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Visit Frequency among Patients with Type 2 Diabetes Mellitus: A Multivariable Poisson Regression Analysis using Indonesia's National Health Insurance Data 2023

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ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) is a chronic condition requiring multidisciplinary management to prevent serious complications with increasing diabetes-related visits, higher hospitalization rates, and greater mortality risk. This study aimed to identify factors associated with the frequency of T2DM patient visits to Advanced Referral Healthcare (ARH) facilities within Indonesia's National Health Insurance (BPJS) system, to support evidence-based improvements in care coordination.

Methods: A cross-sectional study was conducted using 2023 BPJS sample data in the diabetes subcategory. A total of 1,312 patients met the inclusion criteria based on complete ICD-X (E11) diagnostic codes. Variables examined included age, gender, marital status, BPJS class and type, domicile, primary healthcare ownership and type, ARH type, admission diagnosis, complication status, and hospitalization history. Multivariable Poisson regression analysis was performed in R-Studio to estimate the Incidence Rate Ratio (IRR).

Results: Most patients were adult females (64.25%), married (80.64%), lived in districts (80.79%), enrolled in BPJS class 3 (87.96%), and utilized community health centers (77.13%). Patients with complications had significantly higher visit frequencies (IRR = 1.13; 95% CI: 1.03–1.24). After adjustment, gender ($p = 0.049$; IRR = 0.91; 95% CI: 0.82–1.00) and complication status ($p = 0.012$; IRR = 1.13; 95% CI: 1.03–1.24) remained significant predictors.

Conclusion: Female patients had fewer visits, while those with complications had higher utilization of ARH services. These findings highlight the importance of gender-sensitive and multidisciplinary approaches to strengthen care coordination and optimize the BPJS referral system for T2DM management.

Keywords: Type 2 diabetes mellitus; Health services utilization; Referral and consultation; Insurance health; Cross-sectional studies; Poisson distribution

INTRODUCTION

Type 2 diabetes mellitus (T2DM) is considered to be among the most significant global public health issues of the 21st century. In 2024, 589 million adults (aged 20-79 years) worldwide were living with diabetes, with projections estimating an increase to 853 million by 2050 (1). The global prevalence of diabetes stood at 11.1% in 2024, with earlier models projecting T2DM rates at 7,079 per 100,000 individuals by 2030 amid rising trends across regions (1). In 2024, diabetes was responsible for 3.4 million deaths worldwide, at a rate of one death every nine seconds. This figure has led to health expenditures exceeding one trillion United States Dollars, marking a 338% increase compared to the figures from 17 years prior (1-3).

The increasing prevalence of diabetes in Indonesia highlights the urgency for comprehensive and coordinated response strategies, with the prevalence reaching 9.19% in 2020, equivalent to 18.69 million cases. According to the International Diabetes Federation (IDF) Diabetes Atlas, approximately 20.4 million adults are currently affected, and this number is projected to rise to 40.7 million by 2045 (1). In addition, diabetes-related mortality is expected to increase substantially, from 433,752 deaths in 2020 to 944,468 by 2045 (1,4-6). These trends underscore the imperative for enhanced management strategies to address this pressing public health concern.

The chronic and progressive nature of T2DM necessitates continuous medical surveillance, lifestyle modification, and pharmacological management to prevent or delay the onset of serious complications including cardiovascular disease, nephropathy, retinopathy, and neuropathy (7-10). In Indonesia, the implementation of the National Health Insurance system, which is managed by the Social Security Agency for Health (BPJS), has fundamentally transformed healthcare access for millions of citizens since its inception in 2014. The BPJS system functions through a tiered referral mechanism, whereby patients initially receive care at primary healthcare facilities and are then referred to Advanced Referral Healthcare (ARH) facilities when specialized intervention is required (11,12). A thorough understanding of the patterns and determinants of healthcare utilization within this structured system is imperative for

optimizing resource allocation and enhancing patient outcomes (11,13,14).

