

UNIVERSITY FOR DEVELOPMENT STUDIES

**LOGISTIC REGRESSION ANALYSIS OF FACTORS AFFECTING
THERENEWAL OF THE NATIONAL HEALTH INSURANCE POLICY
IN THE TAMALE METROPOLIS, NORTHERN REGION,**

GHANA

AL-HASSAN NASIRU-DEEN

**Thesis submitted to the Department of Statistics, Faculty of Mathematical
Sciences, University for Development Studies in Partial Fulfilment of the
Requirement for the Award of Master of Science Degree in Applied Statistics**

2012



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BY

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(UDS/MAS/0009/10)

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OCTOBER, 2012



DECLARATION

Student

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere except the references to other researchers or writers which have been duly acknowledged.

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Supervisor

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

Supervisor's Signature:  Date: 19/10/2012

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ABSTRACT

The likelihood and factors affecting the chance of renewal in the NHIS in Tamale Metropolis was analyzed using binary logistic model. Primary data was used, collected from Dohin- nayili, Kalariga, Hospital catchment area, Saaka-Saaka, Mohiya-Bihi, Wari'zehi, Kpaan Vuo, Tuutin-li, Ban-vim, Sagnerigu, Education Ridge, Tishigu and Ward-k, all in the Tamale Metropolis. The objectives of the study include identifying factors that affect the renewal decisions of clients and the extent to which these factors affect the chance of the renewal in the NHIS, following the realisation that the Tamale Metropolitan has recorded less than 40% renewal rate since the inception of the scheme in the Metropolis. Analysis of the Data was done using SAS version (9.2) and SPSS version (19) in windows 2007 environment. The study revealed that Gender (gender), Employment status (employ), perception about the efficiency of drug dispensed under the NHIS (pdrug), how often one falls sick (cdisease) and the perception about attitude of health care workers(pattit), were significant in affecting renewal decisions of clients, resulting in a five predictor logistic model: **Predicted** [log(odds of renewal) = - 4.9756 + 1.1073**gender2** + 0.336**employ** + 0.7956**cdisease** + 0.7802**pdrug** + 0.6043**pattit**] . The prediction equation was subjected to several evaluations and it proved to be more than 78% efficient as shown in the ROC curve and the classification tables.



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DEDICATION

This piece of work is dedicated to my parents.



TABLE OF CONTENT

DECLARATION	i
ABSTRACT	ii
ACKNOWLEDGEMENT	iii
DEDICATION	iv
TABLE OF CONTENT	v
LIST OF TABLES	x
LIST OF FIGURES	xii
DEFINITION OF TERMS AND ACRONYMS	xiv
 CHARTER ONE: INTRODUCTION	
1.1 Background of the study	1
1.2 Brief History of Health Care Financing in Ghana	2
1.2.1 Cash and carry.	2
1.3 Intervention in Ghana	4
1.3.1 Private Sector Intervention	4
1.3.2 Government Intervention	5
1.4 Disease/ Services Coverage and Exemptions	5
1.4.1 Disease/Services Covered	5
1.4.2 Disease/Services Exempted	6
1.5 Source of Funding	6
1.6 Performance	8



1.7	Motivation for the Study	9
1.7.1	(SNV) Report on Ghana's NHIS	9
1.7.2	Tamale Metropolitan scheme	10
1.8	Research Questions	11
1.9	Research Objectives	11

CHARTER TWO: LITERATURE REVIEW

2.1	Concept of Health Care Financing and Influential Variables	12
2.1.1	Influential Variables	16
2.1.1.1	Income.	16
2.1.1.2	Health – Care Expenditure	16
2.1.1.3	Education	16
2.1.1.4	Age	17
2.1.1.5	Gender	17
2.1.1.6	Knowledge about the Scheme.	17
2.1.1.7	Number of children in House –holds	18
2.1.1.8	Coverage of Illness	18
2.1.1.9	Customer Satisfaction.	19

CHARPTER THREE: RESEACH METHODOLOGY

3.1	Source of Data	20
3.2	Sampling Techniques	20



3.3	Study Variable	21
3.4	Statistical analysis	21
3.5	Modelling Approach	22
3.5.1	Overview of the Model	22
3.5.2	Binary Data	23
3.5.3	Odds and Odds Ratio	24
3.5.4	Logistic Regression	24
3.5.5	The Logistic Function	25
3.5.6	The Logistic Regression Model	27
3.5.7	Testing Hypothesis in logistic Regression	28
3.5.8	Wald Test	29
3.5.9	Likelihood Ratio Test	29
3.5.10	Model Evaluation and Validation	30
3.5.10.1	Hosmer-Lemeshow Goodness of Fit Test	30
3.5.10.2	Model Validation	30

CHAPTER FOUR: DATA ANALYSIS AND RESULT

4.1	Descriptive Analysis of Data	33
4.2	Model Fitting	44
4.3	Model Evaluation	47
4.3.1	Testing Global Null Hypothesis	48



4.3.2	Statistical Test of Individual Predictors	49
4.3.3	Residual Chi-Square Test	50
4.3.4	Goodness of Fit T-test	51
4.3.4.1	Residual Plot	52
4.3.5	Validation of Predicted Probabilities	53
4.3.5.1	Graphing Prediction Accuracy	54

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1	Introduction	61
5.2	Discussions	61
5.2.1	Overall Model Evaluation	61
5.2.2	Statistical Test of Individual Predictions	63
5.2.3	Discussion on Individual Prediction	64
5.2.4	Goodness of Fit Statistics	68
5.2.4.1	Partition for Hosmer-Lemeshow Test	68
5.2.4.2	Lack Fit Test	69
5.2.4.3	Discussion on Residual Plot	69
5.2.5	Validation of Prediction Probabilities	70
5.2.5.1	Use of Table	70
5.2.5.2	Measures of Association	71
5.2.5.3	ROC (Receiver Operating Characteristics curve)	72



5.3	Conclusion	73
5.4	Recommendation	75
5.5	Suggestion for Further Work	76
REFERENCES		77
APPENDICES		85
APPENDIX A: QUESTIONNAIRE FORMS A AND B		85
APPENDIX B: CODES FOR ANALYSIS		88
APPENDIX C: DATA		90



LIST OF TABLES

1.1	Table of Contributions Payables into the NHIS by Social Grouping in the Informal Sector of Ghana	7
4.1	Distribution of Respondents by Sex.	33
4.2	Distribution of Respondents by Age.	34
4.3	Distribution of Respondents by Educational Status.	35
4.4	Distribution of Respondents by Different Level of Monthly Income	36
4.5	Distribution of Respondents by Access to Health Facility.	37
4.6	Distribution of Respondents by the Different type of Employment Status	38
4.7	Distribution of Respondents by Presence /Absence of Chronic Disease	40
4.8	Distribution of Respondents by Different Perceptions about Efficiency of Drugs under the NHIS	41
4.9	Distribution of Respondents by Different Perceptions about Attitude of Health Care Workers	42
4.10	Distribution of Respondents by General Level of Satisfaction with the Service of Health Care Provider	43
4.11	Distribution of Respondents by Health Care Financing System Preferred.	44
4.12	Summary of Step Wise Selection.	45



4.13	Analysis of Maximum Likelihood Estimate.	46
4.14	Odds Ratio Estimates.	47
4.15	Table of Descriptive Assessment of the Model	47
4.16	Summary of the Result of Global Null Hypothesis (BETA=0).	48
4.17	Analysis of Maximum Likelihood Estimates.	49
4.18	Type 3 Analysis of Effect.	50
4.19	Result of Residual Chi-Square Test.	51
4.20	Partition for the Hosmer and Lemeshow Test.	51
4.21	Hosmer- Lemeshow Goodness of fit Test	52
4.22	Association of Predicted Probabilities and Observed Responses	54
4.23	Classification Table	54
4.24	Summary of Result for Figure 4.14	56
4.25	Summary of Result for Figure 4.15	57
4.26	Summary of Result for Figure 4.16	58
4.27	Summary of Result for Figure 4.17	59
4.28	Summary of Result for Figure 4.18	60



LIST OF FIGURES

3.1	Sigmoid Curve	26
4.1	Pie Chart of Distribution of Respondents by Sex.	33
4.2	Bar Graph of Distribution of Respondents by Age.	34
4.3	Bar Graph of Distribution of Respondents by Educational Status.	35
4.4	Bar Graph of Distribution of Respondents by Different level of Monthly Income.	36
4.5	Pie Chart of Distribution of Respondents by Access to Health Facility	37
4.6	Pie Chart of Distribution of Respondents by Employment Status.	39
4.7	Bar Graph of Distribution of Respondents by Prevalence of Chronic Disease.	40
4.8	Pie Chart of Distribution of Respondents by Perception about Efficiency of Drugs dispensed under NHIS.	41
4.9	Pie Chart of Distribution of Respondents by Perception about Attitude of Health Care Providers	42
4.10	Pie Chart of Distribution of Respondents by General Level of Satisfaction with Service of Health Care Providers	43
4.11	Pie chart of Distribution of Respondents by Health care Financing System Preferred	44
4.12	Influence Diagnostic	53
4.13	ROC Curve for Model	55



4.14	Predicted Probability for Renewal =1 with 95% Confidence	
	Limit (Gender)	56
4.15	Predicted Probability for Renewal =1 with 95% Confidence	
	Limit (employ)	57
4.16	Predicted Probability for Renewal =1 with 95% Confidence	
	Limit (cdisease)	58
4.17	Predicted Probability for Renewal =1 with 95% Confidence	
	Limit (pdrug).	59
4.18	Predicted Probability for Renewal =1 with 95% Confidence	
	Limit (pettit)	60



DEFINITIONS OF TERMS AND ACRONYMS

1.0) HEALTH

Health is defined as a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity.

2.0) PREMIUM

Agreed upon fees paid for coverage of medical benefits for a defined benefit period. Premiums can be paid by employers, unions, employees, or shared by both the insured individual and the plan sponsor.

3.0) HEALTH INSURANCE

Health insurance is a financial scheme that pays for all or part of a person's health care bills. The types of health insurance are group health plans, individual plans, workers' compensation, and government health plans such as Medicare and Medicaid.

4.0) INSURANCE POLICY

A contract of insurance, describing the term, coverage, premiums and deductibles also called policy.

5.0) POLICY HOLDER: The owner of an insurance policy; usually, but not always, the insured.

6.0) SOLVENCY: Financial soundness of an entity that allows it to discharge its monetary obligations as they fall due. It is measured by solvency ratios.

7.0) CASH AND CARRY: Options in which a future contract is sold and a matching cash contract is bought to profit from their price discrepancy.



ACRONYMS

CBHI:	Community Base Health Insurance
MHO:	Mutual Health Organization
NHSI:	National Health Insurance Scheme
NHIC:	National Health Insurance Council
IMF:	International Monetary Fund
SAP:	Structural Adjustment Program
WHO:	World Health Organization
NHIA:	National Health Insurance Authority
AIDS:	Acquired Immune Deficiency Syndrome
SNV:	Skilled Nursing Visit
HI:	Health Insurance
OOP:	Out of Pocket
DV:	Discrete Variable
CCR:	Correct Classification Rate
AIC:	Akaike Information Criterion
SC:	Schwarz Criterion



BIC: Bayesian Information Criterion

ROC: Receiver Operating Characteristic

IPD: Inpatient department



CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Health as the saying goes is wealth. The socio-economic development of every nation depends largely upon the health status of its citizenry.

World wide, health- care financing is a major hurdle in health-care delivery. For a way out, many nations are fast drifting towards various forms of Health Insurance Schemes, which is emerging as the most preferred form of health-care financing mechanism, especially in situations where private out of pocket expenditure on health are significantly high and cost recovery strategies affect the access (Gilson 1998, Sauerborn, R., et al., 1994) to health care. The insurance mechanism helps the communities to pool their risk and transfers risk of unforeseeable health care cost for a pre-determined fixed premium thereby avoiding catastrophic burden (Griffin, 1992).

Since independence in 1957, health care financing in Ghana has experienced many transformations, including the introduction of community based Health Insurance (CBHI) schemes, also known as Mutual Health Organisations (MHO'S). However, as of 2003, such Community Schemes covered only a small portion of the country's then 19 million population, leaving many Ghanaians vulnerable in the event of catastrophic illness. In an attempt to increase access and improve the quality of basic health care service, the Government of Ghana passed the National Health Insurance Act 650 (HI Act) in August 2003, mandating the creation of District Level MHO's in



accordance with National guidelines and the establishment of NATIONAL HEALTH INSURANCE COUNCIL (NHIC).

To maximise benefits of this laudable scheme for Ghanaians, the sustainability is crucial, and this largely depends upon the decisions of policy holders to renew their policy holdings. The decision of policy holders not to renew the policy has implications for the risk pooling and may indicate serious adverse selection or moral hazard problem.

The low renewal rate may be an indication that the insurance scheme is not able to deliver value to its policy holders because of poor networking with the health care providers or inadequate access to health-care facilities and all these indications are not good for the sustenance of the Health Insurance Scheme.

1.2 Brief History of Health Care Financing in Ghana

Following the country's independence in 1957, all Ghanaians could seek medical attention in any Government hospital or health care centres and pharmacy at no financial cost to the individual.

1.2.1 The Cash and Carry

However, hospital fees were re-introduced in 1969 and in some variety until the introduction of the "cash and carry" system in 1985. The Government expenditure on health care was quite high between the late 1960's and mid 1980's. For example, per-capital Health expenditure in 1970 was \$10.00, compared to between \$5.00 and \$6.00 in 1990's (Nyonator and Kutzin, 1999).

In 1983, Government of Ghana adopted the International Monetary Fund (IMF) and World Bank Promoted Structural Adjustment Program (SAP).



Since the key component of the SAP was to reduce Government expenditure (overall) to the barest minimum, the burden of paying for Health was borne by patients.

Cost of medicine alone accounted for 60% of treatment of malaria, one of the commonest illnesses in Ghana (Assensoh, O. and Dzator, 1997). Government expenditure as a result of the cost shifting was reduced from 10% of the National Budget in 1982 to 1.3% in 1997 (Kwado, K.A., 2000).

The negative effect of the cost shifting was that many Ghanaians could not afford to pay the requisite fees at the point of health delivery to seek medical attention. They avoided going to hospitals and the health care centres; instead they engaged in self medication or other cost saving behaviours and practices. (Assensoh, O. et al., 1998).

Like the Ghanaian experience, many low and middle-income countries rely heavily on patients' out-of-pocket health payments to finance their health care systems (Xu et al., 2007). According to the World Health Organisation (WHO), empirical evidence indicates that out-of-pocket health payment is the least efficient and most inequitable means of financing health care and prevents people from seeking medical care and may exacerbate poverty (WHO, 2000; Xu et al. 2003; Hjortsberg, 2003). There is a growing movement, globally and in the Africa region, to reduce financial barriers to quality health care generally, but with particular emphasis on high priority services and vulnerable groups (Witter and Garshong, 2009). Health insurance schemes are increasingly recognized as a tool to finance health care provision in developing countries and has the potential to increase utilization and better



protect people against (catastrophic) health expenses and address issues of equity (WHO, 2000). Health financing systems through general taxation or through the development of social health insurance are generally recognized to be powerful methods to achieving universal coverage with adequate financial protection for all against healthcare costs (Weber et al., 2000 cited in Doetinchem et al., 2006; Carrin et al., 2005). Many African countries *including Ghana, Rwanda, Tanzania, Kenya and Nigeria are experimenting* with a variety of comprehensive, social health insurance schemes that combine both private and public-funding arrangements (Carrin et al., 2008; Witter and Garshong, 2009; Mensah et al., 2010).

1.3 Interventions in Ghana

1.3.1 Private Sector Intervention

The negative effects of the “cash and carry”, prompted some health care centres, mainly the mission hospitals to introduce Insurance Schemes, managed jointly by the facility and the communities in which they operate, as a strategy to avoid the problems associated with paying at the point of care.

Schemes such as those of Nkoranza and Dangme West were established in the early 1990's and became models for other communities to replicate. The subsequent growth in Mutual Health Organisations (MHO) in Ghana was noteworthy. Whereas 47 MHO's existed in 2001 (Atim et al, 2001), this number tripled to 159 by 2002 and continued to rise to 168 by 2003. However, less than 40% of MHO's were functional at that time, and the combined total average they extended to the population was just 1% (Atim et al., 2003).



1.3.2 Government Intervention

In addition, Government of Ghana, recognising the problems “cash and carry” system posed to accessing health care, declared its intention to abolish the system and began exploring the feasibility of introducing the National Health Insurance Scheme (NHIS) to be managed at the District, Metropolitan and Municipal levels. In August 2003, the Government of Ghana moved from planning to action by passing the NHIS Act; (Act 650) but the Scheme became fully operational in March 2005 (Sulzabach et al., 2005).

In addition to providing the guiding principles on the Structure of the District Insurance Scheme, The Health Insurance (Act 650), provides the Legislative frame-work for the establishment of a regulatory body, The “National Health Insurance Council” (NHIC). The mandate of NHIC is to register, licence and regulate Health Insurance Schemes and to accredit and monitor health-care providers operating under the scheme (Sulzabach et al., 2005).

