BMJ Public Health

Cost-of-illness study among patients with diabetes mellitus and coping mechanisms in Northern Ghana

Andrew Mpagwuni Ziblim ,[1,2] John Azaare ,[2] Robert Bagngmen Bio ,[3] Abdul-Hanan Saani Inusah ,[4] Abdul-Nasir Issah,[2] Martin Hushie [2]

To cite: Ziblim AM, Azaare J, Bio RB, *et al*. Cost-of-illness study among patients with diabetes mellitus and coping mechanisms in Northern Ghana. *BMJ Public Health* 2025;**3**:e001223. doi:10.1136/bmjph-2024-001223

► Additional supplemental material is published online only. To view, please visit the journal online (https://doi.org/10.1136/bmjph-2024-001223).

Received 24 March 2024
Accepted 3 December 2024

[1]Department of Accident and Emergency, Tamale Teaching Hospital, Tamale, Ghana
[2]Department of Health Services, Policy Planning, Management and Economics, School of Public Health, University for Development Studies, Tamale, Ghana
[3]College of Health and Well-Being, Kintampo, Ghana
[4]Department of Internal Medicine and Therapeutics, Upper East Regional Hospital, Bolgatanga, Ghana

Correspondence to
Dr Andrew Mpagwuni Ziblim; andyziblim@icloud.com

ABSTRACT

Introduction The increasing prevalence of diabetes globally imposes financial burden on individuals, societies and health systems. However, not much is known about the treatment costs of diabetes and the coping mechanisms patients adopt in seeking care in the northern part of Ghana. In this study, we assessed the annual direct, indirect and intangible costs of diabetes mellitus care and related coping mechanisms of patients at the Tamale Teaching Hospital's Diabetic Clinic.

Methods This was a descriptive cross-sectional cost-of-illness study conducted between June and August 2023 among 385 patients with diabetes in the Tamale Teaching Hospital of Ghana. Participants were selected by systematic random sampling. Direct medical costs (summation of cost of medications, investigations and admissions) and direct non-medical costs (cost of food and water, and transportation during hospital visits) together made up direct costs per patient per year. Indirect costs (lost wages as a result of illness or hospital visits) were estimated using the human capital approach. Intangible costs were analysed using a 5-point Likert Scale. Cost-coping mechanisms were obtained from the perspectives of the participants.

Results The mean direct cost per person per year was found to be US$159.70 (95% CI 126.70 to 193.04), with direct medical costs being on average US$186.04 and direct non-medical costs being on average US$15.59, while the mean indirect cost per person per year was US$130.72. Average total cost of illness per person per year was found to be US$290.44 (95% CI 248.64 to 334.70). The study participants often experienced intangible costs such as physical pain, easy fatiguability and diet changes as a result of diabetes and adopted a number of cost-coping mechanisms which included the use of savings, borrowing and reducing medication use.

Conclusion The costs incurred for care of diabetes mellitus in Northern Ghana are substantial, especially in view of Ghana's low minimum wage which was US$1.35 in 2023. This results in the adoption of adverse-cost-coping mechanisms that can drive families into further poverty with detrimental effects on the treatment of diabetes.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Diabetes mellitus is a costly disease to manage through high direct and indirect costs.

WHAT THIS STUDY ADDS

⇒ This study provides evidence on the limited knowledge about the cost of illness among patients with diabetes mellitus in northern Ghana, a low-resource setting, as well as the often-neglected intangible costs that pose serious challenges to the treatment of the disease.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE, OR POLICY

⇒ More research should be conducted into the intangible costs of diabetes mellitus, and healthcare providers need to be cognizant of such costs in their practice to promote more effective care for patients. Policy-makers need to pay greater attention to interventions that ease the cost burden of diabetes care on patients.

RECOMMENDATIONS FOR POLICY

Policy-makers and implementers will appreciate the need to institute policies that can ease the cost burden of diabetes management on patients, such as strengthening the National Health Insurance Scheme (NHIS) that majority of Ghanaians rely on for healthcare to prevent catastrophic out-of-pocket healthcare expenditure. Additionally, health practitioners need to be conscious of the psychosocial toll the disease can exert on patients and their families and find ways of dealing with it.

