Analysis of the Financial Cost of Diabetes Mellitus in Four Cocoa Clinics of Ghana

Ernest Attuquaye Quaye, BPharm, MPH[1],*, Edward O. Amporful, BPharm, MSc[1], Patricia Akweongo, PhD[2], Moses K. Aikins, PhD[2]

[1]Medical Department, Ghana Cocoa Board, Accra, Ghana; [2]School of Public Health, University of Ghana, Legon, Accra, Ghana

A B S T R A C T

Objective: To estimate the financial cost of managing diabetes mellitus in four Cocoa clinics of Ghana. **Methods:** A descriptive cross-sectional study of diabetes management was carried out in the four Cocoa clinics of Ghana from January to December 2009. The "cost-of-illness" approach from the institutional perspective was used. A pretested data extraction form was used to review the medical records of 304 randomly selected diabetic patients. **Results:** The patients' mean age was 55.4 ± 9.4 years. The mean annual financial cost of managing one diabetic case at the clinics was estimated to be Ghana cedi (GHS) 540.35 (US $372.65). Service cost constituted 22% of the cost, whereas direct medical cost constituted 78% of the cost. Drug cost was 71% of the financial cost. The cost of hospitalization per patient-day at Cocoa clinics was estimated at GHS 32.78 (US $22.61). The total financial cost of diabetes management was estimated at GHS 420,087.67 (US $289,715.63). This accounted for 8% of the total expenditure for the clinics in the year 2009. The study showed that facility type, type of diabetes, and presence of complication are associated with the cost of diabetes management to Cocoa clinics. **Conclusions:** The mean age of detection suggests delay in diagnosis of diabetes mellitus and accompanying complications, which has cost implications. Policy that enhances early detection of diabetes in clinical practice would therefore improve management and reduce costs. The financial cost of managing diabetes can be used to forecast the economic burden of the disease in the area.

Keywords: Cocoa clinics, complication, cost-of-illness, diabetes, financial cost, Ghana.

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Introduction

Diabetes mellitus is one of the most common chronic diseases. The number of diabetes cases has been increasing worldwide with a corresponding increase in health care budgets. It has thus become a growing public health burden for patients, health care providers, and society [1–4].

Complications resulting from late diagnosis and late presentation, lack of access to essential medication and services, and poor management of diabetes have created a heavy socioeconomic burden for Africa. Financing health care is one of the building blocks of health systems [5]. External financial assistance is required in the average low-income country to improve access to quality basic health service. More than 75% of the health expenditure, however, comes from domestic sources [6]. Financing of public sector service has gone through several reforms, ranging from out-of-pocket (before independence) expenses to national health insurance (currently) in Ghana. The National Health Insurance Scheme is based on District Mutual Health Insurance Schemes operating in all 145 districts of the country. The National Health Insurance Scheme covers both the formal and informal sectors of the economy with the goal of providing universal health coverage for all Ghanaians. The national coverage as at December 31, 2009, stood at 62% at the time of this study [7–10].

The benefit package consists of basic health care and covers about 95% of the diseases in Ghana. Provider payment methods used by the District Mutual Health Insurance Schemes are the Diagnosis Related Groups for services only and Itemized Fee for Service to pay for medicines on the National Health Insurance Scheme drug list.

Cost-of-illness evaluation of diabetes has been conducted over the past three decades in many countries [11]. The cost-of-illness study has been used for different purposes. It provides estimates of possible health care costs that can be avoided by institutions and society. It is therefore of interest to economists, policymakers, and health service researchers. These estimates have also been used in identifying the burden of disease, possible areas for future intervention, and establishing priorities in health care and research [12]. Although there is no standard method of estimating cost of illness, a novel method has been made the standard: the direct cost and the indirect cost [13]. The resources

used in managing diabetes, such as expenditure for medical care and treatment of diabetes, are the direct economic costs. The potential resources that could be lost and represent the impact, present or future, and the opportunities lost to the individual and the society as a result of diabetes are the indirect economic costs. These are not easily measured or calculated and include morbidity, disability, and premature mortality [11].

