

Managing Diabetes in Urban Ghana: Is it Affordable?

by

Fengdi Pei

Duke Global Health Institute
Duke University

Date: _____

Approved:

Shenglan Tang, Supervisor

Dennis Clements

Pascale Allotey

Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Duke Global Health Institute
in the Graduate School of Duke University

2015

ABSTRACT

Managing Diabetes in Urban Ghana: Is it Affordable?

by

Fengdi Pei

Duke Global Health Institute
Duke University

Date: _____

Approved:

Shenglan Tang, Supervisor

Dennis Clements

Pascale Allotey

An abstract of a thesis submitted in partial
fulfillment of the requirements for the degree
of Master of Science in the Duke Global Health Institute
in the Graduate School of Duke University

2015

Copyright by
Fengdi Pei
2015

Abstract

Background: In recent decades there has been an escalating epidemic of diabetes in Ghana. However, there has been little research on the economic burdens associated with diabetes in Ghana, despite diabetes's costly nature. This study investigated economic burdens and financial protections of households with diabetes patient(s) in urban Ghana.

Methods: Questionnaire-based interviews were conducted with 40 diabetes patients and their household heads in two urban communities in the city of Accra, Ghana. Information was obtained regarding participants' demographic and socioeconomic characteristics, patterns of healthcare utilization, direct and indirect costs, and financial protections pertaining to diabetes treatment and management. Cost-of-illness analysis and catastrophic health expenditure computation were conducted to investigate the costs associated with diabetes and households' affordability. Statistical tests were also conducted to analyze the effect of the National Health Insurance Scheme (NHIS) on the costs associated with diabetes.

Results: The total cost of diabetes for 40 households was estimated to be 14,989 Cedi/month, of which 66.5% was direct cost and 30.2% was indirect cost. 52.9% of the households occurred catastrophic health expenditure. The means of outpatient and inpatient expenditure were 136 and 418 Cedi/month, respectively. NHIS had a positive financial protection effect on the economic burden of diabetes, while this effect was

diminished by deficiencies in NHIS. Extended family was the main resource of financial support for diabetes treatment and management.

Conclusion: The economic burden of diabetes is high in urban Ghana, with a catastrophic effect on households. Except for NHIS, patients' financial support mainly comes from personal resources rather than public resources. Social supports and improvements in NHIS are needed to protect households with diabetes patient(s) against financial risks.

Table of Contents

Abstract.....	iv
List of Tables.....	viii
List of Figures.....	ix
Acknowledgements.....	x
1 Introduction.....	1
1.1 The Burden of Diabetes.....	2
1.2 The Economic Burdens of Diabetes.....	3
1.3 The Financial Protections of Diabetes.....	5
2 Methods.....	7
2.1 Setting.....	7
2.2 Participants.....	8
2.3 Procedures.....	8
2.4 Measure.....	9
2.5 Analysis.....	11
2.5.1 Descriptive analysis.....	11
2.5.2 Costs of illness.....	11
2.5.3 Catastrophic health expenditure.....	12
2.5.4 Small-Sample Statistical Tests.....	13
3 Limitations.....	14
4 Results.....	15
4.1 Description of the Sample.....	15
4.2 Utilization of Health Service.....	16
4.3 Economic Burdens.....	18
4.3.1 Costs of Illness.....	18
4.3.2 Catastrophic Health Expenditure.....	19
4.4 Financial Protections.....	19
4.4.1 Health Insurance.....	19
4.4.2 Effect of National Health Insurance.....	21
4.4.3 Distribution of NHI Membership and Free Premium Beneficiaries.....	22
4.4.4 Prices and NHIS Coverage of Diabetes Tests.....	23
4.4.5 Coping Strategies.....	23
4.4.6 Financial Support.....	24
5 Discussion.....	24
5.1 The Burden of Diabetes.....	24
5.2 Patterns of Healthcare Utilization.....	25
5.3 The Cost of Diabetes.....	27

5.4	Financial Protections.....	29
6	Conclusion.....	32
	Reference.....	35

List of Tables

Table 1: Description of the Subjects	16
Table 2: Utilization of Health Services in the Past Year	17
Table 3: Cost of Illnesses (Cedi/month)	19
Table 4: The Percentages of NHI Membership and Free Premium Beneficiaries in Different Age Groups and Socio-economic Groups	23
Table 5: Price of Tests (Cedi)	23

List of Figures

Figure 1: Health Insurance Membership and Utilization in the Past Year	21
Figure 2: Effect of National Health Insurance on Outpatient Expenditure and Inpatient Expenditure	22

Acknowledgements

I wish to express my gratitude to everyone who supported me throughout this project. This project is not only a master's thesis for me, but also an invaluable, unforgettable and happy experience in my life.

I am highly indebted to Dr. Shenglan Tang and Dr. Ama de-Graft Aikins for their constant guidance and support as well as for providing information and resources that made it possible for me to complete this project. I express my warm thanks to Dr. Dennis Clements and Dr. Pascale Allotey for their invaluable criticism and friendly advice during my thesis work. I would also like to thank my project guide, my good friend, and my Ghanaian "dad," Henry Tagoe, who guided me throughout this project and gave me incredible encouragement.

Furthermore, I would like to acknowledge with much appreciation the crucial role of Joseph Egger, Lysa Mackeen, and Sarah Martin of the Duke Global Health Institute, and that of students from the Regional Institute for Population Studies at the University of Ghana. Without their great support and encouragement it would not have been possible for me to complete this project.

Finally, I would like to express my special thanks to community members in James Town and Ussher Town. Thank you for supporting this project and sharing your lives with me.

1 Introduction

In recent decades, in many developing countries there has been an epidemiological transition from communicable diseases to non-communicable diseases (NCDs): On the one hand, many communicable diseases have been decreasing dramatically due to social developments, such as improved sanitation and healthcare; On the other hand, non-communicable diseases have been increasing as a result of increasing life expectancy, alcohol abuse, tobacco use, poor dietary habits, inadequate physical activity, and increasing stress (World Health Organization [WHO], 2009a). WHO reported that in 2008, nearly 80% of global NCD deaths occurred in low- and middle-income countries (LMICs). In the African region, even though communicable diseases still produce the greatest burden, the prevalence of NCDs has increased rapidly in recent decades (WHO, 2011). WHO projected estimate indicated that deaths attributed to NCDs in Africa would increase by over 20% between 2010 and 2020 (WHO, 2004)

Diabetes is “a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces” (WHO, 2015). Diabetes is a well-recognized cause of premature death and disability, accounting for 4% of global NCD deaths in 2012. In recent decades, there has been a rapidly increasing prevalence of diabetes all over the world, particularly in LMICs (WHO, 2014). In 2014, the prevalence of diabetes was estimated to be 8.3% worldwide, and 5.1% in the African region (IDF, 2014). The prevalence of Type 2 diabetes in Sub-Saharan Africa ranged from 1% in rural Uganda to 12% in urban Kenya during 1999 to

2011. Type 1 diabetes in Africa ranged from 4 per 100,000 in Mozambique to 12 per 100,000 in Zambia (Hall et al., 2011). Research and action are urgently needed to halt the globally rising epidemic of diabetes.

Among NCDs, diabetes is particularly costly because of its requirement for long-term management and the control of a variety of complications. Research conducted in North America, Europe, Asia, Africa, Latin America, and the Caribbean has shown that diabetes leads to heavy economic burdens to both health system and individual households, in terms of both direct and indirect cost (Ng et al., 2014; Balu, 2007; Currie et al., 2010; Wang et al., 2009; Kirigia et al., 2009; Bahia et al., 2011; Abdulkadri et al., 2009). However, research on the economic burden of diabetes in African countries is still scarce.

1.1 The Burden of Diabetes

The leading causes of both Disability-Adjusted Life Years (DALYs) and deaths in Ghana are malaria, lower respiratory infections, and AIDS (Institute for Health Metric and Evaluation [IHME], 2010). However, the prevalence of NCDs such as diabetes, asthma, and hypertension is rising dramatically in Ghana. Prior studies indicate that the reported prevalence of diabetes increased steadily from 0.2%-0.4% to 6%-7% between the 1960s and the 2000s (Dodu, 1958; Dodu & Heer, 1964; Amoach, 2002; Akins, 2007). In 2014, the nationwide prevalence of diabetes in adults was 3.3% in Ghana; the number of deaths due to diabetes was 8,528, and an estimated 338,000 adults were undiagnosed (International Diabetes Federation [IDF], 2014). In the population aged over 50, the prevalence was as high as 7% and can be expected to continue to increase (Ayernor, 2012). In the capital Accra, the estimated prevalence of diabetes in adults was around

6%-7%, higher than the nationwide prevalence (Amoah et al., 2002). The burden of diabetes in Ghana is also exacerbated by weaknesses in the health system, in terms of high medical costs, poor health infrastructure, poor health services, unavailability of drugs, shortages in human resources, and a lack of financial resources (Aikins, Boynton & Atanga, 2010). In addition, diabetes could increase the risks of many infectious diseases, such as tuberculosis, pneumonia, and HIV. Diabetes therefore causes and aggravates the double burdens of communicable diseases and non-communicable diseases in African countries (Hall et al., 2011; Kengne et al., 2013).