INTRODUCTION

One of the 21st century's urgent worldwide health issues is diabetes mellitus (DM), which is a chronic condition that develops when the pancreas fails to generate enough of the hormone insulin, which controls blood sugar levels, or when the body struggles to use the insulin that is produced.[1]

In 2021, the International Diabetes Federation indicated that about 537 million people were living with diabetes worldwide,

resulting in health expenditures of US$966 billion globally, projected to reach more than US$1054 billion by 2045. The prevalence of diabetes is also increasing in low-income and middle-income countries (LMICs), including those in sub-Saharan Africa (SSA), where an estimated 400 million people had diabetes in 2021, which is expected to rise to 700 million people in 2045. Specifically, in SSA, the prevalence of diabetes has been estimated at 4.5%, which translates to 24 million adults with the disease, with about 416 000 people dying in 2021 with a projected increase to 55 million deaths by 2045.[2]

In Ghana, trends in the prevalence of diabetes do not differ markedly from those of other SSA countries and in 2021, the number of adults with diabetes was estimated at 329 200, having risen from about 32 300 in 2000, with a country prevalence of 2.6% and associated health costs of US$92.00 million. This number is expected to increase to 796 800 by 2045 with costs rising to US$209 million. While earlier studies in the general population have estimated a lower prevalence rate of less than 0.02%, recent figures ranging from 6.2% to 13.9% in the adult population have been documented, which is reflective of the current burden of the disease among adults worldwide. These figures may be understated as an estimated 53.3% of the adult population remain undiagnosed of diabetes.[2–4]

The disease has a significant financial impact on those who have it, their families and society as a whole, in addition to the negative health effects and considerable declines in quality of life. Patients with diabetes do not only incur direct costs of illness from medical care for the condition, its comorbidities and sequelae; an aspect usually covered by social health insurance although with limitations, but they also lose income due to decreased productivity which in extreme cases results in inability to work and leads to a worsened disease state due to the inability to cope with the cost of illness.[5–8]

In many LMICs including Ghana where about 90% of the world's diabetes-related mortalities occur,[2] several diabetes service delivery challenges have been identified. These include high treatment costs arising from hospitalisations, high cost of medications that are often in short supply, the presence of few trained diabetes health professionals and the tendency for individuals to rely on out-of-pocket payments for diabetes care.[9] Thus, a study in Nigeria found that the cost of diabetic medications can range between 72% to 90% of the total costs which must be borne largely by the patient.[10] Moreover, high taxes and markups often placed on imported diabetes medicines such as insulin, which can exceed 500%, tend to increase treatment costs and are often unaffordable by patients.[9] Understanding and estimating the costs associated with diabetes can facilitate the design and adoption of specific interventions targeted at reducing the magnitude and burden of the disease. This is particularly important for countries in SSA that are struggling to achieve universal health coverage.

The cost-of-illness approach used in this study measures costs associated with diabetes care by categorising them into direct, indirect and intangible costs.[11] This approach has been used in numerous studies in high-income countries such as USA and in European countries, with few studies in SSA countries. These studies have found direct costs to be between US$150–14 060 and indirect costs between US$39.60–16 914.[12–14] In Ghana, cost-of-illness studies among patients with diabetes have rarely been conducted. Although some studies in the Southern Belt: Greater Accra, Central and Eastern regions of the country, where better socioeconomic conditions prevail, have found direct costs ranging from US$38.68 to US$390.43,[15–17] much less is known about the costs of diabetes care among patients in the Northern region, one of the poorest parts of the country; this region saw poverty levels decline minimally from 55.7% in 2006 to 50.4% in 2012 compared with a national level decline of 56.5%–24.2% between 1992 and 2013.[18]

This study applied the cost-of-illness approach to estimate the economic burden of the management of diabetes among outpatients receiving care at the Tamale Teaching Hospital (TTH), a tertiary referral facility in the Northern region of Ghana.