Previous studies have documented significant variations in healthcare-seeking behavior among patients with T2DM. These variations are influenced by multiple sociodemographic, clinical, and systemic factors (7,15,16). A comprehensive review of the extant literature reveals a substantial body of evidence indicating that complications, gender, socioeconomic status, and health insurance coverage exert a considerable influence on the frequency and quality of medical visits (17-20). Despite the expansion of universal health coverage in Indonesia, concerns persist regarding equity in access to advanced care and the efficacy of the referral system in managing chronic conditions (12,14).

The frequency of visits to ARH facilities represents an important indicator of both disease severity and the responsiveness of the healthcare system (17,18,21). Increased visit frequency may reflect suboptimal disease control requiring more intensive management, or alternatively, active patient participation in preventive and follow-up care (17,21,22). In contrast, lower visit frequency may indicate effective disease management at the primary care level or, conversely, the presence of barriers to accessing advanced healthcare services (17,18,21,22). Distinguishing between these possibilities requires a comprehensive evaluation of patient characteristics and clinical profiles.

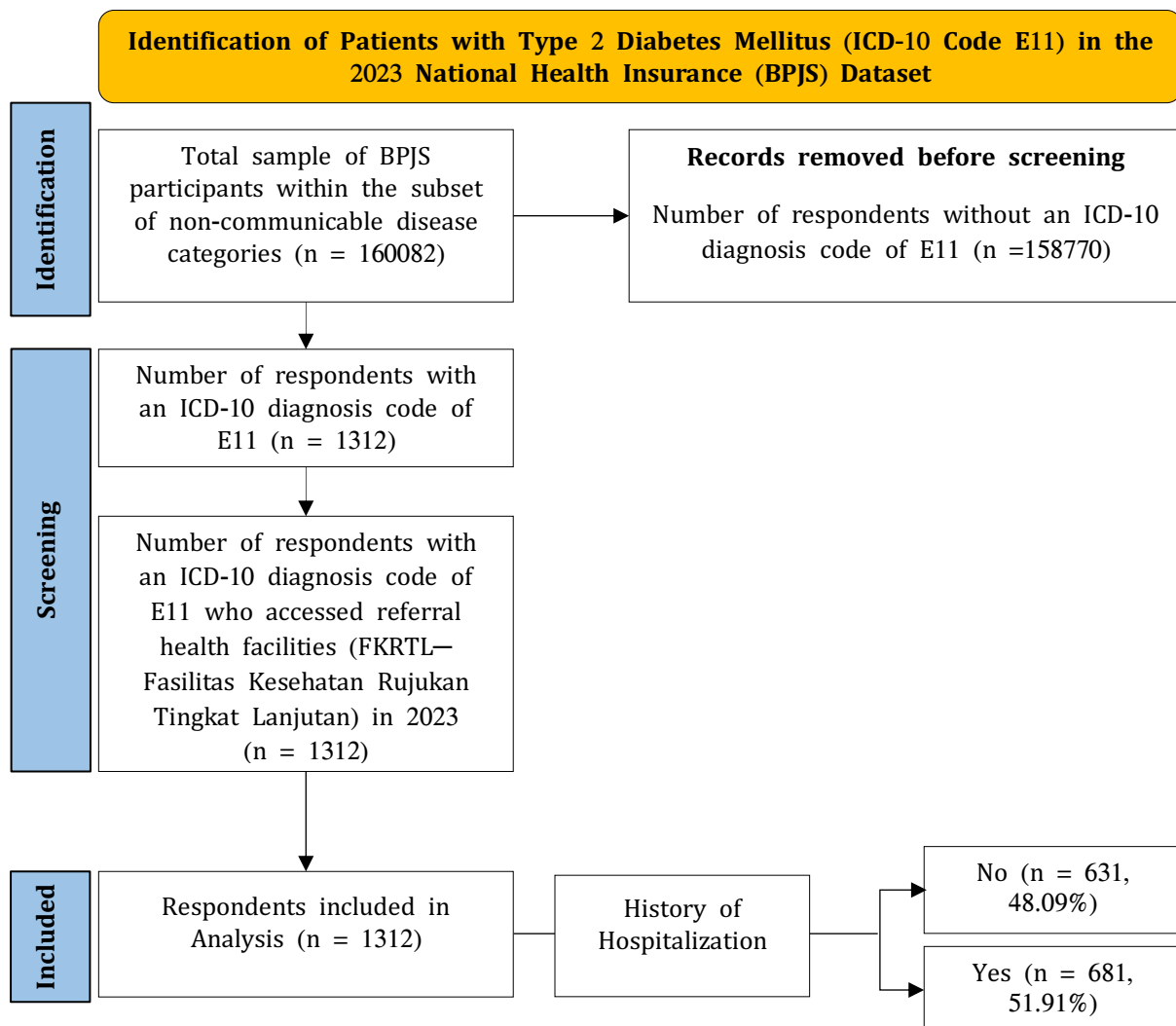
Presently, there has been limited research specifically examining the factors influencing the frequency of ARH visits among individuals with T2DM within the Indonesian BPJS system, utilizing large-scale administrative data sets. The extant literature on the subject has primarily centered on primary care utilization, with a paucity of studies employing sufficiently large samples to ensure generalizability. It is imperative to comprehend which patient subgroups exhibit elevated or diminished utilization patterns. This knowledge is essential for the development of targeted interventions, the enhancement of care coordination between primary and advanced facilities, and the assurance of an equitable and efficient referral system.

