



Knowledge Level and Information Needs of Patients with Diabetes in Yogyakarta City, Indonesia



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ABSTRACT

Aims This study aimed to measure the knowledge level and information needs of patients with diabetes in Yogyakarta City, Indonesia.

Instrument & Methods This cross-sectional study was conducted on 155 patients with diabetes who filled out a questionnaire consisting of three sections, including a demographic information checklist, the 24-item version of the Diabetes Knowledge Questionnaire, and the researcher-made Diabetes Mellitus Information Questionnaire. Sixteen pharmacists were voluntarily recruited to complete a survey that included demographic data and open-ended questions related to pharmacy services in their workplaces. Data were analyzed by SPSS version 22.

Findings No correlation was found between knowledge level and factors, such as age, gender, occupation, income, education, medications, comorbidities, or blood sugar levels. However, a significant link was identified between the duration of diabetes and knowledge level. While pharmacists provide education and counseling, most repowered no specialized training, which limited education to new patients and those with uncontrolled blood sugar levels. Challenges for pharmacists included limited time, lack of dedicated space, and the absence of standardized documentation.

Conclusion DM patients in Yogyakarta City have a moderate level of knowledge.

Keywords Diabetes; Knowledge; Pharmacy Services; Primary Health Care

CITATION LINKS

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Introduction

Diabetes mellitus (DM) is a long-term chronic disease caused by elevated blood glucose levels due to insufficient insulin production or ineffective insulin usage. According to an International Diabetes Federation (IDF) report in 2021, this disease is directly responsible for 1.5 million deaths annually. Globally, about 422 million individuals suffer from DM, with the majority living in low- and middle-income nations, including Indonesia [1].

DM has a significantly high prevalence in Indonesia, and its incidence continues to rise annually. Indonesia ranks among the top seven nations worldwide in terms of diabetes prevalence [1]. Based on data from the Indonesia Basic Health Research from 2013 to 2018, the proportion of diabetes prevalence in Indonesia increased from 6.9% to 8.5%. Among the 38 provinces in Indonesia, Yogyakarta Special Region (DIY) Province ranks second nationally. The prevalence of individuals diagnosed with DM in Yogyakarta City is 4.79%, which corresponds to approximately 15,540 individuals [1,2]. Considering the significant rise in DM cases in Indonesia, healthcare providers and patients must have a sufficient understanding of DM to effectively manage and treat the disease and its complications [3,4].

The patient's understanding of DM enables them to independently implement an appropriate treatment regimen throughout their lifetime. DM is a multifaceted condition; therefore, patients with DM have specific information needs that differ from one another [5]. The patients' needs for information on all diabetes-related topics vary among subgroups affected by factors such as age, level of education, types, and duration of diabetes, comorbid conditions, level of diabetes knowledge, gender-related factors, and changes in information needs along the disease's progression [6,7].

The quality and advancement of health systems also affect the variance in information needs among diabetic patients [8,9]. Several studies have revealed distinct needs for diabetes-related information among Asians and Europeans [8,10,11]. However, there have been a limited number of studies conducted in Indonesia, specifically in Yogyakarta, focusing on patients' perspectives regarding DM information needs [12].

On the other hand, the role of pharmacists in community health centers in providing pharmaceutical services has not yet been optimized. The high workload experienced by pharmacists is evident, often due to understaffing and the need to handle numerous administrative and technical tasks. Pharmacists' responsibilities include counseling and monitoring. Therefore, integrating pharmacists into the primary health care system and recognizing their significant contribution to improving the quality of health services is greatly needed [13]. Consequently, a

study in Yogyakarta City is necessary to gain a better understanding of the current conditions, specifically mapping the prioritization of patient needs and preferences, as well as the types of patient service strategies applied by pharmacists. This will allow for the development and accurate implementation of further strategies to enhance therapeutic outcomes. Therefore, this study aimed to measure the knowledge level and information needs of patients with DM in Yogyakarta and develop an appropriate strategy to address this issue.