METHODS

Study design and setting

This study adopted a descriptive cross-sectional design which was carried out between June and August 2023 at the TTH in the Tamale Metropolis, which is the capital of the Northern Region of Ghana. The region has a population of 2 310 393. The metropolis is one of the 16 districts in the region with a population of 374 744, comprising 185 051 (49.4%) males and 189 693 (50.6%) females.[19]

There are various government and private hospitals in the Tamale Metropolis that see patients with diabetes. The TTH, this study's site, is the third largest hospital in Ghana and the heart of healthcare delivery in Northern Ghana, serving as a specialist referral hospital for 6 (Northern, Savanah, North East, Upper West, Upper East and Oti) out of the 16 regions in the country, providing an access point for secondary and tertiary healthcare. The hospital runs a specialist outpatient department (OPD) diabetes clinic, attending to an average of 211 new diabetic patients monthly. Ghana's NHIS which seeks to provide universal health coverage, is funded from various levies and other income taxes and partially covers the costs of diabetes care for patients. Payments for diabetes care more generally can also be made through private health insurance companies and out of pocket.

Study population and sampling

Patients with DM were recruited using a systematic random sampling technique. The register of patients with diabetes at the TTH between June and August 2023 containing 581 individuals was used as the sampling frame. A sampling interval k was calculated by dividing the population of 581 by the calculated total sample size, 387. k in this case was 1.5, rounded up to 2. A starting

point was to randomly select the first patient from the list and then using a sample interval of 2 for selecting subsequent patients until the list for that day was exhausted. This process was continued on each consecutive diabetes clinic day until a sample size of 385 was obtained.

The inclusion criteria were patients with diabetes attending the TTH for regular follow-up after being medically diagnosed for the first time or as a referral case from other health facilities in the last 1 year or more. These criteria were adopted in line with the prevalence-based cost-of-illness approach which involves measuring the total costs of an illness or disease within a specified time period, typically 1 year, irrespective of when the disease first occurred.[11]

Pregnant women with diabetes were excluded given the chances their diabetes might be due to gestational factors rather than a known pre-existing diabetes. Moreover, patients deemed to require urgent medical attention or emergency treatment such as those presenting with hypoglycaemia or diabetic ketoacidosis were also excluded.

Patient and public involvement

The patients were involved in this study from the conceptualisation stage, where their opinions were sought on how important data on cost of their illness might be in easing any financial burden they experience as a result of their diagnosis. The research questions were developed with the patients in mind, and the questionnaire was drawn up, pretested and finalised, bearing in mind their expectations and experiences in this particular setting. Respondents were not required to assess the time spent in participation. They were given the opportunity to leave their contact information for sharing the results of the study if needed.

Data collection

A structured questionnaire using Google electronic forms was used for data collection. The questionnaire included questions on participants' sociodemographic characteristics, health history, cost of illness (ie, direct, indirect and intangible) and coping mechanisms. The cost-of-illness data were obtained from the perspectives of the patients.

Data analysis

The data were entered into Microsoft Excel 2021 and exported to the Statistical Package for the Social Sciences (SPSS) V.27 for analysis of means and frequencies and presented using tables. The total cost of illness was assessed in three major categories namely: direct costs and indirect costs which were measured in monetary terms, and then intangible costs which were determined qualitatively from the view of patients.

Direct costs were measured by obtaining the direct medical costs which are as follows: cost of medications, admissions and medical investigations over the last year, and the direct non-medical costs which are as follows: transportation to the health facility and food and water per hospital visit. These costs were obtained per patient over a year based on their recall by multiplying their estimated average amount spent per visit by number of hospital visits over the previous year as in the case of food and transportation, or by multiplying the costs incurred in the last month by 12 months as in the case of medications.

Indirect costs were determined by estimating the hourly wage of the respondent and placing a monetary value on the time they spent away from work due to illness and hospital visits by multiplying the hourly wage by number of hours off work. An assumption made here was that monetary value could be attached to the time of all employed respondents, and that anyone who was not working had none. Furthermore, in line with the human capital approach, it was assumed that a person who was visiting the hospital for diabetes-related care at any point in time or staying away from work due to diabetes illness was losing earnings or wages. All monetary data were collected in the Ghanaian Cedi and then converted to the United States Dollar using the August 2023 Bank of Ghana exchange rate of 11.01 Ghanaian Cedis to 1 United States Dollar.

