SCHOOL OF PUBLIC HEALTH, COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA, LEGON

FINANCIAL COST OF DIABETES MANAGEMENT TO COCOBOD CLINICS, GHANA

BY:

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DECLARATION

I hereby declare that this submission is my own work and to the best of my knowledge and belief. It contains no material which to a substantial extent has been accepted for the award of any other degree or diploma of a university or other institution of higher learning except where due acknowledgement is made in the text.

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DEDICATION

This study is dedicated to Cynthia, my wife and my two lovely girls; Shidaa-Beulah and Yehowada-Keren for their love, prayers, support, encouragement and above all understanding when Daddy had to be away.

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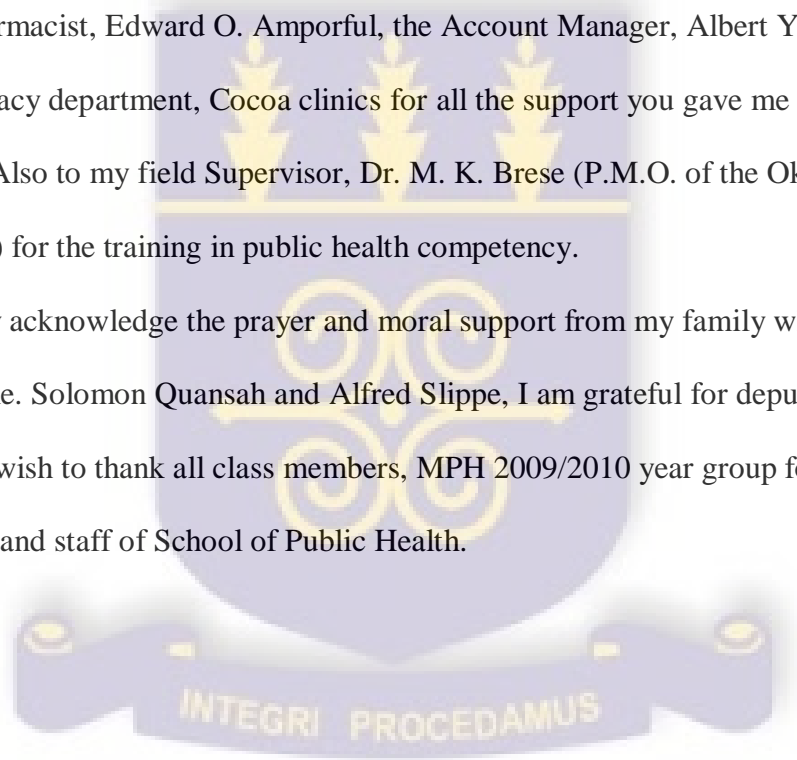
ABSTRACT

BACKGROUND: Diabetes Mellitus (DM) is a serious condition that increases the risk of ill health and shortens life through complications. The number is increasing globally due to lifestyle changes and diet leading to increasing levels of overweight and obesity. Management of DM poses economic burden to society, healthcare providers and sufferers. Costing study has been used for policy advocacy. It has been used to identify the burden of disease, areas for future intervention and priority setting in healthcare.

OBJECTIVE: To determine the financial cost of diabetes management to Cocoa clinics for 2009.

METHODOLOGY: A descriptive cross-sectional study of diabetes management at the four Cocoa clinics in Ghana from May to July 2010 was conducted. The prevalence-based 'Cost-of-illness' approach was employed. A pre-tested data extraction form was used to review the medical records of 304 diabetes patients that were randomly selected.

RESULT: The mean age was 55.4 years. The proportion of Diabetes cases at OPD was 3.1%. The annual financial cost of managing one diabetes patient was estimated to be GH¢ 541.35 (US$ 373.34). Service cost constituted 21.7% whiles direct medical cost was 78.3%. Drug cost was 69.2% of the financial cost. The total financial cost of Diabetes management was estimated at GH¢ 420,087.67 (US$ 289,715.63). This accounted for 8% of the total expenditure for the Clinics in 2009 fiscal year. The study showed that facility type, type of diabetes and complications significantly increased the cost of Diabetes management to Cocoa clinics.

CONCLUSION: Delay in diagnosing Diabetes and accompanying complications with cost implications requires public education to heighten awareness and reverse the

progression of diabetes and associated cost. Prevalence rate for Type 2 diabetes was high due to increasing cases of obesity. Effective management protocols are also required to delay and prevent complications of diabetes such as cardiovascular diseases.

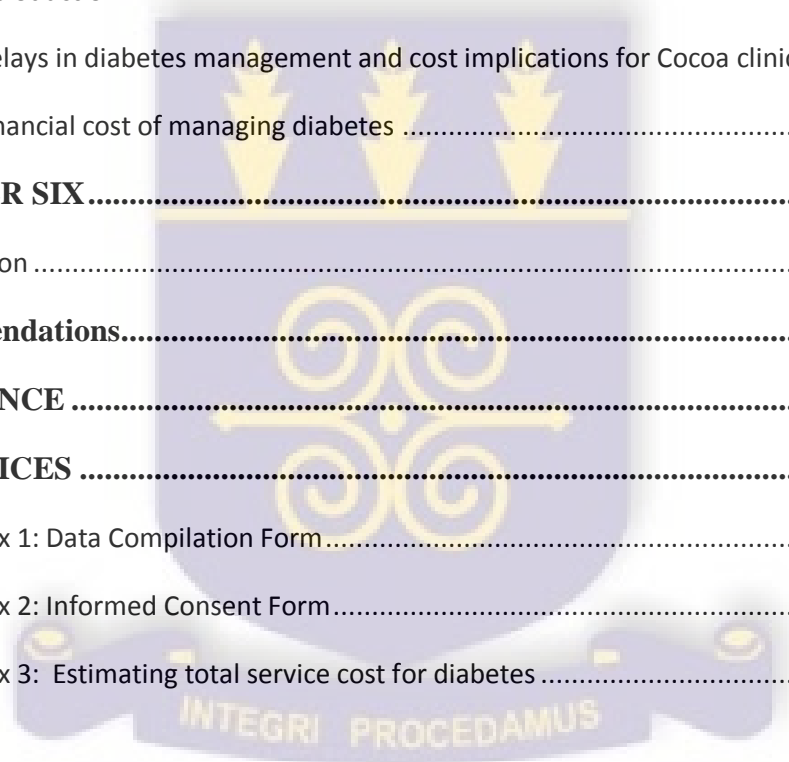*Keywords*: Diabetes, financial cost, Cocoa clinics, complication, Cost-of-illness, Ghana.

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Abbreviations

ADA   American Diabetes Association

AIDS   Acquired Immuno Deficiency Syndrom

CDC   Center for Disease Control and Prevention

COCOBOD   Cocoa Board

COI   Cost-Of-Illness

CVA   Cerebrovascular Accident

DM   Diabetes Mellitus

DPP   The Diabetes Prevention Programme

DTC   Drug & Therapeutics Committee

FBS   Fasting Blood Sugar

g/Kg   gramme per Kilogramme

GDA   Ghana Diabetes Association

GDM   Gestational Diabetes Mellitus

GH¢   Ghana cedi

GHS   Ghana Health Service

GSTG   Ghana Standard Treatment Guidelines

Hb1AC   Glycosilated Haemoglobin

HIV   Human Immune Virus

IDDM   Insulin Dependent Diabetes Mellitus

IDF   International Diabetes Federation

IFG   Impaired Fasting Glucose

IGT   Impaired Glucose Tolerance

LI   Legislative Instrument

mmol/L   Millimoles per Litre

MOH	Ministry Of Health
NHIA	National Health Insurance Authority
NHIS	National Health Insurance Scheme
NHS	National Health Scheme, Scotland
NIDDM	Non -Insulin Dependent Diabetes Mellitus
NLCD	National Liberation Council Decree
OGTT	Oral Glucose Tolerance Test
P.I.	Principal Investigator
PHC	Primary Health Care
PM2	Practice Manager Version 2
R.A.	Research Assistant
SDF	Scottish Diabetes Framework
US	United States of America

Definition OF TERMS

2009 Fiscal year	The financial year of the study is from 1st October 2008 – 30th September 2009
Bottom-Up Approach on	This estimates cost by calculating the average cost of treatment of the illness and multiplying by the prevalence of the illness based on the cost
Cost-Of-Illness	This is defined as the sum of three elements for which cost estimates can be obtained. The three elements are; direct cost, indirect cost and intangible cost.
Economic Evaluation	The comparative analysis of alternative courses of action in terms of both cost and consequences.
Incidence Based Approach of COI	This examines the cost of a disease for a cohort of incidence of the disease over a longer time period (e.g. cost incurred from diagnosis to death) of individual units of service performed in relation to a disease.
Insured Client	Registered member of the National Health Insurance Scheme or any private Health Insurance Scheme
Prevalence Based Approach of COI	This estimates the cost of disease during a specific time period (often one year) for a cohort of individuals with the disease.
Private Client	Client who pays fees out-of-pocket at point of service use.
Top-Down Approach	this estimates cost by calculating the aggregate form for specific diseases. data on total health expenditure and the disease specific

	rates of use of health care encounters related to the disease.
Type 1 Diabetes	Condition of diabetes characterized by cellular-mediated autoimmune destruction of islet ß-cells.
Type 2 Diabetes	Condition of diabetes characterized by insulin insensitivity.

CHAPTER ONE

Introduction

Background

Diabetes mellitus is one of the most common chronic diseases. It has major economic as well as health implications for patients, health services, and society in general.

The number of diabetes cases has been increasing worldwide with corresponding proportion of health care budgets. Two thirds of 150 million people suffering from diabetes live in developing countries. It is estimated that by 2025, 300 million people worldwide will suffer from diabetes from an estimated figure of 30 million in 1985. About 4 million sufferers will die per year especially those with cardiovascular complications with the largest increase in the most economically productive age groups (WHO, 2002). This rise has been attributed to changing lifestyles, urbanization, modernization as well as affluence. Other factors include sedentary nature of occupations, increase in consumption of a wider variety of foreign and local foods and the lack of physical activity (NHS, 2001).

In Africa, diabetes prevalence for adults 20–79 years is estimated at 2.4% (7.1 million persons) in 2003. This is expected to increase to 2.8% (15 million persons) by 2025. Although the number of diabetes cases will double, there will be a slight increase in the prevalence as a result of population growth (Wild et al., 2004). Complications resulting from late diagnosis and late presentation, lack of access to essential medications and services, and poor management of diabetes are common and have created a heavy socio-economic burden for Africa. In Tanzania, it was estimated that the cost for caring for all

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patients with diabetes would be US$138 per patient per the year 1990. This was way above the allocated per capita health expenditure of US$ 2 per person for the same year according to The Diabetes Declaration and Strategy for Africa report (2006).