1.2 The Economic Burdens of Diabetes

The Ghanaian Ministry of Health provided a national policy for the prevention and control of chronic non-communicable diseases in 2012, when they proposed an integrated approach to implementation of NCDs programs (MoH, 2012). There is also a national diabetes association and as a member of the International Diabetes Federation, it conducts diabetes-related programs and campaigns in the country. However, studies of and interventions concerning the economic burdens of diabetes in the African Region are rare. Although limited, existing data demonstrate that diabetes has imposed heavy economic burdens on this region. Kiriga et al. (2009) estimated that the total (direct and indirect) economic loss caused by diabetes, excluding complications, was US\$67.03 billion in total and US\$8836 per patient in the WHO African region in 2000. In Tanzania, the average per capital income per year ranged from \$160 to \$200 in 1989-90, and the average annual direct cost of diabetes was US\$287 for a patient using insulin and \$103 for a patient not using insulin at that time, indicating a heavy economic burden on the

health system (Chale et al., 1992). In Sudan, 65% of family expenditure on health was spent on diabetes healthcare among families with a Type 1 diabetic child in 2004 (Elrayah et al., 2005). In terms of Ghana, by investigating unpublished reports, Akins et al. (2007) found that the monthly costs of treating diabetes in Ghana were between 100 Cedi to 600 Cedi in 2007, which was more than the average salary of civil servants (200 Cedi) at that time. In another study, patients who received the minimum daily wage in Ghana paid 60% of their monthly income for a monthly insulin treatment, and Aikins concluded that the cost of diabetes treatment and management was high in Ghana, possibly resulting from the lack of social support and the lack of a welfare system that could provide financial support (Aikins, 2005). The high cost of diabetes could cause disruption to family livelihood and family relationships and lead to medical inaction (Ayernor, 2012; Aikins, 2007; Aikins, 2005).

In addition to direct health expenditures, indirect cost is also an important component of the overall cost of diabetes. Indirect cost is defined as “output lost because of cessation or reduction of productivity due to morbidity and mortality” (Hodgson & Meiners, 1982, p. 434). Prior studies found that indirect costs could cause greater economic burdens than direct costs in diabetes treatment and management. In Latin America and the Caribbean, the contribution of indirect costs to the total cost of diabetes was as high as 82% (Barcelo et al., 2003; Solli et al., 2010; Ettarroet al., 2004). However, evidence regarding the indirect cost of diabetes in Ghana is absent. Therefore, there is a the important need to investigate both direct and indirect cost in order to capture a more

accurate picture of the economic burdens that Ghanaian households are shouldering in treating and managing diabetes.

1.3 The Financial Protections of Diabetes

Despite the high economic burdens of diabetes, few studies have been conducted on financial protections specifically for diabetes worldwide. Studies in India found that the majority of economic burdens of diabetes were borne by individuals instead of the health system due to a weak Indian health insurance system (Yesudian et al., 2014; Chandra et al., 2014). Elrayah et al.(2005) found that families with a diabetic child in Sudan received little financial support for diabetes treatment other than relatives and friends. Tanzania provided free medical care for diabetes patients in government health facilities, but patients still needed to buy drugs and medical supplies by themselves if these items were not available in government facilities. Also, economic difficulties imposed serious threats to the sustainability of free diabetes healthcare in Tanzania (Chale et al., 1992). In Ghana, the most direct financial protection for diabetes in Ghana is the National Health Insurance Scheme (NHIS), which was established by the Ghanaian government in 2003. Members of NHIS could be exempted from payment for health services, supplies, and medicines included in the benefit package at the point of service, without any copayment or deductible. Reimbursements are given to the providers after they present claims to National Health Insurance Authority (NHIS) offices. Premium for NHIS is exempted for several groups of people, including Social Security and National Insurance Trust Fund (SSNIT) contributors and pensioners, people aged above 70, children under 18 and the indigent (NHIS, 2015). However, as of

2012, the coverage of NHIS was only 35% in Ghana, leaving a large number of patients uncovered (National Health Insurance Authority, 2012). In addition, the effect of NHIS on the economic burden of patients has not been fully evaluated. Only one study investigated this issue and concluded that patients insured by NHIS paid significantly less than the uninsured, even if the insured still incurred out-of-pocket expenses for health services not covered by NHIS (Nguyen, Rajkotia, and Wang, 2011). Aikins et al. (2010) projected that the rising cost of healthcare in Ghana may offset the effect of NHIS. In terms of financial support, Aikins et al. (2010) showed that many diabetes patients in rural Ghana relied on financial support from their immediate and distant family members.

Prior studies also provided some suggestions for relieving the economic burdens of diabetes patients in Ghana, including removing taxes on diabetes medications and supplies (Amoah et al., 1999), reducing the cost of recommended food for diabetes patients by engaging with the food industry, developing cost-effective interventions for diabetes treatment and management, improving NHIS, regulating ethno-medical drugs, and taking advantage of self-help groups and advocacy organizations (Aikins et al., 2010).

Although diabetes contributes an increasingly significant disease burden to Ghana, there has been little public awareness of this issue. Both experts and community members assume that NCDs are not common in Ghana and sparse social resources are allocated for NCDs (Ayernor, 2012; Aikins, 2007; Bosu, 2012). Therefore, there is an urgent need to investigate the economic burdens on and the financial

protections of Ghanaian diabetes patients in order to encourage social awareness and provide evidence for further action. This study aims to

- A. Examine the patterns of healthcare utilization among diabetes patients.
- B. Investigate the economic burden on households with diabetes patient(s) in Ghana.
 - a. investigate the healthcare expenditure of households in terms of both direct and indirect costs of diabetes treatment and management;
 - b. measure household affordability in diabetes treatment and management in terms of catastrophic health expenditure;
- C. Investigate financial protections for households with diabetes patient(s) in Ghana
 - a. evaluate the financial protection effect of National Health Insurance on diabetes treatment and management;
 - b. investigate households' coping strategies and financial supports for treating and managing diabetes; and
 - c. explore potential financial protections for households with diabetes patient(s).

2 Methods

2.1 Setting

This study was conducted in two urban communities in Accra, Ghana: James Town and Ussher Town. These are two poor and densely populated slums adjacent to each other; they are communities where most indigenous people make a living from fishing and small businesses.

2.2 Participants

This study collected data from 40 (excluding pilot study) households with one or more diabetes patient(s) in the two research sites. To be included, a household needed to have one or more members who self-identified as diabetic and were undergoing treatment for diabetes. People who were not undergoing treatment for diabetes at the time of study were excluded. One household was considered a study unit. Household members were defined as individuals who were living in the same house for at least a period of three months, not on a visiting basis, and who contributed to or shared household resources. One individual living alone could also be considered a household.

Data collectors recruited 25 households by visiting patients' houses according to the addresses on a patients' list provided by prior programs conducted by the Regional Institute for Population Studies at the University of Ghana. Then snowball sampling was used to recruit 15 more participants who were recommended by recruited patients and community workers.

2.3 Procedures

The research team provided two two-hour training sessions on data collection for four postgraduate students from the University of Ghana and one community worker from the research site. These research assistants are required to work in the study communities under the Regional Institute for Population Studies (RIPS) Urban Poverty and Health study project for three to five years. Face-to-face interviews were conducted by data collectors using a questionnaire. Informed consent was obtained from each participant before the interview. Participation was voluntary and no compensation was

provided. Due to the small sample size, the pilot study only included two households, the data of which were not included in data analysis. The questionnaire was revised on the basis of the pilot study and feedback from local researchers and data collectors.

The questionnaire included two sections: one section was used with diabetes patients, and the other section was used with household heads responsible for household expenditures. If the household head was not available, the interview was conducted with diabetes patients themselves or caregivers in the household. For households with more than one diabetes patient, patients' expenditures were aggregated under one household.