Intangible costs were analysed using a 5-point Likert Scale that asked respondents about costs such as their self-esteem, enjoyment of hobbies, changes in diet and overall quality of life.

Cost-coping mechanisms were obtained from the perspectives of the respondents.

RESULTS

Respondent sociodemographic characteristics

Table 1 shows that a total of 385 participants (n=385) responded to the questionnaire (online supplemental file 1), representing a 99% response rate. Female respondents were in the majority, 266 (69.1%) compared with men 119 (30.9%). Majority of the study participants were in the age range of 55–64 years *n* 116 (30.1%). Moreover, a total of 296 (76.9%) of the study participants were from 45 to 74 years old. In all, 176 (45.7%) had no formal education while 94 (24.4%) had tertiary education. Of the total participants, 249 (64.7%) were employed, with 103 (26.8%) engaged in trading, and 84 (21.8%) being civil servants. More than half of the study participants (86.8%) resided within an urban area. Moreover, the majority 253 (65.7%) of the participants were Muslims and 284 (73.8%) were married. Of the total participants, 152 (39.5%) had at least one complication or comorbidity such as hypertension or diabetic nephropathy, retinopathy or neuropathy. All participants (100%) were insured with Ghana's NHIS. Study participants on hypoglycaemics were mainly on a combination of metformin and at least one other hypoglycaemic agent 358 (93%). Some were on metformin only, 23 (6%), and few others on insulin only, 4 (1%). A fourth of participants, 97 (25%), were on at least one antihypertensive medication, and 18.4% were on other medications such

Table 1 Sociodemographic and clinical characteristics of study participants; n=385

	Frequency (%)
Age	
18–21	2 (0.5)
25–34	11 (2.9)
35–44	22 (5.7)
45–54	90 (23.4)
55–64	116 (30.1)
65–74	90 (23.4)
75 or older	54 (14.0)
Religion	
Christianity	127 (33.0)
Islam	253 (65.7)
African traditional religion	4 (1.0)
Other	1 (0.3)
Education	
None	176 (45.7)
Primary	36 (9.4)
JHS	23 (6.0)
Secondary/technical/vocational	56 (14.5)
Tertiary	94 (24.4)
Residence	
Urban	334 (86.8)
Rural	51 (13.2)
Marital status	
Single	23 (6.0)
Married	284 (73.8)
Widowed	71 (18.4)
Divorced	7 (1.8)
Employment status	
Unemployed	136 (35.3)
Employed	249 (64.7)
Occupation	
Farming	52 (13.5)
Artisanship/business/private work	11 (2.9)
Trading	103 (26.8)
Civil servant	84 (21.8)
Other	17 (4.4)
Comorbidities/complications	
Comorbidities	151 (39.2)
Complications	26 (6.8)
Comorbidities and complications	152 (39.5)
None	56 (14.5)
Type of medication	
Metformin only	23 (6.0)
Insulin only	4 (1.0)
Metformin and other hypoglycaemics	358 (93.0)
Antihypertensives	97(25)
Others	71 (18.4)
Insurance status	
Yes	385 (100)

Others defined (*Furosemide, Clopidogrel, Atorvastatin, Pregabalin*).

as lipid-lowering agents, diuretics, pain medication and antiplatelet agents.

Direct and indirect cost of illness

Table 2 shows that total cost of medications was GH¢418 416 (US$38 003.27) with a mean of GH¢1086.80 (US$98.71). This was found to be the largest component of the total cost profile (61.8%) for patients. On average per year, laboratory tests cost GH¢338.17 (US$30.71), transportation cost was GH¢131.52 (US$11.95), admission fees cost GH¢623.30 (US$56.61), and food and water cost GH¢40.21 (US$3.65). The mean direct medical costs (medication, laboratory investigations and admission costs) were GH¢2048.27 (US$186.04) while the mean direct non-medical costs (transportation, food and water costs) were GH¢171.63 (US$15.59). The total mean direct cost of DM was GH¢1758.34 (US$159.70).