In Ghana, 302,000 people were affected by the disease in 2000. According to World Health Organization (2008) global report on diabetes, the number of diabetes cases is expected to increase to 851,000 by 2030. A recent analysis of admissions to the largest hospital in the country revealed an increase in prevalence. Diabetes accounted for 6.8% of all adult admissions, 7.3% of adult deaths and 22% of people diagnosed with diabetes die of the disease. A community survey in Accra showed that Ghanaians 25 years and older had a diabetes prevalence of 6.3% (Amoah et al., 2002).

De-Graft Aikins (2007) reported that the chronic diseases epidemic has been neglected. Many people with diabetes are undiagnosed, majority of those diagnosed are also not meeting the recommended treatment goal resulting in destructive complications such as blindness, kidney disease, nerve damage and amputation.

Diabetes as a chronic disease can develop complications, and the treatment protocol required to control diabetes is costly. Diabetes has inherent costs that are both direct and indirect. Direct cost relates to medical and non-medical treatment of the disease to individuals and their families; indirect cost and intangible cost relate to all factors that affect quality of life of the patient such as the pain, anxiety and discrimination associated with the disease.

Diabetes care is expensive. In Ghana, controlling one case and its complications in 2001, ranged between GH¢167 and GH¢392 with a minimum daily wage of GH¢1.12. This has however risen to GH¢1200 and GH¢ 7200 per year with a minimum daily wage of GH¢ 1.9 in 2007 (De-Graft Aikins, 2007). This poses an economic burden not only to the diabetes patient but to the family and society as well as healthcare providers.

Studies on the economic burden of diabetes to patient and families have been carried out in many communities (Mohan et al., 2004). No study was found in a search from literature for cost of managing diabetes to provider in Ghana.

Prevention and efficient management of diabetes is necessary to halt the disease from becoming the leading cause of disability and deaths. This study will determine the financial cost of diabetes management to Cocoa clinics in Ghana.

Financial costing will be considered in this study to derive cost information on diabetes management to Ghana Cocoa Board Clinics. This will serve as basis for planning and resource allocation on primary and secondary preventive measures.

1.2   Statement of the problem

Management of diabetes is expensive. This poses economic burden for the patient, society and cost to health care providers. Diabetes is one of the top 10 diseases reporting at Cocoa clinics. There were 1297 once a week specialist consultations for the year 2008.

Cocoa Clinic Pharmacy Report (2004) indicated 3% of total prescriptions filled for diabetes accounted for 9% of total cost of drugs. The 2006 drug utilization review by the Pharmacy Department revealed two diabetes drugs in the top 20 drugs in terms of value

and volume (Cocoa Clinic, 2007). The average cost per prescription of about 3,247 prescriptions for diabetes filled was GH¢12.00. The last quarter of 2008 had 25 admitted diabetes cases out of a total of 167 admitted cases, representing 15% of hospitalization (Cocoa Clinic, 2008).

Ghana Cocoa Board has a workplace policy to conduct pre-employment medical examination for its newly employed permanent staff. The medical examination covers screening for diabetes, hypertension and other disease conditions through diagnostic services and physical examination. The dependants of the newly employed are left out in the medical examination. One time screening is also insufficient to detect at risk individuals. Staff and their dependants who suffer from diabetes might have been diagnosed late probably with complications. The clinic runs a diabetes clinic once a week and has a dietician consulting once in a week. Treatment costs for staff that develop diabetes are borne by the management of cocoa board clinics and the rising costs of health care in the management of diabetes poses a financial concern for the organization. Prevention of the onset of diabetes and efficient treatment protocols will reduce cost and enhance quality of life. Lifestyle modification and awareness on diabetes reduces or delays diabetes in at risk individuals and could help in efficient use of financial resources of the Ghana Cocoa Board clinics.

1.3   Conceptual Framework

The resulting consequences of diabetes mellitus could be morbidity, disability or mortality. The effects of these contribute to the cost of illness. Mohan et al. (2004) put the cost implications of diabetes mellitus to society into three folds as;

- Direct costs to people with diabetes, their families and to the health care sector or provider.

- Indirect costs to society and government, which are the productivity costs through absenteeism at work due to diabetes and travel time for medical attention.

- Intangible costs which is the effects on the quality of life through pain, stigma, and psychological trauma due to diabetes.

The objective of this study will be to estimate the cost of illness (COI) from the provider's perspective and will employ the bottom up prevalence COI approach. This study will thus consider the financial cost of diabetes mellitus which covers the service and direct medical costs. The service cost includes all cost borne by the provider and is not specific for diabetes. It includes the capital cost, personnel cost, and non-medical supplies. The direct medical cost includes the cost of medical inputs directly used by the diabetes patient e.g. ward space, pharmaceuticals, laboratory reagents and equipments specific for diabetes. The clinical status of the diabetes patient can affect the cost of managing diabetes. A Type 1 diabetes patient will require the use of insulin injection and syringes where as the Type 2 may require only oral medication and/or some insulin depending on the response to oral therapy. A diabetes patient with complication(s) will require treatment for the complications. Depending on the complication, the diabetes patient may require hospitalization. Also, depending on the clinical status, the diabetes patient may either be treated as an OPD case or may be admitted. All of these affect the cost involve to the provider. The variables to be measured have been conceptualized in Figure 1.

Figure 1: Conceptual framework of cost of diabetes mellitus from the healthcare provider's perspective.


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┌──────────────────────────┐
│     DIABETES MELLITUS    │
└──────────────────────────┘
              │
              ▼
       ┌──────────────┐
       │   Morbidity  │
       └──────────────┘
              │
              ▼
     ┌──────────────────┐
     │ Cost of Diabetes │
     └──────────────────┘
              │
              ▼
      ┌─────────────────┐
      │  Financial Cost │
      └─────────────────┘
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Service Cost

Direct medical Cost

Capital cost
Equipments
Buildings
Vehicles

Clinical Status
Type of Diabetes
Type of Complication

Recurrent cost
Personnel cost
Non-medical supplies cost
Emergency/Ambulance
Maintenance cost

Outpatient Medical services
Specialist care
Laboratory
Pharmacy

In-patient medical services
Laboratory
Pharmacy
Surgical
Specialist Care

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1.4   Justification

Prevention and efficient management is one way to stop diabetes from becoming the leading cause of disability and deaths. Prevention of the onset of diabetes and efficient treatment protocols will reduce cost and enhance quality of life. Lifestyle modification and awareness on diabetes reduces or delays diabetes in at risk individuals.

This study will estimate the financial cost of managing diabetes at the Cocoa Clinics with the aim of providing evidence needed for early detection and management of the disease.

Thus conducting a study on the financial cost of managing diabetes for the institution will enhance planning and resource allocation in terms of opportunity cost in prevention of the onset of diabetes and efficient treatment protocols likely to reduce cost and enhance quality of life. Screening for diabetes on regular basis, lifestyle modification and awareness on diabetes may be enhanced to reduce or delay diabetes in at risk individuals.

1.5   Research Questions

- What proportion of total cases seen at Cocoa Board Clinics in a year suffers from diabetes?

- What is the financial cost of managing diabetes for Cocoa Board clinics in a year?

1.6   Study Objective

The general objective of the study is to determine the financial cost of diabetes management to Ghana Cocoa Board Clinics for 2009 fiscal year.

The general objective will be achieved through the following specific objectives;

1. To describe the proportion of outpatient cases that were diabetes mellitus in 2009 at Cocoa clinics

2. To describe the protocol for managing diabetes case at Cocoa Clinics

3. To estimate the unit service cost at cocoa clinics

4. To estimate the direct medical cost of diabetes at Cocoa clinics

5. To estimate the financial cost of managing diabetes mellitus.

CHAPTER TWO

2.1   Burden of disease

Diabetes has become a growing public health burden across the world. Diabetes epidemic will continue due to increase prevalence of obesity. Wild et al., (2004), estimated the global burden through a prevalence data from defined populations and diagnosis based on optimal WHO criteria that 366 million people will be affected by diabetes mellitus in 2030 from 171 million people in 2000. This represents an increase from 2.8% in 2000 to 4.4% in 2030 among adult 20 years and above. India, China, Indonesia, Japan, Pakistan and Bangladesh, all from Asia are ranked in the top 10 countries with highest number of estimated cases of diabetes for 2000. It has been estimated that Egypt would be ranked 10th by 2030 although there was no country from Africa in the top 10 in 2000.

About 29 million (14.4%) persons aged 20years and above had either been diagnosed, undiagnosed or Impaired Fasting blood Glucose (IFG). About 29% of diabetes cases were undiagnosed according to the Centre for Disease Control & Prevention (CDC), (2003) on prevalence of diagnosed, undiagnosed diabetes and IFG in the US. Prevalence increased with age and significantly low in women than in men. Prevalence was significantly lower in non Hispanic whites compared with Mexican Americans and Non-Hispanic blacks. The increase in prevalence compared to 8.3% in 2000 was attributed to increase prevalence of obesity and over weight in the US.

Of the 230 million people suffering from diabetes in 2006, 80% was found in the developing world representing 6% of the world population. India was the hardest hit (Roglic et al., 2005).

Over 30 million persons would be affected in "the diabetic capital of the world", India. The prevalence increased from 2.1% in 1970 to 12.1% in 2000. Projections estimates 300% increase in the number of people with diabetes from 19.4 million to 80 million between 1995 and 2030 (Mohan et al., 2004).

Approximately, 7.1 million Africans were said to be suffering from diabetes at the end of 2000. It is expected to rise to 18.6 million by 2030 (Wild et al., 2004; Motala et al., 2003). Azevedo & Alla (2008) reported that until the mid-1980s, the prevalence rate of diabetes was less than 1.4% with the exception of South Africa estimated to have a rate of 3.6%. The situation on the continent and elsewhere among people of Africa descent is worsening. The rate of diabetes among Africans has been found to be between 1% - 6%, 10% - 13% among Caribbeans of African descent, 12%-15% among African Americans with the white population in Africa hovering between 6% and 10%. Type 2 diabetes forms the majority (70% - 90%) among Africans with 25% showing complications of Type 1 diabetes.

Amoah et al. (2002) and De-Graft Aikins (2007) reported a prevalence rate of between 0.2% from the earliest studies in 1960s in a population of men in Ho to 6.4% in a community in Accra in 2002. The Ghana Diabetes Association (GDA) in the early 1990s suggested a prevalence of 2-3% in the urban areas in southern Ghana.

An unpublished report (2004) at Cocoa clinic indicated a total number of about 2000 diabetes prescriptions were served out of about 58000 prescriptions for the period January to December 2004. This represents about 3% of the total prescriptions served.