1.4 Disease/ Services Coverage and Exemptions

1.4.1 Diseases and Services Covered

The Government of Ghana has come out with a minimum benefit package of diseases and services which every district- wide scheme must cover. This package covers about 95% of diseases in Ghana. Diseases covered include among others Malaria, Diarrhoea, Upper Respiratory Tract Infection, Skin Diseases, Hypertension, Diabetics and Asthma, etc. In Broad terms, all Out-patient consultations, Essential Drugs, Patient care and shared



accommodation, Maternity care (normal and caesarean delivery), Eye care, Dental care and Emergency care.

1.4.2 Diseases and Services Exempted

Certain diseases and services are however excluded from the package. This is mainly because it is too expensive to treat. These include: Optical aids, Hearing aids, Orthopaedic aids, Dentures, Beautician surgery, Supply of AIDS drugs, treatment of Chronic Renal Failure, Heart and Brain Surgery, etc. All these constitute only 5% of the total number of diseases that attack Ghanaians.

1.5 Sources of Funding

To mobilise additional funds to support the implementation of the District Mutual Health Insurance Schemes, the Government of Ghana instituted a National levy of 2.5% on specific goods and services. In addition, 2.5% of the 17.5% Social Security Contribution paid by formal sector employees will automatically be diverted to support the NHIS and formal Sector employees and their dependants below the age of eighteen (18) years will be enrolled in their District Schemes. It was anticipated that approximately 80 percent of the NHIS will

be financed by these taxes. For those in the informal Sector, Community Health Insurance Committees will categorise residents into social groups based on economic status and those identified as “Core Poor” will be exempted from paying the premiums (Government of Ghana 2004). The contributions payable by the Social groupings in the informal Sector are shown in the table below; Table 1.1.



Table 1.1: Table of Contributions Payable into the NHIS by Social Grouping in the Informal Sector of Ghana

FINANCIAL CLASS	GROUP	WHO ARE THEY	MINIMUM CONTRIBUTION PAYABLE ANNUALLY
Core Poor	A	Adults who are unemployed and who do not receive any identifiable and constant support from elsewhere for support	Free
Very Poor	B	Unemployed adults who receive some financial remittances elsewhere	Gh¢7.20
Poor	C	Adults who are employed but with low returns and not able to meet basic needs	Gh¢7.20



Continuation of Table 1.1

Middle Income	D	Adults who are employed and able to meet basic needs	Gh¢18.00
Rich	E	Employed adults who are able to meet their needs and some of their wants.	Gh¢48.00
Very Rich	F	Employed adults who are able to meet their needs and most of their wants	

Children under the age of eighteen (18) years, whose parents or guardian pay their own contributions, are exempted. In addition, Ghanaians up to the age of seventy (70) years and above are exempted.

1.6 Performance

Overall attendance to health facilities for health care has increased between 2005 and 2007.



It is worrying that Inpatient Department (IPD) attendance is increasing (Major Risk). Up to the first quarter of 2008, the Scheme was financially sustainable. However cost per attendance sharply increased, mainly caused by increasing service cost of in-patients, and by the third quarter of 2008 the scheme itself was able to determine that it was running into financial distress due to increasing cost of care and to timely application for assurance to maintain solvency. Also to ensure a long term financial sustainability, the scheme is considering various options for investment. (Agbenyadzi et al., 2009).

1.7 Motivation for the Study

1.7.1 (SNV) Report on Ghana's NHIS.

According to The Skilled Nursing's Visit (SNV) report on Ghana's National Health Insurance Scheme, captioned under the Heading "SNV's assessment of Ghana's national health insurance from governance to performance". The report states; "The recent Ministry of Health Mid-term review highlighted a number of serious concerns related to the operations of the schemes. One of which is that neither The National Health Insurance Authority (NHIA) nor the District Scheme have a proper insight into the cost of the Scheme. This makes it extremely difficult to assess the financial Sustainability and to address the inefficiencies and fraud" (Eunice and Van der Wal, 2009). This means that the Scheme could collapse without the relevant authorities seeing the early warning signals. This has prompted the studies to find out the state of the Tamale Metropolitan Scheme (as a point of beginning), with specific interest into the factors that will determine whether a client is likely to renew or not ,



since renewal is one of the determinants of the financial sustainability of the scheme.

1.7.2 The Tamale Metropolitan Scheme.

The Tamale Metropolitan Insurance Scheme started operation as early as any other District's Scheme under the HI Act 650. As of 31st December 2010, 290,941 had registered to be policy holders under The National Health Insurance Scheme. Out of this number, 110,222 were male and 18,719 were female policy holders. The total number grew up to 314,485 as of 31st October 2011; with male taking 119,870 and female increasing to 194,615.

The worrying revelation is that out of the total of 314,485, only 73,741 policies were active (Renewed up to date). This figure (73,741) was based on waiting period of three months, with exception of pregnant women who do not have a waiting period; representing 23.45% officially as the estimated total active membership. Furthermore, out of the 73,741 active policy holdings 33,742 are below the age of 18 years and 4,998 are above the age of 70 years, (all within the class of those exempted from paying premiums). The implication of this trend can be devastating for the financial sustainability and the overall development and performance of the Scheme in the Tamale Metropolis. (Data source: Tamale Metropolitan Health Insurance Scheme).

The study therefore seeks to find out some of the factors that affect the renewal decisions of health insurance policy holders in the Tamale Metropolis, using binary logistic modelling approach since renewal status can either be yes or a no



1.8 Research Questions

The research is influenced by the following questions:

- i. If an individual takes a decision to purchase a policy under the NHIS, why should the same person decline to renew in spite of all the numerous benefits?
- ii. What are the compelling factors responsible for this unacceptable high level of reluctance to renew?
- iii. To what extent do these factors affect the clients' decision to renew their policies?
- iv. What can be done to improve the situation?

1.9 Research Objectives

The objectives of this research are:

- i). Identify some factors associated with decisions of policy holders to either renew or not.
- ii). Assess the extent to which these factors affect the chances of clients' decisions to renew.
- iii). Use the binary logistic model to explain this phenomenon.
- iv). Come out with some suggestions and recommendations that may help improve the performance of the NHIS in the Tamale Metropolis.



CHAPTER TWO

LITERATURE REVIEW

2.1 Concept of Health Care Financing and Influential Variables

Akazili (2010) in his PhD studies evaluated the factors effecting enrolment in the national health insurance scheme (NHIS), which is the intended means of achieving equitable health financing and universal coverage in Ghana and discovered that health care financing system is progressive. In his view, this is driven largely by the overall progressivity of taxes which account for over 50% of health care financing.

The questions that readily comes to mind is why can't Ghana run the NHIS through premium and renewals but have to rely on taxes to the tune of 50% of the financial requirement of the scheme? This clearly shows there is something wrong.

Another observation made by Dr. James Akazili is that the informal sectors of the NHIS contribution were found to be regressive. This is obviously another area that should be of great concern, because about 70% of Ghanaian workforce is in the informal sector, so that if an encouraging response cannot be recorded from this sector, then it calls for attention. Hence the inclusion of employment type in this study which on the contrary, has indicated progressivity relative to the public sector.

Another observation he made from this study indicated that, the high premiums, ineffective exemptions, fragment pools and perceived poor quality of care, affect the expansion of the NHIS. This therefore informed our choice of perception about quality of health delivery as one of the independent



variables in our study, which in the contrary indicated that perception about quality of service did not directly affect renewal decisions but perception about attitude of health care workers did; with 72.59% of respondents having the view that even though it was not all that bad, the general attitude was not good enough.

From the assessment carried out by (Wahab, 2008) on the implementation of Ghanaian national health insurance scheme law, this is how he concluded:

“From the above assessment, it is clear that provision of health-care in Ghana has improved since the implementation of the NHIS. There are still some problems however. For instance, the Government seems to be experiencing difficulties in enrolling the large segment of the population in the informal sector. According to one report, only about 22% of workers in the informal sector had enrolled in the NHIS as at September, 2006. This is insignificant considering that the informal sector employ 70% of Ghana work force. Familiarly, in speaking with my interviewees there is great consternation about the delays in particularly renewing the ID cards”. Again the informal sector is highlighted, justifying the inclusion of “employment type” which includes the private segment. Between (2004–2008), an assessment of the national health insurance scheme in Ghana was carried out by “Send-Ghana under the Heading: “Balancing Access with Quality Health Care:” Data was collected in 50 districts in the Upper East, Upper- West, Northern and the Greater Accra regions of Ghana. “Send- Ghana” is a non-governmental organization with the mission “to work to promote good governance and quality of women and men in Ghana.



The study indeed indicated that the situation of health facilities in some of the regions was even more serious in view of the fact that the attendance of patients had increased considerably over the years while the numerical strength of health professionals on the other hand had reduced. It cited the case of Northern Region where the number of medical doctors reduced from 32 to 26 between 2006 and 2008, while the NHIS membership increased from 281,775 to 828,805. The research also revealed that more than three quarters of accredited health care facilities (about 76 percent) covered by the study, perceived the NHIS to have negative effect on the quality of health care delivery. In addition, 73 percent of accredited health facilities indicated that the NHIS affected the quality of medicines health providers prescribed for clients. This revelation is worth investigating into hence the decision to add satisfaction in the health delivery system and efficacy of the medicines prescribed for clients to the list of independent variables in our study.

One of the key functions of the health insurance is to provide financial protection against high cost of health care. Evidence of such protection from developing countries has been inconsistent (Nguyen, et al., 2007). In addition the World Bank posited that for any health financing coverage, there are generally three interrelated and separate dimensions: the breadth (number of people covered), the depth (the extent of services covered), and the resulting impacts on health outcomes and financial protection against large out of pocket (OOP) expenditures (World Bank, 2008).

To this effect (Nguyen, et al 2007.) evaluated the impact of Ghana's NHIS on household; out-of-pocket spending and catastrophic health expenditure.



The study was carried out in Nkoranza and Offinso in 2007 (two years after the initiation of the NHIS in collaboration with Research and Development Division of the Ghana Health Service.

The following were the results obtained in their study:

At the time of the survey, insurance coverage for the selected location was 35%.

The study revealed that:

- i. Insured people still incurred out-of-pocket payment for care from informal sources and for uncovered drugs and test at health facilities.
- ii. They paid significantly less than the uninsured.
- iii. The (health) insurance was shown to have a protective effect against the financial burden of health care, reducing significantly the likelihood of incurring catastrophic payment. The effect was particularly remarkable among the poorest quintile of the sample
- iv. The effect was found to be stronger among the poor group than among the general population. With all these remarkable positive effect, Ghanaians, for that matter policy holder, on the expiry of their holdings, feel reluctant to renew. This strongly points to the fact that there should be a genuine cause, and therefore worth researching into to unravel the factors responsible.

Our study indeed has confirmed this assertion because the descriptive analysis of the responses indicated that about 97.7% preferred the NHIS over the CASH AND CARRY mode of financing health care.



2.1.1 Influential Variables

Several factors have the potential of affecting the renewal decisions of policy holders in the National Health Insurance Scheme which include:

2.1.1.1 Income

Studies focusing on examining the factors affecting health insurance purchase decision have found that income is an important factor (Scotton, 1969; Trivedi et. al., 1988; Savage and Wright, 1999).

2.1.1.2 Health-Care Expenditure

Healthcare expenditure is another important variable which affects health insurance purchase decision (Kronick and Gilmer, 1999). This association has been based on the premise that families, which have higher hospitalization risk, will have higher probability of purchasing health insurance and by extension higher chances of renewal.

2.1.1.3 Education

Education has also been found to be important factors affecting health insurance purchase decision. The role of education in health decision-making has been well documented by Grossman (1972) and Muurinen (1982). They suggest that a better educated person is likely to be better informed about both the health services available in the system and the benefits of joining a private health insurance fund and at the same time he/she also likely to be healthier which would lower the probability of health risk.



2.1.1.4 Age

Age has also been found having positive and significant impact on the probability of having health insurance cover in many studies (Trivedi et. al., 1988; Burrows et. al., 1989; Savage and Wright, 1999)

2.1.1.5 Gender

Another important factor considered was gender which also plays an important role in the insurance renewal decision through its effect on expected medical consumption (Sindelar, 1982).

Bhat and Jain (2006) analyses the factors that affect health insurance purchase decision in a micro health insurance setting. The study was based on a household survey in the Anand District of Gujarat in India. The research focused on analyzing two separate but inter-related decisions. The first decision that the household takes is whether to buy health insurance policy and if the decision to purchase is positive, the next decision that follows is the extent (total coverage) of purchase. The study used Heckman two-stage method to analyse both these decisions by taking care of sample selection problem. The study finds that income is an important factor. Another factor that came as significant was the health expenditure of the family. The study also used perception variables related to coverage of illnesses and health expenditure and these were found significant in insurance purchase decision.

2.1.1.6 Knowledge about the Scheme

Knowledge about health insurance came out also as significant important factor affecting the decision. In the case of extent of purchase decision, the study finds that up to a certain level of income households do not allocate



resources to insurance and therefore purchase less health insurance. After a certain level of income, increase in income will result in purchase of health insurance as people now can afford to buy health insurance and it will save them from potential risk. At higher levels of income household purchase of insurance decreases as households are willing to retain the risk (Bhat and Jain, 2006).

2.1.1.7 Number of Children in House-Holds

The number of children in the household was also found as an important factor affecting the extent of health insurance purchase decision. Age also came as an important variable in deciding the extent of insurance and people in higher age groups relatively spend more on insurance (Bhat and Jain, 2006).

2.1.1.8 Coverage of Illness

Two other variables, coverage of illnesses and health/illness expenditure were also significant. These two variables show that illnesses coverage perception and future expectation about the healthcare expenditure are important for the health insurance purchase decision and for the extent of health insurance purchase decision. However, the studies on renewal of health insurance policies are scanty. Generally, it is assumed that factors affecting the purchase will affect the renewal decision. However, I want to hypothesize that factors affecting renewal could be different from factors affecting purchase decision. Had that been the case all policyholders would renew their insurance policies. There are significant numbers of cases who do not renew their insurance. It is also argued that income may be significant factor in influencing the insurance



purchase decision in the first place but less significant in renewal decision. Other than the studies related to health insurance, the literature from marketing field on repeat purchase intention/decision provides some insights into this area.

2.1.1.9 Customer Satisfaction

These studies have been done with different products providing evidence on reasons for intention of repeat purchase (Hocutt, 1998; Storbacka et. al., 1994; Zahorik and Rust, 1992). These studies suggest that customer satisfaction and attitudes are important factors affecting repurchase decision. In a study of the life insurance market, Durvasula et. al., 2004) found that customer satisfaction was positively associated with customer's repurchase decisions. The satisfaction can arise from the experience of using product, from the seller and/or from after sale service. In the field of health insurance, this satisfaction may come from the experience and services provided by insurer and also policyholder's interaction with provider of services may significantly influence his decision



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Source of Data

Primary Data was collected using household survey. Hence data was collected directly from the field.

3.2 Sampling Techniques

In the study, Tamale Metropolis was divided into 19 clusters and a multi phase sampling technique was used. In phase one, a multistage sampling process was used to select the individuals for interviewing. Stage one involved the selection of five clusters at random using random numbers, from the 19 into the sample, and stage two involved a one-in-ten systematic sampling of households from the selected clusters. All members of the selected households were selected for interview.

The interview itself consisted of two phases using two different questionnaires; (questionnaire forms A and B). In phase one, determination was made as to whether the respondent was a policy holder or not by using questionnaire form A. If a person was found not have registered, the interview was terminated. Respondents who were determined to be policy holders in the phase one interview, were further interviewed in phase two using questionnaire form B to determine their renewal status as well as general views on the scheme. This technique was adopted as an inbuilt mechanism to verify at first hand if the data was representative, guided by the fact that an



estimated 85.1% registration rate prevailed in the Tamale Metropolitan Health Scheme as of 31st October, 2011.

In all 502 individuals from 53 households, across the 5 selected clusters were sampled. Out of the 502 individual respondents, 405 were found to have registered and only 173 renewed. It is these 405 individuals whose information was used for the analysis.

3.3 Study Variables.

Insurance Renewals is the response variable and the indicator variables were Age, Gender, Educational Status, Average monthly income, Availability of a Health Care Facility within 5 km radius, Perception about the attitudes of health care providers, Perception about efficacy of Drugs, How often one falls sick, Employment status, General satisfaction and system of health-care financing preferred. These variables were put into various levels on the questionnaire. For example educational status was examined under the following levels: no education, basic level, secondary, and tertiary.

3.4 Statistical Analysis.

SAS (version 9.2) and SPSS (version 19) software were used for analysis of Data. SAS was used in the formulation of the prediction equation and its analysis with stepwise selection procedure for the selection of the predictor variables under study, into the Model. SPSS was used in the descriptive statistical analysis.