Table 3 shows that the total indirect cost of illness of DM is GH¢554 101.60 (US$50 327.12) with GH¢1439.22 (US$130.72) as the mean cost per individual.

The total cost of illness of DM per patient per year is mean GH¢3197.82 (95% CI 2737.58 to 3685.05) and median GH¢2020.00 (920 to 3874.8) (online supplemental table 1).

Intangible cost of illness

Table 4 presents the findings on the intangible costs of diabetes management to study participants. Majority of the participants, 299 (77.7%) responded that they experienced physical pain in relation to DM. Moreover, while 18 (4.7%) of the study participants felt that diabetes affects their self-confidence, 354 (91.9%) thought the disease had no impact on their self-esteem. In addition, 310 (80.5%) of the participants agreed to experiencing easy fatiguability due to the disease. Majority of the study participants 365 (94.8%) also reported modifying their diet following a diagnosis of DM. Finally, 243 (63.2%) reported experiencing a good or very good quality of life following a DM diagnosis.

Cost-coping mechanisms

Table 5 presents the findings on the cost-coping mechanisms patients adopt to deal with the costs following their diagnosis of DM. Study participants reported adopting multiple cost-coping measures when seeking treatment for DM. Majority 310 (39%) use cash at home, while 162 (20%) use their savings. Furthermore, 78 (10%) reported reducing food expenditure to enable them afford care, while 85 (11%) reported skipping some doses of their medication for it to last over a longer period. Additional cost-coping mechanisms among patients were found to include selling off of their property (6%), taking bank loans (2%) and resorting to alternative treatments (3%).

DISCUSSION

Managing DM poses a serious economic burden to individuals, families, communities and healthcare systems in low-income countries. This study provides evidence on

Table 2 Direct cost of illness

Cost item	Cost (GH¢)	Mean (95% CI)	Cost percentage (%)
Direct medical costs			
Medicines	418 416	1086.80 (767.27 to 1406.38)	61.8
Laboratory tests and imaging studies	130 196	338.17 (223.96 to 452.38)	19.2
Admission fees	62 330	623.3 (408.77 to 837.83)	9.2
Direct non-medical costs			
Transportation	50 598	131.42 (102.11 to 160.74)	7.5
Food and water costs	15 439	40.21 (34.92 to 45.28)	2.3
Total	676 979	1758.34 (1393.52 to 2123.45)	100

the costs of managing DM in Ghana from the perspective of patients and shows that many individuals with diabetes not only incur direct costs due to the disease, but they also lose income, bear adverse psychosocial effects and engage in various cost-coping mechanisms that may prove inimical to the treatment of the disease.

Generally, the results show that DM was more prevalent among women (69.1%) which conforms with previous studies in Ghana and elsewhere that report between 68.6% and 80% prevalence among women and may reflect the higher rates of health-seeking rates among women, as this study is a hospital-based one.[4 10 16 17 20] This finding however contrasts with global estimates in which the prevalence of diabetes tends to be higher in men than women.[2] The high prevalence among women could be explained in part by the hormonal differences between men and women, which contributes to obesity in women and the resultant diabetes risk as well as lean muscle mass, fat deposition around internal organs, and the phenomenon of menopause and its biochemical effects, all of which vary between the sexes.[21 22]

The prevalence of diabetes was also found to increase with age, with the highest number of patients with diabetes being between the ages of 45 and 75, similar to previous studies which found most patients with diabetes within this age bracket to suggest that type 2 DM tends to be a disease of the older population.[2 20]

Moreover, this study found that about one-third of the participants had hypertension as a comorbidity in line with previous studies which reported hypertension as a common comorbidity in patients with diabetes, as part of the so-called metabolic syndrome.[23 24]

Regarding treatment, this study found metformin to be both the first-line medication for type 2 diabetes (93%) and the most commonly used hypoglycaemic agent similar to other studies. This is because apart from the fact that it has traditionally been used as the first-line pharmacological agent to treat type 2 DM, it is also affordable and easily tolerated.[17 25 26] Although there was a lack of records differentiating the diagnoses of type 1 and type 2 DM in the study sample, this finding suggests that majority of the respondents have type 2 DM, and this supports the fact that type 2 DM is more prevalent and affects the older population more.

