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Affordability of health services and associated factors among patients with diabetes mellitus under regular follow-up at Dessie Comprehensive Specialized Hospital, Northeast Ethiopia

Wubale Gashaw[1], Asnakew Molla Mekonen[1], Anissa Mohammed[2], Yawkal Tsega[1] and Endalkachew Mesfin Gebeyehu[1*]

Abstract

Background The burden of chronic illnesses, including cardiovascular disease and diabetes, is increasing in low- and middle-income countries. However, health systems often struggle to meet the needs of chronically ill patients. Affordability is crucial in ensuring access to quality healthcare for patients with diabetes mellitus (DM) and evaluating healthcare costs. Therefore, this study aimed to assess the affordability of health services and identify associated factors among DM patients receiving regular follow-ups at Dessie Comprehensive Specialized Hospital in Northeast Ethiopia, 2023.

Methods A cross-sectional study was conducted among 392 DM patients at Dessie Comprehensive Specialized Hospital (DCSH) from July 1 to 30, 2023. Data was collected using a structured questionnaire and chart review checklist. Systematic random sampling was employed, and the data were analyzed using EPI INFO version 7 and SPSS version 26. The outcome variable, affordability of health services, was measured by five items using a structured questionnaire. Logistic regression analysis was performed to identify significant factors associated at 95% confidence interval using odds ratio.

Results Most participants were married (74.2%), and 55.9% were male. Among the DM patients, 211 (53.83%) found the health services affordable, with an interval of 48.85–58.72% at a 95% confidence interval with a p-value less than 0.05. Factors significantly associated with healthcare affordability included marital status, family size, average monthly income, and brand prescription.

Conclusion The study revealed that healthcare services were affordable for approximately half of the DM patients. However, this level of affordability falls short of the ideal standard. Improving the affordability and accessibility of

*Correspondence:
Endalkachew Mesfin Gebeyehu
endalkmes12@gmail.com

Full list of author information is available at the end of the article

healthcare services for DM patients, particularly those from low-income backgrounds, is crucial to ensuring better health outcomes.

Keywords Affordability, Diabetes mellitus, Patients, Health services

Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by elevated blood glucose levels resulting from defects in insulin secretion, insulin action, or both [1]. Globally, the prevalence of diabetes has been on the rise, posing a significant public health challenge. According to the International Diabetes Federation (IDF), the global burden of diabetes is substantial and increasing rapidly. In 2019, an estimated 463 million adults were living with diabetes [2] with a significant number of cases in low- and middle-income countries [3]. It poses significant health challenges globally and requires continuous medical care and self-management to prevent acute complications and reduce the risk of long-term complications [4]. In Ethiopia, the burden of diabetes is also increasing, with a prevalence rate of 5.2% among adults aged 20–79 years in 2019 [5]. Therefore, In Ethiopia, it is rising, exerting considerable pressure on healthcare systems and patients' financial resources [6].

Affordability is a function of income, spending, and judgments about the value of goods and services for their price. This brief considers affordability as an economic concept, as a kitchen-table budget issue for individuals and families, and as a threshold in current policy [7].

A fundamental need for nation's at all economic levels is access to affordable basic healthcare.

Global spending as a percentage of Growth Domestic Product (GDP) is still rising, most lately due to the development of potent new treatment regimens for disease cure. These and other very expensive disease treatments are becoming more common, which will have an impact on a wide variety of stakeholders. Few health systems are set up to meet the needs of patients with chronic illnesses, especially those who are underprivileged and have little money to spend on routine care. Because of this, low-income and middle-income countries frequently fail to reduce the rising expense of treating chronic diseases. One of the most common and deadly non-communicable diseases in the world is diabetes (NCDs). It is seen as a major danger to global development and a primary source of mortality, disability, and financial loss [6].

Healthcare affordability is crucial for health system performance and equity, especially in managing chronic diseases like diabetes [7]. Five key measures include Out-of-Pocket Expenditure (OOP), Catastrophic Health Expenditure (CHE), Impoverishment due to Health Expenditure, Health Insurance Coverage, and Affordability Ratio. High OOP can lead to financial strain, CHE causes severe burden, Impoverishment due to Health Expenditure pushes households below the poverty line, and Health Insurance Coverage protects individuals from high costs [8–10].

The prevalence of diabetes mellitus is relatively high which has serious long-term complications and results in significant economic costs for patients and health systems alike worldwide [11, 12]. Determining the affordability of health services for DM patients and identifying factors influencing it is crucial. As far as my search studies conducted regarding this issue are few.

