these patients eventually progress to late-stage kidney disease [3]. Morbidity and mortality rates were significantly associated with socioeconomic impact, thus being a worldwide public health challenge [4].

Most CKD patients with unmanageable blood sugar and blood pressure could be accelerated to the late stage of kidney disease (Stage 5 of CKD), leading to a high economic charge for treatment. The hospital treatment budget for patients with diabetic kidney disease is extraordinarily high, the approximately 180,000 baht (\$5,501.22) per patient/year after reaching for Hemodialysis or Peritoneal dialysis (not including another supply) [5-6].

Many previous studies have also reported the prevalence of Diabetic Kidney Disease (DKD) in different population groups. Few studies have reported CKD in populations with Diabetic Nephropathy or Renovascular hypertension (RVH) and its determinants. Therefore, these studies analyze the prevalence of CKD among middle -age and elderly populations with T2DM and hypertension and its associated factors in Thailand.

## 2. Materials and Methods

### 2.1. Selection of Samples and Implementation

#### 2.1.1. Study Design

The cross-sectional study used the data from the records of 43- standard healthcare folders of the Health Data Center (HDC) of the Ministry of Public Health (MoPH) with a 19,342,297 population. The inclusion criteria were people aged 45 years old and older with complete hypertension data. 3,957,040 respondents passed the criteria and had processed for the analysis.

#### 2.1.2. Dependent and Independent Factors

The dependent variable of this study was hypertension. Hypertension was categorized as coding 1, whereas coding 0 represented does not have hypertension. The independent variables were nutritional status and risk behaviors, including; BMI, depression, smoking, and drink alcohol. Other covariates were age, marital status, and family history.

### 2.2. Data Analysis

All analysis used the Stata program (Stata Corp, College Station, TX). Descriptive statistics, including frequency and percentage, describe categorical data, such as mean, standard deviation, median, and maximum minimum for continuous data. The independent factors that had p-value were processed to the multivariable analysis using the generalized linear mixed model (GLMM) to analyze the factors associated with CKD when controlling for the effect of other covariates, of which all 77 provinces nationwide had divided into 12 area health (AH) were selected as random effects. The magnitude of the association was presented as adjusted odds ratios ( $OR_{Adj}$ ) 95% confidence interval (CI). The significant level was p-value < 0.05.

### 2.3. Ethical Considerations

This study was approved by the Khon Kaen University Ethics Committee for Human Research (HE642038). It had carried out following the guidelines in the Declaration of Helsinki.

## 3. Results

Among 3,957,040 respondents, 54.65% were females, and their mean age was  $60.61 \pm 11.05$ , of which 35.46 % were in the 50-59 age group. Most of them were married (78.60%) and finished at least elementary school (65.73%). Nearly 80% were under the universal health coverage scheme. Most of them had no family history of hypertension and diabetes. As high as 20.12% were obese, and 21.64 % were overweight.

Table 1 Sociodemographic and risk behavior distribution of middle-age and elderly population in Thailand (n = 3,957,040) (Developed by the authors)

Characteristics	Number	Percent
<b>Sociodemographic</b>		
<b>Gender</b>		
Male	1,794,629	45.35
Female	2,162,411	54.65
<b>Age (Years old)</b>		
< 50	668,993	16.91
50–59	1,403,148	35.46
60–69	1,059,232	26.77
70–79	543,478	13.73
≥ 80	282,189	7.13
Mean ± SD	60.61 (11.05)	
Median (Min : Max)	59 (45:110)	
<b>Marital status</b>		
Single	538,503	13.61
Married	3,110,049	78.60
Widowed	216,409	5.47
Divorced	43,263	1.09
Separated	35,039	0.89
Clergy	13,777	0.35
<b>Educational attainment</b>		
No formal education	206,314	5.21
Pre-elementary school	187,211	4.73
Elementary School	2,600,908	65.73

Continuation of Table 1		
Secondary School	650,581	16.44
Certificate of Technical Vocation/High Vocational Certificate	135,628	3.43
Bachelor Degrees	148,477	3.75
Postgraduate/Doctor degree	27,921	0.71
Occupation		
Farmer	1,914,263	48.38
Entrepreneur	207,926	5.25
Unemployment	211,492	5.34
Service staff and Product supplier	21,298	0.54
Senior Government Officer	120,045	3.03
Manager & Lawmaker		
Practitioner	1,445,514	36.53
Technicians and professionals in various fields	30,642	0.77
Skilled craftsmans and related worker	1,532	0.04
Clerk	1,480	0.04
Machinist and Entrepreneurship worker	2,848	0.07
Health insurance		
Social Security Scheme (SSS)	322,135	8.14
Civil servant medical benefit scheme (CSMBS)	468,560	11.84
Universal Coverage Scheme (UC)	3,166,345	80.02
Family history of diabetes		
No	3,622,390	91.54
Yes	334,650	8.46
Family history of hypertension		
No	3,190,106	80.62
Yes	766,934	19.38
Nutritional Status		
Body mass index (kg/m <sup>2</sup> )		
Underweight (< 18.5)	284,249	7.18
Normal (18.5–22.9)	1,817,786	45.94
Overweight (23.0–24.9)	856,335	21.64