Furthermore, almost all the patients in a study in Ghana[27] reported that they paid for their diabetes care mostly through the NHIS which is in agreement with this study's finding in which 100% of participants reported relying on the NHIS membership which subsidises specialist consultation costs, some investigations and fully covers some medications. This serves as a factor that helps manage the disease, as it is known that cost of illness can prove detrimental to the prognosis of DM.[28]

The mean total annual cost of illness in this study was found to be GH¢3197.82 (US$290.44), which does not differ much from the range of US$29.91 to US$237.38 that was found in a systematic review that analysed studies conducted within Ghana.[29] However, a study conducted in Pakistan found total cost of illness to be US$740.1,[30] which is considerably higher than what was found in this study. The findings also contrast with a study conducted in Cape-Coast, a city in the southern part of Ghana, which estimated the total average annual healthcare management cost per patient as US$1207.80,[17] compared with the US$290.44 found in the current study. While significant, the differences in exchange rates in 2017 (US$1=GH¢4.4) and August 2023 (US$1=GH¢11.01) could account for the dramatic difference in the management cost per patient.
[2728]

Table 3 Total indirect cost of illness

Cost item	Sum total (GH¢)	Mean (95% CI)
Valued productive workdays lost due to hospital visits	256 187.2	665.42 (614.96 to 715.88)
Workdays lost due to illness	297 914.4	773.50 (519.50 to 1028.09)
Total indirect cost	554 101.6	1439.22

Table 4 Intangible cost of illness

Categories on Likert Scale	N (%)
Reduced enjoyment of hobbies post diagnosis	
Strongly disagree	270 (70.1)
Disagree	68 (17.7)
Neutral	16 (4.2)
Agree	12 (3.1)
Strongly agree	19 (4.9)
DM-related physical pain	
Strongly disagree	47 (12.2)
Disagree	20 (5.2)
Neutral	19 (4.9)
Agree	93 (24.2)
Strongly agree	206 (53.5)
DM impacting on self confidence	
Strongly disagree	247 (64.2)
Disagree	88 (22.9)
Neutral	32 (8.3)
Agree	13 (3.4)
Strongly agree	5 (1.3)
DM impacting on self-esteem	
Strongly disagree	285 (74.0)
Disagree	69 (17.9)
Neutral	19 (4.9)
Agree	8 (2.1)
Strongly agree	4 (1.0)
Easy fatiguability due to DM	
Strongly disagree	49 (12.7)
Disagree	10 (2.6)
Neutral	16 (4.2)
Agree	96 (24.9)
Strongly agree	214 (55.6)
Diet modification post diagnosis	
Strongly disagree	11 (2.9)
Disagree	6 (1.6)
Neutral	3 (0.8)
Agree	44 (11.4)
Strongly agree	321 (83.4)
DM-related irritability	
Strongly disagree	233 (60.5)
Disagree	80 (20.8)
Neutral	39 (10.1)
Agree	24 (6.2)
Strongly agree	9 (2.3)
Quality of life	
Very poor	3 (0.8)
Poor	40 (10.4)
Neither poor nor good	99 (25.7)
Good	155 (40.3)
Very good	88 (22.9)

Table 5 Cost-coping mechanisms

Cost-coping mechanism	Frequency	Per cent (%)
Use of cash at home	310	39
Use of savings	162	20
Loans from family and friends	56	7
Sale of property	47	6
Bank loans	18	2
Reduced food expenditure	78	10
Skipping scheduled doses	85	11
Resorting to alternative treatment	23	3
None	18	2