After all this study will provide evidence for different stakeholders regarding the affordability of health services among DM patients, and it will push them to intervene accordingly. Therefore, this study aimed to fill this gap by examining the affordability of health services and associated factors among diabetes patients under regular follow-up at Dessie Comprehensive Specialized Hospital, Northeast Ethiopia.

Methods

Study area and period

Dessie Comprehensive Specialized Hospital, located in Northeast Ethiopia, is a key health facility providing specialized medical services to the region. It serves as a referral center for various chronic conditions, including diabetes. The hospital offers regular follow-up services for patients with DM, aiming to manage their condition effectively through multidisciplinary approaches involving endocrinologists, dietitians, and diabetes educators.

The study was conducted from July 1 to 30/2023.

Study design and participant characteristics

An institution-based cross-sectional study was employed at Dessie Comprehensive Specialized Hospital, Northeast Ethiopia, 2023. All diabetes mellitus patients on regular follow-up at the diabetes clinic in Dessie Comprehensive Specialized Hospital 2023 who were available during the study period were included.

Sample size determination and sampling procedure

The sample size was determined by using the single population proportion formula by considering 36.1% of patients reported essential medicines as affordable in the Ethiopian study [13]. The sample size for the secondary objective has been calculated, and the highest final sample size was taken. The margin of error is 5% at a 95% confidence level by adding 10% of respondents.

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$$n = \frac{\left(\left(Z_{\alpha/2}\right)^2 p\left(1-p\right)\right)}{d^2} = \frac{\left((1.96)^2 \times 0.361(1-0.361)\right)}{(0.05)^2}$$
$$= 355.5 \sim 356$$

Non-response rate: 10% = 36,

   Final sample size (n) = 356 + 36 = 392.
   Where;

- n = sample size.
- Z α/2: Level of confidence at 95%.
- P = population proportion = 36.1%.
- d: Margin of error = 5%.

After all, the final sample size for this study is 392.

Study Participants from the DCSH diabetes mellitus clinic were selected using systematic random sampling. The average number of diabetes mellitus patients on regular follow-up at the diabetes mellitus clinic daily was estimated at 30 patients, and two months were used for data collection (44 working days). The total number of diabetes mellitus patients in the study period was 1320. The K interval was determined by dividing the total diabetes mellitus patients on follow-up by the final sample size of N/n (1320/392), which enabled us to select participants every 4th unit. The starting number was 2 after being drawn randomly, and then participants selected every 4th interval (2, 6, 10, and 14).

Data collection procedure and quality control
The data was gained from face-to-face participants' interviews with Amharic speakers from July 1 to 30, 2023.

The data collection tool was translated into Amharic and then back to English to ensure its consistency. The tool was pre-tested on 10% of nurses at Woldia Comprehensive Specialized Hospital for appropriateness two weeks before the actual data collection. Two BSc nurses were trained as data collectors. The questionnaire has three parts: the first is socio-economic demographic characteristics; the second contains questions about disease and treatment-related factors; and the third is the affordability of healthcare. The tool is adapted from different studies [13–17]. During data collection, the supervisor followed the day-to-day data collection process closely and ensured the completeness and consistency of the interview checklist each day before transferring it into computer software. Problems concerned with data collection were corrected early, and non-overlapping numerical codes were given for each question to enter in Epi-Data Manager version 4.6.

Data processing and analysis
After data collection, the data was checked and entered into a computer using Epi Data version 4.6 and exported to SPSS version 26 for data analysis. Descriptive statistics, including frequencies and percentages, were done for all variables. Initially, univariable logistic regression analysis was carried out to see the association between the outcome and each explanatory variable, and then multivariable logistic regression analysis was computed. Multicollinearity among variables was evaluated using VIF (variables found with VIF < 10), and the Hosmer and model fitness were checked using the HosmeLemeshow test, which was found insignificant (0.44). Variables with P-values < 0.05 in multivariable logistic regression analysis were used to declare a significant association.

Variables and operational definition
Affordability of health service was the outcome variable measured as affordable health service: after computing the sum of the five (0–4) Likert scale-based responses of participants, health service is said to be affordable for patients with a score of mean and below the mean score (4 ± 2.4) of computed values [18]. And non-affordable health service: a health service said to be non-affordable if the patient scores above the mean score (4 ± 2.4) of computed values [18].