Instrument and Methods

Study design

This cross-sectional study was conducted on patients with DM referring to health centers in Yogyakarta City between January and May 2024. Yogyakarta City has 18 health centers. Eight health centers were selected from these 18 because they have the highest number of diabetic patients. From those eight health centers, we invited registered patients with type 2 DM who met the inclusion and exclusion criteria using an accidental sampling approach. A sample size of 155 patients was determined based on the Slovin formula considering a 95% confidence interval (CI) and a 5% margin of error. We received completed questionnaires with a 100% response rate. After gathering the patients' data, a follow-up survey was conducted. Of all the pharmacists working at community health centers in Yogyakarta, 16 participated in this study.

Research tools

We used a questionnaire for the patients and a survey form for the pharmacists.

The questionnaire consisted of three sections, including the demographic information checklist, the 24-item version of the Diabetes Knowledge Questionnaire (DKQ-24), and the researcher-made Diabetes Mellitus Information Questionnaire.

The first section required respondents to provide personal information, such as their age, gender, education level, employment, income, time since DM diagnosis, comorbidities, medications, and blood sugar levels. Then, the DKQ-24 questionnaire was used as a specific standardized instrument to measure the knowledge of patients with DM. We utilized the Indonesian-translated version of the DKQ-24 developed and approved (Cronbach's $\alpha=0.757$) by Zakiudin *et al.* [14]. Each respondent answered 24 questions by choosing one of three responses, namely yes, no, or I do not know. The items were scored as either correct or incorrect. The total number of correct answers was summed, with a higher score indicating better knowledge of DM. We classified the level of patient knowledge into three groups based on their final score; low (score: 0-9), medium (10-16), and high (17-24) [15].

Further, the researcher-made Diabetes Mellitus Information Questionnaire was used to assess the

types of information needs by patients and measure the priority of each type of information related to DM. We conducted a literature review to formulate the questions [16]. The measurement of content validity, face validity, and reliability was applied [17]. Three experts and 30 respondents were involved to confirm that this questionnaire was valid. A reliability coefficient of 0.914 was attained using Cronbach's Alpha. In this final section, respondents were required to answer 21 yes/no questions, which were divided into four domains, including medication, disease, lifestyle, and complications. They were then asked to rank these from most priority to least priority.

We also used a survey form to assess pharmacists' information. The survey form included two sections, including demographic characteristics and types of pharmacy services in their workplace. The first section included age, gender, level of education, capacity, and duration of practice. The next part consisted of open-ended questions related to pharmacy services, covering the forms of patient education, timing of education, educational materials and media, as well as topics related to implementation challenges. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklists [18]. For calculating item difficulty index, we used the formula $P=R/T$, where P is the item difficulty index, R is the number of correct responses, and T is the total number of responses.

Data analysis

The demographic data of patients with type 2 DM were analyzed using descriptive statistics. We used SPSS version 22 to analyze the data using chi-square test. Moreover, the demographic data of pharmacists were analyzed using descriptive statistics. The results are presented as frequencies, percentages, and detailed descriptions.

Findings

Out of 155 patients with DM, the majority were females, and the age group of 55-64 accounted for almost half of the subjects. Based on educational characteristics, most patients had a junior high school level of education. The majority of the patient participants were unemployed, and half of them had no monthly income. Among all patient participants, nearly half were diagnosed with DM within the past five years, more than half were on single treatment with either an oral antidiabetic drug or insulin, only a quarter of the participants were free from comorbidities, and most were in poor condition with high levels of fasting glucose (Table 1).

The level of knowledge among DM patients at the Yogyakarta City Health Center fell into the moderate category (80%), with a total of 124 patients. The mean level of knowledge according to the DKQ-24 was 12.70 ± 2.91 . Only the time since DM diagnosis was associated with patients' knowledge level ($p=0.015$). Furthermore, the other characteristics did not have a significant association with the knowledge level ($p>0.05$; Table 1).