2.2   Diabetes

King et al. (1999) reports that Diabetes was first recognized 3500 years ago by the Ancient Egyptians. One of the first clinical descriptions was by Aretaeus, who wrote that the condition was 'fortunately rare', but 'short will be the life of the man in whom the disease is fully developed'.

Diabetes mellitus (DM) is a clinical syndrome caused by absolute or relative deficiency or diminished effectiveness of endogenous insulin. It is characterized by hyperglycaemia and deranged metabolism of carbohydrate, protein and fat, causing significant disturbance of water and electrolyte homeostasis (Herfindal et al., 1988).

American Diabetes Association (ADA), (2004), defined diabetes as a metabolic disorder caused by different factors characterized by a chronic high level of blood sugar with disturbances to carbohydrate, fat, and protein metabolism resulting from defects in insulin secretion, insulin action or both.

Long-standing metabolic derangement leads to permanent and irreversible functional and structural changes in the cells of the body, with those of the vascular system being particularly susceptible. These changes lead to the development of well-defined clinical entities (complications of diabetes) which affect the eye (blindness), kidney (renal impairment) and the nervous system (neuropathies) (WHO, 1999).

Insulin is synthesized and stored in β-cells of islets of Langerhans, located in the pancreas. The normal human pancreas contains approximately 200 units of insulin (Hardman et al., 1996). A basal amount of insulin is secreted continuously at a rate of approximately 0.5 to 1.0 units/hour. Insulin is also released in response to blood glucose levels of 100mg/dl or more. The average daily insulin secretory rate in the adult is 25 to

50 units per day. The important metabolic sites that are sensitive to insulin include the liver, where glycogen is synthesized, stored and broken down; skeletal muscle, where glucose oxidation produces energy; and adipose tissue, where glucose may be converted to fatty acids, glyceryl phosphate, and triglycerides. Insulin affects the metabolism of carbohydrates, proteins and lipids.

Signs and symptoms

The hallmark symptoms of hyperglycemia include polyuria (excessive urination), polydipsia (excessive thirst), and polyphagia (extreme hunger). Patients may experience unusual weight loss and become fatigued and irritable. Over time, frequent skin, gum, or bladder infections can result from an impaired immune response. Blurred vision and tingling or numbness in the hands and feet are also common. Patients with Type 1 diabetes usually present with a rapid onset of acute symptoms, whereas patients with type 2 Diabetes are often asymptomatic for many years and generally experience a more gradual progression and chronic complications (Diprio et al., 2006).

Diagnosis

WHO (2002) guidelines on diagnosis suggest diabetes when fasting whole blood glucose level is 6.1mmol/L or more and/or random blood glucose, taken two hours after a meal or 75g glucose load (1.75g/kg bodyweight in children) is 10.0mmol/L or more. Plasma glucose estimation remains the basic diagnostic criterion for the establishment of diabetes in patients. WHO guidelines are often followed by most countries for the diagnosis and treatment of diabetes.

Glycosilated Haemoglobin (Hb1AC) is commonly used in the United States to monitor and assess the long-term control of plasma glucose. Newly formed red blood cells enter the blood stream with a minimal amount of glucose attached to the hemoglobin. As the red blood cells circulate, glucose permeates into the cell and attaches irreversibly to the hemoglobin at a rate proportionate to the blood glucose concentration. HbA1C reflects the mean blood glucose concentration over the life span of the red blood cell (approximately 120 days), although it most closely correlates with the mean blood glucose over the previous 8 to 12 weeks. HbA1C is widely used for screening and routine monitoring of diabetes (Diprio et al., 2006)

Classification of diabetes mellitus

There was several classification systems established for Diabetes Mellitus by the WHO Expert Committee on Diabetes in the 1980 and 1985 reports (The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus, 2002). The current WHO classification system has been established in co-operation with the National Diabetes Data Group (US). It is mainly based on the aetiology of diabetes mellitus (Table 1). There are three main types: Type 1 diabetes mellitus or insulin dependent diabetes mellitus (IDDM) which was also known as juvenile onset diabetes. Type 2 diabetes mellitus or noninsulin dependent diabetes mellitus (NIDDM) which was also known as adult-onset diabetes and found in individuals who are insulin resistant with relative insulin deficiency. Gestational diabetes mellitus (GDM) the third type is defined as any degree of glucose intolerance with onset or first recognition during pregnancy.

Table 1: Classification of diabetes mellitus

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Type 1 diabetes mellitus
- Immune mediated
- Idiopathic

Type 2 diabetes mellitus

Other specific types of diabetes
- Genetic defects of islet ß-cell function
- Genetic defects of insulin action
- Diseases of the exocrine pancreas
- Endocrinopathies
- Drug- or chemical- induced diabetes
- Infections
- Uncommon forms of diabetes
- Other genetic syndromes

Gestational diabetes mellitus

Recently diabetologists have added a fourth category, tropical diabetes which is less than 1% cases in Africa and is thought to be related to malnutrition.

The terms IDDM (insulin dependent diabetes mellitus) and NIDDM (non-insulin dependent diabetes mellitus) were used previously but have now been abandoned. Presently, the terms "Type 1" and "Type 2" diabetes are used. The more prevalent form is Type 2 diabetes. Type 1 diabetes is characterized by cellular-mediated autoimmune destruction of islet ß-cells. Type 2 Diabetes is due to insulin insensitivity combined with a failure of insulin secretion to overcome this by hyper secretion, resulting in relative insulin deficiency. There is a strong genetic predisposition. Type 2 Diabetes is more common in individuals with family history of the disease, in individuals with hypertension or dyslipidaemia and in certain ethnic groups (WHO, 2002).

Management of diabetes

The Ghana Standard Treatment Guidelines (MOH, 2004) outlines three objectives in the long term management of diabetes. These are;

- Relieve symptoms and maintain fasting (4-6 mmol/L) and 2-hour post meal (4-8 mmol/L) blood glucose levels within the normal limits.

- Prevent acute diabetes complications such as hypoglycaemia, ketoacidosis and the hyperosmolar state.

- Prevent the chronic complications of diabetes, namely; blindness, limb amputation, kidney disease nerve damage, strokes, heart attacks and neonatal abnormalities.

These objectives can only be achieved by strict blood glucose control and regular screening for diabetes complications. Regular follow up of all individuals with diabetes is therefore important to assess their metabolic control. Current managemnent practice of diabetes care includes the measurement of HbA1C. Health care providers use this measure to relate blood glucose control to the risk of complication (Mbanya, 2005; WHO, 2002)

Treatment of diabetes in general is a combination of non-pharmacological and pharmacological methods. The non-pharmacological employs patient education, life-style modifications (smoking cessation, etc), regular simple exercise, dietary therapy and weight loss in the obese. The pharmacological option involves the use of oral agents for Type 2 diabetes and insulin in Type 1 diabetes, GDM and some forms of Type 2 diabetes. Drug treatment was the initial treatment choice for diabetes patients according to De-Graft Aikins (2003; 2005). This was followed by a second initial option of diet management. An alternate, relatively cheaper and widely used option in the treatment of

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diabetes in Ghana is the use of plant medicine. Plant medicines have been anecdotally claimed to be safe and effective in controlling and sometimes "curing" diabetes (Ofori-Adjei & Nyarko, 2003).

Sulfonylureas were the first widely used oral hypoglycaemic medications. They stimulate insulin production by the β-cells of the pancreas. They include; Tolbutamide, Chlorpropamide, Acetohexamide and Tolazamide (introduced between 1956 and 1962) Glymidine, Glibenclamide, Glibornuride, Glipizide, Gliclazide and Gliquodine (introduced between 1964 and 1979) (Williams & Pickup, 1998).

Biguanides block hepatic production of glucose. The less toxic derivatives guanidine was used in the treatment of diabetes but was forgotten after the discovery of insulin in 1922 for several decades. In the late 1950s, biguanides were reintroduced into Type 2 diabetes treatment. Metformin is widely used for its better safety profile.

Thiazolidinedione (also called glitazones) was introduced in the late 1990s.

The Ghana Standard Treatment Guidelines provides for two oral agents; sulfonylurea and/or biguanide, in the treatment of Type 2 diabetes depending on the patient's response (MOH, 2004). Insulin therapy could be used in patients not responding to oral drug therapy. The NHIA (2009) Medicine list has insulin, sulfonylureas, biguanides and glitazones for management of diabetes. Financing health care in Ghana in the public and private sector has gone through several reforms as resources available to manage health care and chronic illnesses like diabetes dwindled.

2.3   Healthcare financing

The Alma-Ata Declaration of "Health for All" through Primary Health Care (PHC) in 1978 in the then Soviet Union emphasized the need for Health System Strengthening

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(Cueto, 2004; WHO, 2008). Health financing is one component of the six building blocks of health systems. The rest are health workforce; health information; health systems; access to medical products, vaccines and technology; and leadership and governance (WHO, 2007).

According to the 124th session executive board report of WHO (2008), purchase of essential health interventions in many countries is beyond national capacity. External financial assistance is required in the average low income country to improve synergies between external and domestic funding. More than 75% of health expenditure however comes from domestic sources.

Before independence in Ghana, access to health care was mainly through out-of-pocket payment at point of service use. Free health care for all citizenry was initiated after independence. Financing of public sector services was through government tax revenue (Agyepong, 2008). The downturn in Ghana's economy means support for health care could no longer be sustained. This led to a widespread shortage of essential medicines, supplies and equipments as well as compromise in quality of care. Many laws were enacted to introduce out-of-pocket fees to recover recurrent expenditure at health facilities to improve quality. The first law, Hospital Fees Decree, 1969 (NLCD 360) was introduced in 1969. This was amended in 1970 and became Hospital Fees Decree, 1969 (Amendment), 1970 (Act 325). The Hospital Fees Act, 1971 (Act 387) then followed. In 1985, the Hospital Fees Regulation 1985 (LI 1313) also known as "Cash and Carry" was introduced by the then government as part of structural adjustment policies. This allowed providers to charge for consultation, diagnostic, medical, surgical and dental services as well as hospitalization. Patients were to pay full cost for drugs (Adams, 2002).

Although the aim of quality improvement was achieved, there were inequities in financial access to basic and essential clinical services. The National Health Insurance Act, Act 650 (2003) LI 1809 was passed in 2003 to remove the financial barrier created by the cash and carry system. The act is expected to improve access to quality basic health service for the poor and vulnerable in society (NHIA, 2004).

