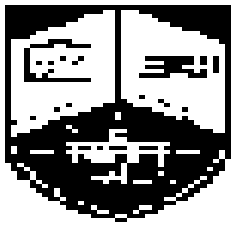
بسم الله الرحمن الرحيم



University of Khartoum

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Statistical Analysis for the Impact of Public Services on Health Care and Illness; **(Case Study: Khartoum State)**

A dissertation submitted in partial fulfillment of the Requirements for the M.Sc. degree in

Econometrics and Social Statistics

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Dedication

To my Mother

To my Father

To my Brothers

To my Sisters

To my Friends

Acknowledgment

I would like to express my sincere appreciation, gratitude, thankfulness to my supervisor Dr. BASSAM YOUNIS IBRAHIM, Head Department of Applied Statistics, College of Science, Sudan University of Science and Technology, for supervising, encouraging and guide me.

I am pleased to express sincere gratitude to the staff members of the department of Econometrics and Social Statistics, Faculty of Economics and Social Studies, University of Khartoum.

My sincere thanks to my colleague in the programme of MSc. and in work and friends to all of them, I extend my thanks and gratitude. I would like to thank all respondents to the questionnaire and many people for helping me in this study.

الخلاصة

تغطى الخدمات الصحية مساحة كبيرة جدا من ولاية الخرطوم وهدفت الدراسة الى وصف مدى استفادة الموطنين من هذه الخدمات بهدف معرفة أهم العوامل الأخرى المؤثرة على العناية الصحية بالولاية.

أستعرضت الدراسة التركيبة السكانية للسودان وحجم الدعم المادى المقدم للقطاع الصحي.

كما أفترضت الدراسة أن الخدمات الصحية المقدمة من الحكومة غير كافية. وان الحالة الصحية للمواطنين تتأثر بعدة عوامل أخرى غير الخدمات الصحية مثل مستوى التعليم ونوعية مصدر مياه الشرب وخدمة قضاء الحاجة وكذلك العوامل السكانية كحجم الأسرة.

وأستخدمت الدراسة باستخدام طريقة الامكان الأكبر لنموذجي العوامل المؤثرة علي الأمراض و تحديد العوامل التي تجعل الإنسان يبحث عن علاج، وفي المرحلة الثانية تم استخدام نموذج الانحدار الخطي بطريقة المربعات الصغرى كأسلوب إحصائي لاختبار الفروض.

وجدت الدراسة أن أكثر العوامل تأثيرا علي حالة المواطن الصحية هي المسافة الى مراكز الخدمات الصحية ومصادر مياه الشرب والتعليم الثانوي للشخص.

وأوصت الدراسة بتطوير الخدمات الصحية بولاية الخرطوم و الاهتمام بتنمية الموارد البشرية العاملة في المجال الصحي عبر الخطط والبرامج وتكثيف التدريب على أساس مجتمعي.وكذلك ترقية البيئة الصحية وتوفير مصادر مياه صحية ومكافحة التلوث الكيميائي، ، أخيرا محاربة ومكافحة والسيطرة علي الأمراض بالاهتمام بالتثقيف الصحي ورفع الوعي بأهمية العناية الصحية الأولية بين المواطنين.

Abstract

The health care services in Khartoum State cover a wide area of the state, this study was aimed to review how the people of the state had benefited from those services and what are the most effective other variables on health care in the state.

The study reviews the demographic factors of the population of the Sudan and the financial support to the health sector.

The study hypothesized that the health care services provided by the government of Khartoum state is not enough and the health status of the individuals affected by other factors as the level of education, drinking water sources, sanitation and demographic factors such as household size.

To test these hypotheses we consider two stage analyses, in the first stage we have two models of binary dependent probit models and in the second stage we use the ordinary least squares regression as statistical techniques to test the hypotheses.

The study found that the most effective variables on health status of an individual are the distance to health facilities, the water supply variables and personal secondary schooling.

To improve the health care services in Khartoum state the study recommended, there should be a great care of human resources that working in the health sector by effective policy and training programmes should be community-based, promotion and protection of a healthy environment and providing safe drinking water and prevention of chemical pollution, lastly elimination, eradication and control of disease by increasing the awareness of the importance of the primary health care between individuals.

