



Comparative Control of Type 2 Diabetes Mellitus Between Primary Care Center and Tertiary Care Hospital in A Thai Rural Area

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ARTICLE INFO

Article type

Original article

Article history

Received: 30 Oct 2024

Accepted: 31 Dec 2024

Keywords

Diabetes mellitus
primary care
tertiary care

ABSTRACT

Introduction: Diabetes mellitus (DM) significantly contributes to morbidity, mortality, and healthcare costs. This study aims to evaluate diabetes control and treatment outcomes in individuals treated at primary healthcare centers and a tertiary care hospital in rural Thailand.

Methods: Data from 27,266 type 2 diabetes patients receiving care in Sakon Nakhon province in 2023 were analyzed. Participants' treatment outcomes, including blood sugar, blood pressure control, and screening rates, were compared across urban community health centers, subdistrict health-promoting hospitals, and a tertiary care hospital.

Results: Primary care settings demonstrated better management of central obesity and renal screening compared to tertiary care. However, blood sugar and blood pressure control rates were suboptimal across all settings, and HbA1c testing frequency remained low. Mortality rates did not differ significantly between settings.

Conclusion: While diabetes management in primary and tertiary care showed similarities, primary care settings were more effective in managing BMI and renal screening. These findings highlight the importance of reinforcing diabetes management strategies, particularly in primary care, to enhance outcomes.

Please cite this paper as:

Waramit S. Comparative Control of Type 2 Diabetes Mellitus Between Primary Care Center and Tertiary Care Hospital in A Thai Rural Area. *Reviews in Clinical Medicine*. 2025;12(1): 49-55.

Introduction

Thailand's healthcare system faces growing challenges due to the increasing prevalence of chronic diseases like diabetes mellitus. This rise is driven by an aging population and lifestyle changes, leading to higher morbidity, mortality, and healthcare costs. (1) Diabetes is particularly expected to increase among those over 60 as the population ages. To address this, the Ministry of Public Health developed a National Strategic Plan to eliminate the diabetes burden. This Cabinet-approved policy emphasizes prevention and promoting healthy living while coordinating efforts

across all levels of healthcare. Under the Universal Coverage Scheme, supervised by the National Health Security Office, most Thai residents have access to quality healthcare, including comprehensive plans for managing diabetes and hypertension. These plans cover prevention, treatment, and rehabilitation and are enhanced by collaboration among various organizations and networks. Diabetes and hypertension are major public health concerns that require proactive, population-based strategies for early detection and prevention of complications. (2-3) However,

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Doi: [10.22038/rcm.2024.83712.1515](https://doi.org/10.22038/rcm.2024.83712.1515)

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challenges remain, particularly in rural areas where access to healthcare is limited. Additionally, demographic shifts, such as a growing elderly population and rising rates of chronic diseases, continue to strain Thailand's healthcare system. Type 2 diabetes, which accounts for 90% of diabetes cases, is primarily managed in primary care settings in Thailand and similar advanced healthcare systems. Expanding primary care services could be a cost-effective way for the Thailand National Health Service to improve care delivery. (4-8) This study aims to compare diabetes management and treatment outcomes between primary and tertiary care settings in a rural Thai province.

Materials and Methods

Study design

This study employed a cross-sectional approach to examine the care and outcomes of type 2 diabetes patients in primary and tertiary healthcare settings in suburban area of Sakon Nakhon province, Thailand. There were 26 primary healthcare stations, which were chosen based on their accessibility and regional representation. These primary healthcare stations consisted of 24 subdistrict health-promoting hospitals and 2 urban community health centers. Comparison with a tertiary care hospital was collected from January 1, 2023 to December 31, 2023. Ethical considerations in this study included obtaining permission from the Ethics Committee of Sakon Nakhon hospital (Ethical ID: SKNH REC No. 056/2567).