Questionnaires were collected and reviewed by researchers at the end of each day. In order to ensure the quality of the interviews, the researchers supervised interviews randomly, debriefed data collectors, and provided feedback following the interviews. Return visits were made to retrieve missing information and address anomalies. All completed questionnaires were locked into a cabinet. After completing all 40 interviews, data were entered into a computer and backed up in Dropbox.

All study procedures were approved by ethical review boards at Duke University and the University of Ghana.

2.4 Measurement

A questionnaire was developed to measure economic burdens on and financial protections of households with diabetes patient(s). The questionnaire has two sections, with one designed for diabetes patients and the other for household heads. All data were self-reported by participants; bills and receipts were not required.

Questions were grouped according to the study aims. Information gathered included:

A. Demographic and socioeconomic information regarding the households.

Socioeconomic statuses were measured by three aspects: household income, household expenditure, and household assets.

B. Patterns of healthcare utilization were mainly measured by the types

(private/public/traditional) and the hierarchical status

(primary/secondary/tertiary) of health facilities that patients visited in the past month/year.

C. Costs of illness were categorized as direct medical costs (outpatient/inpatient

out-of-pocket expenditure, self-care expenditure), direct non-medical costs

(transportation, food and accommodation for healthcare), indirect cost (loss of

income of patient/caregiver, payment for caregiver), and the cost of

complications.

D. Financial protections were mainly measured by NHIS membership and

utilization. In addition, this study also considered a wider range of financial

supports and coping strategies as financial protections, including borrowing

money, selling assets, financial supports from friends, extended families, society

and government etc.

In order to compare the prices of tests in different types of health facilities, we selected 10 routine diabetes tests according to the Ghana Standard Treatment Guideline (Republic of Ghana, 2004), including fasting glucose test, oral glucose tolerance test,

urine analysis, blood urea (BUN), electrolytes, and serum creatinine test, fast blood lipid profile tests, glycosylated hemoglobin test, FBC and ECG, and collected prices information in one tertiary public hospital, one secondary public hospital, one primary public hospital and one primary private clinic around research sites. We also gathered information on whether these tests were covered by NHIS.

2.5 Analysis

The data were analyzed using different analytical approaches dependent on the research question or objective under consideration. These analytical approaches include descriptive analysis, cost of illness, catastrophic health expenditure, and statistical tests. In this study, all data analyses were conducted with Stata12 software.

2.5.1 Descriptive analysis

Descriptive analysis was used to describe participants' demographic characteristics, socio-economic characteristics, characteristics of diabetes (type, length, complications), patterns of healthcare utilization (outpatient/inpatient, type of health facility, hierarchies of health facility, treatments), costs of illness (direct medical cost, direct non-medical cost, indirect cost, cost of complications), financial protections (NHIS membership and premium, coping strategies, financial supports) as counts and percentages.

2.5.2 Costs of illness

This study used household-perspective costs of illness (COI) analysis. The COI analysis was conducted based on Segel's (2006) and Hodgson and Meiner's (1982)

guides recommended by WHO Economic Impact Guide (WHO, 2009b), since these two guides were complementary as well as in agreement with each other. The questionnaire was designed based on cost categories in these two guides, so the data were also categorized in the same way: direct medical cost, direct non-medical cost, and indirect cost. The cost of complications was separated as an individual category because it was difficult to determine whether the complications were related to diabetes and how much they were related.

Calculations of mean, median, and standard deviation of costs in each cost category only included patients who used that service and knew their expenditure. For example, if a patient used an outpatient service in the past month but had no expenditure for it, the cost was calculated as 0; if a patient did not use an outpatient service in the past month or could not tell how much was spent, the cost was treated as a missing value. Costs were omitted if the mean was close to zero or if less than three households had related costs. The mean of the total cost of illness could not be calculated because the missing values of the sum of all categories of costs are too many (35), since many households could not report some of their expenditures due to a difficulty with recollection. Absolute cost and percentage in total costs of illness in each cost category were calculated in order to understand the components of the costs of diabetes in the entire sample population.

2.5.3 Catastrophic health expenditure

Catastrophic health expenditure (CHE) occurs when “people’s health expenditure is so high in relation to income that it results in ‘financial catastrophe’ for

the individual or for the household” (Xu et al., 2005a, p.2). In this study CHE was calculated according to Xu’s (2005b) guide, as recommended by WHO. CHE was recognized if a household’s out-of-pocket health expenditure was more than 40% of a household’s ability to pay (for details of the calculation process, see Xu’s guide). It should be noted that this study excluded expenditure on diabetes complications and other diseases in computation, since, as previously noted, it was difficult to determine accurately which diseases were diabetes complications. Therefore, both health expenditures for diabetes and total household expenditures were underestimated.

2.5.4 Small-sample statistical tests

The participants were categorized as four equal-sized socioeconomic groups based on the “asset-based approach” in Morris et al. (2000). Assets selected for calculation are car, refrigerator, freezer, TV, radio, telephone, clock, electric/gas stove, sofa, fan, computer and electric iron. Since data on the number of each item was not collected, the number of assets was not included in the computation in this study. Each asset was given a weight “equal to the reciprocal of the proportion of the study households who owned that item,” and then the total score was calculated by summing up the weights of the assets owned by the household (Morris, Carletto, Hoddinott & Christiaensen, 2000, p.383); the higher the total score, the better the socio-economic status.

Statistical tests were conducted to investigate the distribution of health expenditures and the effect of NHIS. Since the sample size is small and health expenditures are not normally distributed, non-parametric tests were used instead of

parametric tests. According to the purposes of analysis and the numbers of categories of independent variables, different tests were used in the analysis, using 0.05 as the significance level. The Kruskal Wallis test was used to test differences in the medians of outpatient expenditures among different age groups and socioeconomic groups. The Wilcoxon-Mann-Whitney test was used to test differences in the means of inpatient expenditures among different age groups and socio-economic groups and differences in the means of outpatients and inpatient expenditures between patients using NHIS and patients not using NHIS. The Fisher's Exact test was used to test differences in proportions of free NHIS premium beneficiaries among different age groups and socio-economic groups.

3 Limitations

The following limitations of the study design should be noted. At first, since invoices and receipts were not provided by participants, there was recall bias in self-reported data. Second, the powers of statistical tests were small due to the small sample size. Third, the measurement of households' costs and expenditures was not comprehensive. Households' total expenditures were underestimated: the study didn't gather data on the money that households gave to extended family members regularly, which might be common among the participants, considering the significant role of financial support that extended family plays in Ghana. The average outpatient expenditure was also underestimated: The study only captured households' outpatient expenditures in the previous month due to difficulty with recall. However, some patients went to outpatient service several times a year or every 3 months for routine

check-ups. Their outpatient expenditures were missed because they didn't go to outpatient service in the month before the interview. Finally, the generalizability of this study was low. Results of this study could not be generalized to rural Ghana where the economic burdens of diabetes might be more severe.

4 Results

4.1 Description of the Sample

A total of 40 households participated in the study. The average age of diabetes patients was 59. As Table 1 shows, 80% (32) participants were female. The average monthly household income was 261 Cedi (Median=150, SD=297, Range=0,1200), and 27.5% (11) households had no income. In terms of the type of diabetes, 7.5% (3) patients reported Type 1 and 42.5% (17) reported Type 2, and 50% (20) participants didn't know their status. The average years since diabetes diagnosis were 6.6 years. 67.5% (27) of patients had diabetes-related complications, among which hypertension was reported most commonly (25), followed by eye problems (4), asthma (2), leg problem (1) and heart problem (1).

Table 1: Description of the Subjects

Characteristic category	Subcategory	Number(%)
Age	30-50	8(20)
	51-60	17(42.5)
	>60	15(37.5)
Sex	Male	8(20)
	Female	32(80)
Education	Never attended school	7(17.5)
	Primary school	10(25)
	Middle school	16(40)
	Secondary school and higher	7(17.5)
Employment	Formal work	4(10)
	Informal work	16(40)
	Retired	6(15)
	Unemployed	14(35)
Household Income(Cedis/month) ¹	0	11(27.5)
	1-150	9(22.5)
	151-450	11(27.5)
	>450	8(20)
Types of Diabetes	Type 1	3(7.5)
	Type 2	17(42.5)
	Don't know	20(50)
Years since Diagnosed	0-3	14(35)
	4-6	14(35)
	>6	12(30)
Complications of Diabetes	Yes	27(67.5)
	No	13(32.5)
Total		40

1. One household did not know household income.

4.2 Utilization of Health Service

As Table 2 shows, among the 37 (92.5%) diabetes patients who received outpatient services in the past year, 64.9% (24) used a public health facility, 10.8% (4) used a private health facility, and 16.2% (6) used both. In addition, six patients also used traditional health facilities and two went to church for treatment (faith-healing). In terms of the hierarchy of health facilities, 51.4% (19) patients only used a primary health center, 18.9%(7) only used a tertiary hospital, 10.8% (4) used both, and 5.4% (2) used a secondary hospital combined with a primary health center.