2.4   Cost-of-diabetes estimates

Treating chronic diseases such as diabetes is expensive. Not only does it pose economic burden to the patient and their families but also to healthcare providers and the society because of associated complications. Mohan et al. (2004) and Bolin et al. (2009) reports that it cost more than twice to treat diabetes compared to non diabetes patients as a result of the management of the associated complications. The cost of diabetes in the USA in 2007 was estimated at US$174bn (US$116bn in excess health expenditure and US$58bn in reduced production of goods and services) in the US economy (Bolin et al., 2009). According to estimates, healthcare expenditures attributed to diabetes accounted for 11% of total US healthcare expenditures in 2007. King et al. (1999) reported 2% of the UK population with diabetes consumed 5% of the health service budget compared to the 12% arthritic population which consumed only 1.9%. Approximately 1.4Million people with diabetes in Canada were estimated to have healthcare cost of C$ 4.66bn in 2000. Cost is expected to increase to C$8.4bn estimated for 2.4million people with diabetes in 2016 (Ohinmaa et al., 2004).

In China, Wang et al. (2009) reported annual economic burden of diabetes at more than US$ 2.5bn and 81% of economic cost was used for treatment of complications.

Patients struggle to buy syringes to self-administer insulin all over Africa. According to Azevedo & Alla (2008), the cost of syringe is between US$0.20 and US$0.60 in Mali; $0.04-$0.20 in Mozambique and $0.1-$1.5 in Zambia. Testing, insulin and transport for a city dweller in Mali where the per capita GDP is $900 costs approximately $21.24 a month for diabetes care alone, in Zambia the cost can be as $52 a month. Most diabetics in Kenya, with an estimated GDP of $1,200 a year and government subsidies are unable to afford diabetes health care.

De-Graft Aikins (2007) reported between GH¢1200 ($1276) and GH¢7200 ($7660) for controlling one case of diabetes per year.

Riewpaiboon et al. (2007) in their study; Diabetes cost model of a hospital in Thailand reported that: The highest proportion of the treatment cost was related to pharmacy services (45%), and the proportions of outpatient service, inpatient service and laboratory investigation were 24%, 16%, and 11% respectively. The cost model demonstrated that type of diabetes and its accompanying complications were significant predictor variables. The results showed that, the cost of Type 1 diabetes patients was more than Type 2 diabetes patients.

Medicine accounted for the largest share of direct cost (46%), followed by laboratory investigations (32%). The increase in age, number of complications and longer duration of disease significantly increased the burden of cost on society according to a study by Khowaja et al. (2007) in cost of diabetes care in out-patient clinics of Karachie, Pakistan.

Gerdtham et al. (2009) indicated from their study that events significantly elevated inpatient costs both in the year during which they occur and in subsequent years. They

also illustrate the importance of co-morbidities, which more than double short- and long-inpatient costs compared with the same event without co-morbidities.

Henriksson et al. (2000) estimated that the direct medical cost for Swedish Type 2 diabetes constituted about 6% of the total health care expenditure. Cost due to hospitalization was 42%, ambulatory care was 31%, and drug cost was 27%. Oral drugs for diabetes share of the total medical cost was less than 2% however the cost for cardiovascular and lipid lowering was three times higher. In 2008, the total Diabetes drug cost for the clinics was estimated at GH¢ 46,458.07. This constitutes about 3.5% of total drug cost for 2008.

Cost of Prevention

The cost of prevention and delay of Diabetes have also been estimated. The Diabetes Prevention Program (DPP) in two separated studies (January, 2003 and September, 2003) estimated the costs associated with the prevention of Diabetes using lifestyle intervention or medication (metformin). Direct medical cost for the identification of Impaired Glucose Tolerance (IGT) as primary prevention for Type 2 Diabetes was estimated at US$ 139. This was total cost for Oral Glucose Tolerance Test (OGTT) per randomized subject per year. The placebo intervention which involved counseling sessions and educational materials for randomized subject per year was estimated at US$ 43. The Metformin intervention was estimated at US$ 1,019 per subject per year (66% being cost of Metforrnin). The costs of the interventions were paid by the health systems. The 3-year within-trial economic analysis of DPP concluded that the lifestyle and metformin interventions were cost-effective and could be adopted in clinical practice (DPP, 2003).

2.5   Cost-of-Illness Study

Economic evaluation of diabetes has been conducted over the past 30 years in many countries especially in the US (Ettaro et al., 2004). Study is of interest to economists, policy makers and health service researchers as they provide estimates of the potential health care costs that can be averted to the society.

COI estimates have also been proposed for use in identifying the burden of disease, identifying possible areas for future intervention, and identifying possible areas for priority setting in health care and research (Songer & Ettaro 1998).

Byford et al. (2000), Ettaro et al. (2004) reports of two methods of costing illness to society, the prevalence and incidence approaches. These methods seek to document the overall economic burden of diabetes to the society. To determine the excess costs for a person with diabetes compared to the cost for a person without diabetes, focus is on the cost of diabetes for an individual person with diabetes. The cost of illness study gives no information on prevention costs although treatment cost may be high and prevention costs could also be much greater. Ettaro et al. (2004) thus concluded that there is no standard method for estimating the cost of diabetes after reviewing the results of several cost studies in diabetes published over three decades. Many cost studies conducted have been used for different purposes. Despite the fact that there is no standard method of estimating cost of diabetes, a novel method has been made the standard for estimating cost of illness (Drummond et al., 2005).

Methods used in estimating the cost of illness

In 1966, Dorothy Rice published a monograph that proposed a method for estimating costs from the information available in existing data sets. This work became a de facto

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standard for future COI studies. It addressed the economic cost of illness from the perspective of two categories: direct costs and indirect costs. A third category, the psychosocial cost of illness, or its impact on quality of life, is often mentioned as another dimension in the cost of illness but usually is not included in COI estimates because of the difficulty in measuring such costs (Ettaro et al., 2004).

Direct costs

Direct economic costs of disease are those generated by the resources used in treating or coping with a disease, including expenditures for medical care and the treatment of the illness (hospital care, physician services, nursing home care, drugs and other medical needs). These direct costs are often easily measured by surveys and studies. Researchers have also included direct non-medical costs, this covers transportation costs of patients and costs of care-giving by family members (Ettaro et al., 2004).

Diabetes patients potentially utilized more than three service points depending on their clinical status. For a patient who has a well controlled glycaemic level, the first point of service will be the medical records department for their medical records folder. The diabetes patient then checks the blood sugar level at the laboratory. The patient is then assessed at the vital readings room after which the patient sees the doctor with all reports from the laboratory and vital readings. Depending on the clinical status, or blood glucose level, the patient is either directed to pharmacy for medication, or referred to see the dietician or physician specialist or hospitalized.

Most of the early COI studies used either of two computational methods to determine the direct costs of disease: a "top-down" approach or a "bottom-up" approach specific to diabetes.

Indirect costs

Indirect economic costs address the potential resources that are lost as a result of a disease. They include the societal costs of morbidity, disability, and premature mortality. These non-medical costs of disease are not easily measured or calculated. Indirect costs represent the impact, present and future, of opportunities lost to the individual as a consequence of diabetes.

The literature reviewed revealed the increasing trend in the burden of Diabetes especially in the developing world. Type 2 was more common than Type 1 and often asymptomatic with gradual progression and chronic complications. The associated cost of managing the chronicity of Diabetes and the complications has made Diabetes a public health burden. Different methods have been used to cost Diabetes to assess the burden especially in the Americas and Europe. Little work has been done in the developing world and scanty information is available about the cost of Diabetes in Ghana. This study aimed at estimating the financial cost of diabetes from the provider perspective focusing on recurrent costs, will provide information that will contribute to identifying the public health burden of Diabetes. The direct cost method will be used to estimate the resources (service and direct medical) used in treating diabetes at Cocoa Clinics in Ghana.

CHAPTER THREE

3.0   Methodology

3.1   Type of study

The study design was a descriptive cross sectional survey of cost of treatment of diabetes patients of the four Cocoa Board Clinics in Ghana. It was a retrospective quantitative study of the average costs of treating diabetes patient at the various service points in Cocoa Board clinics.

The prevalence approach of cost of illness study was used to estimate the financial cost of managing diabetes to Cocoa Board clinics.

3.2   Study location

Cocoa clinic was established in 1972 by the Ghana Cocoa Board primarily to provide medical services to its staff and subsidiaries and cocoa farmers. Geographically, the clinic is located in four strategic places; Accra, Kumasi, Tema and Akim Tafo. In 2002, the clinic was opened to the public and has established itself as a provider of quality and affordable health care.

The clinics have staff strength of 208. This is made up of 107 medical staff and 101 non medical staff. The clinics made an operating profit of GH¢ 1,083,466.00 in 2007 and GH¢ 873,038.00 in 2008 according to an audited report (James Quagraine & Co, 2008).

Care service provision at Cocoa Board clinics

The 40 bed in-patient facility in Accra provides Twenty four hour service. Ultrasound, endoscopy/colonoscopy, radiology, laboratory and the following specialist clinics; ophthalmology, surgical, Physician specialist, obstetrics and gynecological services are also available in the Accra clinic. Although the clinics provide some public health programmes like the Voluntary Counseling and Testing for HIV AIDS and vaccination for Hepatitis B, the clinics do not provide prevention education for Diabetes Mellitus. The clinic has a patient mix of people who pay out of pocket for their health needs, subscribers of the National Health Insurance Scheme, Private mutual health insurance and staff and dependants of other corporate organizations besides staff and dependants of Ghana Cocoa Board and its subsidiaries. At the end of 2009, the clinic had a registered patient load of more than 115,000. This comprise of 10 Ghana Cocoa Board subsidiaries, over 60 corporate organizations, 7 insurance companies (public and private insurance) and fee paying clients. There is an average OPD attendance of 7400 per month.

3.3 Variables

Table 2: Dependent and Independent variables

Dependent variable	Independent variables
Financial cost of diabetes management	Cost of laboratory investigations Cost of drug treatment Cost of hospitalization Cost of surgery Cost of emergency service Type of diabetes Type of complication Age Sex

Table 3: Operational Definition of study variables

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Variable	Operational Definition
Financial cost of diabetes management	It is the sum in Ghana Cedi, of the mean service cost and the mean direct medical cost for managing one diabetes case in the 2009 fiscal year.
Service cost	It is the estimated cost in Ghana Cedi; spent by the clinics on one patient for each OPD visit. It includes the costs for personnel, non-medical supplies, administrative and maintenance of buildings and vehicles.
Direct medical cost	It is the cost in Ghana Cedi; spent by the clinics directly in the management of one diabetes case. It includes the costs of laboratory investigations, drug treatment, surgery, emergency, hospitalization and specialist consultations.

3.4   Study population

All medical records of diabetes mellitus cases confirmed by a medical officer at the

clinics. The study unit was one medical record of confirmed diabetes mellitus.

3.5   Sampling

All the four Cocoa clinics were selected purposively based on their stratification.

3.6   Sample size

A total of 304 medical records of diabetes patients from the four Cocoa Board clinics

desk reviewed allowed the estimation of patient cost of diabetes management at a

prevalence of 3.0%, worst acceptable power of 0.05 and confidence interval of 95%.