Other studies have also documented relatively higher direct costs of illness than indirect costs[14 16] similar to the findings in this study where the mean annual direct cost of GH¢1758.34 (US$159.70) contrasted with a mean annual indirect cost of GH¢1439.22 (US$130.72). For example, the direct cost of DM was GH¢1491.55 (US$129.42) in a Ghanaian study which was comparable to the GH¢1758.34 (US$159.70) found by this study.[16] Furthermore, the component of medications accounted for 61.8% of the total direct cost in this study which was closely reflective of the about 65% of two studies conducted in Ghana while medications accounted for 68% of the total direct costs in Nigeria[31 17 29]. The US$159.70 mean annual direct cost found in this study is about a third of the US$423 per person per year reported in a systematic review that looked at the average cost in Africa.[32 31] Another study found that investigations and transportation accounted for 4.0% and 6.8% respectively, which did not take up a significant share of the direct cost, as seen in this study where the figures were 19.2% and 7.5%; the difference being the relatively higher cost of transportation that was found.[17] The relatively lower amount spent on investigations of such a chronic disease is likely due to the fact that these investigations are not conducted on every visit; some of them, such as glycated haemoglobin tests, are typically ordered every 3–6 months. Furthermore, the NHIS heavily subsidises routine investigations such as full blood count, random blood sugar tests and renal function tests. A study in Nigeria however had a more similar cost profile of investigations (17.6%).[10] These findings show that the direct cost of illness is largely driven by the cost of medications and investigations, and that the variation between jurisdictions could be attributed to the various costs of medications, investigations and transportation that result from different healthcare systems, taxation regimes and general living standards.

Mean indirect costs per person per year is GH¢1439.22 (US$130.72) and this amount made up 45% of the total cost of illness of DM, a smaller percentage compared with the direct cost. This is in agreement with a number of studies,[30 33] and one reason why this amount is quite high is that some people earn more, and so they lose

more when they are away from work. Globally, indirect costs accounted for 34.7% of total cost of DM, and this closely reflects the 45% proportion found in this study. Notwithstanding the indirect cost being less than the direct cost, a 45% proportion is a noticeable one and could be explained by the long waiting times in the hospital (average of 6 hours per visit), and the significant morbidity burden that DM places on patients, causing them to lose income through time off work. Indirect costs were found to account for one-fifths to three-fifths of total cost of illness and the findings of this study fall in this bracket.[6]

The findings of a study in Ghana[17] are in contrast with those of this study in terms of the proportion of the total cost that is indirect cost; that study found indirect cost to make up only 6.3%, which is significantly less than the 45% found in this study; the number of productive days lost according to the findings of this study were 703 versus the 304 days in that study. This could be accounted for by the differences in socioeconomic activities, geographical differences and differences in scope of cost between the studies.

There is also significant intangible cost burden, with respondents reporting a variety of physical and psychological burdens as a result of the disease such as pain, the need for diet modifications and irritability. A study in 2022 revealed that 82.4% of respondents had to modify their diet due to the disease, which is similar to the 94.8% figure in this study.[33] This is because diet modification is one of the cornerstones of DM management.[25] The findings of this study show that the intangible costs pose a significant aspect of the cost of illness, with the disease having a hard-to-measure impact on comfort, diet, emotional state and interpersonal relations[34]; more specifically, this study found that there was less impact of the disease on the self-worth and enjoyment of hobbies on the respondents and more on their diet, levels of pain and fatiguability. The study showed that 77.7% thought that the disease caused them to have physical pain. This is consistent with a study that showed that people with diabetes have a higher incidence of physical pain that can lead to anxiety, depression and sleep disturbances.[35] Almost all the study participants (91.9%) reported that the disease did not affect their self-esteem. Although this study did not examine the level of glycaemic control of the participants, it is in agreement with the findings of a study in 2011 that showed that individuals with diabetes typically had good self-esteem particularly when there is adequate glycaemic control.[36]

The current analysis shows that patients with diabetes adopted more than one coping mechanism including the use of savings, borrowing and skipping scheduled doses of medications. A recent study in 2022 found that patients with diabetes worked more hours to enable them afford care, and this is similar to what has been reported in the current analysis.[27] In addition, this study's finding of participants (14%) skipping medication doses and using alternative treatments as a response to high cost of illness has been reported elsewhere, making the cost of illness of type 2 DM a major factor that adversely affects the health-seeking behaviour of patients.[28]