METHODS

This cross-sectional study analyzes secondary data from the 2023 BPJS Kesehatan database, specifically focusing on the non-communicable disease subcategory. We retrieved the dataset via the official PPID BPJS Kesehatan portal (<https://e-ppid.bpjs-kesehatan.go.id/eppid/>). The initial dataset comprised 160,082 participants. From this pool, we applied a filter for the ICD-10 diagnosis code E11 to identify patients with Type 2 Diabetes Mellitus. We excluded 158,770 entries that lacked this specific diagnostic code. The final analytic sample consisted of 1,312 patients who had a confirmed E11 diagnosis and utilized ARH

during the 2023 fiscal year (**Figure 1**). To be included in the analysis, records were required to have a registered E11 diagnosis, a documented visit to a referral facility, and complete administrative data across all study variables. We excluded participants without an E11 code, those who did not access FKRTL, those with incomplete or invalid data, duplicate data, and unverifiable outliers. Moreover, the data underwent a series of procedural steps, including screening, cleaning, and coding. These steps were taken to ensure the completeness and consistency of the variables prior to the execution of statistical analysis.

Figure 1: Sample Selection Flowchart



The independent variables included age category (0–17 years as children, 18–59 years as adults, and ≥ 60 years as older adults), gender (male, female), marital status (unmarried, divorced, married), BPJS class

(class 1, class 2, class 3), BPJS membership type (PBI – *Penerima Bantuan Iuran*, defined as contribution assistance recipients, and non-PBI, defined as non-contribution assistance recipients), domicile (city, defined as urban

administrative areas, and district, defined as regency or rural administrative areas), ownership of primary healthcare facilities (government-owned, privately owned), type of primary healthcare facilities (community health centers, primary clinics, general practitioner practices), type of ARH facilities (main clinics, hospitals), admission diagnosis (diabetes mellitus, non-diabetes mellitus), complication status (diabetes mellitus without complications, diabetes mellitus with complications), and history of hospitalization (yes, no). The dependent variable in this study was the frequency of health service visits by patients with T2DM. The data were analyzed using Poisson regression models, beginning with univariable analyses followed by multivariable modeling, to estimate the Incidence Rate Ratio (IRR) and 95% Confidence Intervals (95% CI). Model assumptions were assessed prior to analysis, and variable selection procedures were applied in building the final model. Model fit

and performance were evaluated using the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and log-likelihood (LL) values. All statistical analyses were conducted using RStudio Desktop version 2024.12.1+563 (Kousa Dogwood), an integrated development environment for R, developed by Posit Software, PBC (Boston, MA, USA).