Among the 10 (25%) patients who received inpatient services in the past year, eight were hospitalized in a public health facility and two were hospitalized in a private health facility. Eight of the ten patients stayed in hospital for less than 15 days.

In terms of the types of treatments used by participants, the top three most common combinations of treatments for diabetes were oral drugs plus herbs plus diet and exercise (12), oral drugs plus diet and exercise (8), and oral drugs only (5). When counted by single treatment, the most common treatments were oral drugs (32, 80%), diet and exercise (25, 62.5%), herbs (19, 47.5%), and insulin (7, 17.5%).

Table 2: Utilization of Health Services in the Past Year

Category	Subcategory	Number(%)
Outpatient (N=37)		
Type of Health Facility	Public health facility only	24(64.9)
	Private health facility only	4(10.8)
	Public & Private	6(16.2)
	Others	3(8.1)
Hierarchies of Health Facilities	Primary only(P)	19(51.4)
	Tertiary only(T)	7(18.9)
	P & T	4(10.8)
	P & Secondary	2(5.4)
	Others	5(13.5)
Inpatient(N=10)		
Type of Health Facility	Public health facility only	8
	Private health facility only	2
Length of Stay(days)	1-5	4
	6-15	4
	>15	2
Treatment for Diabetes (N=40)		
	Oral+Herb+D/E ¹	12(30)
	Oral+D/E	8(20)
	Oral only	5(12.5)
	Oral+Herb	3(7.5)
	Oral+Insulin	3(7.5)
	Others	9(22.5)

1. "Oral" is oral drug; "D/E" is diet or exercise

4.3 Economic Burdens

4.3.1 Costs of Illness

Table 3 displays the different components of the costs of diabetes among households. For households who occurred expenditures in each cost category, the average cost of outpatient service, inpatient service, supplements, glucose self-monitoring, transportation, food, loss of patients' income, payment for caregivers, and costs of complication were estimated to be 136, 418, 25, 6, 4, 1, 297, 356, 43 (Cedi/month), respectively. No cost was occurred in terms of accommodation for seeking healthcare, loss of income of household members, and extra cost of household members during patients' hospitalizations.

The total costs of diabetes in the entire sample was estimated to be 14,539 Cedi/month, of which 66.5% was direct cost, 30.2% was indirect cost, and 3.3% was the cost of complications. Direct medical cost was the largest component of the total cost (65.4%). Within direct medical cost, outpatient cost and inpatient cost were the two largest components, occupying 34.6% and 28.8% of the total cost of diabetes respectively. In outpatient costs, medicine, herb, tests, and consultation occupied 15.5%, 14.2%, 4.1% and 0.7% of the total costs of diabetes respectively. In terms of indirect cost, 20.4% of the total cost of diabetes was loss of the patients' income due to diabetes, and 9.8% was payment for caregivers.

Table 3: Cost of Illnesses (Cedi/month)

Cost	N ¹	Mean	Median	SD	Total	% of total cost of illness
Direct medical cost (out-of-pocket)					9511	65.42
Total Outpatient	37	136	50	279	5024	34.56
Medicine	31	68	20	147	2260	15.54
Herb	16	129	12	335	2067	14.22
Consultation	33	3	0	11	100	0.69
Tests	34	18	0	63	597	4.11
Total Inpatient	10	418	332	439	4185	28.78
Supplements	9	25	10	29	225	1.55
Glucose self-monitoring	15	6	5	9	77	0.53
Direct non-medical cost					161	1.11
Transportation	31	4	2	4	124	0.85
Food	37	1	0	2	37	0.25
Indirect cost					4394	30.22
Loss of income of patients	10	297	280	265	2970	20.43
Payment for caregiver	4	356	175	479	1424	9.79
Cost of complications	11	43	35	55	473	3.25
Total cost of illness²					14539	100.00

1.N is the number of patients who used each service and knew their expenditure.

2. The mean of the total cost of illness could not be calculated because the missing values of the sum of all categories of costs are too many (35), since many households did not know some of their expenditures due to recall difficulties.

4.3.2 Catastrophic Health Expenditure

Among the 34 households who could provide information about both health expenditures and household expenditures, the mean of the ratio of out-of-pocket health expenditures to household's capacity to pay was 122.7%(Median=41.8%, SD=1.74, Range=0, 692.8%). Using 40% of household's capacity to pay as the threshold, 18 of the 34 (52.9%) households incurred catastrophic health expenditure.

4.4 Financial Protections

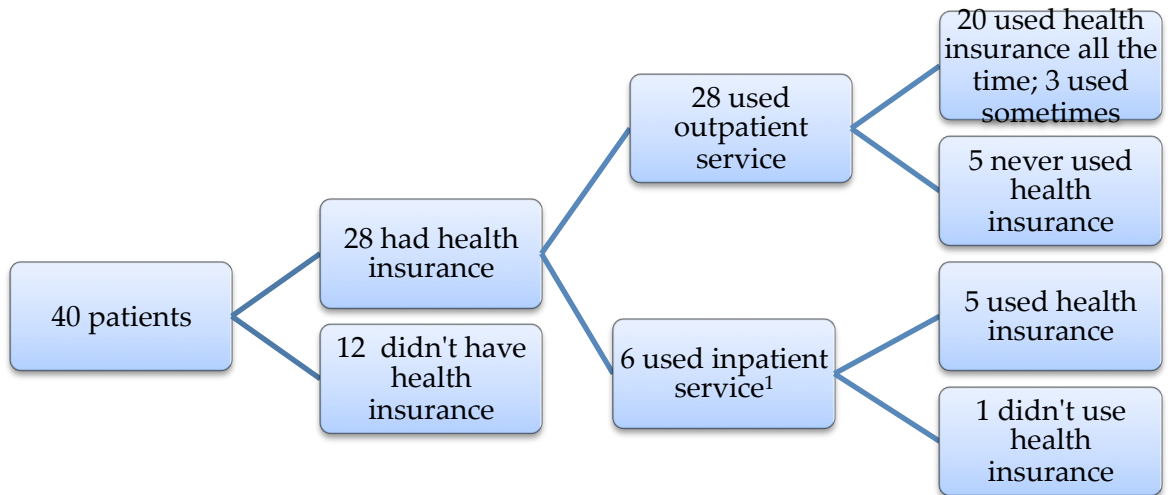
4.4.1 Health Insurance

Figure 1 shows the participants' health insurance membership and utilization during the past year. Among the 40 diabetes patients, 28 (70%) had health insurance, all of which were National Health Insurance (NHI); no other type of health insurance was mentioned. Nine of the 28 (32.1%) patients who had NHI enjoyed free premiums, and

the remaining 19 (67.9%) patients paid an average premium of 23 Cedi/year (Median=24, SD=6.1, Range=8,40).

Among patients who did not have health insurance, the most common reasons mentioned were “waiting time for the insured is longer than the uninsured” (3), “premium is high” (2), and “I registered in NHIS’ promotion activity but I didn’t get insurance card” (2).

Among the 37 patients who used outpatient service in the past year, 28 had health insurance. Only 20 patients used health insurance for every outpatient visit. Three patients used health insurance sometimes and five patients never used it. Among the 10 patients who were hospitalized in the past year, six had health insurance. Only five patients used health insurance for hospitalization. The most common reasons reported for not using health insurance among NHI members were “health facilities I went to didn’t have health insurance accreditation” (3), “health services I needed were not covered” (3), and “waiting time for the insured is longer than the uninsured” (2).



1. Some patients used both outpatient and inpatient services in the past year.

Figure 1: Health Insurance Membership and Utilization in the Past Year

4.4.2 Effect of National Health Insurance

As shown in Figure 2, for outpatient service, the average cost of patients using NHI (both all the time and sometimes) was 127.1 Cedi/month; the average cost of patients who never used NHI (including those not having NHI) was 163.5 Cedi/month. Patients using NHI spent 36.4 Cedi/month less than patients who never used NHI, with no significant difference ($z=-1.34$, $p=0.18$).