Cost-of-illness studies have rarely been conducted in Ghana. According to a report based on Korle Bu Teaching Hospital statistics and patients' accounts, the cost of managing one case of diabetes in Ghana ranged between Ghana cedi (GHS) 167 and GHS 392 in 2001 to between GHS 1200 and GHS 7200 in 2007 [14]. In Mali, it cost approximately US $21.24 and in Zambia US $52 per month for diabetes care [15].

Ghana Cocoa Board has a workplace policy of conducting pre-employment medical examination for its newly employed staff. The medical examination covers screening for diabetes, hypertension, and other disease conditions through diagnostic services and physical examination. The dependents of the newly employed, who are covered by the institution, are, however, excluded from this pre-employment medical examination. Staff and their dependents who suffer from diabetes might have been diagnosed late, probably with complications. Prevention of the onset of diabetes and efficient treatment protocols will reduce cost and enhance quality of life. It is also a way to prevent diabetes from becoming the leading cause of disability and death [16]. An analysis of the cost of managing diabetes mellitus will thus serve as the basis for planning and resource allocation by Cocoa clinics in Ghana and will also provide the evidence needed for early detection and management of the disease.

Methods

Study Site and Population

The government of Ghana, the private sector, traditional non-governmental organizations, civil society, and community groups have been involved in the provision of health services in Ghana. There exist a strong collaboration and partnership with ministries, departments, and agencies whose policies and services have a major impact on health outcomes. The health services are organized in several levels from the subdistrict to the national level and include both clinical and public health services from the private and public facilities.

Ghana Cocoa Board established the Accra Cocoa clinic in 1972 to provide medical services to its staff and their dependents as well as cocoa farmers. It established itself as a provider of good services and was opened to the general public in 2002. There are four clinics currently located in Accra, Kumasi, Akim-Tafo, and Tema. The National Health Insurance Authority accreditation survey in 2006 placed the Accra and Kumasi clinics at the level of a district hospital, the Akim-Tafo clinic at the level of a polyclinic, and the Tema clinic at the level of a health center.

All medical records of diabetic cases were confirmed by a medical doctor. Diabetic cases belong to all age groups and from both sexes. Patients should have been regular for checkup and received treatment from January 1, 2009, to December 31, 2009.

Study Design

The study design was a descriptive cross-sectional survey of cost of treatment of diabetic patients. It was a retrospective quantitative study of the average annual treatment costs using the prevalence-based approach of cost-of-illness study from the institutional perspective.

Data Collection

Data were collected at the four facilities between May and July 2010 using a pretested data extraction form. The extraction form was coded to correspond to a particular medical record for the purposes of auditing and data cleaning.

Sample Size Determination

The medical records of 304 diabetic patients from the four clinics were desk reviewed. This allowed the estimation of patient cost of diabetes management to the clinics at a prevalence of 3.0%, worst acceptable power of 0.05, and confidence interval of 95%. The statcalc function of Epi Info version 3.4.1 (July 2007) was used in estimating the sample size for each clinic.

Sampling Procedure

All the four Cocoa clinics were purposively selected for convenience. Quota sampling was used to select the number of medical records to be reviewed from each facility using the outpatient department (OPD) attendance proportion of diabetic patients, which varied for each facility. A list of diabetic patients who attended the facilities in 2009 was generated by the Practice Manager (version 2, Browse.com) software used at the clinics. Systematic sampling was then used to select each medical record for estimating patient cost. The sample interval was determined, and simple random sampling was used to select the first number in the sample interval.

Cost-of-Illness Analysis

The mean financial cost was the sum of the mean service cost and the mean direct medical cost. The mean service cost was obtained by estimating the unit service cost per patient per OPD visit. The records obtained for the year 2009 from the accountant on expenses made at the cost centers were entered on a spreadsheet. The expenses were categorized into cost on personnel, administrative cost, material and supplies cost, and maintenance cost for each facility. The unit service cost for each facility was estimated using the total service cost at each facility divided by the total OPD attendance for each facility. The total service cost for each diabetic patient was obtained by multiplying the unit service cost for the facility by the number of OPD visits within the year 2009 by the diabetic patient. The direct medical cost for each diabetic patient whose medical record was reviewed was obtained by summing the laboratory cost, drug cost for diabetes and diabetes complications, specialist cost for diabetes care, emergency/ambulance cost related to diabetes services, diabetes-related hospitalization cost, and surgical cost for diabetes complications in the year 2009.