The sample size was proportionate to size of diabetes patients OPD attendance at each

facility. The statcalc function of Epi Info [TM] version 3.4.1 (July 2007) was used in

estimating the sample size for each clinic. The population size of diabetes patients for

each of the four clinics was determined using OPD attendance of diabetes patients for the

2009 fiscal year.

3.7   Sampling method

The four Cocoa clinics were sampled purposively. A multi stage sampling was used to

select sampling unit from each facility for the desk review. Quota sampling was used to

select the number of medical records to be reviewed from each clinic using the OPD attendance proportion of diabetes patients for each of the clinics. Systematic sampling was then used to select each medical record for estimating patient cost of diabetes management. Systematic sampling was done using the list of diabetes patients that was generated by the PM2 software used at the clinics for the 2009 fiscal year. List was used as the sampling frame. The sample interval was determined using the number of medical records required for each facility. Simple random sampling was used to select the first number in the sample interval.

3.8   Data collection techniques/methods and tools

Data was collected at the four facilities between May and July 2010. Data extraction form was used for the desk review of the medical records for service points.

An interview guide was used to interview 2 key informants (Administrator and Accountant) at the Accra Clinic.

3.9   Quality control

Pre- Data collection

Presentations in class and seminars on the proposal were done for fine tuning. The proposal was reviewed by the primary supervisor. Five (5) Intern-Pharmacists who have been trained in data extraction from medical records and interviewing of patients for medication profiling, were retrained for purpose of this study. They were used as research

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assistants. The Biostatistician assisted in training of research assistants. Pre-testing of the data collection tools was done in a private clinic in Tema as a quality control measure for the study.

Data collection

One personnel of the Information Technology unit was involved in data collection to provide technical support and to manage electronic data. Extraction forms were coded to correspond to a particular medical record for auditing and data cleaning. The research assistants were supervised daily. Data extraction forms were reviewed daily by Principal Investigator (PI) for blanks. The P.I. was at all four clinics with assistants for data collection. Data extraction forms were serialized to prevent double entry.

Post- Data collection

Data was cleaned. Data was entered twice and outputs compared to ensure there is no variation in output. The Academic supervisor was involved at each stage of data collection, editing and analysis.

3.10   Data processing and analysis

The financial cost was the sum of the mean service cost and the mean direct medical cost. This provided the mean financial cost per patient for 2009 fiscal year.

The mean service cost was obtained by estimating the unit service cost per patient per OPD visit. The records obtained for the 2009 fiscal year from the Accountant on expenses made at the cost centers were entered on a spread sheet. The expenses were categorized into cost on personnel, administrative cost, material/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 diabetes patient medical record reviewed was obtained by multiplying the unit service cost for the facility by the number of OPD attendance within the 2009 fiscal year by the diabetes patient. The direct medical cost for each diabetes patient medical record 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 services in the 2009 fiscal year.

The data obtained from the medical records was entered on an excel spread sheet. This was transferred into STATA version 10 for analysis.

Statistical Methods
STATA version 10 was used to describe statistics on background characteristics of the medical records reviewed, clinical status and mean financial cost of diabetes management.

Independent t-test and analysis of variance on means were conducted to analyze association between financial cost (dependant variable) and some independent variables (Age, sex, type of diabetes, number of complication and facility type).

3.11 Sensitivity Analysis
In analyzing the uncertainty of the results due to data, one-way simple sensitivity analysis was conducted. The pharmaceutical component of the mean financial cost of diabetes management was used since drug price in Ghana vary among brand-names. The generic

brands average cost price for 2009 fiscal year was used in estimating the total mean cost of diabetes management. This is because the generic brands were widely used. The average cost price of the ethical brands was used to assess the effect on the mean financial cost of diabetes management to COCOBOD Clinics.

3.12   Ethical considerations
Approval

The Ghana Health Service Research Ethics Committee and the Director of Health, Ghana Cocoa Board gave approval for this study.

Risk

Key informants were told the study poses no or minimal potential harm or risk to their job positions and the outcome could influence policy in preventive health.

Privacy and Confidentiality

Key Informants were assured of privacy and the confidentiality. Interviews were conducted based on appointment in their respective offices and were given the option to opt out if they so wish.

The data from medical records, information on expenditure from the Accountant and from the human resource department were kept confidential.

Consent

Consent from the key Informants.

Data

The data gathered was stored in a well secured device by the IT unit personnel and P.I.

Data was only released to the statistician for analysis.

Interest

Although an employee of Cocoa clinic as a pharmacist and member of the Drug and
Therapeutics Committee (DTC), there was no conflict of interest on my part or the
School Of Public Health.

Funding

The study was funded by the Principal Investigator.

3.13   Pre-test of tools
The research tools were pre-tested at a private clinic in Tema. The necessary changes
were effected to suite the requirement for the study.

3.14   Limitations
The data in the PM2 database was not a standardized data. The software was custom
made thus the reports generated by the software varied from one institution to the other.

The Accuracy in reporting coded procedures and processes at the clinic varied from
person to person.

Another limitation was the fact that the PM2 software could not generate a list based on age or sex for sampling.

The medical records of diabetes patients did not indicate duration of diabetes and which co-morbid condition was first, diabetes or hypertension.

CHAPTER FOUR

4.0   Results

4.1   Introduction

This chapter presents the findings of the study in five sections: section one describes ~~the~~
background characteristics of the diabetes patients using the medical records. Section two
presents the findings on the clinical status of patients, section three presents results on
utilization of services by the diabetes patients. Section four then presents the financial
cost of managing diabetes in the four Cocoa Board clinics in Ghana and section five
presents the results of the tests on the robustness of the costing methodology applied in
this study.

4.2   Background characteristics of respondents

A total of 304 medical records of diabetes patients were reviewed in four COCOBOD
clinics in Accra, Tema, Kumasi and Tafo between May and July of 2010 for the 2009
fiscal year.   Of the 304 medical records, 184 (60.5%) were from the Accra COCOBOD
clinic, 45 (14.8%) were from the Kumasi facility, 51 (16.8%) from the Tafo facility and
24 (7.9%) were from the Tema facility. The total number of medical records reviewed at
each facility was in proportionate to the size of the facility attendance for diabetes.

Diabetes affects all age categories but the cost of management could be affected by a
person's age depending on how long the person has had the disease and the
complications. Of the 304 medical records reviewed, the average age was 55.4 years. The

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minimum age observed was 17 years whiles the maximum was 86 years. The economic

productive age group constituted 198(65.2%) and 95 (31.2%) were on retirement and

represented the vulnerable dependant group.

Table 4: Background characteristics of diabetes patients (*n=304*).

Variable		Observations	Percentage (%)
Age Group			
	>40	11	3.6
	50-59	198	65.2
	60+	95	31.2
Sex	Male	167	54.9
	Female	137	45.1
Marital Status	Married	292	96.1
	Single	12	3.9
Type of Client	Staff	138	45.3
	Dependent	54	17.8
	Retired staff	82	27.0
	Insured	9	3.0
	Private	21	6.9

More males had diabetes 167 (54.9%) than females 137 (45.1%) (Table 4).

Majority of the patients who had diabetes were married, 292 (96.1%) (Table 4).

Personnel of various organizations who use medical services for diabetes with the

organizations being responsible for paying the medical bills were 138 (45.3%) and their

dependants were 54 (17.8%). Retired staff and their dependants were 82 (27.0%), the

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insured in both private and the public insurance schemes were 9 (3.0%) and 21 (6.9%)

were the non-insured who paid out of pocket for medical service (Table 4).

The majority of diabetes patients were staff of COCOBOD.

4.3 Description of the proportion of outpatient cases that had diabetes mellitus in 2009 at Cocoa clinics

The proportion of diabetes patients OPD attendance is the percentage of the total OPD

attendance at the four Cocobod clinics in the 2009 fiscal year. The Tafo facility registered

the highest proportion of 4.5% whiles the Accra facility registered the lowest proportion

of 2.7%. The overall proportion for the four clinics was 3.1% (Table 5).

Table 5: Proportion of diabetes OPD cases at Cocoa Clinics

Facility Type	Total OPD Attendance	Diabetes patients OPD attendance	Proportion of diabetes patients (%)
Accra	187,996	5,058	2.7
Kumasi	34,228	1,446	4.2
Tafo	18,236	815	4.5
Tema	8,569	274	3.2
Total	**249,029**	**7593**	**3.1**

Type of diabetes patients and associated complications

Of the medical records reviewed, approximately 10% (29) were Type 1diabetes and 90%

(275) were Type2 diabetes (Figure 2).

Figure 2: Type of diabetes at Cocoa Clinics
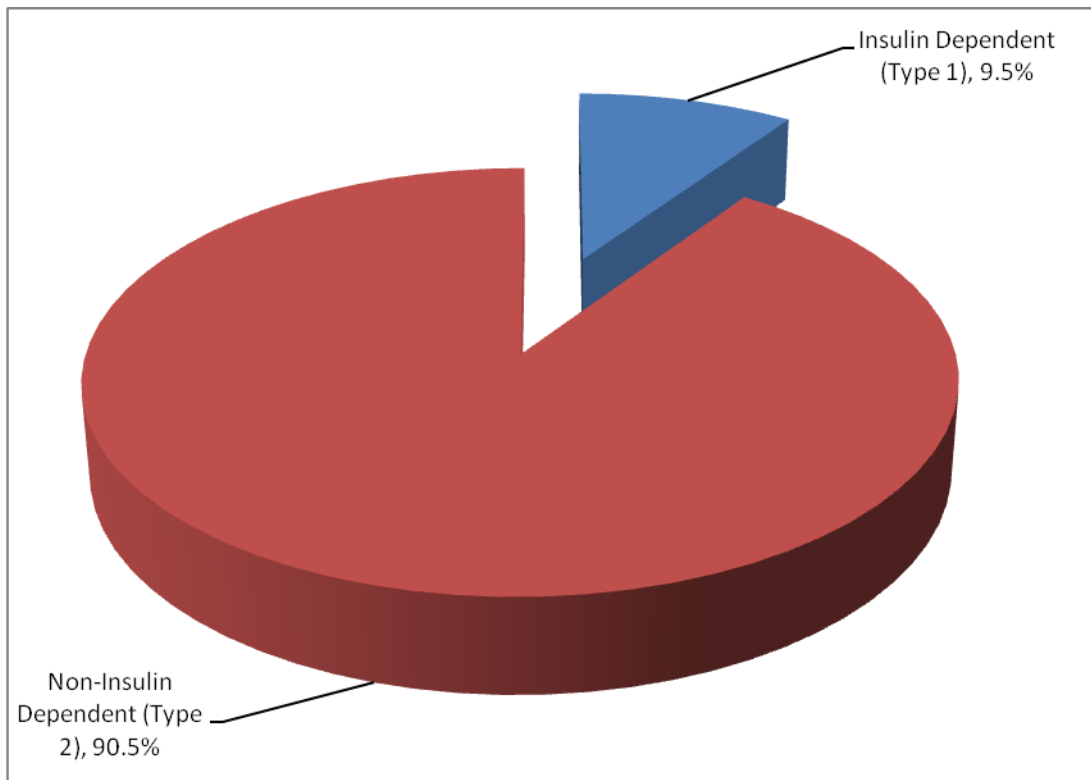
A similar pattern was observed for the presence or absence of complications among

patient records. About 90.1% (274) of the patients whose records were reviewed had one

or more complication and 9.9% (30) did not have any complication (Figure 3).