RESULT

Table 1 outlines the characteristics of the 1,312 patients included in the final analysis. The study population was predominantly female (64.25%) and married (80.64%). Geographically, the vast majority of patients (80.79%) resided in regency (kabupaten) areas rather than major cities. regarding healthcare access, a significant proportion held Class 3 BPJS coverage (87.96%) and utilized Community Health Centers as their primary healthcare system (77.13%).

Table 1: Characteristics of Respondents (N = 1312)

Variable	Category	Frequency (f)	Percentage (%)
Age Category	Young (0–17 years)	8	0.61
	Adult (18–59 years)	911	69.44
	Elderly (≥60 years)	393	29.95
Gender	Male	469	35.75
	Female	843	64.25
Marital Status	Single	111	8.46
	Divorced	143	10.9
	Married	1058	80.64
BPJS Class	Class 3	1154	87.96
	Class 2	100	7.62
	Class 1	58	4.42
BPJS Type	PBI	616	46.95
	Non-PBI	696	53.05
Domicile	District	1060	80.79
	City	252	19.21
Ownership of Primary Healthcare Facility	Government	1026	78.2
	Private	286	21.8
Type of Primary Healthcare Facility	PHC	1012	77.13
	Primary Clinic	221	16.84
	General Practitioner	79	6.02
Type of Referral Healthcare Facility	Main Clinic	28	2.13
	Hospital	1284	97.87
Admission Diagnosis	Non-Diabetes Mellitus	771	58.77
	Diabetes Mellitus	541	41.23
Complication Status	DM Without Complications	655	49.92
	DM With Complications	657	50.08
History of Hospitalization	No	631	48.09
	Yes	681	51.91

The multivariable Poisson regression analysis assessed the relationship between patient characteristics and visit frequency after controlling for age, marital status, BPJS class, domicile, and hospitalization history (**Table 2**). The model identified two independent predictors that remained statistically significant, compared with male patients, female patients had a significantly lower

frequency of healthcare visits (IRR = 0.91; 95% CI: 0.82–1.00; $p = 0.049$), indicating a 9% reduction in healthcare utilization among women. Conversely, the presence of complications was associated with increased healthcare utilization. Patients with complications visited referral facilities 13% more frequently than those without (IRR = 1.13; 95% CI 1.03–1.24; $p = 0.012$).

Table 2: Multivariable Poisson Regression Results of Visit Frequency in T2DM Patients (N = 1312)

Variable	IRR	Std. Error	z-Stat	p-value	95% CI
Age Category					
Young (0–17 years)	Ref	–	–	–	–
Adult (18–59 years)	1.08	0.33	0.237	0.813	0.597 – 2.21
Elderly (≥ 60 years)	0.98	0.332	–0.074	0.941	0.536 – 2.00
Gender					
Male	Ref	–	–	–	–
Female	0.91	0.05	–1.97	0.049	0.822 – 1.00
Marital Status					
Single	Ref	–	–	–	–
Divorced	1.04	0.115	0.315	0.753	0.828 – 1.30
Married	1.05	0.093	0.504	0.614	0.877 – 1.26
BPJS Class					
Class 3	Ref	–	–	–	–
Class 2	0.91	0.138	–0.678	0.497	0.696 – 1.20
Class 1	0.9	0.116	–0.915	0.36	0.722 – 1.14
BPJS Type					
PBI	Ref	–	–	–	–
Non-PBI	1.11	0.056	1.85	0.065	0.993 – 1.24
Domicile					
District	Ref	–	–	–	–
City	1.03	0.062	0.505	0.614	0.913 – 1.16
Ownership of Primary Health Facility					
Government	Ref	–	–	–	–
Private	0.95	0.234	–0.207	0.836	0.619 – 1.55
Type of Primary Health Facility					
PHC	Ref	–	–	–	–
Primary Clinic	1.02	0.231	0.1	0.92	0.630 – 1.56
General Practitioner	0.94	0.258	–0.239	0.811	0.552 – 1.52
Type of Referral Facility					
Main Clinic	Ref	–	–	–	–
Hospital	0.86	0.156	–0.979	0.328	0.641 – 1.18
Admission Diagnosis					
Non-Diabetes Mellitus	Ref	–	–	–	–
Diabetes Mellitus	1.04	0.049	0.702	0.482	0.940 – 1.14
Complication Status					
DM Without Complications	Ref	–	–	–	–
DM With Complications	1.13	0.049	2.5	0.012	1.03 – 1.24
History of Hospitalization					
No	Ref	–	–	–	–
Yes	1.01	0.05	0.14	0.889	0.913 – 1.11
Intercept	1.45	0.377	0.981	0.327	0.655 – 2.91