For inpatient service, the average cost of patients using NHI was 259 Cedi/month; the average cost of patients who never used NHI (including those not having NHI) was 578 Cedi/month. Patients using NHI spent 319 Cedi/month less than patients who didn't use NHI, with no significant difference ($z=-1.15$, $p=0.25$).

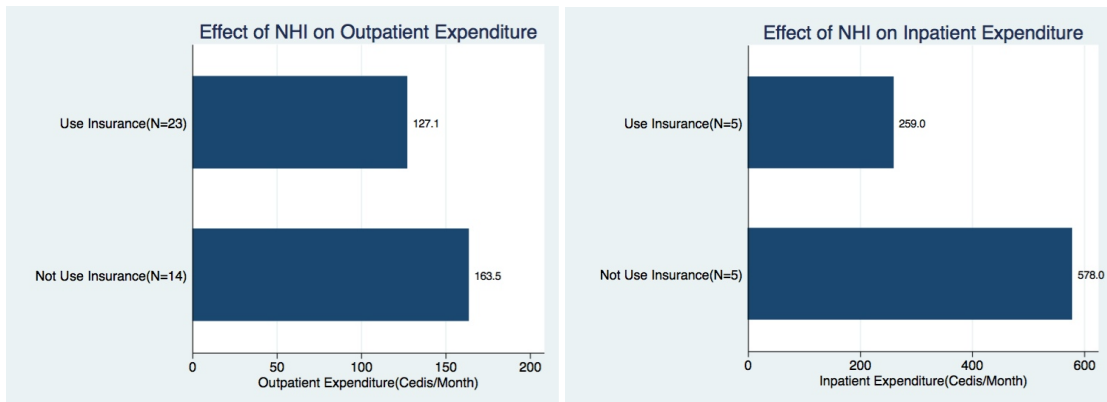


Figure 2: Effect of National Health Insurance on Outpatient Expenditure and Inpatient Expenditure

4.4.3 Distribution of NHI Membership and Free Premium Beneficiaries

As Table 4 shows, the proportions of NHI membership increased with an increase in age (43%, 77%, 86%), with no significant differences among the three age groups ($p=0.13$). The poorest socioeconomic group had lower NHI membership (50%) than the other three groups that had similar proportions (80%, 70%, 80%), with no significant differences among the four socioeconomic groups ($p=0.69$).

Among the patients with NHI, the proportions of free premium beneficiaries increased with the increase in age (0%, 23%, 50%), with no significant differences among the three age groups ($p=0.22$). The poorest socioeconomic group had higher proportions of free premium beneficiaries (60%) than the other three groups that had similar proportions (25%, 29%, 25%), with no significant differences among the four socioeconomic groups ($p=0.65$).

Table 4: The Percentages of NHI Membership and Free Premium Beneficiaries in Different Age Groups and Socio-economic Groups

	Age			Socio-economic Status			
	30-50(N=8)	51-60(N=17)	>60(=15)	Poorest(N=10)	Poor(N=10)	Rich(N=10)	Richest(N=10)
NHI Membership(%)	43%	77%	86%	50%	80%	70%	80%
Free Premium Beneficiaries (%)	30-50(N=3)	51-60(N=13)	>60(=12)	Poorest(N=5)	Poor(N=8)	Rich(N=7)	Richest(N=8)
	0%	23%	50%	60%	25%	29%	25%

4.4.4 Prices and NHIS Coverage of Diabetes Tests

As Table 5 shows, glycosylated hemoglobin tests and ECG were only available in the tertiary hospital, and oral glucose tests were only available in the tertiary and primary hospital. Among the 5 tests available in all the four health facilities, the tertiary hospital and the primary hospital had the lowest price for three of the tests, and the secondary hospital had the lowest price for two tests. Only fasting glucose tests and oral glucose tolerance tests were covered by NHIS in the secondary hospital. Other than those, no test was covered by NHIS in any type of health facility.

Table 5: Price of Tests (Cedi)

Test	Tertiary	Secondary	Primary	Private
Fasting/Random blood glucose	10	5(NHI) ¹	5	7
Oral glucose tolerance test	no data ²	25(NHI)	N.A. ³	N.A.
Urine analysis(Urine ketones and protein)	6	5	7	8
Blood Urea, electrolytes and creatinine	15	15	15	20
Fasting blood lipid profile	10	15	30	30
Glycated haemoglobin (HbA1c)	30	N.A.	N.A.	N.A.
FBC	7	10	18	20
ECG	30	N.A.	N.A.	N.A.

1. The test is covered by National Health Insurance.

2. Data is not available.

3. The test is not available in this health facility.

4.4.5 Coping Strategies

Among the 40 households, 14 (35%) borrowed money for treating and managing diabetes in the past year. The average amount of money borrowed was 247.5 Cedi/year

(Median=150, SD=273.9, Range=15, 1000). Four (10%) households sold assets for treating and managing diabetes in the past year.

4.4.6 Financial Support

Among the 40 households, the most common sources of financial support for treating and managing diabetes were extended family members (25, 62.5%), friends (5, 12.5%), church (3, 7.5%), and self-help groups (2, 5%).

Among the 14 households who did not have any financial support, the most common reasons mentioned were “never thought about seeking financial support” (9), and “I sought financial support but could not get any” (3).

5 Discussion

The results of this study reveal the characteristics of the burden of diabetes, the patterns of healthcare utilization, the costs of diabetes treatment and management, and the financial protections available for 40 households with diabetes patient(s) in two urban communities in Ghana.

5.1 The Burden of Diabetes

The characteristics of the sample displayed some worldwide and Africa-specific features of diabetes. First, 62.5% of diabetes cases were undiagnosed in Africa in 2014 (IDF, 2014), which might be the reason for the small sample size of this study; the number of diabetes cases was estimated to be much higher in the two communities. Second, the predominance of females among participants was in concordance with the fact that women are more susceptible to diabetes than men in Africa (WHO, 2011,P.16).

A prior study which reported that 75% of Ghanaian diabetes participants were female explained that women had a more sedentary lifestyle, restricted socioeconomic conditions, and limited participation in athletics (Danquah et al., 2012). In this study, the predominance of female participants may also be explained by selection bias. Since most interviews were conducted during the day, when men were out working or fishing, but most women traded within the communities or surrounding areas, thus women were more available to respond to interviews. Third, Type 2 diabetes accounted for the majority of all diabetes among patients who knew their status--consistent with the worldwide predominance of Type 2 diabetes. However, half of the participants did not know the type of diabetes they had, although almost all the participants visited health facilities in the past year. There are several reasons for this phenomenon: First, local doctors could not diagnose types of diabetes; Second, patients were not informed of their types of diabetes; Third, patients were informed but they did not notice. Regardless of the reason, this phenomenon might reflect either the lack of communication or the lack of knowledge about diabetes among patients and doctors. Finally, this study reflected some common complications or comorbidities of diabetes: 63% patients had hypertension--exactly the same prevalence found in a prior study conducted in Kumasi, Ghana--and some patients occurred eye-related complications (Danquah et al., 2012).

5.2 Patterns of Healthcare Utilization

This study showed that the utilization of health services among diabetes patients concentrated on outpatient services, public health facilities, and primary health facilities. More patients received outpatient service than inpatient service in the past year. For

both outpatient and inpatient service, patients chose public health facilities predominantly. For outpatient service, patients mainly visited primary health facilities and tertiary health facilities, while only two patients visited secondary health facilities, which might be the case for multiple reasons. Primary health facilities located within the communities were most accessible for patients. Investigation of tests given showed that two routine diabetes tests were only available in tertiary hospitals. In addition, healthcare utilization was also influenced by referrals between health facilities--primary health facilities might tend to refer severe cases to tertiary hospitals equipped with better resources rather than secondary hospitals.

Traditional treatment also played an important role in diabetes treatment and management among participants. In this study, eight participants reported visits to churches and traditional health facilities for diabetes treatment in the past year. Prior studies found that the high cost of diabetes might force patients to seek cure from ethno-medicine and faith healing, which were less costly but might threaten self-care and undermine biomedical goals (Aikins, 2005). However, the analysis of the costs of illness showed that households' average expenditure on herbs (129 Cedi/month) was higher than the average expenditure on medicine (68 Cedi/month), possibly because herbs were not covered by health insurance and are mainly provided by the private sector. This might imply that patients used ethno-medicine and faith healing due to their beliefs about health and wellness, rather than because biomedical treatment is too expensive. Therefore, this study suggests that exploring the reasons behind people's preference for

herbs might be important for alleviating the significant economic burdens caused by ethno-medicine.