Table 1. Frequency of demographic characteristics of patients with diabetes mellitus (n=155)

Parameter	Values	Knowledge level			p-Value
		Low	Medium	High	
Age (year)	45	2(1.30)	0	1	0.103
	45-54	15(9.70)	2	12	
	55-64	74(47.70)	9	59	
	≥65	64(41.30)	11	52	
Gender	Male	53(34.20)	6	42	0.317
	Female	102(65.80)	16	82	
Education	Having no formal education	2(1.30)	1	0	0.213
	Elementary school	26(16.80)	6	19	
	Junior high school	53(34.20)	5	46	
	Senior high school	37(23.90)	8	27	
	College	37(23.90)	2	31	
Occupation	Unemployed	111(71.60)	14	91	0.610
	Private company/public institution	44(28.40)	8	33	
	0	78(50.30)	10	64	
Monthly income (Dollar)	<150.58	43(27.70)	10	31	0.440
	150.58-301.16	24(15.50)	2	20	
	>301.16	10(6.50)	0	9	
Time since diabetes diagnosis (year)	<5	68(43.90)	17	47	0.015*
	5-10	38(24.50)	1	35	
	>10	49(31.60)	4	42	
Diabetes treatment	Single treatment (oral antidiabetic agents Or insulin)	96(61.90)	16	75	0.508
	Oral antidiabetic agents and insulin injection	59(38.10)	6	49	
Comorbidities	Detected	111(71.60)	17	88	0.786
	None	44(28.40)	5	36	
Fasting blood sugar levels (mg/dL)	Low	3(1.90)	1	2	0.466
	Normal	26(16.80)	6	18	
	High	126(81.30)	15	104	

* $p<0.05$.

Table 2. Item difficulty of each item in the 24-Item Version of the Diabetes Knowledge Questionnaire (n=155)

Parameter	Item	Frequency of correct responses	Item difficulty index
Disease	1	26(16.77)	0.83
	12	30(19.35)	0.81
	4	49(31.61)	0.68
	3	52(33.55)	0.66
	11	77(49.68)	0.50
	7	83(53.55)	0.46
	2	96(61.94)	0.38
	6	104(67.10)	0.33
	9	118(76.13)	0.24
Treatment	8	134(86.45)	0.14
	17	37(23.87)	0.76
	13	106(68.39)	0.32
Lifestyle	5	137(88.39)	0.12
	10	14(9.03)	0.91
	24	39(25.16)	0.75
	23	72(46.45)	0.54
	16	75(48.39)	0.52
Complications	18	139(89.68)	0.10
	15	67(43.23)	0.57
	21	82(52.90)	0.47
	22	83(53.55)	0.46
	20	93(60.00)	0.40
	14	123(79.35)	0.21
	19	133(85.81)	0.14

Table 3. Categories of information needs among patients with diabetes mellitus (DM)

Parameter	Frequency of patients who need information	Knowledge level			Information needs	Percentage of information priority
		Low	Medium	High		
Treatment	80(51.61)	5	70	5	Side effects of diabetes drugs	81.29
					Treatment and how to use medication	80.00
					How to control glucose level	76.77
					How to handle side effects of diabetes drugs	23.87
					Recommended herbal medicine	21.29
					How to use herbal medicine	12.90
					Drug storage	3.87
Disease	34(21.93)	14	19	1	Risk factors of DM	91.61
					Type of DM	63.87
					Symptoms of DM	60.65
					Definition of DM	51.61
					Blood sugar measurement	25.81
					Frequency of blood sugar measurement	7.10
					Diet recommendation	88.39
Lifestyle	34(21.93)	3	29	2	Recommended and avoided food ingredients	86.45
					Physical activity recommendations	14.19
					Duration of physical activity	11.61
					Symptom of complication	91.61
Complication	7(4.52)	0	6	1	Type of complication	68.39
					Prevention of complication	33.55
					Treatment of complication	6.45

The three items with the most correct responses were items 18, 5, and 8, which addressed food preparation, diabetes conditions without treatment, and the results of fasting glucose level measurement. According to the four key domains, the participants' responses exhibited distinct item difficulty indices for each question, varying between 0.12 and 0.91. Specifically, item 10 had the highest difficulty score, followed by items 1 and 12, which examined the impact of regular physical examinations on insulin requirements, the consumption of sugar and sweet foods as a cause of DM, and the reasons for insulin reactions (Table 2). Patients who need information regarding disease, treatment, lifestyle, and complications exhibited moderate knowledge (Table 3).