Statistical Analysis

STATA version 10 was used to determine the descriptive statistics of the patients as well as the mean financial cost of diabetes management.

Independent t test was used to analyze association between sexes, type of diabetes, and number of complications. Analysis of variance on means was also conducted to analyze the association between financial cost (dependent variable) and some independent variables such as the age group, type of client, and facility type.

Sensitivity Analysis

In analyzing the uncertainty of the results, one-way simple sensitivity analysis was conducted. The pharmaceutical component of the mean financial cost of diabetes was used because

drug prices in Ghana vary among brand names. The generic brands' average cost price for the year 2009 was used for estimating the mean financial cost of diabetes management because they are widely used at the clinics. The average cost of the ethical brands was used to assess the effect of the mean financial cost of diabetes management on Cocoa clinics.

Results

The average age of the 304 patients whose medical records were reviewed was 55.4 ± 9.4 years, which represents about 75% of the diabetic patients. The minimum age observed was 17 years, whereas the maximum age was 86 years. The number was made up of 167 males and 137 females. There were 184 diabetic patients from Accra, 51 from Akim-Tafo, 45 from Kumasi, and 24 from Tema facilities.

The total financial cost (cost of medical services and medical supplies) for the four facilities for the year 2009 was approximately GHS 5.3 million (US $3.7 million). The total number of OPD visits recorded was 249,029, with 776 visits by diabetic patients. The average unit cost of OPD service (per visit) was estimated at GHS 14.05 (US $9.69). However, this varied for each facility (Table 1). Although the total medical service cost for Accra constituted about 65% of the total cost for all facilities, it had the lowest unit service cost of GHS 12.02 (US $8.29) per OPD visit because of the high OPD attendance. The Tema facility, which recorded the lowest medical service cost of 6.3% of the total, with a low OPD attendance recorded the highest unit service cost of GHS 25.59 (US $17.65). Fig. 1.

The mean financial cost per diabetic patient per year at the four facilities was estimated at GHS 540.35 (US $372.65). However, the mean financial cost varied per facility (Table 1). The analysis of variance between the mean financial cost for the facilities indicated that the facility type was significant ($P = 0.018$) in the financial cost of diabetes management (Table 2).

The mean service cost constituted 22% and the direct medical cost constituted 78% of the mean financial cost. Drug cost was 71% of the financial cost, representing the highest cost component of diabetes management to the clinics. The cost of insulin 1000 I.U. to the clinics was GHS 19.25 (US $13.28) on average depending on the type. Drug cost for the management of diabetes complications was about twice the cost for the management of diabetes (Fig. 2). The laboratory investigation cost was about 4% and emergency services, hospitalization, and surgical costs together accounted for about 3%. Those who were attended to by a specialist (dietician, physician specialist, ophthalmologist, or the surgeon) constituted 26%, and most of those who were hospitalized stayed for longer periods, an average of 28.8 days. The cost of hospitalization per patient-day at Cocoa clinics was estimated at GHS 32.78 (US $22.61).

The cost of managing type 1 diabetes at Cocoa clinics is almost twice the cost of managing type 2 diabetes (Table 2). An independent t test of the means ($P = 0.001$) indicated the significance of the type of diabetes mellitus in the financial cost of diabetes. The cost of managing diabetes mellitus with complications is more than twice the amount spent on managing diabetes mellitus without complications (Table 2). This study demonstrated that the type of facility ($P = 0.018$), type of diabetes ($P = 0.001$), and presence or absence of diabetes complications ($P = 0.002$) were significant variables to the financial cost of diabetes to the clinics. The total financial cost of diabetes management to Cocoa clinics in 2009 was estimated at GHS 420,087.67 (US $300,062.62). This constituted about 8% of the total expenditure for the clinics.

Table 1 – Cost of medical services and OPD attendance at Cocoa clinics, 2009.