5.3 The Cost of Diabetes

This study showed that diabetes treatment and management had a catastrophic effect on households' economic situation. Most studies of the costs of diabetes have investigated the economic burdens of diabetes from a social perspective, but few studies have investigated the effect of diabetes costs on individual households. By comparing health expenditures associated with diabetes with a household's ability to pay, this study found that 52.9% households incurred catastrophic health expenditures, which demonstrates the urgent need for financial protections for households with diabetes patient(s) in Ghana.

Many prior studies indicated that inpatient cost was the most significant contributor to the direct cost of diabetes in both developing countries and developed countries, due to the inherent high cost of inpatient healthcare (Ng et al., 2014; Le et al., 2013; Van Der Linden et al., 2009). In this study, even though the absolute cost of outpatient healthcare was higher than inpatient healthcare, the average inpatient expenditure per household (418 Cedi/month) was higher than that of outpatient service (136 Cedi/month), as well as higher than the average household income (261 Cedi/month). This result suggests that financial protections should prioritize inpatient service because it was more likely to result in a catastrophic effect on households, despite the fact that outpatient service was used most commonly. In this study, diabetes related complications contributed to 3.25% of the total cost of diabetes, but this

proportion was estimated to be much higher, since 16 of the 27 patients living with complications could not separate their health expenditure on complications from the total health expenditure on diabetes. Prior studies found that diabetes-related complications contributed significantly to the direct cost of diabetes in the US, Poland, and Iran (Zhuo, Zhang & Hoerger, 2013; Leśniowska et al., 2014; Javanbakht et al., 2011), and the presence and progression of complications increased the cost of diabetes treatment substantially (Al-Maskari, El-Sadig & Nagelkerke, 2010; Chatterjee et al., 2011). Therefore, this study suggests that controlling and managing complications might also be significant for alleviating economic burdens caused by diabetes in Ghana.

Some studies of the cost of diabetes have found indirect costs to be higher than direct costs (Barcelo et al., 2003; Solli et al., 2010; Ettarroet al., 2004). Other studies have obtained the opposite results (Le et al., 2013; Chatterjee et al., 2011; Chandra et al., 2014; Ng et al., 2014). Such difference largely results from the wide variations in the cost-of-illness analysis methodologies, which made it difficult to compare results from different studies. This study found that the contribution of direct costs to the total cost of diabetes were higher than that of indirect costs, which might be heavily influenced by the fact that no lost productivity of caregivers occurred: 50% patients were still working at the time of study. No patient's family member quit a job or reduced working hours to take care of patients, even though some patients employed caregivers. In addition, no extra expenditure for patients' family members occurred during patients' hospitalization, which might result from the reality that hospitals were close to patients' homes so that family members could come and go with no need for extra accommodation and food.

However, this expenditure might be high for patients living in remote areas. These results showed that diabetes patients in urban Ghana were relatively independent from their family caregivers.

5.4 Financial Protections

This study showed that insured patients paid less than the uninsured for both outpatient and inpatient services; this finding is similar to the results of a prior study on the effect of NHIS on general health expenditures in Ghana (Nguyen et al., 2011), except that the difference was not significant in this study. Prior studies also found that people of higher socio-economic status were more likely to be insured (Sarpong et al., 2010; Akazili, 2014), and this study showed a similar result: the poorest group had the lowest NHI membership rate, which implied that NHIS has not achieved the goal of protecting the most vulnerable against health-related financial risks. NHIS's premium was exempted for people aged above 70 and those classified as indigent (NHIS, 2012), although the definition of "indigent" was not clear. This study showed that NHIS's pro-poor and pro-elderly premium policies were effective in the two communities: The proportion of free premium beneficiaries increased with age, and the lowest socio-economic status group had the highest proportion. Even though all the statistical tests were not significant in this study (this might be a result of the small sample size), this study might still provide some clues regarding the positive effect of NHIS on diabetes patients.

NHI's coverage among participants (70%) was much higher than national coverage (35%), which may be explained by the "adverse selection" phenomenon:

people who have worse health conditions are more likely to subscribe to health insurance programs due to their relatively higher risks of loss. However, there was non-equivalence between NHIS membership and utilization. Some NHI members didn't use NHI when they received health services, which reflected some deficiencies in NHIS: At first, some NHI members reflected that the health facilities they went to didn't have NHIS accreditation, which might partly result from the failures in NHIS's reimbursement. Agyepong & Nagai (2011) found that some health providers in Ghana attributed their negative reactions to the NHIS to the reimbursement uncertainty and delays. This study also found that some health facilities withdrew their NHIS accreditation for the same reasons. Secondly, some patients reported that the insured always waited in health facilities for a longer time than the uninsured. Also because health facilities could not get in-time reimbursement from National Health Insurance Authority, doctors tended to treat patients using cash first, even though they were not supposed to do so. At last, some health services needed by participants were not covered by NHIS. Some patients would rather pay out-of-pocket to buy medicines of better quality. These results implied that the effect of NHIS on diabetes patients was diminished by its failures in reimbursements and by the lack of quality and variety in benefit packages.

The main financial supports for treating and managing diabetes were from patients' personal resources and community resources, which reflected some social features characteristic of much of Africa. Extended family and friends played the most important roles in supporting family members in financial crisis--which was also found

to be the case in Sudan (Elrayah et al., 2005) and rural Ghana (Aikins, 2010), and religious groups played supportive roles in all aspects of life (in this study, financial support from churches mainly refers to voluntary support from church members who knew the patient's situation). However, the economic burdens of diabetes might be underestimated because they were transferred to extended families. The public sector didn't have any financial protection for diabetes patients: No participant received financial support from government or social organizations, despite the fact that Ghana has some general social welfare programs providing financial support for the aged and the disabled, such as Livelihood Empowerment Against Poverty (LEAP) (Abebrese, 2011). Besides outside financial supports, the high cost of diabetes also forced some patients to cope by borrowing money and selling assets.

This study indicated some potential financial protections for diabetes patients: Some participants reported financial support from self-help groups, in which group members donated money voluntarily and regularly, and took out money from the pool when they encountered difficulty. The 2010 Population and Housing Census of Ghana reported that almost all Ghanaians are affiliated with one religion or the other with only 5.3% of the 24,658,823 total population affiliating with no religion (GSS, 2012). Therefore, churches might develop more organized self-help groups to expand the pooling scale for patients with chronic diseases. No participant reported financial support from local NGOs, although several NGOs were active in the two communities. These NGOs might run diabetes screenings and follow-up programs to reduce the costs of diabetes indirectly through early detection and the control of disease progression. Because there

are many competing priorities such as infectious diseases in Ghana, it may be difficult for the Ghanaian government to improve financial protection specifically for patients with diabetes or other chronic diseases. This study suggests that the government might reduce economic burdens of diabetes as well as other competing priorities through improving NHIS's administration process, in-time reimbursements, and the quality and variety of benefit packages. In addition, Ghana might learn from successful interventions in other African countries. For example, the government of Tanzania established 38 diabetes clinics across the country and provided free consultations in these clinics; the Tanzanian government also highly subsidized diabetes treatment and even provided free healthcare depending on patients' economic status (Nordisk, 2007). However, Tanzania's free diabetes healthcare has not been evaluated by any study, so Ghana should learn from Tanzania after great scrutiny. In addition, a retinopathy-screening program in South Africa that used a mobile retinal camera to detect eye-related complications caused by diabetes at early stages was proved to be cost-effective (Hofmand, Cook & Levitt, 2014). Considering the significant cost of diabetes complications in this study, similar low-cost and convenient technology for controlling diabetes complications might also be effective in reducing the costs of diabetes in Ghana.

6 Conclusion

This study demonstrates the primary-public-outpatient-centered patterns of healthcare utilization, the high economic burden of diabetes and its catastrophic effect on households, and the lack of financial protections among households with diabetes patient(s) in urban Ghana. The results showed that although NHIS had a positive

financial protection effect on the economic burdens of diabetes, this effect was significantly diminished by deficiencies in the national health insurance system. Except for NHIS, financial supports for patients mainly come from personal resources, with little from the public sector.