Socio-demographic characteristics (age, sex, marital status, level of education, employment status, religion, residence, family size, occupation), economic-related factors (source of finance for care, average transport cost, average expenditure of follow-up, monthly income, monthly follow-up), payment methods (CBHI, OOP, others), and disease- and treatment-related factors (classification of drugs, duration of the disease, family history of DM, types of DM, comorbidity, number of drugs prescribed, additional drugs used, nature of drugs prescription) were the independent variables that affect the outcome variable.

Essential medicines are those that satisfy the priority healthcare needs of a population. They are selected with due regard to disease prevalence, public health relevance, evidence of efficacy and safety, and comparative cost-effectiveness. They are intended to be available in functioning health systems at all times, in appropriate dosage forms, of assured quality, and at prices individuals and health systems can afford [19].

Result
Socio-demographic characteristics of health professionals
Out of them, 219 (55.9%) were males, 137 (34.9%) were aged 46–60 years old and only 73 (18.6%) aged below 30 years. The majority of participants, 291 (74.2%), were married, 140 (35.7%) completed primary and secondary education equally, and 216 (55.1%) were Muslim in religion. The majority of participants (318 (81%) were found to live in urban areas; 163 (41%) had less than 3000 ETB in average monthly income; and 239 (61%) had three or fewer family members (Table 1).

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Table 1 Socio-demographic characteristics of DM patients visiting DCSH, 2022/23 (n = 392)

Variables	Categories	Frequency	
		No	**%**
Sex	Male	219	55.9
	Female	173	44.1
Age	< 30	73	18.6
	31–45	85	21.7
	46–60	137	34.9
	> 60	97	24.7
Marital status	Single	40	10.2
	Married	291	74.2
	Divorced, Widowed, Others	61	15.6
Religion	Orthodox	157	40.1
	Muslim	216	55.1
	Protestant	19	4.8
Educational status	unable to read and write	57	14.5
	primary education	140	35.7
	secondary education	140	35.7
	College and above	55	14.0
Occupation	Merchant	63	16.1
	daily labor	19	4.8
	Gov't employee	81	20.7
	Non-gov't employee	34	8.7
	Others	195	49.7
Residence	Urban	318	81.1
	Rular	74	18.9
Average monthly income	< 3000	163	41.6
	3000–6000	136	34.7
	> 6000	93	23.7
Family size	<=3	239	61.0
	4–6	135	34.4
	> 6	18	4.6

Table 2 Economically related factors of DM patients visiting DCSH, 2023 (n = 392)

Variables	Categories	Frequency	percentage
Payment method	CBHI	259	66.1
	OOP	115	29.3
	Others	18	4.6
Average monthly income	< 3000	163	41.6
	3000–6000	136	34.7
	> 6000	93	23.7
Average expenditure per follow-up	< 200 ETB	239	61.0
	200–400 ETB	88	22.4
	> 400 ETB	65	16.6
Average expenditure per follow-up	< 50 ETB	292	74.5
	50–100 ETB	19	4.8
	100–150 ETB	58	14.8
	> 150 ETB	21	5.4
Source of finance	self-sponsored	307	78.3
	Family	35	8.9
	government or	23	5.9
	NGO and other	27	6.9

Table 3 Drug and treatment-related factors of DM patients visiting DCSH, 2023 (n = 392)

Variables	Categories	Frequency	%
Types of DM	Type 1	162	41.3
	Type 2	230	58.7
Presence of comorbidities	Yes	108	27.6
	No	284	72.4
Family history of DM	Yes	28	7.1
	No	364	92.9
Number of drugs prescribed	One	244	62.2
	Two	65	16.6
	3 and above	83	21.2
type of treatment	Biguanides	202	51.5
	Sulfonylureas	50	12.8
	Insulin	128	32.7
	Mixed	12	3.1
Nature of prescription	Essential	313	79.8
	Generic	69	17.6
	Brand	10	2.6
Duration of disease	< 10 years	370	94.4
	>= 10 years	22	5.6
Number of follow-ups per month	1 time	365	93.1
	> 1 times	27	6.9

Economic-related factors

From the total of 392 DM patients who participated in this study, 259 (66%) of them were community-based health insurance users, 163 (41%) had an average monthly income of less than 3000 ETB, and 239 (61%) had an average expenditure of less than 200 ETB per follow-up (Table 2).