Inferential analysis (model fitting and evaluation) was done in two stages. In stage one all the study variables were used and, only the significant covariates



were considered in the second stage. The Optimization Technique used was Fisher's Scoring and the probability modeled is Renewal = 1, with education (at four levels) taken as the class variable for the first stage of the analysis and Gender as class variable for the second stage. All tests were carried out at 0.05 level of significance. Logistic Regression has this important assumption: The binomial distribution is the assumed distribution for the conditional mean of the dichotomous outcome. This assumption implies that the same probability is maintained across the range of predictor values. The binomial assumption may be tested by the normal Z test (Siegel and Castellan, 1988) or may be taken to be robust as long as the sample is random; thus, observations are independent from each other. The assessment and analysis included Model Formulation, Parameter Estimation, Model Evaluation and Validation of predicted probabilities

3.5 Modelling Approach

3.5.1 Overview of the Model

Many different types of linear models have been applied in many practical situations. But in many of the linear models, the response variable has been a quantitative variable, which has been assumed to be normally distributed. In this research, we consider a situation where the response variable is a categorical (renewal status), attaining only two possible outcomes; whether a client has renewed his/her policy or not. Since the response variable is dichotomous (that is, they have only two possible outcomes), it is only appropriate to use binary logistic regression for the analysis of the data.



3.5.2 Binary Data

When the response variable is dichotomous, it is convenient to denote one of the outcomes as success and the other as failure. For example, if a policy holder renews his policy, the response is 'success', if not, then the response is 'failure'. It is standard to let the response variable Y be a binary variable, which attains the value 1, if the outcome is 'successes, and 0 if the outcome is 'failure'. " In a regression situation, each response variable is associated with given values of a set of explanatory variables $x_1, x_2, x_3 \dots x_k$. For example, whether or not a patient is cured of a disease may depend on the particular medical treatment the patient is given, the patient's general state of health, age, gender, etc.; whether or not an item in a manufacturing process passes the quality control may depend on various conditions regarding the production process, such as temperature, quality of raw material, time since last service of the machinery. In the same way whether a policy holder has renewed or not may depend upon the income, age, perceptions, etc.

In linear regression models the response variables are considered to be normally distributed. The main concern in such models is to express the value of the response variable Y as a function of the values of the explanatory variables. However, when the response variable is binary, its value is not particularly interesting: either it is 0 or it is 1. Instead, the interest centres on the probability of the response being success, that is, $P(Y = 1)$, for given values of the explanatory variables" (Pia, 2008).



3.5.3 Odds and Odds Ratio

The odds of some event happening (e.g. the event that $Y = 1$) is defined as the ratio of the Probability that the event will occur divided by the probability that the event will not occur.

That is, the odds of the event E are given by:

$$\text{Odds}(E) = \frac{P(E)}{P(\text{not}E)} = \frac{P(E)}{1 - P(E)} \quad (3.1)$$

Sometimes it may be necessary to compare the odds of two events, or the odds of an event at two different levels. In such situations the odds ratio is used. For example, "the odds ratio $R_{A,B}$ that compares the odds of events A and B (that is, Event E occurring in group A and B , respectively), is defined as the ratio between the two odds; that is:

$$R_{A,B} = \frac{\text{Odds}(A)}{\text{Odds}(B)} = \frac{P(A)}{1 - P(A)} / \frac{P(B)}{1 - P(B)} \quad (3.2)$$

In particular, if an odds ratio is equal to one, the odds are the same for the two groups. Note that, if we define a factor with levels corresponding to groups A and B , respectively, then an odds ratio equal to one is equivalent to there being no factor-effect". (Pia, 2008)

3.5.4 Logistic Regression

For binary data, since the response variable does not assume a specific value we are usually interested in analysing the relationship between the probability of the response being success and the explanatory variables of interest and not the relationship between the value of the response variable and the explanatory variables. "Logistic regression is often used because the relationship between the DV (a discrete variable) and a predictor is non-linear" (Pia, 2008).



“When choosing an appropriate transformation for data, two problems need to be addressed. One is that the relationship between the variables can be curved rather than being linear; the other is that the probability of success can only take values between 0 and 1, while a linear function can attain any real value. It turns out that, often, one can take care of both of these problems by transforming the probability using the logistic function. The logistic function will turn a probability into a quantity which can take any real value, and which is often linearly related to the explanatory variables” (Pia, 2008).

3.5.5 The Logistic Function

“The curved relationship is typical for many situations where the response variable is binary. The underlying smooth curve is called a sigmoid. A sigmoid curve has the properties that the y-variable (the probability of success) is constrained to lie between 0 and 1 such that y tends to 0 when x becomes small and y tends to 1 when x becomes large. There are various types of functions that produce sigmoid curves, but the most common one is of the following form:

$$P(x) = y = \frac{1}{1 + \exp(-\beta_0 - \beta_1 x)}, \quad (3.3)$$

where $P(x)$ denotes the probability of success when the explanatory variable has the value x ” (Guestrin, 2007).



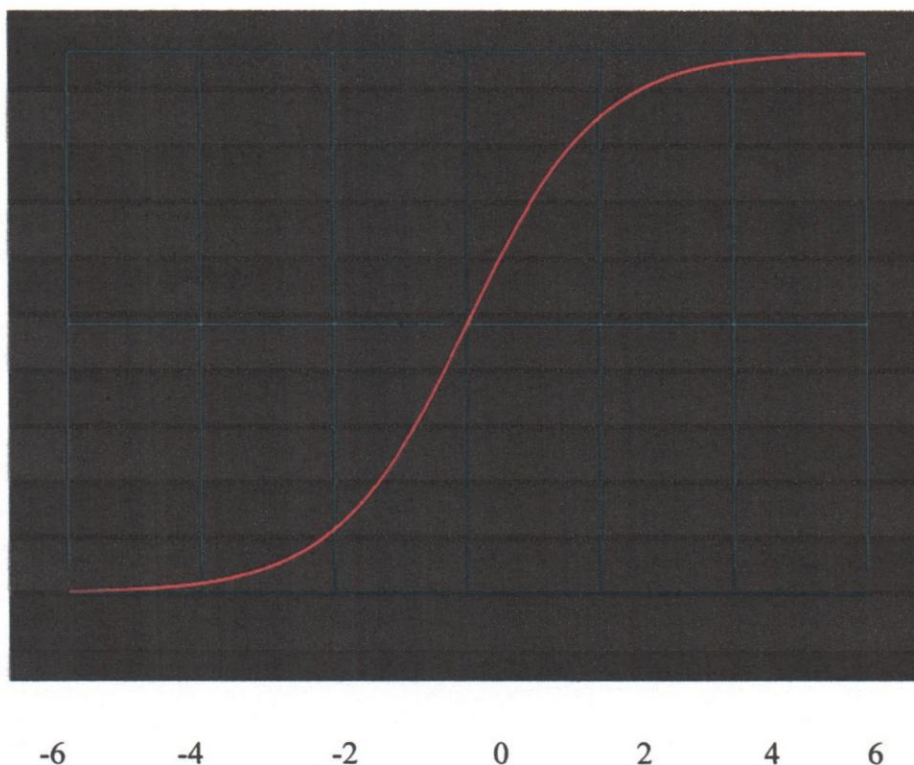


Figure 3.1 Sigmoid curve

The two parameters β_0 and β_1 determine the location, slope of the curve. The function is symmetric about the point $x = \frac{-\beta_0}{\beta_1}$. In particular, when

$x = \frac{-\beta_0}{\beta_1}$ then $P(x) = 0.5$ (Pia,2008). The function $\pi(x)$ is not linear in the

explanatory variable x . However, if we transform both sides of the equation using the logit (or logistic) transformation the result is the following equation:

$$\ln \pi(x) = \ln \frac{\pi(x)}{1 - \pi(x)} = \beta_0 + \beta_1 x \quad (3.4)$$

And this function is linear in x . Thus, if we transform the probability of success using the logit transformation, we get a quantity logit ($\pi(x)$) which is

linear in the explanatory variable x . The ratio is the ratio $\frac{p(\pi)}{1 - p(\pi)}$ between the



probability of success and the probability of failure (Hosmer, 2000). That is, it is the odds of success. Hence, logit $\pi(x)$ is the logarithm of the odds of success—called the log odds of success, given the value x of the explanatory variable. “Further, the log odds ratio (that is, the logarithm of the odds ratio) corresponding to the probability of success when the explanatory variable has a value x and the probability of success when the explanatory variable has the value $x + 1$, is given by:

$$\log \frac{P(x+1)}{1-P(x+1)} - \log \frac{P(x)}{1-P(x)} = [\beta_0 + \beta_1(x+1)] - (\beta_0 + \beta_1 x) = \beta_1, \quad (3.5)$$

which does not depend on the value x . That is, the parameter β_1 represents the difference in log odds given a one unit increase in the explanatory variable. Since β_1 is the logarithm of the odds ratio, it follows that the odds ratio is given by e^{β_1} (Pia, 2008).

“The odds ratio is sometimes called the odds multiplier, because it is the value the odds which are multiplied by, when the value of the explanatory variable is increased by one unit”. (Pia, 2008). The logit transformation often works well in linearising the relationship between $P(x)$ and x . Another important reason is the useful interpretations one can make in terms of odds and odds ratios. (Pia, 2008)

3.5.6 The Logistic Regression Model

The ultimate goal of carrying a logistic process is get a model with a high classification rate.

The logistic regression model is defined as follows. Taking that the responses $Y_1, Y_2, Y_3, \dots, Y_n$ are independent Bernoulli variables, and let p_i denote the mean



value $E(y_i)$ of Y_i that is, $p_i = E[Y_i] = P(Y_i = 1)$. The mean value $p_i = E(y_i)$

“can be expressed in terms of the explanatory variables $x_{i,1}, x_{i,2}, x_{i,3}, \dots, x_{i,k}$ as

$$P_i = \frac{1}{1 + \exp(-\beta_0 - \sum_{j=1}^k \beta_j x_{ij})} \quad (3.6)$$

If we apply the logit-transformation to p_i we get a linear relationship between logit (p_i) and the explanatory variables:

$$\log it(p_i) = \log \frac{p_i}{1-p_i} = \beta_0 + \sum_{j=1}^k \beta_j x_{ij} \quad (3.7)$$

In linear regression, least squares method to estimate the parameters unlike in logistic regression where the parameters are estimated using maximum likelihood estimation. A computer software can be faster and more appropriate here.

“In general, when the explanatory variables are quantitative, each of the regression parameter $\beta_1, \beta_2, \beta_3, \dots, \beta_k$ can be interpreted as log odds ratios for the corresponding explanatory variable, when all other explanatory variables are held fixed. That is, the odds multiplier for x_i is equal to e^{β_i} : When the explanatory variable x_i is increased by 1 unit, and all other explanatory variables are held constant, the odds of success is increased by a factor e^{β_i} : (Pia, 2008).

3.5.7 Testing Hypotheses in Logistic Regression

“In logistic regression, hypotheses on significance of explanatory variables cannot be tested in quite the same way as in linear regression. In linear regression, where the response variables are normally distributed, we can use



t- or F-test statistics for testing significance of explanatory variables. But in logistic regression, the response variables are Bernoulli distributed, so we have to use different test statistics, which exact distributions are unknown. Fortunately, there exist fairly good approximations to the distributions of the test statistics. In this we shall use two different types of test statistics: the (log) likelihood ratio statistic (often referred to as the -2 Log Q statistic) and the Wald statistic. In general, the likelihood statistic is superior to the Wald statistic (in the sense that it gives more reliable results),” (Pia, 2008) so we shall mainly concentrate on the likelihood ratio statistic in this work

3.5.8 Wald Test:

A Wald test is used to test the statistical significance of each coefficient (β) in the model. A Wald test calculates a Z statistic, which is:

$$z = \frac{\hat{B}}{SE} \quad (3.8)$$

This z value is then squared, yielding a Wald statistic with a chi-square distribution.

3.5.9 Likelihood-Ratio Test:

The likelihood-ratio test uses the ratio of the maximized value of the likelihood function for the full model (L_1) over the maximized value of the likelihood function for the simpler model (L_0). The likelihood-ratio test statistic equals:

$$-2 \log\left(\frac{L_0}{L_1}\right) = -2[\log(L_0) - \log(L_1)] = -2(L_0 - L_1) \quad (3.9)$$



This log transformation of the likelihood functions yields a chi-squared statistic that can be used to verify if there is an improvement of the expanded model over the Null (a model containing the intercept only).

3.5.10 Model Evaluation and Validation

3.5.10.1 Hosmer - Lemeshow Goodness of Fit Test:

“The Hosmer - Lemeshow statistic evaluates the goodness-of-fit by creating 10 ordered groups of subjects and then compares the number actually in the each group (observed) to the number predicted by the logistic regression model (predicted). Thus, the test statistic is a chi-square statistic with a desirable outcome of non-significance, indicating that the model prediction does not significantly differ from the observed.

The 10 ordered groups are created based on their estimated probability; those with estimated probability below 0.1 form one group, and so on, up to those with probability 0.9 to 1.0. Each of these categories is further divided into two groups based on the actual observed outcome variable (success, failure). The expected frequencies for each of the cells are obtained from the model. If the model is good, then most of the subjects with success are classified in the higher deciles of risk and those with failure in the lower deciles of risk.” (Hosmer and Lemeshow, 2000).

3.5.10.2. Model Validation

Application of modelling techniques without carrying out performance analysis on the obtained models can result in poorly fitting results that inaccurately predict outcomes on new subjects. “Validation is a useful and



necessary part of the model-building process (Shao,1993)” .There are many statistical tools for model validation in binary logistic regression, but the primary tool for most process modelling applications is summary measures of goodness-of-fit analysis. Different types of summary measures of goodness-of-fit from a fitted model provide information on the adequacy of different aspects of the model. The graphical residual analysis was used in assessing the model adequacy. In global test of model adequacy use the corresponding chi-squared approximations for the deviance and Pearson-statistics. Although normal approximations to the deviance and studentized Pearson residual are often reasonable, they are questionably for logistic regression with sparse data with small sample (Hosmer and Lemeshew, 2000). Under the normality assumption with sufficiently large sample such as ours, deviance residuals or studentized Pearson Residuals follow the chi-square distribution with a single degree of freedom.

“If the logistic regression model is Infact True, one would expect to observe a horizontal band with most of the residuals falling within ± 2 ” (Christensen, 1997).

The leverage is another tool used to detect influential outliers.” The average of any given case can be compared to the average leverage which is $(\frac{k+1}{n})$, where k is the number of covariates in the model and n is the sample size. If the sample is sufficiently large, the leverage value $h_{ii} > 2(\frac{k+1}{n})$ (Beseley et al, 1980, Bagheri et al, 2010) and for large samples, $h_{ii} > 3(\frac{k+1}{n})$. This is where our model applies.

Assumptions for the use of binary logistic regression model



- The response variable is discrete and dichotomous
- The covariates are independent of each other



CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1 Descriptive Data Analysis

Table 4.1 Distribution of Respondents by Sex

Gender	Frequency	Percent	Cumulative Percent
Male	194	47.9	47.0
Female	211	52.1	100.0
Total	405	100.0	

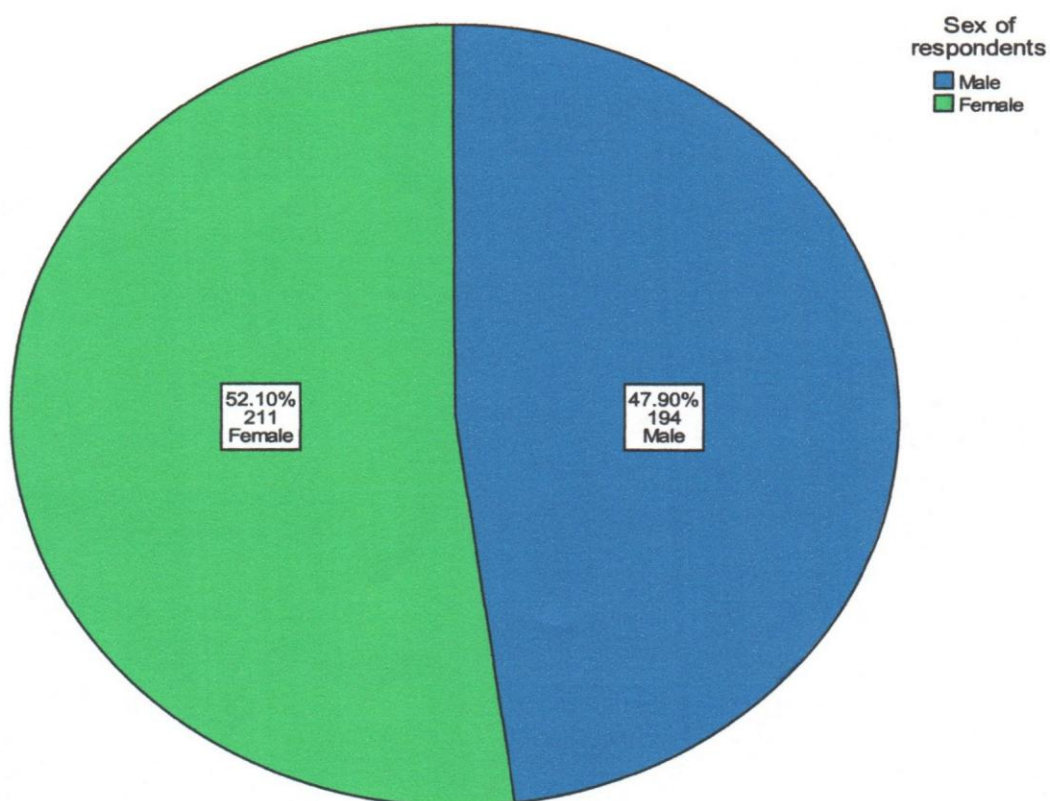


Figure 4.1 Pie Chart of Distribution of Respondents by Sex

From table 4.1 and figure 4.1, out of the 405 respondents, 211 were females representing 52.10% and 194 male respondents representing 47.90%.