The majority of the pharmacists were women, aged 31-45 years. Only two pharmacists held a master's degree, and almost half had more than ten years of practical experience. A total of 68.75% reported attending training, but only 12.50% reported participating in specialized training related to DM. Other training attended by the pharmacists included pharmaceutical services for health center pharmacy staff, pharmacovigilance, pharmaceutical management, clinical pharmacy, preceptor training, and specialized tuberculosis training (Table 4). The types of services provided by all pharmacists included prescription review and services, as well as education, which encompassed providing drug information and counseling. Other services included monitoring adverse drug reactions (43.75%), drug

therapy monitoring (25.00%), and health promotion (12.50%).

The education provided by pharmacists included various forms of counseling, drug information services, and playing videos in the health center's waiting room. The timing of the education varied,

occurring both when medication was dispensed and during educational sessions. The materials and media used for education also differed. Challenges in implementing education included limited time, staffing, pharmacist skills, and documentation (Table 5).

Table 4. Demographic characteristics of pharmacists (n=16)

Parameter		Values
Age (years)	18-30	2(12.50)
	31-45	11(68.75)
	>45	3(18.75)
Gender	Male	4(25.00)
	Female	12(75.00)
Education	Doctor of pharmacy	14(87.50)
	Master's degree	2(12.50)
Training	Training related to diabetes topics	2(12.50)
	Training other healthcare topics	11(68.75)
Work experience (year)	1-5	6(37.50)
	6-10	3(18.75)
	>10	7(43.75)

Table 5. Education provided by pharmacists at the health centers

Forms of patient education
-Counseling involving patients and their families with the help of leaflets.
-Counseling for first-time diabetes mellitus (DM) patients on proper medication use, including insulin administration and DM medication usage.
-Counseling for DM patients with low adherence motivates them to be more consistent with their medication intake.
-Counseling and direct interaction by listening to patient responses and documenting them with a counseling form.
-Providing drug information in easily understood language, including medication use, adherence to medication, and advising compliance with nutritionist recommendations and routine check-ups.
-Playing health promotion videos related to diabetes mellitus in the waiting room.
Timing of education
-During medication dispensing (prescription service) every time a patient visits the health center for a check-up.
-During medication dispensing and education sessions at every Prolanis (Prolanis is a chronic disease management program initiated by the Indonesia National Health Insurance to improve patient's quality of life) activity or mobile health center visit.
-Whenever a new DM patient picks up their medication.
-Whenever an uncontrolled long-term DM patient is seen or if a DM patient is not adhering to their medication regimen.
-When meeting new or existing patients receiving internal referrals.
Education materials and media
-Using booklets from the Ministry of Health about DM.
-Using leaflets made by the health center, containing information about DM medication, types of DM, DM symptoms, and DM medications.
-Using PowerPoint presentations that cover DM definitions, DM risk factors, side effects, interactions, non-pharmacological therapy, types of DM, DM medications, side effects, and lifestyle.
-Verbally conveying information in simple language that is understandable to the general public.
-Tailoring materials to the doctor's notes.
-Providing information on DM medication, indications, dosage, usage, side effects, signs of hypoglycemia and hyperglycemia and their management, and medication use during fasting.
-Providing additional materials on DM medication interactions and recommending follow-up before the medication runs out.
-Special materials for new patients: DM understanding, types of DM medication, possible side effects and their management, adherence to medication; For long-term patients: Focusing on medication adherence.
Implementation challenges
-Limited time during prescription services due to a high number of patients.
-Limited pharmacy staff, making it difficult to provide specialized counseling.
-Time constraints for pharmacy staff due to heavy routine workloads.
-Most DM patients are elderly and unaccompanied by family members, making it challenging for them to receive and retain education, and difficult to understand the explanations given.
-Pharmacists' limited ability to communicate education in easily understandable language.
-Limited documentation due to a lack of standard documentation procedures and limited staff to record information.
-Limited facilities, such as the absence of a dedicated counseling room.
-Many patients are not receptive, feel they do not need the information, and perceive it as increasing their wait time.
-Inability to monitor drug interactions, monitor for DM medication side effects, and prioritize patients with uncontrolled blood sugar.