A study found that in Ghana, borrowing and selling of assets were the two most used coping mechanisms and they accounted for 40% of all coping mechanisms. This contrasts with this study that found the combined percentage of those two variables to be 13%.[37] A study conducted in Nigeria also found that, in response to cost of DM, households resorted to use of household savings and borrowing from relatives and friends; 99% and 85.3%, respectively. This is much higher than the 20% and 7%, respectively, found in this study.[38] These observations could be attributed to the different spending patterns in different jurisdictions, where the people in this part of the world might be more averse to borrowing money for healthcare and be more reliant on their household cash or savings. One study found that patients with diabetes were more likely to report spending less on basic needs such as food in order to afford medications; this study found that 10% of patients with diabetes engaged in this coping mechanism.[39] A substantial 11% of participants reported that they sometimes skip scheduled doses of their medication so that it can last a set period of time; this means that about one in ten patients with diabetes are treating the disease suboptimally in terms of drug compliance due to affordability and this could lead to complications and cost escalation.

A study in Kenya found that patients sometimes borrow (23.3%) from friends or family, sell off property (29.9%), or use savings (36.8%) to pay for care of DM. This study also found similar coping mechanisms of borrowing, selling of property and using savings: 7%, 6% and 20%, respectively, but they were in different frequencies, which shows a different pattern of coping mechanisms.[26]

Limitations

This study has some limitations. In measuring the cost of illness, it uses the human capital approach which has the propensity to overestimate intangible costs as compared with the friction method which may give a closer estimate. Also, the study did not take into account 'presenteeism' (being at work but being less productive) and premature mortality in its assessment and estimation of indirect cost; it only measured absenteeism (being away from work due to illness) leading to a further possible underestimation of the indirect costs of illness.

Furthermore, the indirect costs incurred by caregivers of the clients with diabetes were not taken into account and this could result in an overall underestimation of the costs.

In addition, the study was limited in the sense that it only recruited patients that presented at the OPD and hence were stable as opposed to those who present at the hospital through the emergency department. This

latter group of patients may have unique cost considerations not experienced by the relatively stable outpatients.

Finally, the results of this study may not be necessarily generalizable even within Ghana due to sample size as well as cost variability.

CONCLUSION

DM is a lifelong and progressive disease that can result in multiple complications posing a serious cost burden to patients. Although the annual direct costs of managing DM were found to be marginally higher than annual indirect costs due to the relatively high cost of medications not covered under the NHIS and high cost of transportation and food among others, both constituted significant economic burden for patients. Intangible costs of the disease such as pain, fatigue and irritability were found to be substantial and may explain the significant amount of physical, mental and emotional strain patients experience due to the disease. Moreover, as a result of the considerable annual costs associated with managing DM, individual and household savings can become eroded, thus plunging families into debt and worsening the state of the disease. Ghana's non-communicable disease policy which prioritises disease prevention can be made more comprehensive to include measures that reduce the cost burden of diabetes, as this is necessary for improving the health outcomes of patients and achieving universal health coverage in resource-limited settings. Furthermore, in view of the fact that a large percentage of cost comes from medications and investigations, the Government of Ghana, through the NHIS, should prioritise expanding coverage to ensure all these costs are absorbed in order to reduce the cost burden on patients and their families. Finally, cost can be reduced when people with diabetes are targeted for detailed education on medication adherence, diet and self-glucose monitoring to minimise frequenting the hospital.

X Andrew Mpagwuni Ziblim @bauz_shady

Contributors AMZ, JA and RBB conceptualised and designed the study. AMZ collected and analysed the data, and drafted the manuscript. JA, MH, A-HSI and A-NI screened the data, critically revised the analysis and discussed the results. All authors read and approved the final manuscript for publication. AMZ accepts full responsibility for the finished work and/or the conduct of the study, had access to the data and controlled the decision to publish.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by Ethical clearance No. CHRPE/AP/473/23 from the Committee on Human Research, Publications, and Ethics of the Kwame Nkrumah University of Science and Technology, Ghana. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

ORCID iDs
Andrew Mpagwuni Ziblim http://orcid.org/0009-0000-6428-6288
John Azaare http://orcid.org/0000-0001-7167-8175
Robert Bagngmen Bio http://orcid.org/0000-0001-8552-5188
Abdul-Hanan Saani Inusah http://orcid.org/0009-0007-4483-2473
Martin Hushie http://orcid.org/0000-0001-6127-4150

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