Figure 3: Proportion of Diabetes cases with complications
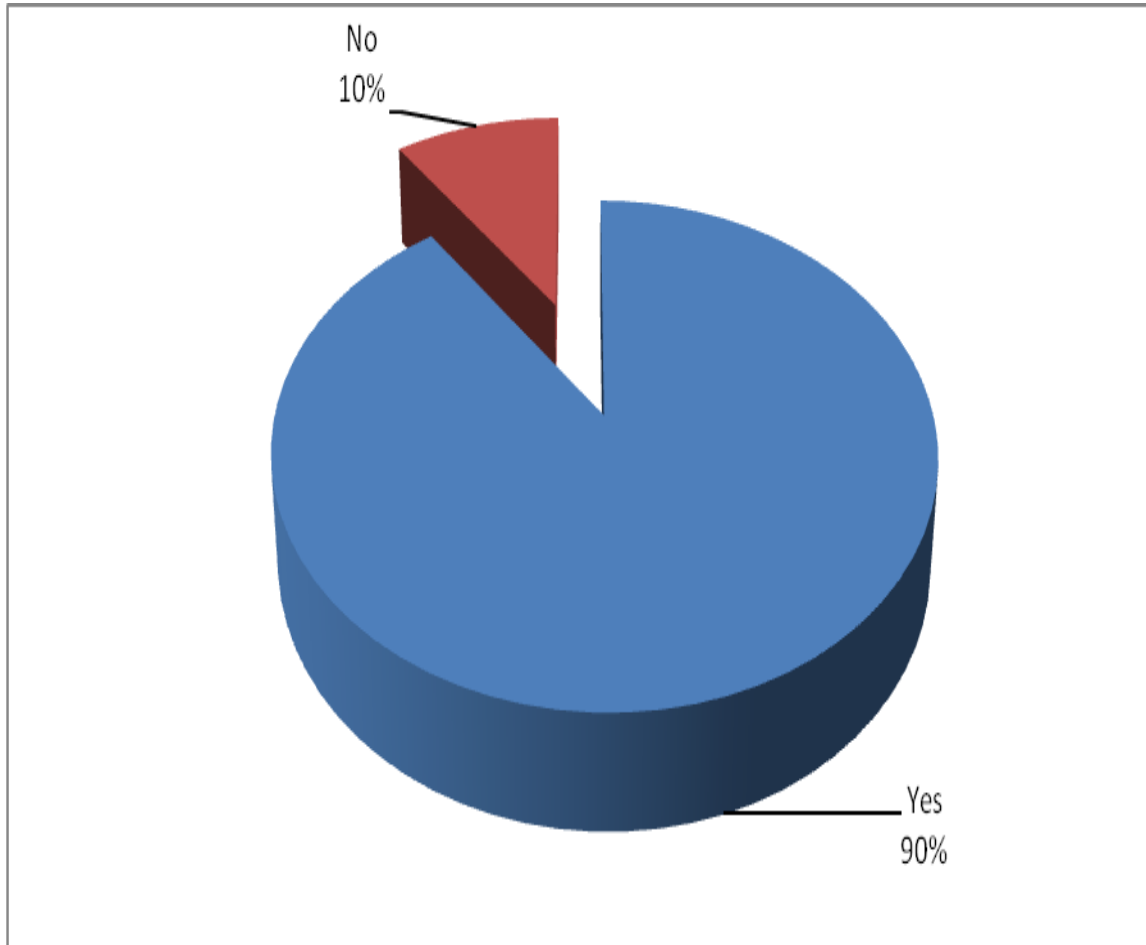
For those who had complications, 154 (50.7%) had only one complication, 96 (31.6%) had two complications, 16 (5.3%) had three complications and about 8 (2.7%) had four or more complications (Figure 4).

Figure 4: Percentage of Diabetes complications among diabetes patients
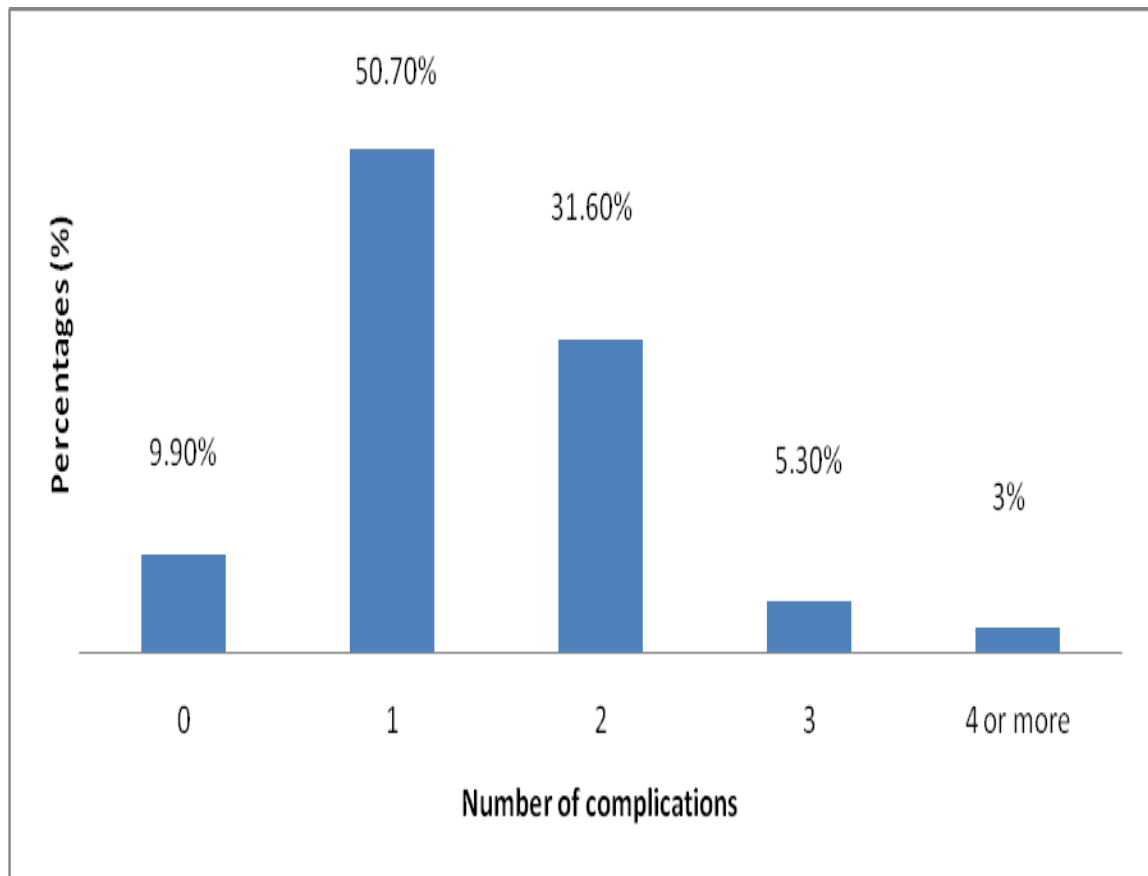
The complications present in the diabetes patients were cardiovascular, 264 (86.9%) being the highest followed by neurological, 75 (24.70%). Retinopathy condition was 38 (12.5%) and diabetes foot ulcer was 12 (4.0%) and other complications constituted 41(13.4%) (Figure 5).

Figure 5: Percentage of some Diabetes complications among diabetes patients
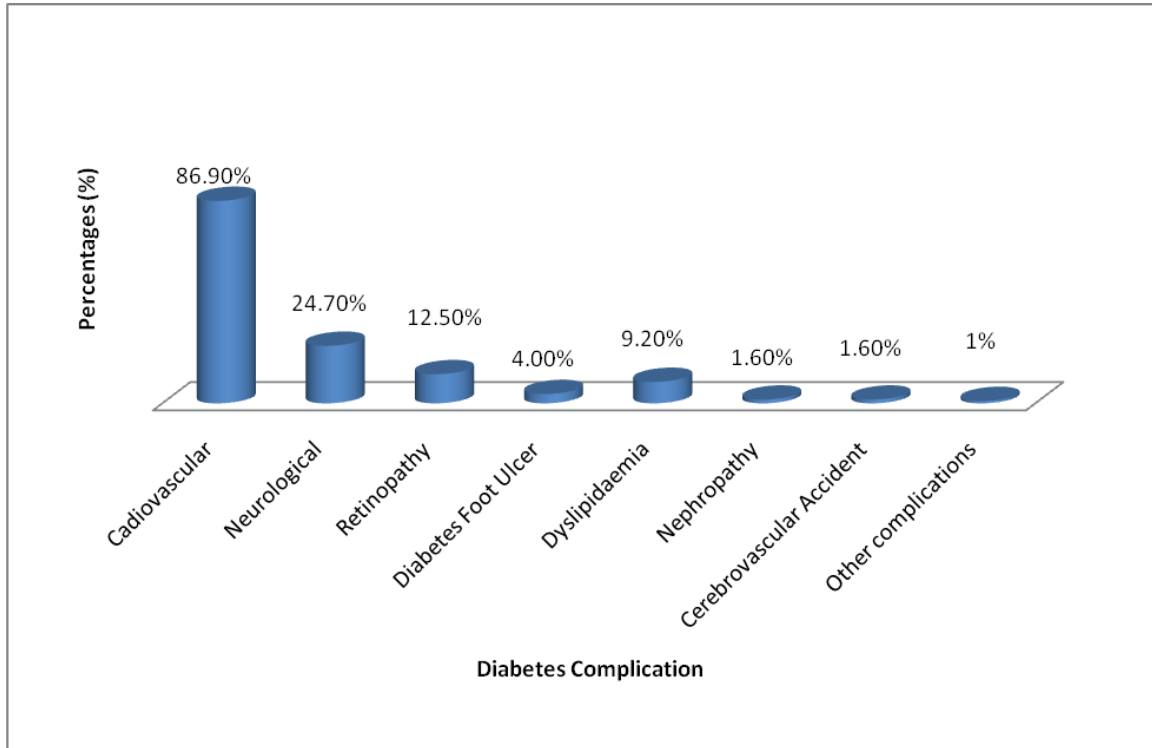
Utilization of services depends on the type of complication present as this required the services of different specialists

4.4   Utilization of health services for diabetes management

The 304 patients whose medical records were reviewed used OPD services, laboratory services and pharmacy services. However, only 80 (26.4%) were attended to by a specialist. The specialists included the Physician Specialist, the Dietician, the Ophthalmologist and/or the Surgeon. Those who were hospitalized were 11 (3.6%). Only the Accra facility had wards for admission. Hospitalization in Accra thus was

approximately 6.0% of the 184 of the medical records reviewed. The other three facilities could only detain overnight and refer if need be. The use of the ambulance basically constituted the emergency services. This was accessed by 10 patients (3.3%). The cost of services for diabetes at the three facilities was related to the complication and the specialist care sought.