Disease and treatment-related factors

Above half, 230 (58.7%) of the participants had type 2 DM, the majority of participants had no comorbidities, only 28 (7%) of them had a family history of DM; and nearly 313 (80%) of prescriptions were essential, followed by 69 (17.6%) of generic prescriptions (Table 3).

Affordability of health service among DM patients

This study assessed the affordability of health service among DM patients on follow up and who were visiting Dessie comprehensive specialized hospital by using five questions. Among the DM patients, 211 (53.83%) found the health services affordable, with an interval of 48.85–58.72% at a 95% confidence interval with a p-value less than 0.05 and it was unaffordable for the rest 181(46.17%) with 41.28–51.15% confidence interval.

For the first question, are there times when you don't take drugs prescribed by a doctor because of their costs? The majority (290, or 74% of participants) replied that it was rare, and none of them reacted very often. Similarly, 246 (62.8%) of participants reported that they didn't take laboratory tests or exams because of their costs. A relatively higher number of participants decided not to get

health services prescribed by a doctor but not covered by health insurance because of their costs, sometimes 151 (38.5%) and often 40 (10.2%). The majority (344, or 87.8%) of participants revealed that they didn't face difficulty getting health care services because of the additional costs involved (babysitting, parking, etc.) (See Table 4; Fig. 1).

Factors affecting the affordability of health service among DM patients

From socio-demographic factors, only marital status, and religion were variables that were significantly associated with the affordability of health services among DM patients visiting DCSH. The health service was found to be relatively affordable for 56,166 (57%) of married DM patients. With multivariable binary logistic regression

Table 4 Affordability of health service-related questionnaires to diabetes patients at the outpatient clinic of DCSH, north-east Ethiopia, 2023

| SN	Questions	Response				
		Never	**Rarely**	**Sometimes**	**Often**	**Very often**
		Frequency /Percentage	Frequency /Percentage	Frequency /Percentage	Frequency /Percentage	Frequency / Percentage
1	Are there times when you don't take drugs prescribed by a doctor because of their costs?	79/20.2	290/74	21/5.4	2/0.5	0
2	Are there times when you don't take laboratory tests or exams because of their costs?	61/15.6	246/62,8	76/19.4	8/2	1/0.3
3	Are there times when you decide not to get services prescribed by a doctor but not covered by health insurance because of their costs?151/38.5 40/10.2	74/19	121/31	151/38.5	40/10.2	6/1.5
4	Are there times when you find it difficult to get health care services because of the loss of income it involves?	168/43	158/40.3	36/9.2	19/4.8	11/2.8
5	Are there times when you find it difficult to get health care services because of the additional costs it involves (babysitting, parking, etc.)?	344/87.8	44/11.2	3/0.8	1/0.3	0
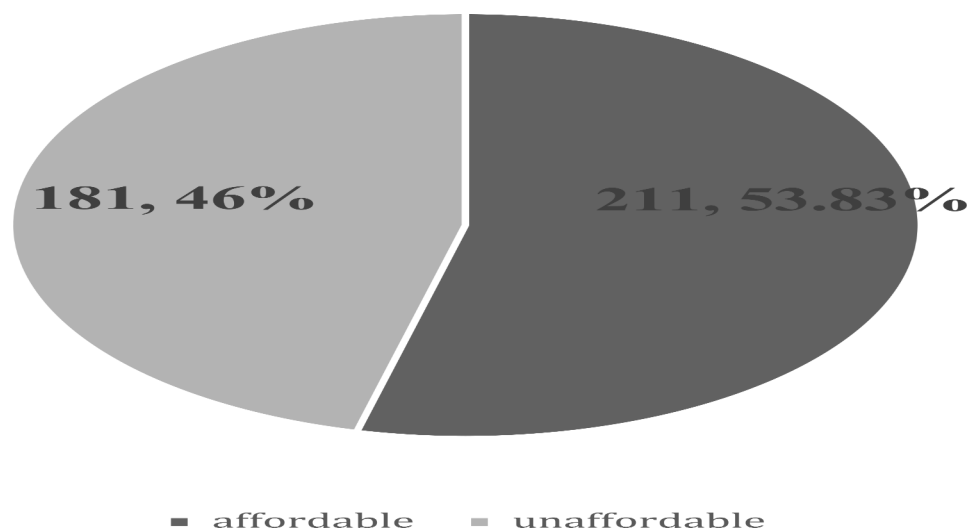
Fig. 1 Affordability of health service among DM patients visiting Dessie comprehensive specialized hospital, Northeast Ethiopia, 2022/2023