Definition

1. Primary care center : The primary care practice models are classified into two categories.

1) Subdistrict health promoting hospitals: These facilities were converted from original health centers to satisfy specific standards. These are tiny community health clinics that serve the subdistrict and village populations, with coverage ranging from 5,000 to 10,000 persons. They are staffed by competent nurses and, while not limited to a specific nature or extensive network, aspired to provide full healthcare services.

2) Community health centers : These concepts

included health centers that had a "non-rotating" family practitioner or general medicine physician. They serve maximum of 30,000 people per location and offered services such as general practice, dental, pharmacy, physical therapy, and occupational therapy. Personnel involved include few general practitioners, dentists, pharmacists, professional nurses, medical technologists, physical therapists, occupational therapists, and public health academics.

2. Tertiary care hospital : A hospital that can handle patients who require complex, high-tech, and costly treatments. Its purpose is to educate and conduct medical research. As a result, it is made up of professionals from the major fields. All secondary branches and sub-branch branches are essential. Designated as a high-level patient referral facility.

Participants: The study comprised 27,266 type 2 diabetes patients who had been receiving follow-up care for more than a year at selected primary and tertiary healthcare stations in suburban area of Sakon Nakhon province, Thailand.

Data collection: Data for the study was obtained by reviewing medical records from the Health Data Center (HDC) of the Ministry of Public Health and Sakon Nakhon hospital. These sources provided thorough information about patient demographics, preventions of complication, clinical features, treatment regimens, and clinical results.

Data analysis: The demographics and clinical aspects of the study subjects were described using descriptive statistics. Inferential statistics can also be used to investigate relationships between various variables and outcomes, as appropriate. In the univariate analysis, we used the Analysis of Variance to compare three groups. Statistics Kingdom® (Version 2017; Australia) was used to evaluate the data. Statistical significance was determined with a two-tailed test ($P < 0.05$).

Results

The study examined the demographic characteristics of type 2 diabetes patients from various age groups and healthcare settings. As seen in [Figure 1](#).

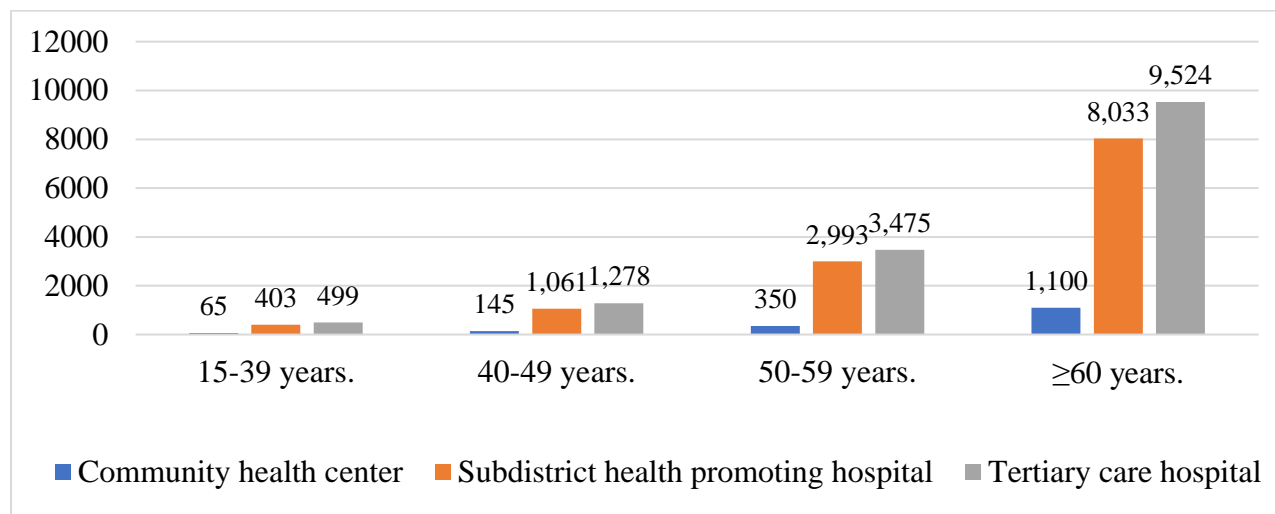


Figure 1. Distribution of age groups and healthcare settings of type 2 diabetes patients