Table 4.2 Distribution of Respondents by Age Groups

Age groups	Frequency	Percent	Cumulative percent
Below 18 years	157	38.8	38.8
18-69	222	54.8	93.6
70 and above	26	6.4	100
Total	405	100	

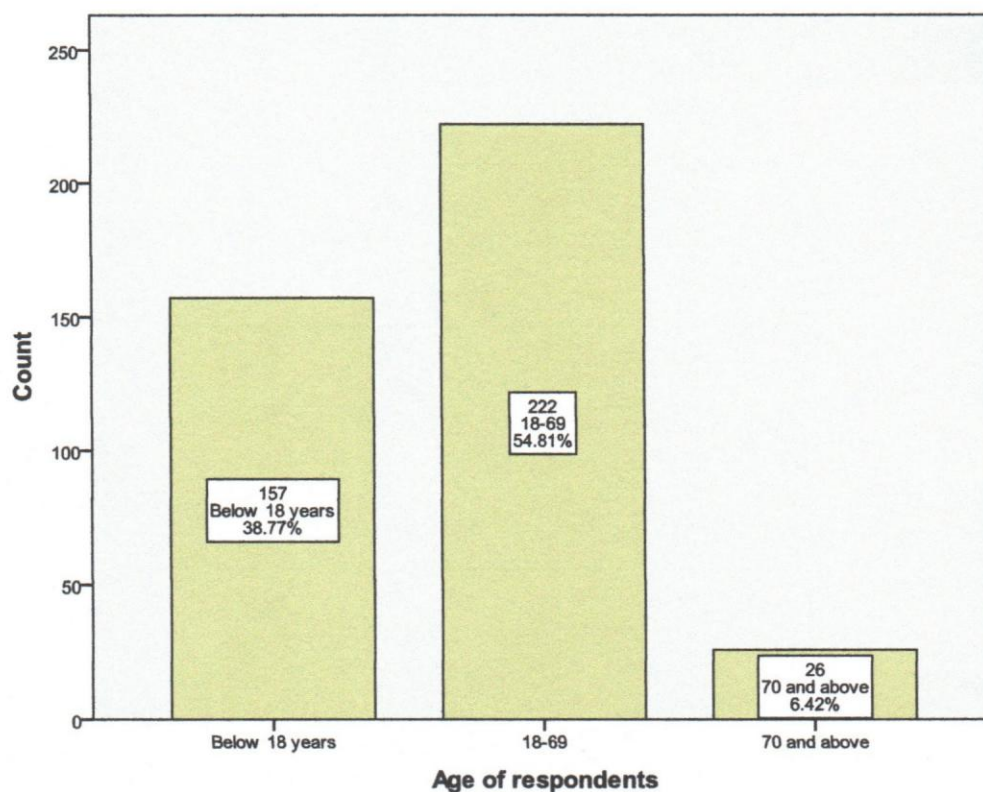


Figure 4.2 Bar Graph of Distribution of Respondents by Age Groupings

From table 4.2 and figure 4.2, of the 405 respondents, 157 representing 38.77% were below the age 18 years, 222 representing 54.81% were between 18 and 69 years of age and 26 subjects representing 6.42% were 70 years and above.



Table 4.3 Distribution of Respondents by Educational Status

Educational Status	Frequency	Percent	Cummulative Percent
No Education	98	24.2	24.2
Basic Education	199	49.1	73.3
Secondary Education	55	13.6	86.9
Tertiary Education	53	13.1	100
Total	405	100	

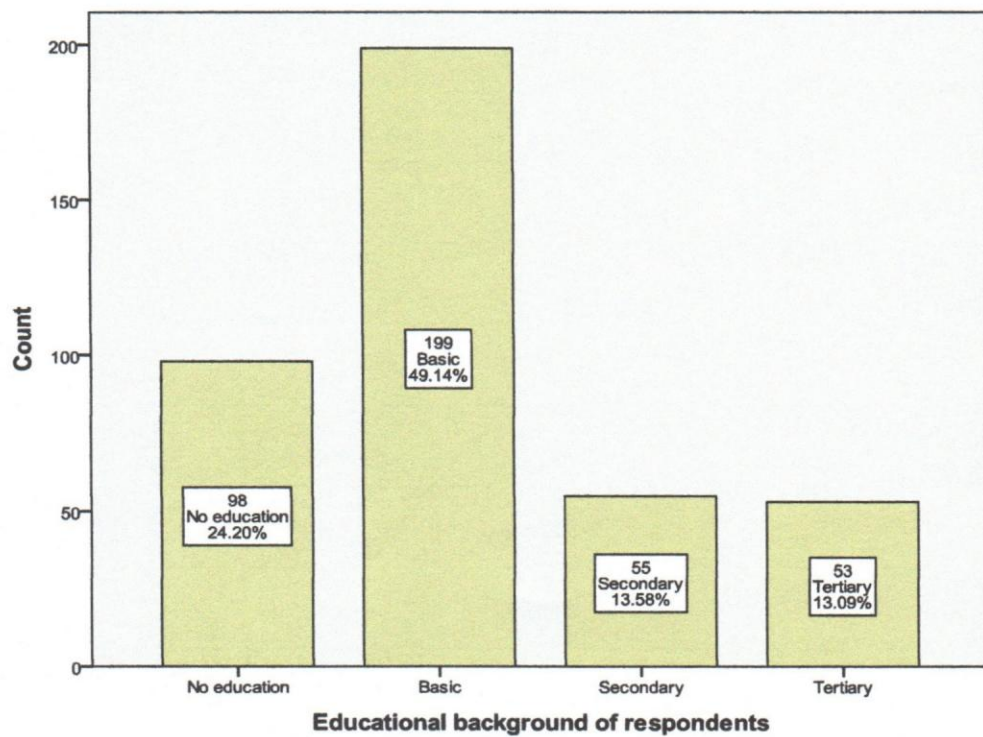


Figure 4.3 Bar Graph of Distribution of Respondents by Educational Status



From table 4.3 and figure 4.3, of the 405 respondents, 98 representing 24.20% had no formal education, 199 representing 49.14% had up to basic level education, 55 representing 13.58% had up to secondary education and 53 representing 13.09% got above secondary level education.

Table 4.4 Distribution of Respondents by Levels of Monthly income

Monthly Income	Frequency	Percent	Cummulative Percent
Nil	158	39.0	39.0
Below GhC 134.40	143	35.3	74.3
Above GhC 134.40	104	25.3	100
Total	405	100	

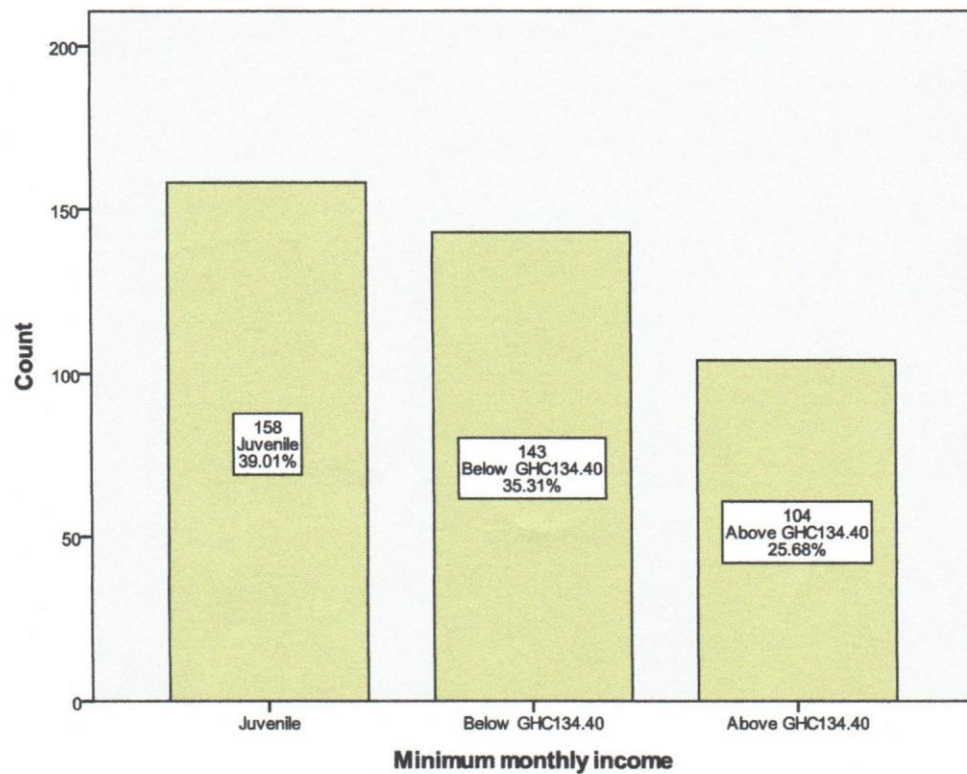


Figure 4.4 Bar Graph of Distribution of Respondents by Minimum Monthly Income



From table 4.4 and figure 4.4, of the 405 subjects interviewed, 158 representing 39.01% were juveniles, 143 representing 35.31% earned less than the minimum monthly wage and 104 representing 25.68 % earned at least up to the monthly minimum wage of GHC 134.40 per month.

Table 4.5 Distribution of Respondents by Access to Health Facility

Accessibility	Frequency	Percent	Cumulative percent
Less than 5km	265	65.43	65.4
More than 5km	140	34.57	100.0
Total	405	100.0	

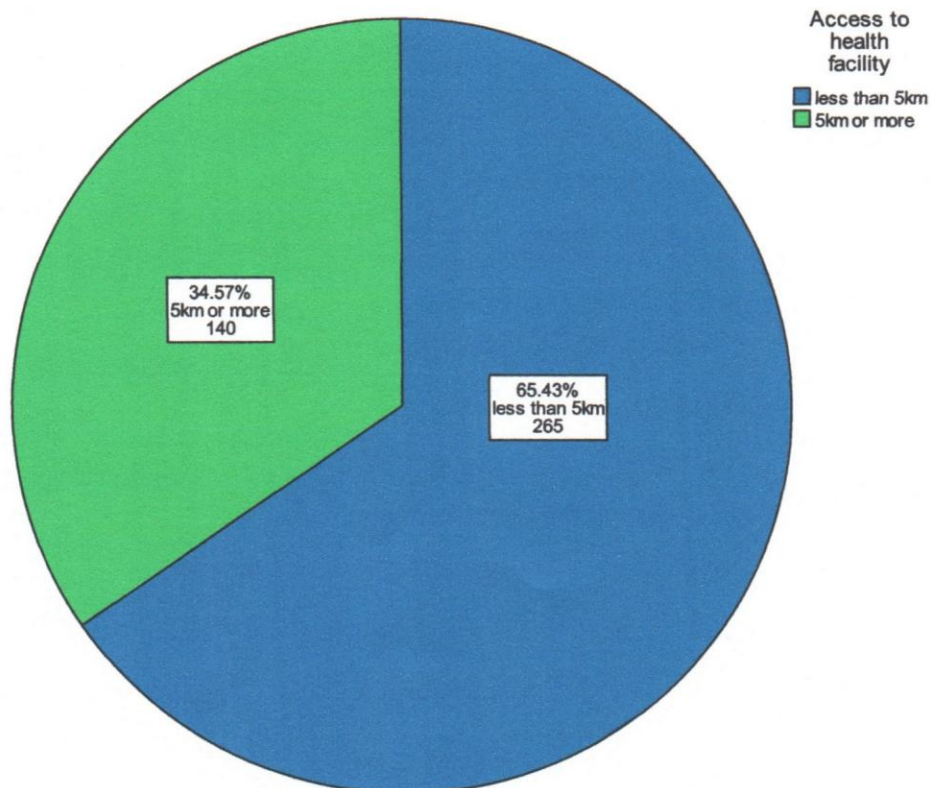


Figure 4.5 Pie Chart of Distribution of Respondents by Access to a Health Facility



From table 4.5 and figure 4.5, of the 405 respondents, 140 representing 34.57% indicated that there is no health facility within 5km radius from where they stay and 265 representing 65.43% can access a health facility within 5km radius from where they stay.

Table 4.6 Distribution of Respondents by Employment Type

Employment type	Frequency	Percent	Cumulative percent
Unemployed	92	22.7	22.7
Public	39	9.6	32.3
Private	111	27.4	59.8
Juvenile	156	38.5	98.3
Pensioned	7	1.7	100.0
Total	405	100.0	



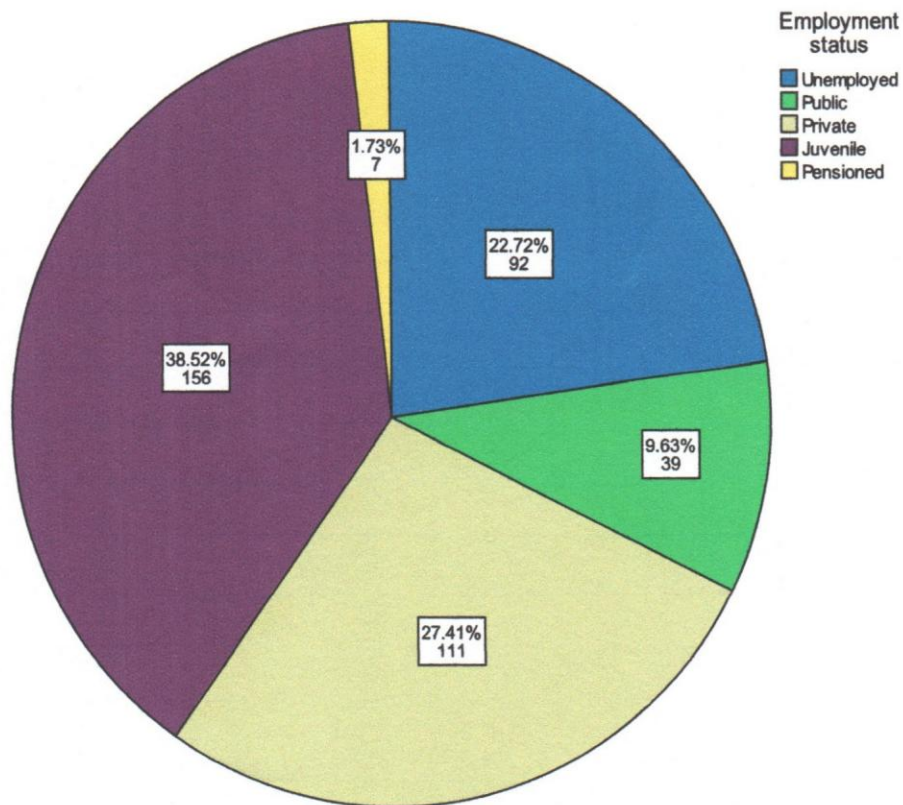


Figure 4.6 Pie Chart of Distribution of Respondents by Employment Status.

From table 4.6 and figure 4.6, of the 405 respondents, 92 subjects representing 22.72% were unemployed, 39 representing 9.63% worked in the public sector, 111 representing 27.41% worked in the private sector, 156 representing 38.52% were juvenile and by law do not work and 7 representing 1.73% were pensioned

Table 4.7 Distribution of Respondents by Presence/ Absence of Chronic Disease

Health Status	Frequency	Percent	Cumulative percent
No chronic disease	352	86.9	86.9
Has chronic disease	53	13.1	100.0
Total	405	100.0	

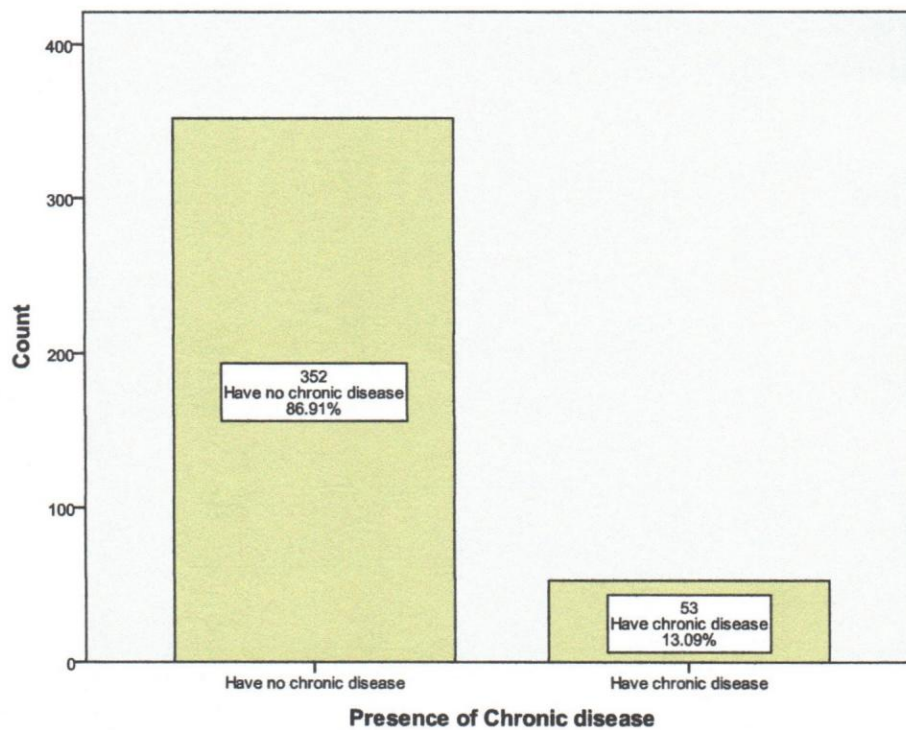


Figure 4.7 Bar Graph of Distribution of Respondents by Prevalence of Chronic Disease

From table 4.7 and figure 4.7, of the 405 respondents, 352 representing 86.91% did not have any form of chronic disease and 53 representing 13.09% suffered some form of chronic disease.