This study is exploratory. Similar studies on a larger scale are needed in Ghana, especially for less-developed rural areas. Further studies could increase sample size through identifying undiagnosed cases and following up patients' treatment expenditures. With a larger sample size, further studies could investigate associations between the costs of diabetes and socio-economic characteristics of patients, in order to identify the most vulnerable population needing financial protections for diabetes treatment in Ghana. During data collection, the research team found that many participants had poor diabetes management behaviors, which might be the reason that the conditions of some patients with discontinued treatment got worse suddenly and progressed to a later stage. Such poor management behaviors may lead to higher economic burdens due to the need for higher-level healthcare at progressed stages of disease. Therefore, this study suggests that further studies could investigate the effect of patients' management behaviors and doctors' behaviors on the cost of diabetes, as well as the cost of diabetes at different disease stages, in order to provide evidence regarding the cost-effectiveness of diabetes control and management. Finally, since this study found some potential financial protections for households with diabetes patients, it is hoped that further studies might provide evidence regarding the feasibility of these proposals. For example, further studies might investigate whether local NGOs have the

ability to manage diabetes-screening programs in the two communities and how the NHIS system might be improved in ways that would increase utilization and the effectiveness of health insurance.

Reference

- Abdulkadri, A. O., Cunningham-Myrie, C., & Forrester, T. (2009). Economic burden of diabetes and hypertension in CARICOM states. *Social and Economic Studies*, 58(3-4), 175-197.
- Abebrese, B. J. (2011). Social protection in Ghana An overview of existing programmes and their prospects and challenges. Retrieved from http://www.google.com.hk/url?sa=t&rct=j&q=&esrc=s&source=web&cd=7&ved=0CFAQFjAG&url=http%3A%2F%2Fwww.fesghana.org%2Fuploads%2FPDF%2FFES_SocialProtectionGhana_2011_FINAL.pdf&ei=69TXVL60JsarggTCw4PAAw&usq=AFQjCNFJenPB0kvp2da8TbPeSREKK-RTVw&bvm=bv.85464276,d.eXY
- Agyepong, I. A., & Nagai, R. A. (2011). "We charge them; otherwise we cannot run the hospital" front line workers, clients and health financing policy implementation gaps in Ghana. *Health Policy*, 99(3), 226-233.
- Akazili, J., Welaga, P., Bawah, A., Achana, F. S., Oduro, A., Awoonor-Williams, J. K., ... Phillips, J. F. (2014). Is Ghana's pro-poor health insurance scheme really for the poor? Evidence from Northern Ghana. *BMC Health Services Research*, 14(1), 637. doi:10.1186/s12913-014-0637-7
- Al-Maskari, F., El-Sadig, M., & Nagelkerke, N. (2010). Assessment of the direct medical costs of diabetes mellitus and its complications in the United Arab Emirates. *BMC Public Health*, 10(1), 679. doi:10.1186/1471-2458-10-679
- Amoah AG, Owusu SK, Adjei S.(2002) Diabetes in Ghana: a community based prevalence study in Greater Accra. *Diabetes Research and Clinical Practice*, 56,197-205.
- Amoah, A.G.B., Owusu, S.K., Acheampong, K., Agyenim-Boateng, K., Asare, H.R., Owusu, A.A., ... Woode, M.K.A. (1999). A national diabetes care and education programme: the Ghana model. *Diabetes Research and Clinical Practice*, 49 (2000), 149-157.
- Ayernor, P.K. Diseases of aging in Ghana. (2012). *Ghana Medical Journal*,(46), 18 - 22.
- Bahia, L. R., Araujo, D. V., Schaan, B. D., Dib, S. a, Negrato, C. A., Leão, M. P. S., Ramos, A. J. S., et al. (2011). The costs of type 2 diabetes mellitus outpatient care in the Brazilian public health system. *Value in Health : the Journal of the International Society for Pharmacoeconomics and Outcomes Research*, 14(5 Suppl 1), S137-40. Elsevier Inc. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/21839888>
- Balu, S. (2007). Incremental treatment expenditure of diabetes in the United States. *Managed Care Interface*, 20(4), 20-27.

- Barceló, A., Aedo, C., Rajpathak, S., & Robles, S. (2003). The cost of diabetes in Latin America and the Caribbean. *Bulletin of the World Health Organization*, 81(1), 19-27.
- Bosu WK. A.(2012) Comprehensive review of the policy and programmatic response to chronic noncommunicable disease in Ghana. *Ghana Med Journal*,46(2), 69-78.
- Chale, S. S., Swai, a B., Mujinja, P. G., & McLarty, D. G. (1992). Must diabetes be a fatal disease in Africa? Study of costs of treatment. *BMJ (Clinical Research Ed.)*, 304(May), 1215–1218. doi:10.1136/bmj.304.6836.1215
- Chandra, P., Gogate, B., Gogate, P., Thite, N., Mutha, A., & Walimbe, A. (2014). Economic Burden of Diabetes in Urban Indians, 14508, 91–94.
- Chatterjee, S., Riewpaiboon, A., Piyauthakit, P., Riewpaiboon, W., Boupaijit, K., Panpuwong, N., & Archavanuntagul, V. (2011). Cost of diabetes and its complications in Thailand: a complete picture of economic burden. *Health & Social Care in the Community*, 19(3), 289–298. doi:10.1111/j.1365-2524.2010.00981.x
- Currie, C. J., Gale, E. A. M., & Poole, C. D. (2010). Estimation of primary care treatment costs and treatment efficacy for people with Type 1 and Type 2 diabetes in the United Kingdom from 1997 to 2007. *Diabetic medicine: a Journal of the British Diabetic Association*, 27(8), 938-948. Wiley. Retrieved from <http://dx.doi.org/10.1111/j.1464-5491.2010.03040.x>
- Danquah, I., Bedu-Addo, G., Terpe, K.-J., Micah, F., Amoako, Y. A., Awuku, Y. A., Dietz, E., et al. (2012). Diabetes mellitus type 2 in urban Ghana: characteristics and associated factors. *BMC Public Health*.
- De-Graft Aikins, A. (2005). Healer shopping in Africa: new evidence from rural-urban qualitative study of Ghanaian diabetes experiences. *Bmj*, 331(7519), 737. doi: 10.1136/bmj.331.751
- De-Graft Aikins, A. (2007). Ghana's neglected chronic disease epidemic: a developmental challenge. *Ghana Med Journal*, 41(4), 154-159.
- De-Graft Aikins, A., Boynton, P., & Atanga, L. L. (2010). Developing effective chronic disease interventions in Africa: insights from Ghana and Cameroon. *Global Health*, 6, 6. doi: 10.1186/1744-8603-6-6
- DODU, S. R. (1958). The incidence of diabetes mellitus in Accra (Ghana); a study of 4,000 patients. *The West African Medical Journal*, 7(3), 129-134.
- Dodu, S. R. A., & Heer, N. de. (1964). A diabetes case-finding survey in Ho, Ghana. *Ghana Medical Journal*, 3, 75-80.

- Elrayah, H., Eltom, M., Bedri, A., Belal, A., Rosling, H., & Östenson, C. G. (2005). Economic burden on families of childhood type 1 diabetes in urban Sudan. *Diabetes Research and Clinical Practice*, 70(2), 159-165.
- Ettaro, L., Songer, T. J., Zhang, P., & Engelgau, M. M. (2004). Cost-of-illness studies in diabetes mellitus. *Pharmacoeconomics*, 22(3), 149-164.
- Ghana Statistical Service. (2012). 2010 Population and Housing Census: Summary Report of Final Results. Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CB0QFjAA&url=http%3A%2F%2Fwww.statsghana.gov.gh%2Fdocfiles%2F2010phc%2FCensus2010_Summary_report_of_final_results.pdf&ei=YuoEVeyVKYHsgwTg8oD4CQ&usg=AFQjCNEDAowUIFeJH9-eZWn8R0QWJWIVhQ&sig2=-VNYtHq5dO0qHY0spK1jvQ&bvm=bv.88198703,d.eXY
- Hall, V., Thomsen, R. W., Henriksen, O., & Lohse, N. (2011). Diabetes in Sub Saharan Africa 1999-2011: Epidemiology and public health implications. a systematic review. *BMC Public Health*, 11(1), 564. doi:10.1186/1471-2458-11-564
- Hodgson, T. A., & Meiners, M. R. (1982). *Cost-of-Illness Methodology : A Guide to Current Practices and Procedures*, 60(3), 429-462.
- Hodgson, T. A., & Meiners, M. R. (2014). *Cost-of-Illness Methodology : A Guide to Current Practices and Procedures*, 60(3), 429-462.
- Hofman, K. J., Cook, C., & Levitt, N. (2014). Preventing diabetic blindness: a priority for South Africa. *South African Medical Journal = Suid-Afrikaanse Tydskrif Vir Geneeskunde*, 104(10), 661-662.
- Institute for Health Metrics and Evaluation.(2010). GBD Profile: Ghana. Retrieved from [http://www.healthmetricsandevaluation.org/sites/default/files/country-profiles/G BD%20Country%20Report%20-%20Ghana.pdf](http://www.healthmetricsandevaluation.org/sites/default/files/country-profiles/G%20BD%20Country%20Report%20-%20Ghana.pdf)
- International Diabetes Federation.(2014). Ghana. Retrieved from <http://www.idf.org/membership/afr/ghana>
- Javanbakht, M., Baradaran, H. R., Mashayekhi, A., Haghdoost, A. A., Khamseh, M. E., Kharazmi, E., & Sadeghi, A. (2011). Cost-of-illness analysis of type 2 diabetes mellitus in Iran. *PLoS ONE*, 6(10), 1-7. doi:10.1371/journal.pone.0026864
- Ke Xu. Distribution of Health Payments and Catastrophic Expenditure (2005b). Retrieved from: http://www.who.int/health_financing/catastrophic/en/index1.html