analysis, the health service was 76% less likely to be affordable for married DM patients when compared to that of single DM patients (AOR=0.24, 95% CI 1 715, P-value=0.010). The odds of affordability of health service among protestant religion followers DM patients were 4.6 times that of orthodox Christian followers (AOR=4.681, 95% CI 1.145–19.1388, P-value=0.032). The service was affordable for DM patients aged between 3 and −45 years (AOR=4.432, 95% 1.691–11.95% CI 1.691–11.620.6200.002) and 46–60 years (AOR=3.771, 95% CI 1.033–13.768, P-value=0.045) 4.4 and 3.7 times, respectively, when compared to that of DM patients aged below 30 years. The affordability of health services was found to be 60% less likely among DM patients having 4–6 family members when compared to those with DM patients who have three or less family size (AOR=0.401, 95% CI −0.759, P-value=0.005) (Table 5).

Average monthly income, payment method, and average expenditure per follow-up were found significant economical related factors which determine the affordability of health services among DM patients. The odds of affordable health service among DM patients having an average monthly income above 6000 ETB was 3.4 times that of those DM patients having an average monthly income≤3000 ETB (AOR=3.379, 95% CI 1.366–8.363, P-value=0.001). on the other hand, the affordability of health service among DM patients who have an average expenditure of more than 400 Ethiopian birr was found 74% less likely when compared to those who expend<200 ETB per follow-up (AOR=0.236, 95% CI 0.101-0.548, P-value=0.008). Similarly, the affordability of health service among DM patients who were using out-of-pocket payment methods was 84% less likely when compared to those who were using CBHI (AOR=0.157, 95% CI 0.072–0.345, P-value=0.000) (Table 5).

This study demonstrated that there was a significant association between the affordability of health services and the nature of drug prescription and treatment type from variables categorized under disease and treatment-related factors. The health service was affordable 83% and 63% less likely among DM patients with brand prescription (AOR=0.174, 95% CI 0.033–0.917, P-value=0.039) and insulin treatment type (AOR=0.368, 95% CI 0.141–0.961, P-value=0.041) respectively (Table 5).

Discussion

This study aimed to assess the affordability of health services and associated factors among DM patients visiting DCSH 202/2023. Hence, the current study showed that the affordability of health services among DM patients was 53.8% (95% CI, 47.9–58.2). This figure illustrates that the health care service was not affordable for nearly half of DM patients which seeks attention. Global reports from low, middle and high-income countries reflected similar figures and strengthened the fact that healthcare affordability has long been a top concern for patients [2, 19, 20]. Particularly these reports indicate that managing diabetes is an expensive condition [7]. The average annual expenditure of DM patients for treatment of DM in this study was found to be 4100 ETB ($81). It is in line with a systematic search of eight suitable studies carried out in poor and lower middle-income nations which shows type 2 diabetes mellitus treatment expenses ranged from USD 29.91 to USD 237.38 per person annually [5]. The reason behind this similarity might be the nature of the disease and healthcare provision approach across the globe said to be almost similar which made patients invest in the same way and amount. Again the cost of the disease is UN disputable even for patients living in developed countries [19].

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Table 5 Multivariable analysis of the affordability of health service among DM patients visiting DCSH, 2022/23 (*n* = 392)