Table 4.8 Distribution of respondents by the different Perceptions about efficacy of drugs under the NHIS

Perception	Frequency	Percent	Cumulative percent
Bad	16	4.0	4.0
Fair	170	42.0	45.9
Good	219	54.1	100.0
Total	405	100.0	

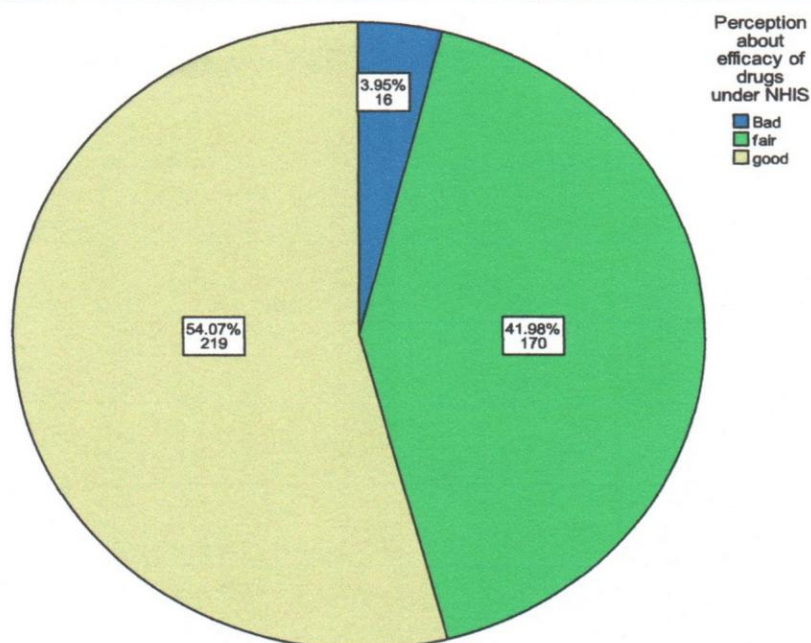


Figure 4.8 Pie Chart of distribution of respondents by perception about efficacy of drugs dispensed under the NHIS

From table 4.8 and figure 4.8, out of the 405 subjects interviewed 16 representing 3.95% had bad perception about efficacy of drugs issued under the NHIS, 170 representing 41.98% had fair perception and 219 representing 54.07% had good perception about efficacy about drugs dispensed under the NHIS

Table 4.9 Distribution of Respondents by the Different Perceptions about Attitude of Health Care Workers

Perception	Frequency	Percent	Cumulative percent
Bad	17	4.2	4.2
Fair	294	72.6	76.8
Good	94	23.2	100.0
Total	405	100.0	

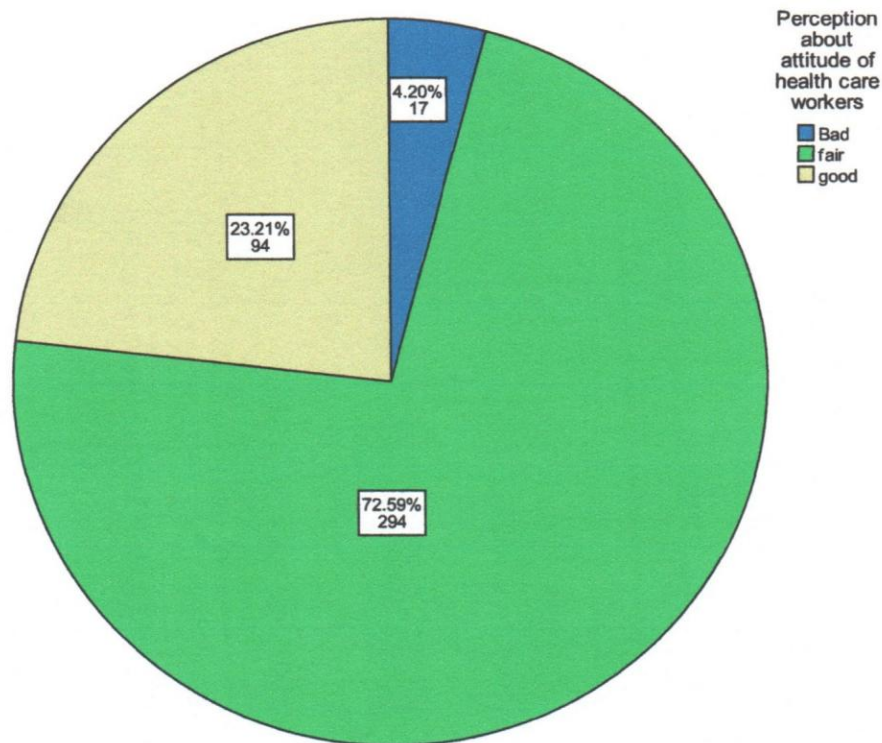


Fig.4.9 Pie Chart of Distribution of Respondents by the Different Perceptions about Attitude of Health Care Workers

From table 4.9 and figure 4.9, 17 representing 4.20% out of the 405 respondents said the attitude of health workers bad, 294 representing 72.59% said it is fair and 94 representing 23.21% said it is good.



Table 4.10 Distribution of Respondents by General Level of Satisfaction with Services under the NHIS

Satisfaction	Frequency	Percent	Cumulative percent
Bad	14	3.5	3.5
Fair	187	46.2	49.6
Good	204	50.4	100
Total	405	100	

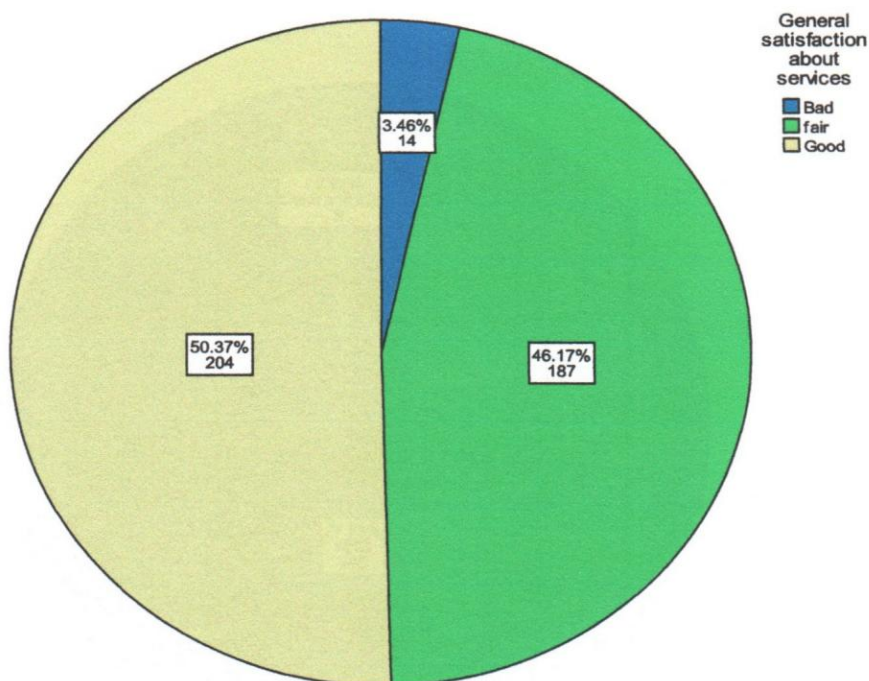


Figure 4.10 Bar Graph of Distribution of Respondents by General Level of Satisfaction with Services of Health Care Provide

Figure 4.10 and table 4.10 indicate that of all the 405 respondents, 14 representing 3.46% were not in the least satisfied with the quality of service at the health centres, 187 representing 46.17% were fairly satisfied and 204 representing 50.37% were very satisfied.

Table 4.11 Distribution of respondents by health care financing system preferred

System	Frequency	Percent	Cumulative percent
NHIS	396	97.8	97.8
Cash and carry	9	2.2	100.0
Total	405	100.0	

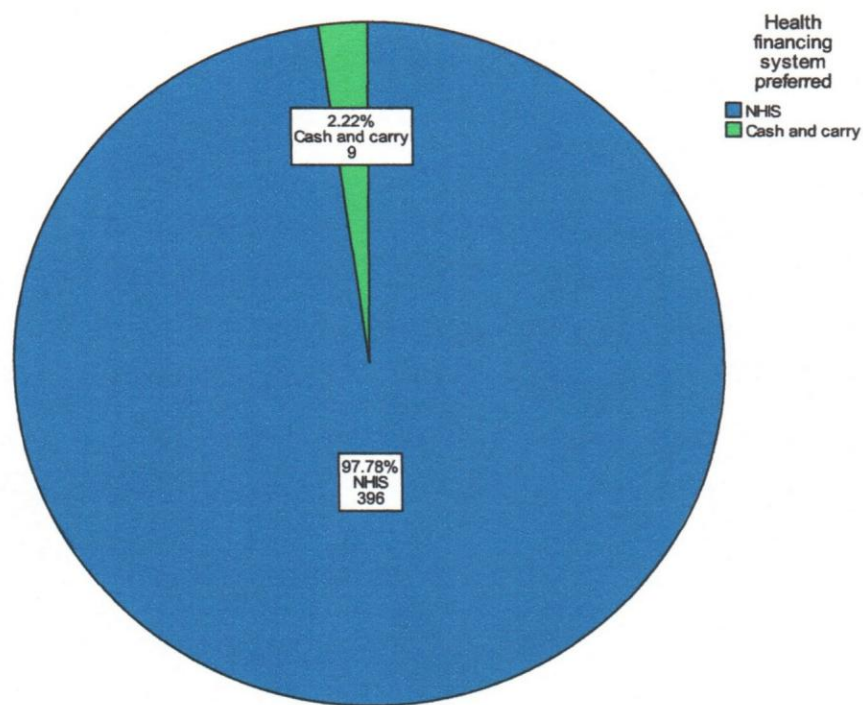


Figure 4.11 Pie Chart of Distribution of Respondents by the System of Health Care Financing System Preferred

From table 4.11 and figure 4.11, of the 405 respondents, 396 representing 97.7% preferred the NHIS and 9 representing 2.22% prefer to pay cash at the point of health care delivery (Cash and Carry).

4.2 Model Fitting

A five-predictor logistic model was fitted to the data to test the research hypothesis regarding the relationship between the likelihood that a subject



picked at random from the Tamale Metropolis has renewed his/her health insurance policy, and his/her gender, employment status (employ), presence/absence of chronic disease (cdisease), perception about the efficacy of drugs dispensed under the NHIS (pdrug), perception about attitudes of service providers (pattit).

The logistic analysis was carried out by the proc logistic procedure in SAS version 9.2 in the windows 2007 environment. SAS programming codes can be found in Appendix B. The result was as follows:

Table 4.12

Summary of Stepwise Selection

Step	Effect Entered	Removed	DF	Number In	Score Chi-Square	Pr>ChiSq	Variable Label
1	Gender 2		1	1	37.4872	<0001	Gender 2
2	Pdrug		1	2	25.3198	<0001	Pdrug
3	Employ		1	3	10.7139	0.0011	Employ
4	Pattit		1	4	6.2167	0.0127	Pattit
5	Cdisease		1	5	5.6026	0.0179	Cdisease



Table 4.13

Analysis of Maximum Likelihood Estimates

Variable	DF	Parameter Estimate	Error	Standard Chi -Square	Wald Pr > ChSq
Intercept	1	-4.9756	0.8291	53.8258	<.0001
Gender 2	1	1.1073	0.2282	23.5375	<.0001
Employ	1	0.3368	0.0980	11.8187	0.0006
Cdisease	1	0.7956	0.3400	5.4768	0.0193
Pdrug	1	0.7802	0.2206	12.5098	0.0004
Pattit	1	0.6043	0.2542	5.6533	0.0174

From the tables (4.12) and (4.13) of results, it is clear that the prediction equation is:

$$\text{Predicted Log (odds of renewal)} = -6.0829 + 1.1073\text{Gender 2} + 0.3368\text{Employ} + 0.7956\text{Cdisease} + 0.7802\text{Pdrug} + 0.6043\text{Pattit}$$

Gender 2 (female)

Employ employment status

Cdisease presence of chronic disease

Pdrug perception about efficacy of drugs

Pattit perception about attitude of health care providers



Table 4.14

Odds Ratio Estimates

Effect	Point Estimate	95% Confidence	Wald Limits
Gender 2	3.026	1.935	4.733
Employ	1.400	1.156	1.697
Cdisease	2.216	1.138	1.314
Pdrug	2.182	1.416	3.362
Pattit	1.830	1.112	3.011

The odd ratio of each predictor indicated in Table (4.14) measures the multiplicative increase in the odds of renewal when there is a unit change in the given the predictor under study, keeping all others constant. It is given by e^{β} , where β is the parameter of the predictor in table (4.13).

4.3 Model Evaluation

Table 4.15 Descriptive Analysis of the Model

STEP	VARIABLE ENTERED	CONVERGENCE CRTERION	-2logL	AIC 2k +(- 2logL	SC/BIC Klogn+ (-2logL)
0	Intercept	1E-8	552.823	554.823	558.827
1	Gender 2	„	514.554	518.554	526.561
2	Pdrug	„	488.406	494.406	506.417
3	Employ	„	477.581	485.581	501.596
4	Pattit	„	471.333	481.333	501.352
5	Cdisease	1E-8	465.702	477.702	501.725



The total deviance measured by $-2\log L$ (from table 4.15) continue to decrease, as more predictors are entered in the model, indicating improvement due to decreasing levels of total variability. The AIC and SC/BIC are all derivatives of the total deviance ($-2\log L$).

4.3.1 Testing Global Null Hypothesis ($BETA=0$)

$H_0 : \beta_1 = \beta_2 \dots = \beta_5 = 0$, (all the parameters are statistically zero).

H_1 : At least the parameter of a predictor i , $\beta_i \neq 0$ (is statistically different from zero) and $i = 1, 2, \dots$ at $\alpha = 0.05$

Table 4.16 Summary of Results of Global Null Hypothesis Test ($BETA=0$)

STEP	VARIABLE ENTERED	LIKELIHOOD RATIO CHI-SQ	SCORE (CHI- SQ)	WALD (CHI- SQ)	Df	Pr> ChiSq
0	Intercept	-	-	-	-	-
1	Gender 2	38.2699	37.4872	36.0860	1	<0.0001
2	Pdrug	64.4178	60.2082	53.8727	2	<0.0001
3	Employ	75.2426	69.3829	60.5026	3	<0.0001
4	Pattit	81.4808	73.4304	62.7378	4	<0.0001
5	Cdisease	87.1217	78.0304	65.1575	5	<0.0001

For all the predictor variables (Table 4.16), p-values are less than 0.05; ($0.0001 < 0.05$), indicating that the Null Hypothesis (H_0) is rejected in favour of (H_1), meaning at least one parameter is statistically different from zero.



4.3.2 Statistical Test of Individual Predictors

From the previous test discussed (Global Null Hypothesis Test: $BETA=0$), we sought to evaluate the performance of the entire model, comprising the selected predictors. Statistical test of individual predictors is a further test on the contribution of each individual predictor in the performance of the model. This is called the WALD TEST.

The test statistic, called the Wald statistic was computed using the relation

$$Z^2 = \left[\frac{\hat{\beta}}{SE(\hat{\beta})} \right]^2 \text{ at Df=1 for all the parameters of the selected predictors. The}$$

computation of the Wald test statistic for all the selected predictors can be found in the table that follows:

Table 4.17

Analysis Of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	-4.9756	0.8291	53.8258	<.0001
Gender 2	1	1.1073	0.2282	23.5375	<.0001
Employ	1	0.3368	0.0980	11.8187	0.0006
Cdisease	1	0.7956	0.3400	5.4768	0.0193
Pdrug	1	0.7802	0.2206	12.5098	0.0004
Pattit	1	0.6043	0.2542	5.6533	0.0174



THE WALD TEST

$H_0 : \beta_i = 0$ ($i=0,1,2,...5$) ; the parameter in question is statistically zero.