Discussion

This study aimed to measure the knowledge level and information needs of patients with diabetes in Yogyakarta City, Indonesia. DM patients in Yogyakarta City had a moderate level of knowledge, a positive outcome attributed to essential information

on diet, exercise, and treatments provided by doctors and pharmacists, with some patients also seeking information online [19]. The DKQ-24 revealed common misconceptions, such as the belief that exercise increases insulin requirements. Better-informed patients are more likely to follow

recommended dietary, exercise, and medication guidelines [20]. Studies in Malaysia, Ethiopia, and Brazil show varying levels of diabetes knowledge and self-care [21-24]. A meta-analysis indicates mixed knowledge levels among Southeast Asian type 2 DM patients [25].

This study found no relationship between age, gender, occupation, income, education, and knowledge level, unlike some previous studies [22, 25-27]. However, there was a significant link between the duration of diabetes and knowledge, as complications often correlate with longer disease duration [22, 24, 25, 28, 29]. Additionally, no significant relationship was found between knowledge level and the number of DM medications, comorbidities, or blood sugar levels, similar to previous studies [29, 30].

The priority information needs were identified based on patient perceptions, where patients selected the information they deemed most important. Knowledge of DM therapy is influenced by the information patients receive. According to Crangle *et al.*, DM management is highly complex and requires diverse information [12].

The top priorities included understanding DM risk factors, the side effects of DM medications, managing a healthy diet, and recognizing symptoms of complications. Many patients lack knowledge in these areas, including chronic complications such as nephropathy, neuropathy, and retinopathy [21, 23, 31].

Despite variations in diabetes knowledge among type 2 DM patients in different studies, all recommend the need for more intensive and continuous health education programs to enhance understanding and improve disease management [20, 21, 23-25].

Pharmacists at community health centers provided education and counseling, although most lacked specialized training in diabetes management. Consequently, education was limited to new patients and those with uncontrolled blood sugar levels during center visits. Studies show that pharmacist-led education and counseling significantly improve clinical outcomes, patient knowledge, and adherence, and reduce complications [32-34].

Educational materials vary, with some sourced from the Ministry of Health and others from community centers, primarily focusing on diabetes and its treatment. These materials need to be updated and standardized for comprehensive reference in education and counseling programs.

Comprehensive educational programs covering diabetes management, medication use, diet, physical activity, self-monitoring, and ongoing counseling can help patients manage diabetes more effectively, reduce complications, and improve well-being [32-34].

Interventions, such as comprehensive medication management, patient education, pharmacist consultations, and health information technology have proven effective in improving patient safety, reducing adverse drug events, and lowering healthcare costs [35, 36].

Challenges for pharmacists included limited time, a lack of dedicated space, and the absence of standardized documentation. Policies are needed to address these issues and promote collaboration between pharmacists and other healthcare providers to deliver integrated and accessible primary care services. The involvement of pharmacists in primary care teams can improve patient outcomes, reduce hospitalization rates, better manage chronic conditions, and increase patient satisfaction [37, 38].

Elderly patients often lack accompanying family members, resulting in suboptimal education. Despite opportunities to provide information, pharmacists face rejection or resistance from patients. Based on this research, we recommend improving educational services through specialized training, updating materials, implementing standardized documentation, and collaborating with other professionals [4, 37].

Considering the challenges in implementing pharmacy services, this research recommends enhancing the quality of educational and counseling services by providing specialized training, updating educational materials to be more comprehensive, implementing standardized documentation forms, and collaborating with other healthcare professionals.

Educational strategies, including training, workshops, and materials, enhance the understanding and application of evidence-based practices. Training programs demonstrate high satisfaction, knowledge improvement, and positive attitudes toward evidence-based practices, preparing participants to adopt these practices and improve the quality of patient care [39].

Collaboration between pharmacists and other healthcare professionals is crucial for service quality, delivering integrated care, managing medications, monitoring side effects, ensuring adherence, and addressing medication-related issues [37, 38].

This study was limited to patients with DM who are registered at health centers in Yogyakarta City. Patients with DM who are not registered at any health centers in Yogyakarta City are underreported and need to be included in future studies.

Conclusion

DM patients in the Yogyakarta City have a moderate level of knowledge.

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Ethical Permissions: Prior to commencing the study, ethical approval was obtained from the Ethical Committee, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Indonesia, number KE/FK/1879/EC/2023. Before the data collection process, they received an explanation of the study. Patients who consented to participate signed the informed consent form and voluntarily filled out the questionnaire.

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