Table 1 shows the control measures and results for type 2 diabetes patients in two healthcare settings. The percentage of patients who received therapy varied between settings (Community health centers 72.3%, Subdistrict health promoting hospital 74.8% and Tertiary care hospital 69.9%, with no significant difference found ($P= 0.73$). There were significant disparities in the prevalence of central obesity between settings. There were no significant differences in the frequency of HbA1c

testing, LDL tests, or attained LDL values (< 100 mg/dl) across settings ($P = 0.70$, $P = 0.74$, and $P = 0.78$, respectively). Furthermore, there were no significant differences in optimal blood sugar and blood pressure control between settings. Eye and foot screening did not differ significantly between settings, although renal screening did ($P = 0.03$). Finally, the incidence of acute complications did not differ substantially between settings ($P = 0.82$).

Table 1. Control and management of type 2 diabetic patients

Control factors and outcomes	Primary care center (%)			P-value
	Community health center	Subdistrict health promoting hospital	Tertiary Care Center (%)	
Patients following treatment	72.3	74.8	69.9	0.73
Patients with central obesity	62.4	69.8	53.1	0.01*
HbA1c test ≥ 1 time/year	58.2	62.6	63.4	0.70
Optimal blood sugar [#]	28.4	24.0	24.4	0.76
Optimal blood pressure ^δ	58.8	62.6	49.0	0.12
Receiving LDL testing	73.8	78.1	77.7	0.74
LDL < 100 mg/dl	46.5	51.7	49.6	0.78
Eyes screening test	60.1	65.5	60.2	0.60
Renal screening test	35.8	19.9	25.1	0.03*
Foot screening test	70.9	72.0	69.1	0.95
Acute complications	1.10	1.50	1.70	0.82

* P -value <0.05 = statistical significance

The recommended target blood pressure[#] $< 130/80$ mmHg, and glycated hemoglobin^δ $< 7\%$

While Table 2 displays the mortality rates among type 2 diabetes patients across different age groups

and healthcare settings, along with no significant difference observed.

Table 2. Mortality rate of type 2 diabetic patients

Age	Primary care center (%)		Tertiary care center (%)	P-value
	Urban community health center	Subdistrict health promoting hospital		
15-39	0	1.40	0	0.37
40-49	0	0.70	2.27	0.37
50-59	0.65	1.41	1.42	1.00
≥ 60	0.85	3.12	3.07	0.81

*P-value<0.05 = statistical significance

Discussion

This study examined diabetes management in primary and tertiary care settings in rural Thailand, revealing key insights. Overall, diabetes control was similar between primary and tertiary care patients, but with some differences. A concerning trend was the low rate of HbA1c testing, particularly in primary care, indicating inadequate monitoring of blood sugar levels. (9,10) An important finding was that patients in primary care settings had better control of their body mass index (BMI) compared to those in tertiary care, suggesting that primary care may be more effective in addressing obesity-related issues. (11-12) However, there were no significant differences in blood sugar control, blood pressure control, or LDL levels between the two settings. For both primary and tertiary care, good blood sugar and blood pressure control were achieved in only 24.0-28.4% and 58.8-62.6% of patients, respectively. These results were better than those reported in some previous studies.