4.5   Financial cost of managing diabetes by Cocoa clinics
The total cost of medical services and medical supplies for the four facilities for the 2009 fiscal year was approximately GH¢ 5.3 million (US$ 3.7 million).

The unit cost of OPD service (per visit) and hospitalization (per patient-day) were GH¢ 14.05 (US$9.69) and GH¢ 32.78 (US$ 22.61) respectively. The unit cost per OPD visit however varied for each facility. 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 GH¢ 12.02 (US$ 8.29) per OPD visit. This was attributed to the high OPD attendance. the Tema facility recorded the lowest medical service cost of 6.3% of the total for the four clinics. The facility however had the highest unit service cost of GH¢ 25.59 (US$ 17.65) per OPD visit with a low OPD attendance (Table 6).

Table 6: Cost of medical services at Cocoa Clinics, 2009

Facility Type	Total medical service cost (GH¢) (US$)	OPD service cost per visit (GH¢) (US$)	Mean service cost (GH¢) (US$)	mean direct medical cost (GH¢) (US$)	Financial cost per patient (GH¢) (US$)
Accra	2,259,033.32 (1,557,954.01)	12.02 (8.29)	90.87 (62.67)	510.43 (352.02)	600.74 (415.04)
Kumasi	701,296.98 (483,653.09)	20.49 (14.13)	152.08 (104.88)	298.25 (205.69)	447.40 (308.55)
Tafo	318,621.76 (219,739,15)	17.47 (12.05)	111.67 (77.01)	256.79 (177.10)	368.50 (254.14)
Tema	219,292.31 (151,236.08)	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)	14.05 (9.69)	117.37 (80.94)	422.98 (291.71)	541.35 (373.10)

The mean financial cost per diabetes patient at the four facilities was GH¢ 541.35 where as the mean financial cost varied per facility. The Tema facility recorded the highest mean financial cost of GH¢ 617.95 whiles the Tafo facility had the lowest mean financial cost of GH¢ 368.50. The analysis of variance between the mean financial cost for the facilities indicated that the facility type was significant (p value = 0.018) in the financial cost of diabetes management (Table 7).

The clinical state of the diabetes patient had influence on the mean financial cost of managing diabetes. The mean financial cost for Type 1 Diabetes was GH¢ 906.74 (US$ 647.67) whiles that of the Type 2 Diabetes was GH¢ 502.82 (US$ 359.16) (Table 7). The cost of managing Type 1 diabetes at Cocoa clinic is almost twice the cost of managing

Table 7: Socio-demographic and clinical characteristics correlated with financial cost of diabetes management to Cocoa clinics among medical records reviewed.

Characteristics	Financial cost (GH¢)*[1] Mean ± SD	*p*-value
Socio-demographic Characteristics		
Facility type		
Accra (n=184)	601.30 ± 617.72	0.018
Kumasi (n=45)	450.84 ± 360.07	
Tafo (n=51)	368.46 ± 215.59	
Tema (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+ (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 complivation (n=274)	571.91 ± 537.90	

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[*] The 2009 exchange rate of US$ 1.00 was equivalent to GH¢ 1.45.

Type 2 diabetes. An independent t-test of the means (p value= 0.001) indicated the significance of the type of diabetes in the financial cost of diabetes.

For diabetes without complication, the mean financial cost was GH¢ 262.18 (US$187.27) whiles diabetes with complication had a mean financial cost of GH¢ 571.92(US$408.51) (Table 7). This cost the facilities more than twice the amount spent on diabetes without complication.

The cost model thus demonstrated that the type of facility (p value = 0.018), type of diabetes (p value = .001) and presence or not of diabetes complications (p value = 0.002) were significant variables to financial cost in this study. There was however no statistically significant association between type of diabetes and presence or not of diabetes complication (Chi = 0.3183; p value = 0.573).

The total financial cost of diabetes management to Cocoa clinics in the 2009 fiscal year was estimated at GH¢ 420,087.67 (US$300,062.62) for Diabetes patients. This constituted about 8% of the total expenditure for the clinics (Table 8).

Table 8: Summary of the financial cost of managing diabetes to Cocoa Board Clinics in Ghana for 2009

Facility	Total cost of medical Service (GH¢) (US$)	Total Cost of Medical supplies (GH¢) (US$)	Total expenditure (GH¢) (US$)	Mean Financial cost for diabetes management (GH¢) (US$)	Total cost for managing Diabetes patients (GH¢) (US$)	Proportion of cost of managing diabetes patients (%)
Accra	2,259,033.32 (1,557,954.01)	1,267,778.78 (874,330.19)	3,526,812.10 (2,432,284.21)	600.74 (414.30)	278,743.36 (192,236.80)	7.9
Kumasi	701,296.98 (483,653.09)	262,483.78 (181,023.30)	963,780.76 (664,676.40)	447.4 (308.55)	52,345.80 (36,100.55)	5.4
Tafo	318,621.76 (219,739.14)	180,346.00 (124,375.55)	498,967.75 (344,115.70)	368.5 (254.14)	53,432.50 (36,850.00)	10.7
Tema	219,292.31 (151,236.10)	74,995.36 (51,720.94)	294,287.67 (202,957.01)	617.95 (426.17)	30,897.50 (21,308.62)	10.5
Total	3,498,244.37 (2,412,582.32)	1,785,603.92 (1,231,450.97)	5,283,848.29 (3,644,033.30)	541.35 (343.44)	420,087.60 (289,715.60)	8.0

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4.6   **Sensitivity analysis**

The cost of the most widely used oral anti diabetes drugs at all the facilities (metformin, daonil and pioglitazone) was used in testing the sensitivity of the costing methodology.

The cost component for each generic brand deducted from the mean financial cost for diabetes revealed a percentage reduction of 4.4% for metformin, 1.6% for glibenclamide and 7.2% for pioglitazone. The cost component for each of the corresponding ethical brand added to the mean financial cost also revealed a general percentage increase of 69.4% for glucophage, 19.7% for daonil and 108.3% for avandia (see Appendix 4 for table on sensitivity analysis).

CHAPTER FIVE

5.0 Discussion

5.1 Introduction

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

Ettaro et al. (2004) stated in a review article that:

> Healthcare components considered in the direct cost calculations vary between studies. Nearly all the studies included costs associated with hospital care, physician services, prescription drugs, but there are marked discrepancies with respect to inclusion of long-term care, emergency department services, home healthcare and other services.

Based on the aforementioned, the study employed micro costing of diabetes in the estimation of the financial cost of management and explored factors that affect the costs observed in the study.

5.2 Delays in diabetes management and cost implications for Cocoa clinic

The protocol for management of diabetes at the four clinics required that a diabetes patient sees a medical doctor with laboratory investigation on blood sugar level and any other related to diabetes management. However, patients who are diagnosed were in late stage age.

The mean age of 55.4 years representing about 75% of patients whose records were reviewed show the delay in the time of diagnosing patients with diabetes at the clinics.

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Epidemiological data suggest that in most populations at least 50%, and in Tanzania 80-90%, of people with diabetes have not been diagnosed (Whiting et al, 2003). Amoah et al. (2002) reported 69.9% of undiagnosed diabetes in Ghana as a result of lack of diabetes awareness and thus present late with diabetes complications.

This confirms the report by Mohan et al. (2004) on the age-wise distribution of diabetes patients in developing countries. In the developed world however, majority of diabetes patients are aged 65 years and above.

The majority of diabetes patients (65.2%) were in the productive period of their lives and this implies lost of productive hours to the institutions they work for through absenteeism at work for diabetes care. The cost of managing diabetes in the productive age group was the highest with a cost of GH¢ 562.81 (US$388.14) implying more resources were required in their management and interestingly 92.1% of diabetes patients belonged to staff, retired staff or their dependants whose medical costs are paid by their institutions.

Type 2 diabetes is a genetic disease with strong familial and environmental components (Osei et al., 2003). A report by Azevedo & Alla (2008) indicated that Type 2 diabetes formed the majority (70-90%) among Africans. This study revealed a similar pattern (90.5%) of the medical records reviewed at the four clinics was Type 2. The high prevalence rate of Type 2 diabetes can be attributed to modernization and adoption of western lifestyle with the associated increased caloric dense diets, less physical activity and obesity. Type 2 Diabetes inherently has more complications and this consequently leads to high cost of managing diabetes.

Over 90% of the diabetes patients had one or more complications with cardiovascular complications representing 86.9%. The high rate of cardiovascular disease reported confirms cardiovascular as the main risk factor (De-Graft Aikins, 2007). Although hypertension is also a major risk factor for diabetes, this study could not establish which of the two conditions, diabetes and hypertension, was first diagnosed from the records studied.

Complications require the use of specialist services which are more costly than normal consultation. Those who were attended to by a specialist (Dietician, Physician specialist, Ophthalmologist or the Surgeon) constituted 26% and majority of those who were hospitalized stayed for longer periods of an average of 28.8 days increasing the cost of managing diabetes to the management of Cocobod as a result of the long stay.

5.3 Financial cost of managing diabetes

The study found that the financial cost of diabetes management for Cocoa clinics per diabetes patient for the 2009 fiscal year was GH¢ 541.35 (US$373.10). The financial cost varied however for each facility. The Tema facility had the highest financial cost. This was attributed to the high service mean cost of GH¢ 267.63 (US$184.57). However, the Accra facility registered the lowest mean service cost of GH¢ 90.87 (US$62.67). The variation in the service cost was attributed to the fact that in Tema, most diabetes patients attended the facility on monthly basis whereas in Accra most attended the facility every three to four months. Diabetes, being a chronic disease requires regular check up; however attendance to the clinics for diabetes care depends on the effectiveness of the management protocol for each patient. Those whose blood sugar are well controlled and 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 diabetes patients in Accra. The direct medical cost was almost twice in Accra compared to the other three facilities. This was due to the special services available (theatre, ward and specialists care) at this facility.