$H_1 : \beta_i \neq 0$ ($i=0,1,2,...5$); the parameter in question is statistically different from zero, at

$$\alpha = 0.05$$

The table below indicates the summary of result of the Wald Test on parameters of each of the selected predictors:

Table 4.18 Type 3 Analysis Of Effects

Effect	DF	Wald	
		Chi-Square	Pr > ChiSq
Gender 2	1	23.5375	<.0001
Employ	1	11.8187	0.0006
Cdisease	1	5.4768	0.0193
Pdrug	1	12.5098	0.0004
Pattit	1	5.6533	0.0174

From table of results,(Table 4.18) for all the predictor variables, the p-value < 0.05, rejecting the Null hypothesis H_0 in favour of H_1 to mean all the predictor variables are contribute significantly to improving the performance of the model because their parameters are all statistically significant.

4.3.3 Residual Chi-Square Test

H_0 : Residual Error $E(\epsilon_i)=0$: (Residual error $E(\epsilon_i)$ is statistically not significant in the model)

H_1 :Residual Error $E(\epsilon_i) \neq 0$: (Residual error $E(\epsilon_i)$ is statistically significant in the model).



Table 4.19 Summary of Results of Residual Chi-Square Test

STEP	RESIDUAL ChiSq	Df	Pr > ChiSq
0 . (intercept)	88.1833	13	< 0.0001
1. (gender 2)	56.1397	12	0.0001
2. (employ)	33.8519	11	0.0004
3. (cdisease)	24.4167	10	0.0066
4. (pdrug)	18.9141	9	0.0259
5. (pattit)	13.6150	8	0.0924

From the table of results, (table 4.19), as the residual Chi-Sq values decline with more predictors entering the model, the p-values increase and finally, for the saturated model, the p-value is 0.0924 which is greater than 0.05 thus ($p > 0.05$) accepting the Null Hypothesis (H_0) meaning that the residual error $E(\epsilon_i)$ is not statistically significant in the saturated model.

4.3.4 Goodness of Fit Test

Table 4.20: Partition for the Hosmer and Lemeshow Test

Group	Total	Renewal=1		Renewal=0	
		Observed	Expected	Observed	Expected
1	41	1	3.55	40	37.45
2	41	6	7.37	35	33.63
3	41	17	9.85	24	31.15
4	42	9	13.28	33	28.72
5	42	17	16.34	25	25.66
6	43	20	19.55	23	23.45
7	46	26	25.37	20	20.63
8	58	41	38.04	17	19.96
9	51	36	39.65	15	11.35



If the model is good, then most subjects with renewal=1 are classified in the higher deciles of the probabilities and for those with renewal=0, most of the subjects are classified in the lower deciles of the risk (the probability values). This is the exact picture in the table values, (table 4.20) indicating that the model is good and also fits the data well. This assertion is confirmed by the test that follows.

Test Procedure (LACKFIT).

H_0 : The model does **not** lack fit (the model fits the data)

H_1 : The model lack fit (the model does not fit the data)

Table 4.21: Hosmer and lemeshow Goodness – of – Fit test

Chi – Square	DF	Pr > ChiSq
13.4326	7	0.0622

Table (4.21) summarises the results and since p-value = 0.0622 indicating (p-value > 0.05), means that we have no statistical evidence to reject the Null Hypothesis (H_0), implying that the model fit to the data is statistically significant.

4.3.4.1 Residual Analysis from Graphs/Plots

For true model, most of the Pearson Residual and the Deviated Residuals fall within ± 2 . Those outside are considered outliers especially observations 7, 20, and 360 lie outside the cut-offs

(± 2) in figure (4.12) below.

Denoting Leverage by h_{ii} and the average Leverage by $(\frac{k+1}{n})$ where k is the number of covariates in the model and n is the sample size.



for large n , $h_{ii} > 3\left(\frac{k+1}{n}\right)$. In the case of our model as seen in the table below, $0.04 < 3(0.0148)$ or $(0.04 < 0.044)$. This means that the outlying cases are not so influential due to the large sample size.

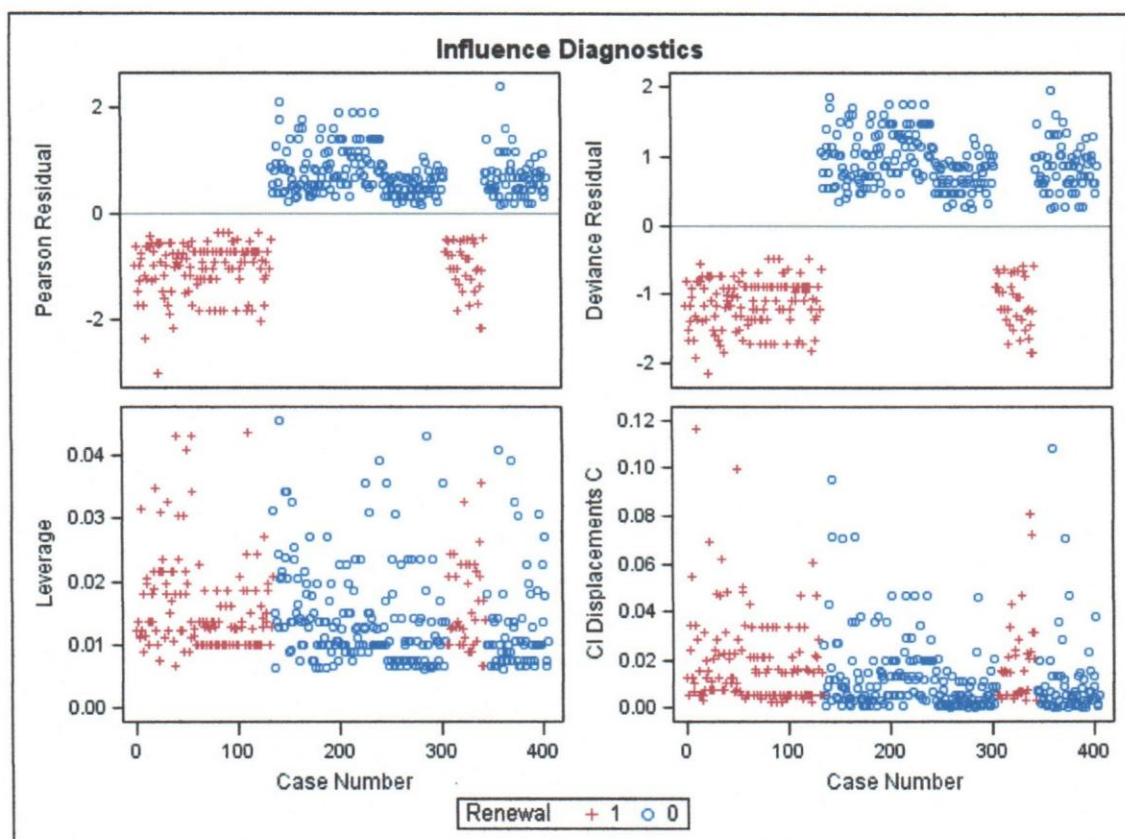


Figure 4.12 Influence Diagnostic Plots

4.3.5 Validation of Predicted Probabilities

The adequacy of prediction of a logistic regression model is measured by the degree to which predicted probabilities agree with actual outcomes. This is expressed as either a measure of association or a classification table as shown below.

Table 4.22: Association of Predicted Probabilities and Observed Responses

Table 4.22: Association of Predicted Probabilities and Observed Responses

Percentage Concordant	77.0	Somers' D	0.569
Percentage Discordant	20.1	Gamma	0.586
Percentage Tied	3.0	Tay-a	0.279
Pairs	40136	c	0.785

Table (4.22) above gives the result of the measure of association of predicted and observed responses. As indicated by the “percent concordant” among other measures, it can be inferred that in 77% of the overall time the model will predict correctly

4.3.5.1 Graphing Prediction Accuracy

Table 4.23 Classification Table

Prob Level	Correct		Incorrect		Percentages				
	Event	Non-Event	Event	Non-Event	Correct	Sensitivity	Specificity	False POS	False NEG
0.000	173	0	232	0	42.7	100.0	0.0	57.3	.
0.100	166	51	181	7	53.6	96.0	22.0	52.2	12.1
0.200	157	81	151	16	58.8	90.8	34.9	49.0	16.5
0.300	139	85	147	34	55.3	80.3	36.6	51.4	28.6
0.400	130	134	98	43	65.2	75.1	57.8	43.0	24.3
0.500	97	164	68	76	64.4	56.1	70.7	41.2	31.7
0.600	80	181	51	93	64.4	46.2	78.0	38.9	33.9
0.700	29	216	16	144	60.5	16.8	93.1	35.6	40.0
0.800	19	225	7	154	60.2	11.0	97.0	26.9	40.6
0.900	2	231	1	171	57.5	1.2	99.6	33.3	42.5
1.000	0	232	0	173	57.3	0.0	100.0	.	42.7



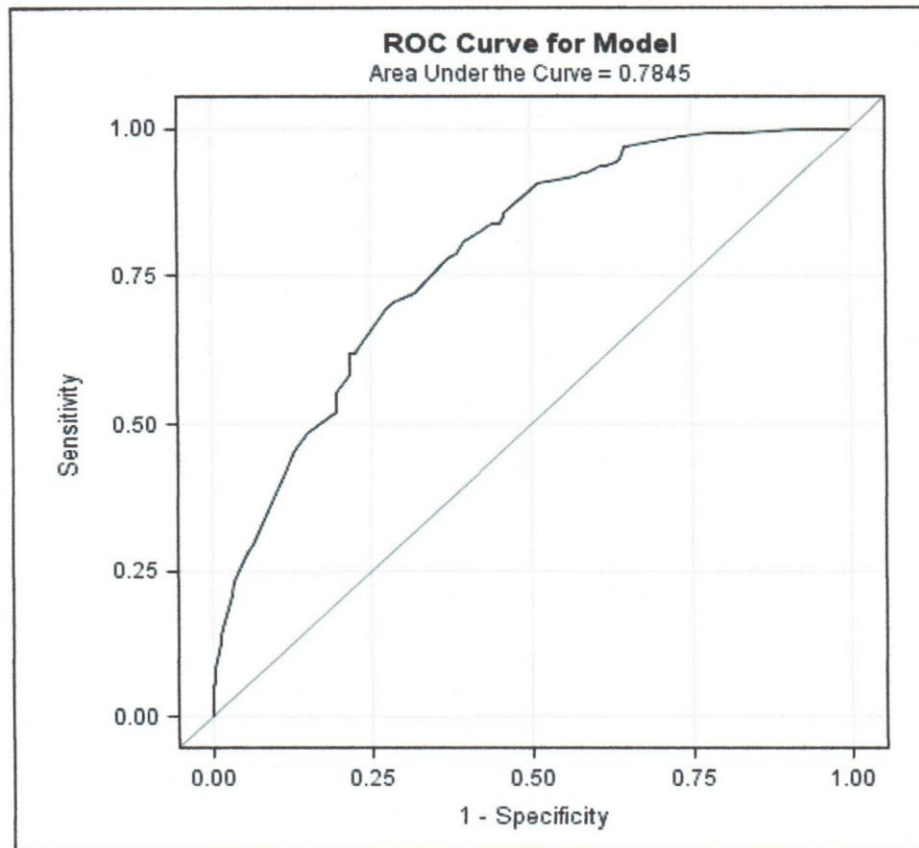


Fig 4.13: ROC Curve for Model

The model as indicated by the area under the ROC Curve (Figure 4.13), makes correct prediction 78.45% of the overall time.



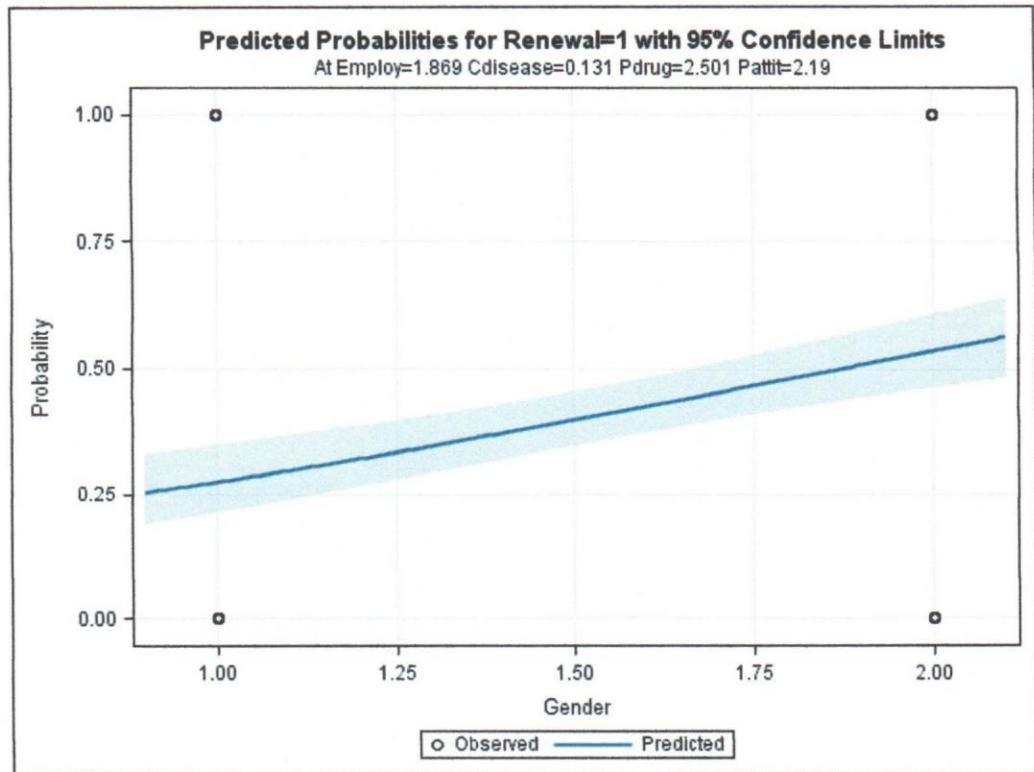


Figure 4.14: (for Gender)

Table 4.24 SUMMARY OF RESULTS FOR FIG. 4.14

Gender	Code	Approximate measure of renewal chance
Male	1	A little above 0.25
Female	2	A little above 0.50

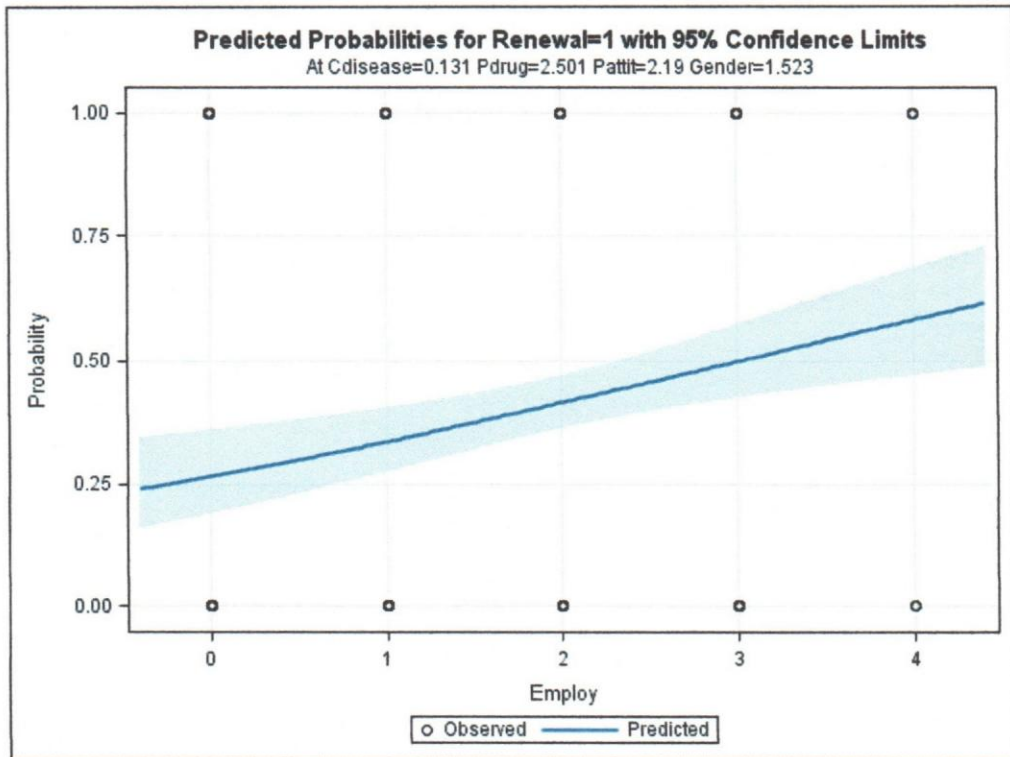


Figure 4.15: (Employment Status)

Table 4.25: SUMMARY OF RESULTS FOR FIG. 4.15

Employment status	Code	Approximate measure of renewal chance
Unemployed	0	Approximately 0.25
Public sector	1	About 0.33
Private sector	2	About 0.42
Juvenile	3	0.50
Pensioned	4	About 0.58