In primary care patients had better results than those reported by Al Khaja KA et al. (13), which were 10% and 11% respectively. While the frequency of foot and eye screens did not differ substantially across primary and tertiary care settings, there were differences in the prevalence of specific problems, particularly renal screening, with primary care patients having a greater prevalence than tertiary care patients. This highlighted the importance of thorough screening processes and early detection activities at all levels of healthcare to reduce the risk of diabetes-related complications. Screening rates for eye, kidney, and foot problems among primary care patients were equivalent or somewhat higher than those reported in prior studies. (14-16) However, there is still space for improvement, especially given the importance of early detection and intervention in avoiding diabetic complications. (17-18) Implementing comprehensive screening programs

in primary care settings could help close the gap and enhance patient outcomes. The study's identification of risk variables for diabetic complications, such as longer diabetes duration, hypertension, and hyperlipidemia, supports the multifaceted nature of diabetes care. (19-20) Effective management of these risk factors through lifestyle changes and medication is critical for lowering the burden of diabetic complications. (21-22)

Primary care patients showed better outcomes than those reported by Al Khaja KA et al. (13), where control rates were 10% and 11%. While foot and eye screening rates were similar in primary and tertiary care, renal screening was more prevalent in primary care. This underscores the importance of thorough screening and early detection at all levels of healthcare to reduce diabetes-related complications. Screening rates for eye, kidney, and foot problems in primary care were comparable or slightly better than previous studies (14-16). However, there is still room for improvement, as early detection and intervention are vital in preventing complications (17-18). Implementing comprehensive screening programs in primary care could help bridge gaps and improve patient outcomes.

The study identified key risk factors for complications, such as longer diabetes duration, hypertension, and hyperlipidemia, highlighting the complexity of diabetes care (19-20). Managing these risks through lifestyle changes and medication is crucial to reducing the burden of complications (21-22). Several studies have compared diabetes management outcomes in primary care and tertiary care settings. (23-26) Lenz ER et al. (27) found similar results between the two settings for blood pressure, blood glucose, creatinine tests, foot exams, and ophthalmologist referrals. However, primary care settings were more consistent in documenting diabetes

education, including guidance on nutrition, exercise, HbA1c testing, and medications.

Conlon P et al. (28) observed that nurse practitioners in primary care reduced HbA1c and glucose levels more effectively than physicians, while blood pressure outcomes were comparable in both settings. Primary care also demonstrated better consistency in providing and documenting patient education. Condosta D et al. (29) found no significant differences in HbA1c, HDL, or LDL levels between primary and tertiary care. However, primary care providers conducted more referrals for ophthalmology, podiatry, and microfilament testing. In contrast, Leinung MC et al. (30) reported that endocrinology clinics, following American Diabetes Association (ADA) guidelines, outperformed primary care in areas like hypoglycemia management, frequency of HbA1c testing, and annual lipid and eye exams. Endocrinology clinics also had lower mean HbA1c levels compared to primary care. Similarly, Ismail H et al. (31) noted that patients in specialist diabetes clinics had higher HbA1c levels than those in primary care, but both settings showed comparable improvement rates over time. While cholesterol reduction was greater in primary care, diastolic blood pressure and screening rates for podiatry and retinal issues initially lagged but improved significantly over time. Weight gain was observed in both groups, especially in specialty clinics. Özkan EF et al. (32) found no significant differences in HbA1c levels between tertiary care hospitals and primary care clinics. However, hypoglycemia occurred more frequently in tertiary care (12.8%) than in primary care (7.3%), with similar rates of diabetes-related complications like retinopathy, nephropathy, and neuropathy across both settings.

These findings have important implications for healthcare policy, highlighting the need to strengthen primary care while addressing gaps in tertiary care. Policies should prioritize scaling successful primary care interventions to tertiary care and improving coordination between the two levels. Study limitations include reliance on potentially incomplete medical records and a cross-sectional design that limits causal interpretations. Future research should focus on longitudinal outcomes and evaluate interventions to address these gaps.

Conclusion

Primary care settings in rural Thailand demonstrate comparable diabetes management

outcomes to tertiary care, with advantages in BMI management and renal screening. These findings highlight the potential of primary care as a cornerstone for effective diabetes management. Policy efforts should focus on enhancing primary care capacity while addressing systemic gaps in glycemic monitoring and complication screening.

Conflict of Interests

The author declares that there is no conflict of interest.

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