Variables	Category	Affordability of service		95% C.I.		
		affordable	Non-affordable	COR	AOR	p-value
Religion	Orthodox	82	75	1	1	
	Muslim	122	94	0.534(0.200-1.426)	0.95 (0.554–1.645)	0.866
	Protestant	7	12	0.449(0.170-1.186)	4.68 (1.145–19.138)	0.032
Marital status	single	18	22	1	1	
	Married	**166**	**125**	**0.598 (0.343-0.643)**	**0.24(0.083–0.715)**	**0.010**
	others	27	34	0.971 (0.435-2.165)	0.26(0.068–1.008)	0.051
Family size	<=3	115	124	1	1	
	4–6	**85**	**50**	**1.694(0.635-0.819)**	**0.40(0.212- 0.759)**	**0.005**
	>6	11	7	0.924(0.337-2.538)	0.310(0.085- 1.136)	0.077
Treatment type	Biguanides	102	100	1	1	
	sulfonylureas	32	18	0.700(0.215 − 2.280)	0.46 (0.202–1.087)	0.077
	Insulin	**72**	**56**	**0.402 (0.111-0.852)**	**0.36 (0.0141-0 961)**	**0.041**
	Mixed	5	7	0.556(0.167-1.844)	0.69 (0.121-3.944)	0.676
Average expenditure per follow-up	< 200 ETB	113	126	1	1	
	200–400 ETB	51	37	2.912(1.598–5.303)	0.67 (0.353-1.301)	0.242
	>400 ETB	**47**	**18**	**0.34(0.951-3.772)**	**00.23 (0.101-0.548)**	**0.001**
Payment method	CBHI	124	135	1	1	
	OOP	**80**	**35**	**0.402(0.693-0.943)**	**0.15 (0.072–0.345)**	**0.000**
	Others	7	11	1.44	0.83 (0.247–2.814)	0.769
Average monthly income	<3000 ETB	82	81	1	1	
	3000–6000 ETB	78	58	0.75(0.720-1.999)	1.33 (0.695–2.541)	0.390
	>6000 ETB	**51**	**42**	**0.52(0.531-9.995)**	**3.38 (1.366–8.363)**	**0.008**
Prescription type	Essential	171	142	1	1	
	Generic	33	36	1.31(0.492 − 7.63)	1.30 (0.671–2.503)	0.441
	Brand	**7**	**3**	**0.52(0.608-9.995)**	**0.17 (0.033–0.917)**	**0.039**

The result of this study was higher than that of finding from Eastern Uganda, the health service for the management of DM was affordable for a small number of diabetic patients (5.7%) [21]. This variation might be due to the set-up where the study was conducted. The study in Uganda was conducted at a tertiary care hospital with higher expenditure per prescription (11 USD), the current study was conducted for services to manage DM at the DCSH, it was believed that the charge for health care services at tertiary care centers was relatively higher [22] and parallel to this the affordability of service for patients may decrease.

Again the result of this study was higher than another study conducted locally at Jimma Ethiopia showed that the affordability of essential medicines was only 36.1% [13]. This inconsistency might be due to the difference in target population; the current study was conducted among DM patients while the study at Jimma was conducted among patients diagnosed with DM, hypertension, and other communicable diseases. The average expenditure is supposed to be increased as the number of diseases considered, in line with the affordability of health services for patients with a number of pathological problems might decline.

Age and marital status were among the socio-demographic factors that were significantly associated with the affordability of health services among DM patients visiting Dessie Comprehensive Specialized Hospital. With multivariable binary logistic regression analysis, the service was affordable for DM patients aged between 31 and 45 years and 46–60 years, 4.4 and 3.7 times respectively when compared to that of DM patients aged below 30 years. Again the affordability of health service was found 60% less likely among DM patients having 4–6 family members when compared to those DM patients who have three and less family size.

The finding of this study was supported by a result gained from a systematic review conducted to evaluate the cost of treating type 1 and type 2 DM. The study revealed that age was among the Socio-demographic factors which determine the affordability of DM treatments significantly [5]. Again a study in Thailand reported that age was mentioned as a determinant factor which affects the affordability of healthcare costs for diabetic patients [4]. Another study in Ghana highlighted that older adults are also more susceptible to economic dangers, the senior population is burdened by high healthcare costs and services are not affordable for them [23]. The study conducted at Jimma Ethiopia reported there was a significant association between service affordability and the age of patients. Health service was found affordable for patients aged 30–44 and 45–64 years by those aged 65 years and

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above. Almost all of the studies mentioned above were in line with the current study in this regard. This similarity among these studies might be linked to the state of productivity through age. The age group between 30 and 60 years is the age of productivity when people engage in better-yielding work and put themselves on a stable life [24]. As a result, their productivity enables them to pay for services easily when compared to those above 60 with minimal income, retirement issues, and those aged below 30 which is a period of searching for income sources and struggling for independence.

The socio-demographic factor that was associated significantly with the affordability of health service was marital status as the affordability of health service was 76% less likely for married DM patients when compared to that of single DM patients. In the same way, the study conducted at Jimma showed that being married and single was significantly associated with the non-affordability of health services when compared to widowed patients. The cause for this consistency among these studies and the current study might be patients engaged in marriage were more likely to get a child (the number of dependent families) which will increase their expenses for daily living, as a result, their ability to pay for medical service could decrease and in turn, health services become unaffordable for them.