Facility type	Total medical service cost (GHS) (US $)	Total OPD attendance	Total OPD diabetic patients attendance	OPD service cost per visit (GHS) (US $)	Mean service cost (GHS) (US $)	Mean direct medical cost (GHS) (US $)	Financial cost per patient (GHS) (US $)
Accra	2,259,033.32 (1,557,954.01)	187,996	464	12.02 (8.29)	90.87 (62.67)	510.43 (352.02)	600.74 (415.04)
Kumasi	701,296.98 (483,653.09)	34,228	117	20.49 (14.13)	152.08 (104.88)	298.25 (205.69)	447.40 (308.55)
Tafo	318,621.76 (219,739.15)	18,236	145	17.47 (12.05)	111.67 (77.01)	256.79 (177.10)	368.50 (254.14)
Tema	219,292.31 (151,236.08)	8,569	50	25.59 (17.65)	267.63 (184.54)	351.21 (242.21)	617.95 (426.17)
Total	3,498,244.37 (2,412,582.32)	249,029	776	14.05 (9.69)	117.37 (80.94)	422.98 (291.71)	540.35 (372.65)

GHS, Ghana cedi; OPD, outpatient department.
* The 2009 exchange rate of US $1.00 was equivalent to GHS 1.45.
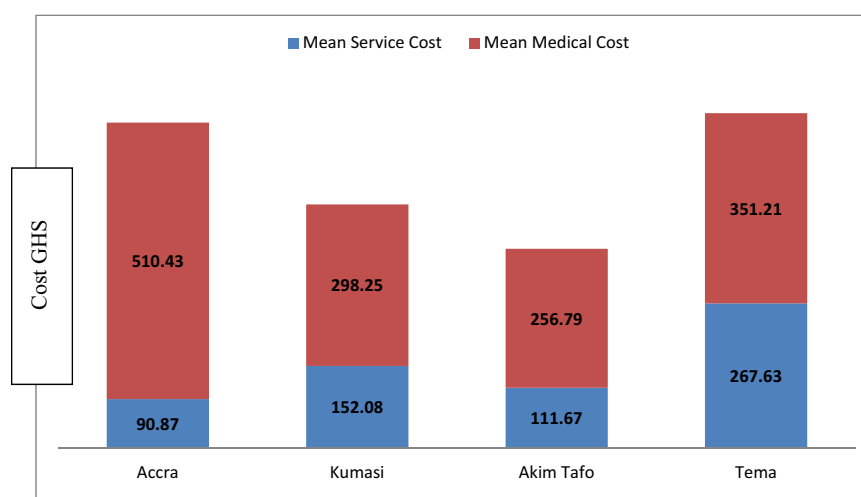
Fig. 1 – Comparison of the cost of diabetes at four Cocoa clinics. GHS, Ghana cedi.

Sensitivity Analysis

In determining the direct medical cost of diabetes, the quantities and corresponding values of generic drugs, glibenclamide and metformin, were extracted from the diabetic patients' records and used for the sensitivity analysis. The cost component for each generic brand deducted from the mean financial cost for diabetes revealed a reduction of 4.4% for metformin and 1.6% for glibenclamide. The cost component for each of the corresponding ethical brands added to the mean financial cost also revealed an increase of 69.4% for metformin and 19.7% for glibenclamide.

Discussion

The management of diabetes is expensive, and the cost affects individuals, families, society, health care providers, and national productivity. This study provides a provider perspective of the cost of managing diabetes. The public health implication of the study is to provide cost-of-illness information for determining the burden of disease and identifying areas for future intervention by policymakers using the cost-of-illness approach. Efforts were made in this study to include the relevant cost components related to managing diabetes mellitus.