The financial cost of managing Type 1 diabetes which has a low prevalence in this population was about twice the cost in managing Type 2. Riewpaiboon et al. (2007) reported of a similar trend in their study on Diabetes cost model for Thailand. The cost for Type 1 without complication was US$502.96 whiles the cost of Type 2 without complication was US$ 190.07. This could be explained by the fact that the clinics used insulin in exact amounts to treat type 1 diabetes patients. Insulin is very expensive and a patient may require two or three of 1000 I.U. of insulin in a month. The cost per 1000 I.U. to the clinics is GH¢19.25 (US$13.28) on the average depending on the brand. The financial cost for managing diabetes with complications was more than twice the cost in managing diabetes without complications. Also treatment of the complications required regular monitoring of some indicators e.g. lipid profile for hyperlipidaemia. The complications also require specialist care and sometimes hospitalization which were predictor variables in the cost model. Thus the delay in detecting and diagnosing diabetes invariably increases costs of managing diabetes as this causes them to come with complications.

The largest component of financial cost was accounted for by medicines. This was similar to Riewpaiboon et al. (2007) report. Most of the medicines were generic brands which were relatively cheaper. The total financial cost of diabetes management for Cocoa

clinics constituted 8% of the total expenditure. This appears to be high for the management of 3% of the clients suffering from diabetes compared to a study by Henriksson et al. (2000). The study on direct medical costs for Type 2 diabetes patients in Sweden, a developed country, estimated 6% of health care expenditure to the 3.5% diabetes population.

The mean financial cost for managing one case of diabetes (US$ 373.10) was higher than the cost of the prevention programme by the DPP (2003). The costs of the medical intervention and the lifestyle or placebo were estimated at US$ 139 and US$ 43 respectively. The findings related to cost of diabetes may contribute to better health planning. It indicated how much providers spend on diabetes management, which can be weighted against the cost of implementing prevention programmes.

The cost model demonstrated that type of facility, type of diabetes and presence or not of diabetes complications were significant predictor variables. Riewpaiboon et al. (2007) reported of two variables being associated with cost; the type of Diabetes and complication presence. This means that higher proportion of Type 1 diabetes could significantly impact on the financial cost of diabetes.

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

CHAPTER SIX

Conclusion

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 indicate late diagnosis of Diabetes and accompanying complications which has cost implications. This calls for public education and diabetes awareness for early detection and management. Also addressing the associated late complications at an early stage can significantly reduce cost of managing diabetes. There is therefore an urgent need for a health policy shift towards control and prevention of diabetes considering the associated cost of managing Diabetes complications. The high prevalence of Type 2 Diabetes is as a result of increased prevalence of obesity attributed to modernization and western lifestyle. The high rate of cardiovascular complications from the study confirms cardiovascular disease as a major risk factor for Diabetes Mellitus.

The study demonstrated association between facility type, Type of Diabetes and the presence or not of Diabetes complication on the financial cost of Diabetes management.

Compliance to treatment can enhance effective treatment protocol and prevent complication thus the associated cost. Diabetes patients were not directly dealt with on their compliance to treatment protocol. The study did not consider the duration of diabetes and which co-morbid condition was first. In estimating the financial cost of Diabetes management, the fixed cost was not used and has been considered as a limitation for this study.

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Recommendations

There will be the need for the costing of other diseases using the institutional/ healthcare provider perspective. This will provide basis for comparing the results for policy advocy.

Due to the late diagnosis of Diabetes, regular screening programmes for staffs and dependants of institutions could be adopted in clinical practice for early detection and treatment of diabetes. There is thus the urgent need for health policy shift towards prevention and effective control of Diabetes. Finally, an economic evaluation study on prevention of diabetes will be recommended.

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APPENDICES

Appendix 1: Data Compilation Form

DATA COMPILATION FORM

FINANCIAL COST OF DIABETES TO COCOBOD CLINICS, GHANA.

Diabetes is a serious condition that increases the risk of ill health and shortens life through complications. The number is increasing globally. The increase is due to lifestyle changes and diet leading to increasing levels of overweight and obesity. The 3% of prescriptions filled represented 9% of total drug cost in 2004. Diabetes patients accounted for 15% of In-patient cases in 2008 at the Accra clinic. This study aims at determining the financial cost of diabetes management for Cocoa clinics in Ghana.

Serial number: ☐ ☐ ☐

Study site: Accra ☐   Kumasi ☐   Tafo ☐   Tema ☐

NO.	QUESTION
	BACKGROUND OF RESPONDENTS
B1	Medical Record number: _____
B2	**Age** ☐☐
B3	**Sex** 1. Male ☐ 2. Female ☐
B4	**Marital Status** 1. Single ☐ 2. Married ☐
B5	☐☐☐

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	Mode of Payment	1. Cocobod Subsidiaries	
		2. Corporate Organisation	
		3. Insurance	
		4. Private (Cash payment)	
B6	**Status**	1. Staff ☐	2. Dependant ☐

INFORMATION ON DIABETES

Q1	**Type of Diabetes**	1. Type 1	☐	2. Type 2	☐
		3. GDM	☐	4. Other	☐
Q2	**Complication Present**	1. Yes ☐		2. No ☐	
	If no skip question 3				
Q3	**Type of complication**	1. Cardiovascular ☐			
		2. Neurological ☐			
		3. Ophthamological ☐			
		4. Foot Ulcer ☐			
		5. Dislipidaemia ☐			
		6. Kidney related ☐			
		7. Cerebrovascular ☐			
		8. Other ☐			
Q4	**Number of complications**	☐			
	Service Utilization				
Q5	**Type of medical service(s) utilized**	1.Medical Records ☐			
		2. Outpatient ☐			
		3. Laboratory ☐			
		4. Pharmacy ☐			
		5. In-patient ☐			

	6. Emergency 7. Specialist care 8. Surgical		
Q6	**Number of Service(s) Utilized**		

MEDICAL SERVICES UTILIZED

	Description of service		Number of visits 2009
Q7	OPD Visits for diabetes clinic		
Q8	Specialist care and referrals for diabetes		
Q9	Emergency and Ambulance		
Q10	Laboratory Investigations Type of investigations		Number of investigation 2009
	Blood sugar Test Urine sugar Test		
	Lipid Profile		
Q11			Total number of days of hospitalization for 2009
	Hospitalization		

	Detention		
Q12	surgical services		

	DRUGS	No. of drugs per day	Total number of days used in 2009
Q13	FOR DIABETES		
Q14	FOR COMPLICATION		

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Date of interview: ☐☐☐☐☐☐   Interviewer Code: ☐

Appendix 2: Informed Consent Form

INFORMED CONSENT FORM

Project Title

Financial Cost of Diabetes Management at COCOBOD Clinics

Institutional affiliation

Department of Health Policy, Planning and Management, School of Public Health, College of Health Sciences, University of Ghana, Legon

Background

My name is Ernest Attuquaye Quaye, a student from the School of Public Health, University of Ghana. I am conducting a study on the cost of Diabetes management to Cocobod Clinics. The financial cost comprises of the medical cost and service cost. The medical cost will be obtained from the medical records whiles the service cost will obtained from accounting/expenditure records. This is purely an academic research which forms part of my work for the award of a Master of Public Health Degree.

Procedures

You will be required to assist principal investigator in extracting expenditure records for the estimation of service cost of management of Diabetes.

Risks and Benefits

The study does not involve any risks. However, you may feel uneasy with some of the questions I will be asking you. Your responses will be very helpful to the study. The information you provide will contribute to estimating the financial cost of managing Diabetes to COCOBOD Clinics.

Right to refuse

Participation in this study is voluntary and you can choose not to answer any individual question or all the questions. You are at liberty to withdraw from the study at any time. However, I will encourage you to participate and complete the questions since the information is important for policy formulation and implementation and improvement in the healthcare sector.

Anonymity and Confidentiality

I would like to assure you that whatever information you will provide will be handled with strict confidentiality and will be used purely for research purposes. Your responses will not be shared with anybody who is not part of the study team.   Data analysis will be done at the aggregate level to ensure anonymity.

The results of this study will be sent to you, if you provide us with your address below.

Before taking consent

Do you have any questions you wish to ask about the study? Yes ☐   No ☐

 (If yes, questions to be noted below)

_____

_____

If you have questions later, you may contact **Ernest Attuquaye Quaye   0244537178**

Consent

I _____, declare that the purpose, procedures as well as risks and benefits of the study have been thoroughly explained to me in English language and I have understood. I hereby [agree ☐ isagree ☐] to participate in the study.

Signature/Thumbprint of Participant _____

Date: _____/_____/_____

Address: _____

Interviewer's statement:

I, the undersigned, have explained this consent form to the subject in the English language. She/He understands the purpose of the study, procedures to be followed, as well as the risks and benefits involved. The subject has freely agreed to participate in the study.

Signature of Interviewer _____

Date: _____/_____/_____

Appendix 3: Estimating total service cost for diabetes

Description	Clinical Service Diabetes share (%)	Total annual cost (GHC)	service cost for diabetes (GHC)
RECURRENT			
Personnel			
Building maintenance			
Utility-water			
Electricity			
Veh. maintenance and operational			
Stationary			
Sub total			
CAPITAL			
Building			
Vehicle			
Equipment			

Clothing			
Sub-total			
TOTAL			

Appendix 4: Sensitivity analysis of financial cost of diabetes using the most widely used oral anti diabetes drugs

A: Using the 2009 fiscal year average cost price of generic brands; metformin, glibenclamide and Pioglitazone (Glizone).

Drug	Observations (*n*)	Mean quantity of drug used by *n*	Unit cost (GHC)	Mean total cost of Diabetes management for *n* (GHC)	cost component of drug in mean cost of Diabetes drugs (GHC)	Mean total cost of Diabetes mgt without cost of generic drug (GHC)	% Decrease
Metformin	278	1160	0.02	524.36	23.20	501.16	4.4
Glibenclamide	246	770	0.01	475.94	7.70	468.24	1.6
Glizone	127	314	0.15	650.16	47.10	603.06	7.2

B: Using the 2009 fiscal year average cost price of ethical brands; Glucophage (metformin), Daonil (glibenclamide) and Avandia (Rosiglitazone).

Drug	Observations (n)	Mean quantity of drug used by *n*	Unit cost (GHC)	cost component of ethical brands (Unit cost X Mean quantity) (GHC)	Mean total cost of Diabetes management for *n* using ethical brands (GHC)	% Increase
Glucophage	278	1160	0.30	348.00	849.16	69.4
Daonil	246	770	0.12	92.40	560.64	19.7
Avandia	127	314	2.08	653.12	1256.18	108.3