This study revealed that the average monthly income and payment method were found to have significant economic-related factors which determine the affordability of health services among DM patients. The odds of affordable health services among DM patients having an average monthly income above 6000 ETB ($120) was 3.4 times that of those DM patients having an average monthly income ≤ 3000 ETB ($60). On the other hand, the affordability of health services among DM patients who were using out-of-pocket payment methods was 84% less likely when compared to those who were using community-based health insurance.

Likewise, the study at Jimma revealed that patients having an average monthly income of $ 51–115 and $ 116–170 were associated with affordability of services at p-value < 0.001 when compared to those who have less. These results showed similar figures, the reason behind this might be due to the increased ability of patients to pay for services as their income becomes better.

The current study identified that patients using out-of-pocket payment methods were less likely to afford payment for services. Similarly, payment methods (out-of-pocket) were significantly associated with higher healthcare costs in a study in Thailand [22]. Again, reviews from low and middle-income countries showed that Out-of-pocket expense (OOP) payments are the primary source of healthcare financing and continue to be a cause for non-affordable healthcare costs in LMICs [7].

It may be due to that pocket method exposing them to unpredictable expenses while other payment methods like CBHI makes patients invest in their health with a plan and make service affordable to them as the coast for the service is not determined by number and quality of service they gained (payment done annually regardless of service they will get). This makes them not to worry about payment.

This study demonstrated that there was a significant association between the affordability of health services and the nature of drug prescriptions and treatment types based on variables categorized under disease and treatment-related factors. The health service was 83% less likely among DM patients with brand prescriptions. The study in Uganda showed that affordability went down with the order of drugs by brand [21]. The study mentioned that the percentage of prescriptions of drugs by generic name and from the essential medicine and health supplies list of Uganda was 82.6% and 81%, respectively, and by far it was 17% and 79% in the current study, respectively, which is against the WHO standard of 100% [21]. According to the report from Nepal, the majority of prescriptions were by brands (54.7%) [25]. The link between brand prescription and higher cost might be that drugs with brand prescription will narrow patient's chances of getting drugs with different trade names with consideration of cost and force them to buy the ordered brand only. As a result, patients may not be able to afford the cost of it.

This study mentioned that the health service was 63% less likely among DM patients with insulin treatment types. Similarly, the study in Uganda reflected that patients with insulin therapy were 17.8 times more unaffordable than patients treated with biguanides [21]. Again, medication therapies for type 2 diabetes non-insulin treatment were affordable in the Iranian study [26]. Similarly, a study in Thailand reported that diabetic patients taking insulin had significantly higher healthcare costs [22]. The reason behind this could be the relatively higher price of insulin, which makes it less likely to be an affordable health service [14].

Limitations of this study

Since a cross-sectional study design was used in this study, it can't show us a causal relationship between outcome and explanatory variables.

Conclusion

This study showed that healthcare services at Dessie Comprehensive Specialized Hospital were found affordable for nearly half of diabetes mellitus patients, which was low when compared to the ideal affordability of health services. Age, marital status, average monthly income, payment method, nature of drug prescription,

and treatment type were among the factors that came into play to determine the affordability of health services among diabetes mellitus patients.

Abbreviations

CHE	Catastrophic Health Expenditure
DCSH	Dessie Comprehensive Specialized Hospital
DM	Diabetes Mellitus
EMs	Essential Medications
GDP	Gross Domestic Product
HPs	Health Posts
IDF	International Diabetes Federation
LMICs	Low- and middle-income nations
NCDs	Non-Communicable Diseases
OPD	Out-Patient Department
OOP	Out-of-pocket
SPSS	Statistical Package for Social Science
USD	United States Dollar
WHO	World Health Organization

Data availability

All relevant data are within the manuscript.

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the Ethical Review committee of College of Medicine and Health Sciences at Wollo University, with reference number CMHS/789/2016, on July 1, 2023, and supporting letter was taken from the Dessie Comprehensive Specialized Hospital in the study area. The study was conducted following the ethical principles of the Declaration of Helsinki. This study adhered to ethical guidelines, ensuring the study participants' privacy, confidentiality, and voluntary participation. Written informed consent was obtained from all participants before data collection. Participants were informed of their right to withdraw from the study at any time without any consequences. Confidentiality was maintained throughout the study. The study protocol was submitted to the relevant ethical review committee of College of Medicine and Health Sciences at Wollo University for approval.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Department of Health System Management, School of Public Health, College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia
²Department of Epidemiology and Biostatistics, School of Public Health, College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia

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