The clinical state of the diabetic patient had an influence on the mean financial cost of managing diabetes. Epidemiological data suggest that in most populations at least 50%, and in Tanzania 80% to 90%, of the people with diabetes have not been diagnosed [17]. In Ghana, it has been reported that 69.9% cases of diabetes are undiagnosed as a result of lack of diabetes awareness and thus present late with complications [18]. This has significant cost implications. More than 90% of the patients with diabetes had one or more complications.
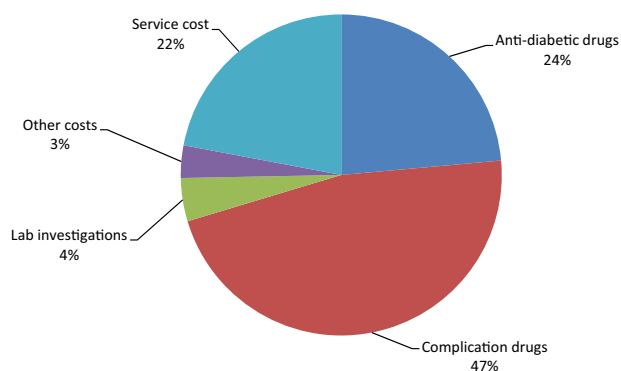
Table 2 – Sociodemographic and clinical characteristics correlated with financial cost of managing diabetes mellitus at Cocoa clinics.		
Socio-demographic Characteristicss	Financial cost (GHS)[*]1 Mean ± SD	P-value
Facility type		
Accra (n = 184)	601.30 ± 617.72	0.018
Kumasi (n = 45)	450.84 ± 360.07	
Akim-Tafo (n = 51)	368.46 ± 215.59	
Tema (n = 24)	618.84 ± 272.45	
Age Group		
<40 (n = 11)	415.88 ± 409.03	0.525
40–59 (n = 198)	562.81 ± 552.62	
60+ (n = 95)	511.15 ± 462.12	
Sex		
Male (n = 167)	581.69 ± 535.73	0.134
Female (n = 137)	492.17 ± 500.10	
Type of Client		
Staff (n = 138)	597.43 ± 608.30	0.546
Dependent (n = 54)	473.30 ± 341.88	
Retired Staff (n = 82)	507.07 ± 583.15	
Insured (n = 21)	478.77 ± 491.36	
Private (n = 9)	506.07 ± 583.15	
Clinical state of diabetes patient		
Type of diabetes		
Type 1 (n = 29)	906.74 ± 591.90	0.001
Type 2 (n = 275)	502.82 ± 498.79	
Complications		
No complication (n = 30)	262.18 ± 152.86	0.002
≥One complication (n = 274)	571.91 ± 537.90	

GHS, Ghana cedi.
* The 2009 exchange rate of US $1.00 was equivalent to GHS 1.45.

Fig. 2 – Cost components of diabetes management to Cocoa clinics.

The financial cost of managing diabetes with complications was more than twice the cost of managing diabetes without complications. Also, treatment of the complications required regular monitoring of some indicators, for example, lipid profile for hyperlipidaemia. The complications also require specialist care and sometimes hospitalization, which were predictor variables in the cost model. The delay in detecting and diagnosing diabetes invariably increases costs of managing diabetes because this causes them to come with complications.

The financial cost of managing type 1 diabetes was about twice the cost of managing type 2 diabetes. The mainstay antidiabetic drug used for type 1 diabetes per the clinics' guidelines is insulin. Regular insulin, NPH insulin, and the 30/70 mixture of regular and NPH were the three main types of insulin on the clinics' formulary at the time of the study. It was observed that some diabetic patients require two or three vials of 1000 I.U. of insulin in a month for managing the diabetes; because insulin is expensive, it adds to the total cost of managing the disease. A study on the diabetes cost model for Thailand reported a similar trend. In the study by Riewpaiboon et al. [1], they estimated the cost for type 1 diabetes without complications at US $502.96 whereas the cost of type 2 diabetes without complications was US $190.07 [1].

However, the financial cost varied for each facility. The variation in the service cost was attributed to the fact that in Tema most diabetic patients attended the facility on a monthly basis, whereas in Accra most attended the facility every 3 to 4 months. Diabetes being a chronic disease requires regular checkup; however, visits to the clinics for diabetes care depend on the effectiveness of the management protocol followed for each patient. Those whose blood sugar levels are well controlled and who are adhering to treatment can visit the facility bimonthly to reduce the service cost component of the financial cost of diabetes. This contributed to the low mean service cost for diabetic patients in Accra. The direct medical cost was almost twice in Accra compared with that in the other three facilities because of the special services available (theater, ward, and specialist care) at the facility.

The largest component of financial cost was accounted for by medicines. Most of the medicines were generic brands, which were relatively cheaper. In our study, the total financial cost of managing diabetes mellitus for Cocoa clinics constituted 8% of the total expenditure, which appears to be high for the 3% of the clients suffering from diabetes, compared with 6% in the study on direct medical costs for patients with type 2 diabetes in Sweden, a developed country with a diabetic population of 3.5% [19].

The results of the sensitivity analysis indicated considerable changes, with a unit change in the drug cost confirming the appropriateness of the parameters selected.