- Kengne, A. P., Echouffo-Tcheugui, J.-B., Sobngwi, E., & Mbanya, J.-C. (2013). New insights on diabetes mellitus and obesity in Africa-Part 1: prevalence, pathogenesis and comorbidities. *Heart (British Cardiac Society)*, 1-5. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/23680891>
- Kirigia, J. M., Sambo, H. B., Sambo, L. G., & Barry, S. P. (2009). Economic burden of diabetes mellitus in the WHO African region. *BMC International Health and Human rights*, 9, 6.
- Kirigia, J. M., Sambo, H. B., Sambo, L. G., & Barry, S. P. (2009). Economic burden of diabetes mellitus in the WHO African region. *BMC International Health and Human Rights*, 9, 6. doi:10.1186/1472-698X-9-6
- Le, C., Lin, L., Jun, D., Jianhui, H., Keying, Z., Wenlong, C., ... Tao, W. (2013). The economic burden of type 2 diabetes mellitus in rural southwest China. *International Journal of Cardiology*, 165, 273–277. doi:10.1016/j.ijcard.2011.08.039
- Le, C., Lin, L., Jun, D., Jianhui, H., Keying, Z., Wenlong, C., ... Tao, W. (2013). The economic burden of type 2 diabetes mellitus in rural southwest China. *International Journal of Cardiology*, 165(2), 273–7. doi:10.1016/j.ijcard.2011.08.039
- Leśniowska, J., Schubert, A., Wojna, M., Skrzekowska-Baran, I., & Fedyna, M. (2014). Costs of diabetes and its complications in Poland. *European Journal of Health Economics*, 15, 653–660. doi:10.1007/s10198-013-0513-0
- Mena, N. A., Sea, E. A., & Lucia, S. (2014). IDF Diabetes Atlas 6th edn. 2014 update. Retrieved from <http://www.idf.org/diabetesatlas/update-2014>
- MoH. (2012). REPUBLIC OF GHANA National Policy for the Prevention and Control of Chronic Non-Communicable Diseases in Ghana, (August). Retrieved from [http://www.iccp-portal.org/sites/default/files/plans/national_policy_for_the_prevention_and_control_of_chronic_non-communicable_diseases_in_ghana\(1\).pdf](http://www.iccp-portal.org/sites/default/files/plans/national_policy_for_the_prevention_and_control_of_chronic_non-communicable_diseases_in_ghana(1).pdf)
- Morris, S., Carletto, C., Hoddinott, J., & Christiaensen, L. (2000). Validity of rapid estimates of household wealth and income for health surveys in rural Africa. *Journal of Epidemiology and Community Health*, 54(5), 381–387. doi:10.1136/jech.54.5.381
- National Health Insurance Authority(NHIA). National Health Insurance Scheme Annual Report 2012.(2012). Retrieved from <http://www.nhis.gov.gh/files/2012%20NHIA%20ANNUAL%20REPORT.pdf>

- Ng, C. S., Lee, J. Y. C., Toh, M. P. H. S., & Ko, Y. (2014). Cost-of-illness studies of diabetes mellitus: A systematic review. *Diabetes Research and Clinical Practice*, 105, 151–163. doi:10.1016/j.diabres.2014.03.020
- Nguyen, H. T., Rajkotia, Y., & Wang, H. (2011). The financial protection effect of Ghana National Health Insurance Scheme: evidence from a study in two rural districts. *International Journal for Equity in Health*, 10, 4. doi:10.1186/1475-9276-10-4
- National Health Insurance Scheme (NHIS). NHIS - Your Access to Healthcare. (2015). Retrieved from <http://www.nhis.gov.gh/Default.aspx>
- Novo Nordisk. (2007). The silent epidemic-An economic study of diabetes in developed and developing countries. Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=31&ved=0CBwQFjAAOB4&url=http%3A%2F%2Fgraphics.eiu.com%2Fupload%2Fportal%2FDIABETES_WEB.pdf&ei=Yj75VliwC8yZgwSmn4HQDw&usg=AFQjCNGrv_B0HaSswLkyRHYelE9cvHN6cg&sig2=WqJ2Oz9kAlHqQxRQBdaLg
- Republic of Ghana. Ministry of Health. (2004). Standard Treatment Guidelines. Retrieved from <http://apps.who.int/medicinedocs/en/d/Js16434e/>
- Sarpong, N., Loag, W., Fobil, J., Meyer, C. G., Adu-Sarkodie, Y., May, J. and Schwarz, N. G. (2010), National health insurance coverage and socio-economic status in a rural district of Ghana. *Tropical Medicine & International Health*, 15: 191–197. doi: 10.1111/j.1365-3156.2009.02439.x
- Segel, J. E. (2006). Cost-of-Illness Studies — A Primer. *Diabetes*, (January), 1-39. RTI-UNC Center of Excellence in Health Promotion Economics. Retrieved from http://www.rti.org/pubs/coi_primer.pdf
- Solli, O., Jenssen, T., & Kristiansen, I. S. (2010). Diabetes: cost of illness in Norway. *BMC Endocrine Disorders*, 10, 15. doi:10.1186/1472-6823-10-15
- Van Der Linden, M. W., Plat, A. W., Erkens, J. a., Emneus, M., & Herings, R. M. C. (2009). Large impact of antidiabetic drug treatment and hospitalizations on economic burden of diabetes mellitus in the Netherlands during 2000 to 2004. *Value in Health*, 12(6), 909–914. doi:10.1111/j.1524-4733.2009.00506.x
- Wang, W., McGreevey, W. P., Fu, C., Zhan, S., Luan, R., Chen, W., & Xu, B. (2009). Type 2 diabetes mellitus in China: a preventable economic burden. *American Journal of Managed Care*, 15(9), 593-601.
- World Health Organization(WHO). (2009b). WHO guide to identifying the economic consequences of disease and injury. Geneva: World Health Organization. Retrieved from <http://www.who.int/choice/economicburden/en/>

- WHO. (2011). Chapter 1 Burden : mortality, morbidity and risk factors. Global Status Report on Non-Communicable diseases 2010, 9-31. WHO. Retrieved from http://www.who.int/nmh/publications/ncd_report_chapter1.pdf
- WHO. (2014). Global Status Report On Noncommunicable Diseases 2014. Retrieved from <http://www.who.int/nmh/publications/ncd-status-report-2014/en/>
- WHO. (2015). Diabetes. Retrieved from <http://www.who.int/mediacentre/factsheets/fs312/en/>
- WHO. (2008). The Global Burden of Disease: 2004 update. Update. Retrieved from http://www.who.int/healthinfo/global_burden_disease/2004_report_update/en/index.html
- WHO. (2009a). Country Cooperation Strategy Brief. Retrieved from <http://www.afro.who.int/en/ghana/country-cooperation-strategy.html>
- Xu, K., Xu, K., Evans, D., Evans, D., Carrin, G., Carrin, G., Aguilar-Rivera, A. M., et al. (2005a). Designing health financing systems to reduce catastrophic health expenditure. *Bulletin of the World Health Organization*. WHO.
- Yesudian, C. a K., Grepstad, M., Visintin, E., & Ferrario, A. (2014). The economic burden of diabetes in India : a review of the literature, 1–18. doi:10.1186/s12992-014-0080-x
- Zhuo, X., Zhang, P., & Hoerger, T. J. (2013). Lifetime direct medical costs of treating type 2 diabetes and diabetic complications. *American Journal of Preventive Medicine*, 45(3), 253–261. doi:10.1016/j.amepre.2013.04.017