Model fit statistics: AIC = 3346.037; BIC = 3434.085; log-likelihood = –1656.018; residual deviance = 477.894 (df = 1,295); overdispersion ratio = 0.628, indicating adequate fit of the Poisson regression model.

DISCUSSION

The present study examined the factors associated with the frequency of visits to Advanced Referral Healthcare (ARH) facilities among patients with T2DM who were enrolled in Indonesia's Social Security Agency for Health (BPJS) system. Multivariable Poisson regression analysis revealed that, after controlling for multiple sociodemographic, insurance-related, and clinical factors, gender and complication status remained significant predictors of visit frequency. Male patients exhibited a 9% decrease in visit frequency compared to female patients. Furthermore, patients with complications demonstrated a 13% increase in visit frequency compared to those without complications.

Gender Disparities in Healthcare-Seeking Behavior

The finding that male patients had significantly lower visit frequency aligns with established patterns of gender differences in healthcare utilization documented across various healthcare systems (23). This phenomenon extends beyond simple access issues and reflects deeper behavioral and sociocultural factors that influence health-seeking behavior. The observed gender disparity supports the "masculinity barrier" hypothesis, which posits that traditional gender norms discourage men from acknowledging illness and seeking timely medical care. Men often perceive illness as a threat to their identity as providers and delay care-seeking until symptoms substantially interfere with their occupational or social functioning (17–21,24).

This finding is consistent with diabetes management literature emphasizing that successful disease control requires sustained engagement with self-care behaviors, including dietary management, physical activity, blood glucose monitoring, and medication adherence (25,26). Studies indicate that men generally exhibit lower health literacy, reduced preventive service utilization, and delayed responses to early symptoms compared to women. Lutfiyya et al. demonstrated that patients receiving inadequate diabetes care disproportionately included males, those with lower educational attainment, unmarried individuals, and persons of lower socioeconomic status, reinforcing the intersection of gender with other social determinants of health (27).

From a clinical perspective, the lower visit frequency among male patients raises concerns about undetected disease progression and missed opportunities for early intervention (28). Even when men are aware of their medication needs, they demonstrate reduced active engagement with healthcare facilities for monitoring and follow-up (29). This suggests that awareness alone is insufficient and that targeted interventions addressing masculine norms around illness and vulnerability are necessary. Family-centered approaches that engage spouses or family members as partners in diabetes management may prove more effective than individual-focused patient education, particularly in cultural contexts where spousal influence significantly affects health decisions (28).

Complications as Drivers of Healthcare Utilization

Patients with diabetes-related complications demonstrated significantly higher visit frequency, a finding that reflects the clinical reality that complications substantially increase healthcare resource consumption and necessitate more intensive monitoring and intervention. Complications arising from diabetes, including cardiovascular disease, nephropathy, retinopathy, neuropathy, and diabetic foot, necessitate specialized care, frequent laboratory monitoring, medication adjustments, and frequently involve involvement from a multidisciplinary team (30). This finding aligns with international evidence demonstrating that comorbid conditions and complications significantly influence both disease management capacity and healthcare utilization patterns (31,32).