The study did not consider the duration of diabetes and which comorbid condition was first. In estimating the financial cost of diabetes management, the fixed cost was not used and these have been considered as limitations for this study.

Conclusions

Determining the financial cost of diabetes in this study showed useful information relating to the high cost of managing diabetes and the associated complications. The mean age suggests delay in diagnosing diabetes and accompanying complications, which has cost implications. A policy that enhances early detection of diabetes in clinical practice would therefore improve management and reduce costs. The financial cost of managing diabetes can be used to forecast the economic burden of the disease in the area.

There will be a need for the costing of other diseases using the institutional/health care provider perspective. This will provide a basis for comparing the results for policy advocacy. There is also an urgent need for a health policy shift toward prevention and effective control of diabetes through regular screening programs in clinical practice for early detection and treatment. Finally, an economic evaluation study on the prevention of diabetes is recommended.

REFERENCES

[1] Riewpaiboon A, Pornlertwadee P, Pongsawat K. Diabetes cost model of a hospital in Thailand. Value Health 2007;10:223–30.
[2] Ohinmaa A, Simpson S, Johnson JA. The projection of prevalence and cost of diabetes in Canada: 2000–2016. Can J Diabetes 2004;28:116–23.
[3] Wild S, Roglic G, Green A, et al. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care 2004;27:1047–53.
[4] Mohan V, Madan Z, Jha R, et al. Diabetes—social and economic perspectives in the new millennium. Int J Diabetes Developing Countries 2004;24:29–35.
[5] World Health Organization. Everybody's Business: Strengthening Health Systems to Improve Health Outcomes. WHO's Framework for Action. Geneva: World Health Organization, 2007.
[6] World Health Organization. Primary Health Care, Including Health System Strengthening, Report by the Secretariat. Executive Board 124th Session. Geneva: World Health Organization, 2008.
[7] Agyepong IA, Adjei S. Public social policy development and implementation: a case study of the Ghana National Health Insurance Scheme. Health Policy Plan 2008;23:150–60.
[8] Adams I. Implementation of user fee policy in Ghana: a review of the issues (part 1). Inform Action Bull Health Inform 2002;1:3–13.
[9] National Health Insurance Authority. National Health Insurance Policy Framework for Ghana Revised Version. Accra: National Health Insurance Authority, 2004.
[10] National Health Insurance Authority. Annual report. Available from: http://www.nhis.gov.gh/annualreport.aspx_full.pdf/17-06-2012. [Accessed June 17, 2012].
[11] Ettaro L, Songer TJ, Zhang P, Engelgau MM. Cost-of-illness studies in diabetes mellitus. Pharmacoeconomics 2004;22:149–64.
[12] Songer TJ, Ettaro L. Studies on the Cost of Diabetes. Atlanta, GA: Centers for Disease Control and Prevention, 1998.
[13] Drummond MF, O'Brien BJ, Stoddart GL, et al. Methods for the Economic Evaluation of Health Care Programmes (3rd ed). New York: Oxford University Press, 2005.
[14] De-Graft Aikins A. Ghana's neglected chronic disease epidemic: a developmental challenge. Ghana Med J 2007;41:1549.
[15] Azevedo M, Alla S. Diabetes in Sub-Saharan Africa: Kenya, Mali, Mozambique, Nigeria, South Africa and Zambia. Int J Diabetes Developing Countries 2008;28:101–8.
[16] The Diabetes Declaration and Strategy for Africa. A call to action and plan to prevent and control diabetes and related chronic diseases. 2006. Available from: http://www.idf.org/webdata/docs/DiabetesDeclaration&StrategyforAfrica_full.pdf/05-02-2010. [Accessed February 5, 2010].
[17] Whiting DR, Hayes L, Unwin NC. Challenges to health care for diabetes in Africa. J Cardiovasc Risk 2003;10:103–10.
[18] Amoah AG, Owusu SK, Adjei S. Diabetes in Ghana: a community based prevalence study in Greater Accra. Diabetes Res Clin Pract 2002;56:197–205.
[19] Henriksson F, Agardh CD, Berne C, et al. Direct medical costs for patients with type 2 diabetes in Sweden. J Int Med 2000;248:378–96.