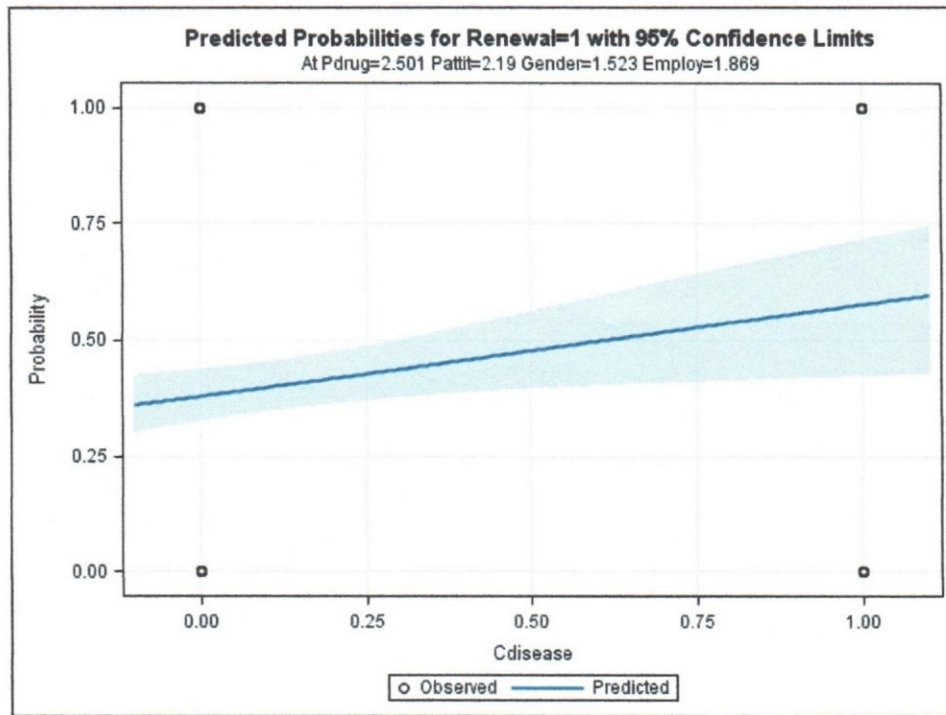


Figure 4.16: (for Presence of Chronic Disease)

Table 4.26: SUMMARY OF RESULTS FOR FIG. 4.16

Presence of chronic disease	Code	Approximate measure of renewal chance
No	0	About 0.38
Yes	1	About 0.58

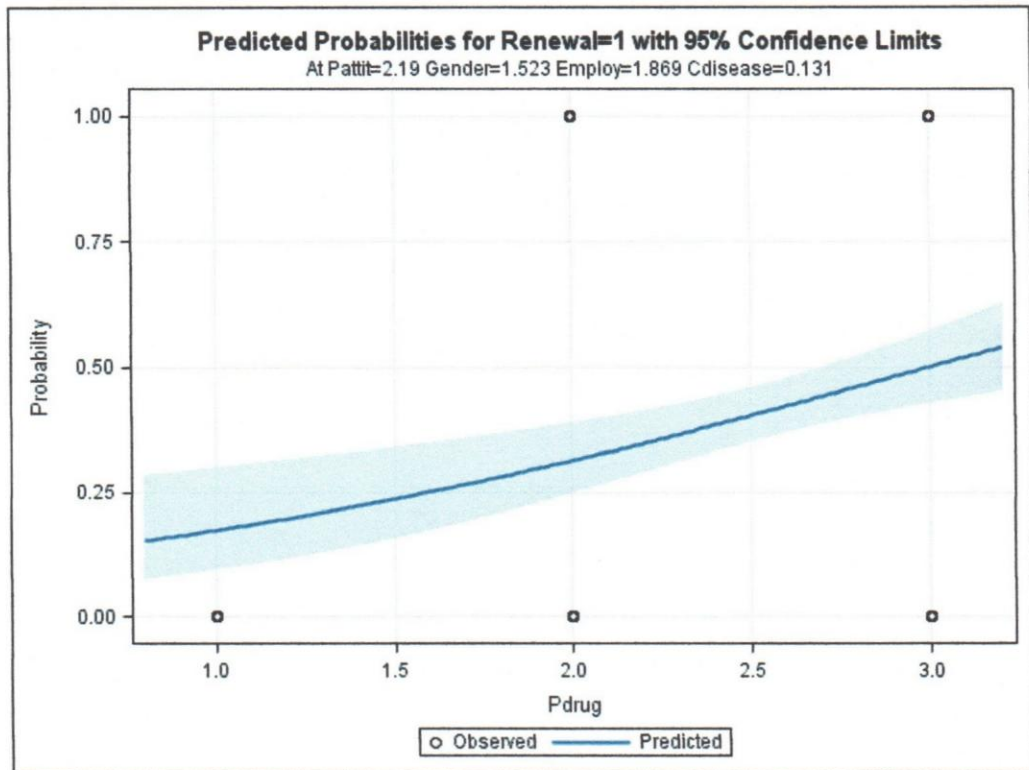


Figure 4.17: (for Perception on Efficacy of Drugs Dispensed Under NHIS

Table 4.27: SUMMARY OF RESULTS OF FIG. 4.17

Perception on efficacy of drugs	Code	Approximate measure of chance of renewal
Bad	1	About 0.17
Fair	2	About 0.33
Good	3	0.50



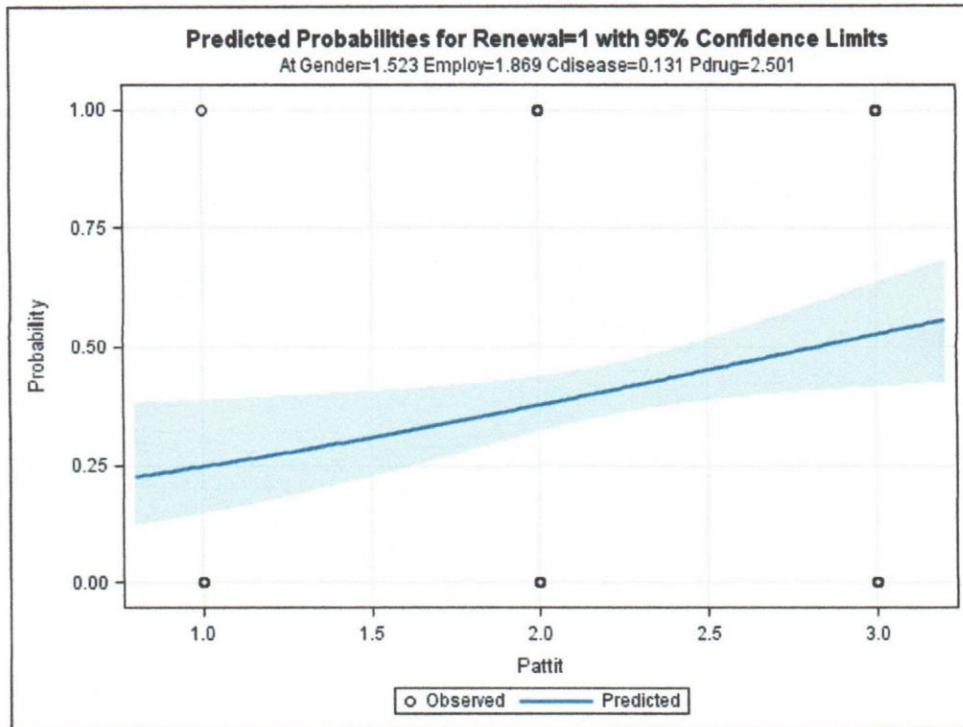


Figure 4.18: (for Perception on Attitude about Health Care Providers)

Table 4.28: SUMMARY OF RESULTS OF FIG. 4.18

Perception of clients about attitude of health workers	Code	Approximate measure of renewal chance.
Bad	1	About 0.25
Fair	2	About 0.38
Good	3	A little above 0.50

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The main essence of this work is to get a model that will express the relationship between the likelihood of an individual, selected from the Tamale Metropolis, renewing his or her health insurance policy, given the Age, Gender, Educational Status, Average monthly income, Availability of a Health Care Facility within 5 km radius, Perception about the attitudes of health care providers, Perception about efficacy of Drugs, How often one falls sick, Employment status, General satisfaction and system of health-care financing preferred, with greater accuracy. Tables (4.12) and (4.13) were summary of the results obtained which clearly indicated the significant predictor variables and their optimal parameters and hence the prediction equation as:

$$\text{Predicted Log(Odds of Renewal)} = -4.9756 + 1.1073\text{Gender2} + 0.3368\text{Employ} + 0.7956\text{Cdisease} + 0.7802\text{Ddrug} + 0.6043\text{Pattit}.$$

To assess the soundness of the model, it was subjected to several methods of model evaluation procedures which included overall model evaluation, statistical tests of individual predictors, goodness of fit test and validation of predicted probabilities.

5.2 Discussions

5.2.1 Overall Model Evaluation

A logistic model is said to provide a better fit to the data if it demonstrates an improvement over the intercept-only model (Null model). The Null model serves as the base line because it contains no predictors. An improvement over



this base line was examined by looking at Table (4.15) that gave the descriptive analysis of the model and table (4.16) which gave the likelihood ratio.

In table (4.15) the total variability of the model, measured by -2logL and its derivatives like the AIC and SC/BIC, continued to reduce in value as more of significant predictor variables were entered into the model. This meant that as more of these significant variables were entered, the performance of the expanded model improved significantly over the Null model due to progressive decrease in the total variability leading to increase in efficiency of the model.

In addition to this, table (4.16) also demonstrates an improvement of the expanded model over the Null model but this time using the likelihood ratio. Table (4.16) is the result of Global Null hypothesis test ($BETA=0$) which sought to test the Null hypothesis that all the parameters are zero meaning that no effect (predictor) was significant, to imply that there was no improvement over the Null model; **against** the assertion that at least one predictor is significant, resulting in some improvement of the expanded model over the Null model. From the test carried out, the result in the table (4.16) indicates that p-values for all the effects are 0.0001 and ($0.0001 < 0.05$) meaning that we failed to uphold the Null Hypothesis that all the parameters are statistically zero, in favour of the assertion that at least one parameter is significant indicating some improvement in the expanded model over the Null model. This conclusion manifest itself in the increasing values of the likelihood ratio, the score and the Wald chi-squares in the table: Table (4.16). All the three (the likelihood ratio, the score and the Wald chi-sq) yielded the



same results by indicating increasing order. In some situations all the three may not follow the same trend and under such we rely on the likelihood values ratio and score tests only.

5.2.2 Statistical Test of Individual Predictors

The statistical test of individual of individual logistic regression parameter (i.e. β_s) was tested using the Wald Chi-square statistic and the results summarised in table (4.17). In the test, we sought to examine the hypothesis that a given coefficient $\beta_i = 0$ as Null (H_0) against the assertion that the particular parameter of the given predictor $\beta_i \neq 0$. The result as indicated in Table (4.18) showed that all the p-values were less than 0.05; ($p < 0.05$) indicating the lack of enough statistical evidence to retain the Null Hypothesis hence we reject H_0 , (the assertion that the particular coefficient under consideration) is statistically zero. This therefore means that for all the predictors, the coefficients are different from zero and all the predictors contribute significantly to the performance of the model.

To account for the intercept, we looked at table (4.17), the analysis of maximum likelihood estimate which indicated a p-value of < 0.0001 for the intercept (i.e., $p < 0.05$) to indicate that the model will perform better with the intercept than without it. Since the tests have shown that the individual predictors are all significant, we need to understand their implications in the study. Interchanging the codes for the different levels of gender (male and female) has the potential of changing the parameter for gender but the female group may still have a higher probability. This is subject to further investigation.



5.2.3 Discussion on Individual Predictors

According to the model, the log odds of an individual's renewal in the Tamale Metropolis was positively related to all the significant predictor variables in the model, ($p < 0.05$) namely: Gender, Employ, Cdisease, Pdrug, and Pattit.

Gender

Gender was put into two levels; male and female coded 1 and 2 respectively.

In the descriptive analysis of the data, out of the 405 respondents, 47.9% were female and 52.1% were male (see table 4.1). By the data collected from the Tamale Metropolitan offices of the NHIS, 194,615 female registrations were recorded against 119,870 males as of 31st October 2011, indicating a higher relative patronage of female group than the male counterparts.

In the model too, keeping all other covariates constant, female were more likely to renew their health insurance policy than male. In fact the odds of a female renewing is $e^{1.1079}$ (3.026) times greater than the odds of male renewing. This is depicted in (figure 4.14). The statement is also confirmed by the positive parameter (1.1079) associated with the gender 2 predictor. This could be related to the numerous anti-natal and child birth related health issues which are more prevalent in female than in male. So to avert any unforeseen situation they always have their policies renewed ready for any eventuality.



Employ: (Employment Status)

Similarly, in the descriptive analysis of the data, employment status was categorised into five levels namely; unemployed, public sector, private sector, juvenile and finally pensioned coded 0,1,2,3 and 4 respectively. Out of the 405 respondents, 22.7% were unemployed, 9.6% worked in the public sector, 27.4% in the private sector, 38.5% were in the juvenile group and by law do not work and finally those pensioned stood at 1.7%. (See figure 4.6). From the model however, the log odds of renewal, is also positively related to employment status keeping all other predictors constant. Comparing the extreme cases; the unemployed and the pensioned, the model indicated that the log odds of renewal for the pensioned is 1.400 or ($e^{0.3368}$) times greater than the odds of the unemployed. Figure (4.15) indicates that the pensioner had a higher probability of renewal than the unemployed. This trend could be due to the fact that both the juveniles and the pensioned belong to the exemptions who do not pay for registration and renewal, so the financial impact is almost non-existent and additionally, more vulnerable in terms of susceptibility to diseases, hence the relatively higher likelihood of renewal for the two groups. What looks surprising is the relatively low numbers and low likelihood of the renewal of the public sector worker as shown in (figure 4.15), against what we captured in literature. In reality, this group of workers do not pay directly, but from their social security contributions for renewal and even the initial registration. There could be the issue of complacency as they do not bear the direct and instant pain of having to off-set all the unpaid renewal premiums, for it has already been covered, hence the feeling that even at emergency one can still renew without any direct financial impact or difficulty unlike the



counterpart in the private sector, who would have to go through the pain and difficulty of getting bulk money to defray the outstanding unpaid premiums before the policy could be updated. Thus the motivation to renew earlier, in order to avert this unwanted difficulty on the part of the private sector worker and, hence the relatively higher likelihood of renewing over the public sector worker.

Cdisease: (the Presence or Absence of Chronic Disease).

This predictor was put into two categories; those who had chronic disease and those who did not, coded 0 and 1 respectively. Out the 405 respondents, 86.9% said they did not have any form of chronic disease and 13.1% answered yes (figure 4.7). By inference we can hypothetically say that majority of inhabitants of the Tamale Metropolis do not have any form of chronic disease. (Figure 4.16) gives a more revealing picture. From the model, the parameter of the predictor (Cdisease) is 0.7956 . This means that in the metropolis, the odds of a renewal of one who has a chronic disease is 2.216 or $e^{0.7956}$ times greater than one who has no chronic disease. This indicates that those who had chronic diseases were more likely to renew their health insurance policy than those who did not have any form of chronic disease.

Pdrug (Perception about the Efficacy of Drugs Dispensed under the NHIS)

This predictor variable was put into three levels: bad, fair and good coded 1,2 and 3 respectively. The following results were achieved on analysis. Out of the 405 respondents 4.0% had bad perception about the efficacy of the drugs, 42%



felt that even though not too bad the efficacy was not the best (fair) and finally 54.1% felt that it was good for them (see table 4.8). The model shows a positive relation between log odds of the renewal and perception about the efficacy of drugs issued under the NHIS with the coefficient being 0.7802. Considering the two extreme responses; bad and good, the implication is that the odds of renewal for those who had good perception is 2.182 ($e^{0.7802}$) times greater than those who had bad perception. This means the likelihood of renewal grows with improvement in perception about the efficacy of the drugs. This is depicted in figure (4.17). Perception generally is a psychological feeling and can influence to a large extent the action or inaction of an individual.

Pattit (Perception about Attitude of Health Workers towards Clients)

Clients' perception about the attitude of health delivery staff greatly impacts on the chances of renewal for, many individuals are sensitive to their human rights. From descriptive data analysis 4.2% of the 405 respondents felt that service delivery staff at the various health centres had bad attitude towards clients, as much as 72.6% felt that even though the attitudes were not all that bad, it was not the best and 23.2% said it was good (see figure 4.9). The model has indicated that the log odds of an individual's renewal have a positive relation with the attitude of health workers with parameter 0.6043 keeping other predictors remaining constant. Comparing the two extreme cases of those who said the attitude is bad against those who felt it was good, we can therefore infer that the odds of renewal for those who said it was good is 1.830 or $e^{0.6049}$ times higher than those who indicated that it was bad. This is clearly



seen in (figure 4.18), meaning that the perception index on attitude of health workers towards clients at the point of delivery, directly affects the chances of clients renewal in the Tamale Metropolis.