The presence of complications fundamentally alters the trajectory of diabetes care from relatively straightforward glycemic management to complex, multi-system disease requiring coordination across specialties. Studies have shown that diabetes patients with cardiovascular or renal complications incur treatment costs approximately double those of patients without complications, reflecting the substantial resource burden associated with advanced disease (33). Moreover, complications are the primary drivers of diabetes-related mortality and morbidity, with ketoacidosis, cardiovascular events, and renal failure accounting for the majority of in-hospital deaths among Indonesian T2DM patients (34).

The elevated visit frequency among patients with complications highlights a critical challenge within the BPJS referral system: the healthcare delivery model appears predominantly reactive rather than proactive (10,12,14). Ideally, the tiered referral system should identify at-risk patients early through robust primary care screening and prevention programs, intervening before complications develop. However, the data suggest that many patients access ARH facilities only after complications have already manifested, indicating potential gaps in primary care capacity for early detection and prevention. Strengthening the "Program Rujuk Balik" (PRB)—which aims to stabilize patients at hospitals and return them to primary care for maintenance management—is essential to shift the system toward prevention rather than merely treating established complications.

Healthcare Utilization Within Indonesia's Tiered Insurance System

The finding that patients visited ARH facilities an average of only 1.33 times per year must be interpreted within the unique structural context of Indonesia's national health insurance system. Unlike direct-access healthcare models, BPJS operates on a strict tiered referral mechanism where patients with stable chronic conditions are primarily managed at primary healthcare facilities, with referrals to hospitals reserved for cases requiring specialized intervention or when metabolic targets remain unmet despite primary care management (10,12,14).

This low visit frequency likely reflects the intended "gatekeeper" function of primary care rather than complete absence of medical monitoring (35,36). Recent evaluations of the Performance-Based Capitation policy indicate that while primary care contact rates are increasing, the referral ratio to hospitals remains a critical bottleneck in the system. Consequently, primary care providers bear substantial responsibility as the frontline defense against disease progression, a role requiring continuous competency enhancement and adequate resources (27,37–40).

However, this system design also reveals potential vulnerabilities. The high prevalence of complications (50.08%) and hospitalization history (51.91%) among patients who do access ARH facilities suggests that referrals often occur late in the disease trajectory, primarily for "damage control" rather than

disease stabilization. This pattern indicates that the current system may inadvertently delay access to specialized care until complications become severe, undermining preventive efforts and potentially increasing long-term costs.

Socioeconomic Disparities and Referral Access

The discussion on BPJS class distribution appears inconsistent with **Table 1**. The manuscript states that BPJS Class 1 participants comprised 87.96% of the study population; however, **Table 1** shows that 87.96% of participants were enrolled in BPJS Class 3. Within the BPJS system, Class 1 represents the highest contribution tier and typically correlates with higher socioeconomic status. The stark underrepresentation of Class 2 and Class 3 participants in the referral setting suggests potential systemic inequity in accessing advanced care (41,42).

While T2DM prevalence is generally distributed across all economic strata, the ability to successfully navigate the tiered referral system appears disproportionately concentrated among higher socioeconomic groups. Lower-income patients may encounter invisible barriers including transportation costs, loss of daily wages during hospital visits, lower administrative literacy, or reluctance to advocate for referral (43). These structural barriers can prevent clinically indicated referrals from materializing, resulting in delayed diagnosis of complications and worse health outcomes among economically disadvantaged populations (44,45).

This finding is consistent broader literature on healthcare equity demonstrating that universal health insurance coverage, while necessary, is insufficient to guarantee equitable access (46). Social determinants including education, income, geographic location, and health literacy substantially mediate the relationship between insurance coverage and actual service utilization⁴⁷. Addressing these disparities requires interventions beyond insurance policy, including community health worker programs, transportation subsidies, patient navigation services, and strengthened outreach to underserved populations (12,17,46,47).