Obesity 1 <sup>st</sup> level (25.0–29.9)	796,162	20.12
Obesity 2 <sup>nd</sup> level (≥ 30)	202,508	5.12
Risk Behavior		
Smoking		
No	3,657,879	92.44
Yes	299,161	7.56
Drinking Alcohol		
No	3,547,759	89.66
Yes	409,281	10.34

The prevalence of CKD with comorbidity was 4.97% (95% CI: 4.42 – 5.08). The prevalence was higher among females (0.46 %) compared to males (0.42%) (Table 2).

Table 2 Number and percentage of CKD with comorbidity among middle-aged and elderly populations in Thailand (n = 3,957,040) (Developed by the authors)

CKD with Comorbidity	Number	Percent	95%CI
No	3,760,416	95.03	94.98–95.66
Yes	196,624	4.97	4.42–5.08

The multivariable analysis in an adjusted model that indicated factors were significantly associated with CKD included age ≥ 80 years (OR<sub>adj</sub>: 9.40, 95% CI: 8.51–10.38), being female (1.03, 1.01–1.07), and being comorbidity (6.69, 6.47–6.92). CKD prevalence in populations dissociated with nutritional status, smoking, and drinking behavior. There is an urgent need for screening efforts in prevention, early detection, and improved practice for managing T2DM, hypertension, and CKD in the T2DM population in Thailand (Table 3).

Table 3 The multivariable analysis of factors associated with CKD among the middle-aged and elderly populations with T2DM and HT in Thailand (n = 3,957,040) (Developed by the authors)

Factors	Number	% CKD	OR <sub>crude</sub>	OR <sub>adj</sub>	95% CI	p-value
Gender						< 0.001
Male	1,794,629	0.42	1	1		
Female	2,162,411	0.46	1.09	1.03	1.01-1.07	
Age (Years old)						< 0.001
< 50	668,993	0.07	1	1		
50–59	1,403,148	0.17	2.43	1.73	1.57-1.92	
60–69	1,059,232	0.44	6.19	3.01	2.73-3.31	
70–79	543,478	0.94	13.40	5.09	4.62-5.62	
≥ 80	282,189	1.73	24.86	9.40	8.51-10.38	
Being comorbidity						< 0.001
No	3,760,416	0.32	1			
Yes	196,624	2.81	9.01	6.69	6.47-6.92	

## 4. Discussion

Our study reports the first prevalence of the population with CKD and its associated factors in middle age and elderly with comorbidities in Thailand. Gender, aging (>80 years old), and comorbidity were significantly associated with CKD in the populations. The studies conducted in other Southeast Asia and low-middle-income countries report a high relative prevalence. These disparities might be differences in population health, healthcare assessment, methods of CKD diagnosis, socioeconomic, health literacy, quality

of health care, and intervention for managing comorbidities [7–8].

T2DM and HT were comorbidities common in patients or populations with CKD. Furthermore, they are a classical risk factors for renal damage. Uncontrolled blood pressure causing to an essential role in the furtherance of CKD by increasing pressure filtration and subsequent kidney dysfunction [9]. Populations with T2DM may have HT for years before the onset of over-diabetes. Moreover, the population with Diabetic Kidney Disease has indicated low

treatment adherence in Thailand, which exposes them to high risks of CKD complications [10–11]. The comorbidity of T2DM and HT among our populations was also significantly associated with CKD after adjusting all covariates, supported by a previous study, which showed a significantly high association of Diabetic Nephropathy or Renovascular hypertension (RVH) and a positive correlation between these two variables [12–14].

## 5. Conclusion

With old age, concomitant T2DM and HT are rising, which are the potential risk factors for developing CKD with the fast-changing lifestyle of people. Hence, a regular screening process is required in such high-risk groups before one reaches a stage of irreversible adverse outcomes. This early detection would benefit in preventing disease progression and associated morbidity and mortality.

These studies had a few limitations. Due to, had not assessed for a history of cardiovascular disease and eGFR, which may contribute to CKD. However, our report of this study could be clear on different study designs, and more spacious studies with more vigorous measurements are required.

The role of the aging process has long been recognized for other organ systems and diseases as well. Co-morbidities coherent with the aging process, such as T2DM and HT, are common in CKD patients. Further work must determine whether renal impairment in elderly patients is associated with or causes other conditions.

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