5.2.4 Goodness of Fit Statistics

Goodness of fit statistics assess the fit of a logistic model against the actual outcomes. This was assessed by results in table(4.20) of “partition for Hosmer-Lemeshow test, Hosmer –Lemeshow Goodness of fit test (Lackfit test) and finally the influence diagnostic plots.

5.2.4.1 Partition for Hosmer-Lemeshow Test

Table (4.20) shows the result of Hosmmer-Lemeshow approach of partitioning the subjects into “observed” and “expected” out-comes for both “renewal=1” and “renewal=0” according to their probability values ranging from any value less than 0.1 to 1.0, constituting nine groups for our models. If the model is good, then most subjects with renewal=1 are classified in the higher deciles of the probabilities and for those with renewal=0, most of the subjects are classified in the lower deciles of the risk (the probability values). This is the exact picture in the table (4.20) values, indicating that the model is good and also fits the data well.

Based on these out-comes in the table 4.20. the chi-square test statistic was computed and evaluated at $Df=7$, for an inferential test discussed below:



5.2.4.2 Lackfit Test

Table (4.21) is the result of the LACKFIT test which sought to test the Null Hypothesis (H_0) that the model does NOT lackfit against the alternative with an assertion that the model lackfit.

From the test results it could be seen that the p-value of the test statistic is (0.0622) which is greater than $\alpha = 0.05$; ($0.0622 > 0.05$) meaning that we have failed to reject the Null Hypothesis (H_0) which asserts that the model does NOT LACKFIT to imply that it fits the data well.

5.2.4.3 Discussion on Residual Plots

Another way of examining model adequacy is by the index plots as a way of carrying out influence diagnostics to reveal the outliers that do have great influence on the estimated parameters of the predictors (see figure 4.12).

In global test of model adequacy, we use the corresponding chi-squared approximations for the deviance and Pearson-statistics. Under the normality assumption with sufficiently large sample such as ours, deviance residuals or studentized Pearson Residuals follow the chi-square distribution with a single degree of freedom.

If the logistic regression model is In fact True, one would expect to observe a horizontal band with most of the residuals falling within ± 2 . This is clearly seen in (figure 4.12) with a few lying outside the range, namely observation 7, 20, and 360. The leverage is another tool used to detect influential outliers. The leverage of any given case can be compared to the average leverage which is $\left(\frac{k+1}{n} \right)$, where k is the number of predictor variables in the model and



n is the sample size. If the sample is sufficiently large, the leverage value $h_{ii} > 2\left(\frac{k+1}{n}\right)$ and for large samples, $h_{ii} > 3\left(\frac{k+1}{n}\right)$. This is where our model applies.

The highest leverage h_{ii} in (fig 4.3.4.1.1) is 0.04, and average leverage is $h_{ii} < 3\left(\frac{k+1}{n}\right)$; thus $(0.04 < 0.044)$. If $h_{ii} < 3\left(\frac{k+1}{n}\right)$, then the outlying cases are not so influential due to the large sample size. Notwithstanding the results that $h_{ii} < 3\left(\frac{k+1}{n}\right)$, we still went ahead and deleted observations which were considered outliers as seen in figure 4.12 namely observation 7, 20, 360, from the Pearson residual plot and observation 40, 53, 54, 113, 147 and 286 from the leverage plot. This was re-analysed and the result yielded marginal changes in the coefficient, but the Hosmer – Lemeshow Goodness of fit test indicated that $P - \text{value } (0.0247) < 0.05$ implying the resulting model lacks fit.

Next we deleted only observations 7, 20, and 360 as indicated in Pearson Residual and Deviance residual in (figure 4.12) and the changes in the parameter values were simply insignificant. Based on all these checks and counter checks to get the optimum model, it still proved that we would be better off retaining the observation.

5.2.5 Validation of Predicted Probabilities

5.2.5.1 Use of Tables

Under this, we sought to find the accuracy in using the model to predict. The resultant predicted probabilities can then be revalidated with the actual outcomes to determine if high probabilities are indeed associated with events



and low probabilities with non-events. Table (4.20) clearly shows this trend, an obvious indication of the ability of the model to accurately classify.

Validation of predicted probabilities can also be carried by the determination of the degree to which the predicted probabilities agree with actual outcomes.

This is expressed as a measure of Association.

5.2.5.2 Measures of Association

Considering table (4.22) it can be seen that out of 100 predictions by the model about the renewal status in the NHIS of an individuals picked at random in the Tamale Metropolis 77 are likely to be correctly classified, hence a higher predictive power as indicated by the concordant percentage.

Somers' D, Gamma, Tau-a and C statistics are all alternative measures of the strength of association between estimated probabilities using the model and the actual outcomes. However, they have different computational procedures and relative advantages over each other, hence the different values. They are all based on Kendall's coefficients.

The Gamma statistic, from the table, is 0.586 which means there are 58.6% fewer errors made in predicting renewals using the estimated probability by the model than by chance.

The Gamma statistic has a tendency to over estimate the strength of the association because it does not adjust for ties, hence a measure of 56.9% as against a relatively lower measure of 56.9% for Somer's D which adjust for ties. Tau-a has the lowest value because it takes care of the total number of possible pairs in the subjects, standing at 27.9%.



The C statistic, represent the proportion of the respondents pairs with different observed outcomes for which the model correctly predicts a higher probability for observations with the event outcomes than the probability of non-event observations. The C value 0.785 of our model therefore means that, for 78.5% of all possible pairs of the respondents- one renewal and the other non-renewal, the model correctly assigned a higher probability to those who renewed and lower probabilities to those did not, a clear indication of a higher predictive power of the model. This was clearly shown in table (4.20). The value is almost like the area under the ROC curve.

The level of agreement between the predicted probabilities with the actual outcome is expressed by the percent concordant which stands at 77% and disagreement 20.1% expressed by percent discordant. Those which neither agree nor disagree stand 3%. This means that when 100 predictions are made using this model 77 are likely to be correct, about 23 likely to be incorrect.

5.2.5.3 ROC (Receiver Operating Characteristics) Curve

The ROC Curve is another probability validation tool. The area under the curve specifies the probability that, when we draw one event and one non event example at random, the decision function assigns a higher value to the event than to the non-event.

Sensitivity is the measure of proportion of observations correctly classified as event.

Specificity is the proportion of observation correctly classified as a non event.

1-minus-specificity measures the proportion of observation misclassified as an event.



ROC is a plot of sensitivity against 1-specificity. The ROC Curve is based on multiple cut off points.

The area under the curve discriminates between good and bad models. The diagonal (having an area of 0.5) means lack of discriminating power, and therefore forecast is random and an area of 1.0 means perfect discrimination, which is rare in real life situation.

The ability of the model to discriminate in our case, renewal from non renewal, demonstrates its performance. Good models are as close to one as possible, graphed as the area under the curve and the larger the area under the curve, the better overall performance of the model to correctly identify and classify events from non-events

The Area under the ROC curve of our model is estimated at 0.7845 (see figure 4.13). This means that the likelihood that the model will assign a higher value to renewal than to non-renewal when we draw one renewal and one non-renewal subject at random, is 78.45%. Thus our model has a correct classification rate (CCR) of 78.45% almost equal to the C value under measures of association (see table 4.22)

5.3 Conclusion

The following conclusions can be drawn from the analysis of the data;

The model suggested that gender, perception, about attitudes of health care workers, perception about efficacy of drugs, how often one falls sick, were the significant factors that influence the likelihood of renewal in the NHIS, in the Tamale metropolis.



The models efficiency was 78.45% measured by the “correct classification rate”. Thus if the model is used to classify say 100 subjects with respect to their renewal status in the NHIS, more than 78 of them will be correctly classified as those who have renewed, and less than 22 of them will wrongly classified as those who have renewed.

The likelihood of female renewing exceeds that of male; thus female have a higher probability of renewing the NHIS policy than the male counterparts. Women generally have shown interest in the NHIS, for, out of the 405 respondents, 211 representing 52.1% registered to be part of the scheme.

Private sector workers incidentally have a higher chance of renewing his/her policy than those in the public sector, but those pensioned had the highest chance of renewing than other categories of workers grouped under this study.

Individuals who had chronic diseases had a higher chance of renewal than those who did not have any form of chronic diseases.

People who had good perception about the efficacy of drugs dispensed under the NHIS have higher probability of renewal than those who had bad perception. In the same way as those who had good perception about the attitude of health workers against those whose perceptions were bad.

In general, the likelihood of renewal in the NHIS in the Tamale Metropolis increased with improvement in perceptions about attitudes of health, efficacy and drugs dispensed under the NHIS.



5.4 Recommendations

Perception is psychological feeling that requires a lot of carefully planned measures to erase.

If the studies has indicated that certain perception affect once chance of renewal especially on efficiency of drug and generally attitude of health workers, then health care providers should be encouraged to improve their interpersonal relationship with their client, especially at the point of service delivery.

Service providers should put their client at centre of their expected success stories and that failure to satisfy their client means failure as a health service providers

Education for clients on drugs should be heightened; especially with respect to colour and packaging. Many respondents were of the view that the white tablets are not an effective as the coloured ones. This could be in the form of Television shows radio-discussion or Drama.

Public sector workers happened to have a relatively lower chance of renewing. This could be due to complacency or lack of time to visit renewal canter for their renewal .To avert this, the health Insurance authorities could deploy some of their personnel to occasionally move round the various department and agencies to afford the public sector workers the opportunities to renew their policies.



The central Government or the local assemblies could also design special financial schemes to assist the unemployed who fall within the age of 18 and 69 years to renew their policies.

5.5 Suggestions for Future Work

The study has considered only a few predictor variables out of several others that have the potential of affecting the chances of renewal of policies under The NHIS. Examples of variables not considered in the study but could also be significant, include the family size, belief systems, place of residence (whether Rural or Urban), access to renewal centers, to mention a few. It is therefore suggested that further work could include these factors and others which are not captured in this study.

The order of coding of the various levels of the study variables in this study, could be changed to see if there will be any changes in the parameter values, directions and also the relative probability measures of the levels of the significant factors.

Some study could also be carried out to find out factors that affect policy purchasing decisions, so that comparism can be made with those affecting policy renewal decisions, and the directions of the effects.

The study was limited to Tamale Metropolis. Further studies could cover the whole of the Northern Region and subsequently the entire country so that comparism can be made to see if some of the factors are dependent on location or cut across Districts or even Regional boundaries.



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APPENDIX A

QUESTIONNAIRE FORM A

1. AGE:

Below 18 years ☐ 18-69 years ☐ 70 years and over ☐

2. SEX: Male ☐

Female ☐

3. HAVE YOU REGISTERED TO BE PART OF THE NHIS?

Yes ☐ No ☐

4. EMPLOYMENT STATUS

- Not Employed ☐
- Private ☐
- Public ☐
- Juvenile ☐
- Pensioned ☐

IF ANSWER TO QUESTION 3 IS YES, CONTINUE TO
QUESTIONNAIRE B OTHERWISE DISCONTINUE INTERVIEW.



QUESTIONNAIRE FORM (B)

1. RENEWAL STATUS :

- Renewed ☐
- Not Renewed ☐

2. SEX : MALE ☐

FEMALE ☐

3. AGE:

below 18 years ☐ between 18-69 years ☐ 70 years and above ☐

4. EDUCATION:

- No Education ☐
- Basic ☐
- Secondary ☐
- Tertiary ☐

5. MONTHLY INCOME :

- Juvenile ☐
- Below GH¢134.4 ☐
- Above GH¢134.4 ☐

6. ACCESS TO HEALTH FACILITY (DISTANCE)

- Less than 5km. ☐
- 5km or More ☐

7. EMPLOYMENT STATUS

- Not Employed ☐
- Public ☐
- Private ☐
- Juvenile ☐
- Pensioned ☐

8. DO YOU SUFFER ANY CHRONIC DISEASE?

- No ☐
- Yes ☐



9. WHAT IS YOUR PERCEPTION ABOUT THE DRUGS DISPENSED UNDER THE NHIS?

- Bad ☐
- Fair ☐
- Good ☐

10. WHAT IS YOUR PERCEPTION ABOUT THE GENERAL ATTITUDE OF SERVICE PROVIDERS TOWARDS YOU EACH TIME YOU VISIT THE FACILITY?

- Bad ☐
- Fair ☐
- Good ☐

11. HOW WOULD YOU DESCRIBE

- Bad ☐
- Fair ☐
- Good ☐

12. YOUR GENERAL LEVEL OF SATISFACTION ABOUT SERVICES RENDERED UNDER SCHEME

.....

.....

.....

13. WHICH SYSTEM DO YOU PREFER

- Cash and Carry ☐
- NHIS ☐



APPENDIX B

SAS CODES FOR ANALYSIS
www.udsspace.uds.edu.gh

Initial Analysis comprising all the predictor variables

```
PROC LOGISTIC DATA=Work.Nash DESCENDING;
TITLE "Predicting NHIS Renewal Using Logistic Regression";
CLASS Educ (PARAM=Ref REF=First);
MODEL Renewal= Gender Age Educ Mincome Access Employ Cdisease
Pdrug Pattit Lsatis Spref /
SELECTION=Stepwise HIERARCHY=Multiple LACKFIT;
RUN;
QUIT;
```

**Codes for final analysis comprising only significant predictor variables
(from the results of the initial analysis)**

```
ods graphics on;

PROC LOGISTIC DATA=Work.Nash DESCENDING;

TITLE "Predicting NHIS Renewal Using Logistic Regression";
CLASS Gender (PARAM=Ref REF=First);
MODEL Renewal= Gender Cdisease Pdrug Employ Pdrug Pattit/
CTABLE PPROB=(0 to 1 by .10)
OUT ROC=OUTROC;
OUTPUT OUT=PREDICTED P=PHAT LOWER=LCL UPPER=UCL;
RUN;
QUIT;
ods graphics off;
```

APPENDIX C: DATA

Renewal	Gender	Age	Educ	Mincome	Access	Employ	Cdisease	Pdrug	Pattit	Lsatis	Spref
1	2	2	3	2	1	1	0	3	2	2	1
1	2	2	0	1	2	2	0	3	3	3	1
1	1	2	3	2	1	1	0	3	2	2	1
1	2	2	2	2	1	1	0	2	2	2	1
1	2	2	3	2	2	1	0	3	2	2	1
1	2	2	0	1	1	0	0	2	3	2	1
1	2	2	3	2	1	1	0	3	3	3	1
1	2	2	0	2	2	2	0	3	2	3	1
1	1	2	3	2	2	1	0	3	2	2	1
1	2	2	2	1	1	0	0	3	2	2	1
1	2	2	0	1	2	0	0	2	1	2	1
1	2	2	0	2	1	2	0	2	2	3	1
1	2	2	2	2	1	2	0	3	3	3	1
1	2	2	0	1	1	2	0	3	3	2	1
1	2	2	0	2	1	2	1	3	3	3	1
1	2	2	0	1	1	2	1	3	2	2	1
1	1	2	3	2	2	1	0	3	3	3	1
1	1	2	0	2	1	2	1	3	3	2	1
1	2	2	1	2	1	1	0	3	2	3	1
1	2	2	1	2	1	2	0	2	2	3	1
1	1	2	2	1	2	0	0	2	2	3	1
1	2	2	0	2	1	2	1	3	2	3	1
1	2	2	0	2	1	2	1	3	2	2	1
1	2	2	2	1	1	0	1	3	3	3	1
1	2	2	1	1	1	2	0	2	3	3	1
1	2	2	0	2	2	2	1	3	2	2	1
1	2	2	3	2	1	1	0	2	2	3	1
1	1	2	2	2	1	2	0	2	3	3	1
1	2	2	2	1	1	0	0	3	2	3	1
1	2	2	0	1	1	0	1	3	2	2	1
1	2	2	2	2	1	1	0	3	2	3	1
1	2	2	0	1	2	0	0	2	2	3	1
1	1	2	3	2	1	1	0	2	3	3	1
1	2	2	1	1	1	2	1	3	2	2	1
1	1	2	2	2	1	2	0	3	2	3	1
1	2	2	3	2	1	2	1	3	2	3	1
1	2	2	3	2	1	1	0	3	3	3	1
1	1	2	0	2	1	2	0	2	2	3	1
1	1	2	0	1	1	0	1	3	3	3	1
1	2	2	0	2	1	2	0	2	3	3	1
1	2	2	0	2	2	2	1	2	2	3	1
1	2	2	3	2	1	1	0	3	2	2	1



1	2	2	3	2	1	1	0	3	3	3	1
1	2	2	1	2	2	1	0	3	2	3	1
1	2	2	1	2	1	2	0	3	2	2	1
1	2	2	0	2	1	2	1	2	2	2	1
1	2	2	2	2	1	1	0	3	3	3	1
1	2	2	0	2	1	2	1	3	2	2	1
1	2	2	2	1	1	0	0	3	2	2	1
1	1	2	0	1	1	0	1	2	3	3	1
1	2	2	0	2	1	2	0	3	2	2	1
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0	1	3	0	1	1	0	0	2	2	2	1
0	1	2	0	2	1	2	0	3	2	3	1