The Critical Role of Primary Care

The data revealed that 77.13% of patients utilized Community Health Centers as their primary care entry point, with the majority (80.79%) residing in district areas rather than urban centers. This underscores the vital role of rural and semi-urban primary care facilities as gatekeepers within the national health insurance system. The competence and capacity of general practitioners in these peripheral areas directly determine the quality of diabetes management and appropriateness of referrals to advanced facilities (40,48–50).

However, previous research has documented substantial challenges facing primary care facilities in resource-limited settings, including inadequate availability of essential medications, inconsistent supply chains, limited diagnostic capabilities, and insufficient numbers of trained healthcare workers (48,49). These structural limitations may contribute to suboptimal diabetes management at the primary level, necessitating more frequent referrals than would otherwise be necessary with adequately resourced primary care.

Strengthening primary care capacity through continuous medical education, reliable medication supply chains, point-of-care diagnostic tools (such as HbA1c testing), and decision-support systems could substantially improve diabetes outcomes while reducing unnecessary referrals (51). International evidence demonstrates that well-functioning primary care systems can effectively manage the majority of T2DM patients, reserving hospital referrals for genuine complications or treatment-resistant cases (51,52). Indonesia's healthcare system would benefit from sustained investment in primary care infrastructure and workforce development to realize the full potential of the tiered referral model.

CONCLUSION

The findings of this study carry several important implications for policy and practice. First, the identification of gender disparities necessitates development of gender-sensitive interventions that actively engage female patients and their families in diabetes management. Strategies might include workplace-based screening programs, male-friendly clinic hours, peer support groups, and

family-centered education that leverages spousal influence on health behaviors.

Second, the strong association between complications and visit frequency underscores the urgent need to shift healthcare delivery from reactive complication management to proactive prevention. This requires strengthening screening protocols at primary care, ensuring timely referrals for patients at high risk of complications, and implementing robust disease management programs that maintain patients in optimal metabolic control before complications develop.

Third, addressing socioeconomic disparities in ARH access requires multi-level interventions including patient navigation services, community health worker outreach, transportation assistance, and simplified referral procedures that reduce administrative burden. Monitoring referral patterns by BPJS class and implementing equity-focused quality improvement initiatives can help identify and address access barriers for disadvantaged populations.

Finally, sustained investment in primary care capacity—including workforce training, essential medicine availability, diagnostic infrastructure, and health information systems—is essential for optimizing the tiered referral model. Primary care must be empowered not merely as a triage point but as the site of comprehensive chronic disease management, with hospitals serving as consultative resources for complex cases rather than routine care providers.

LIMITATIONS AND RECOMMENDATIONS

This study has several limitations that warrant consideration. First, the cross-sectional design precludes causal inference, capturing only associations at a single time point. Second, potential information bias from ICD-10 coding errors and documentation variations across facilities may affect accuracy. Third, the study included only BPJS participants accessing ARH facilities, potentially limiting generalizability to patients managed exclusively in primary care or those not accessing formal healthcare.

Future research should employ longitudinal designs to track utilization patterns over time and assess intervention impacts. Mixed-methods approaches combining quantitative analysis with qualitative interviews would illuminate barriers and facilitators to care

access. Linkage of administrative data with clinical registries containing HbA1c values and medication records would enable more comprehensive analysis.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

MZS: Conceptualization, methodology design, data curation, formal analysis, data interpretation, manuscript drafting (Results and partial Discussion), review and editing.

APR: Conceptualization, project administration, supervision, manuscript drafting (partial Discussion and Conclusion), critical review and editing, correspondence management.

AIT: Literature review, manuscript drafting (Introduction and partial Discussion), critical review for clinical content, editing and proofreading.

BS: Data validation, methodology consultation, manuscript drafting (Methods section), critical review and editing, supervision.

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