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Abbreviations

Abbreviation	Meaning
DALYs	Disability Adjusted Life Years
GDP	Gross Domestic Product
GNP	Gross National Product
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
IDD	Iodine Deficiency Disorder
IDRC	International Development Research Centre
MNL	Multinomial Logit
NMNL	Nested Multinomial Logit
PEM	Protein Energy Malnutrition
PQLI	Physical Quality of Life index
UNICEF	United Nations International Children's Fund
VAD	Vitamin A Deficiency
WHO-EMRO	World Health Organization East Mediterranean Region Office

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CHAPTER ONE
INTRODUCTION

1.1 Preface:

The term health and public services or family welfare services cover a wide spectrum of personal and community services for a treatment of disease, prevention of illness and promotion of health. The purpose of health services is to improve the health status of population. For example, immunization of children influences the incidence/prevalence of particular diseases. Provision of safe water can prevent mortality and morbidity from water-borne diseases. The maternity health care would contribute to the reduction of maternal and child morbidity and mortality. To be effective, the health services must reach the social periphery, equitably distributed, accessible all across the country and community can afford and socially acceptable. Health services can also be seen as essential for social and economic development. Health along with education is now regarded by many as playing a major role in determining living standards in developing countries. The analysis of health processes plays an important role in economic development literature. The concept of health services research has been defined as"the systematic study of the means by which biomedical and other relevant knowledge is brought to bear on the health of individuals and communities under a given set of conditions." Health services research deals with all aspects of management of health services, viz prioritization of health problems, planning, management, logistics and delivery of health services. Health services research also deals with such topics as manpower, organization, and the utilization of facilities, the quality of health care, cost-benefit and cost-effectiveness. (Park K).

Many exercises can be carried out to evaluate the effect of public services upon health. There is a substantial micro econometric literature using anthropometric measurements. However height and weight are

measures of size rather than of health. A more direct but subjective indicator is peoples own assessments of their health, now commonly gathered by general purpose household sample surveys. This data from household surveys can be used to evaluate the impact of health services.

1.2 The Problem Statement:

Thousands of people suffer morbidity, mortality and disability not because of deficiencies in biomedical knowledge but as a result of the failure to apply this knowledge effectively. People suffer from many diseases and these diseases have an economic cost. The economic cost of the disease comes from its effect on mortality (infected individuals can die prematurely) and mortality (lower productivity and or lower flow of utility from a given consumption bundle).

1.3 The Objectives of the Study:

1-The study attempts to estimate the curative impact of using health services.

2-The study try to know the determinants of the duration of illness for adults and children.

3-The study also wants to make policy recommendations on strategies that can be used to improve health care and reduce illness.

1.4 Importance of the Study:

Health care and the health services provision being the final products of the health activities. Thus, primary health delivery programmes, which have a focus on such diseases and health conditions, benefit the poor most and cost-effective. The robust gain out of primary health programmes coupled with the assumption that a long healthy life provides incentives to invest more in education and other inputs that enhances individual capacity to earn more, enables accelerated gains that would be disproportionately large. Thus, the inter-linkage between health lives and increased longevity

translates itself into skill formation-on essential prerequisite to gear the process of economic development.

1.5 Hypotheses of the Study:

1-Distance to health facilities has a negative association with seeking treatment.

2-Personal secondary schooling power full reduces people's illness.

3-Treatment reduces the duration of illness.

4-The water supply variables have a positive effect of seeking treatment and duration of illness.

1.6 Methodology:

In this study we use a primary data that collected by a questionnaire designed to Khartoum State population during December 2006.

The study used an econometric model of health care as an endogenous dummy variable which determines the length of illness. The model will be estimated using two-stage process. The first stage uses maximum likelihood method, and in the second stage, the method will be used is the ordinary least squares.

1.7 Organization of the Study:

The study consists of five chapters, which are organized as follows: Chapter one, contains introduction, problem, objectives, importance, hypotheses, methodology and organization of the study. Chapter two explains literatures review about population structure and some indicators and links between health sector and other sectors; also it explains some previous empirical studies of health care services. Chapter three explains econometric model specification and variables used in the study. Chapter four provides an empirical result of estimated model. Chapter five consists of the results and recommendations.

CHAPTER TWO

LITERATURE REVIEW & PREVIOUS EMPIRICALSTUDIES

2.1Brief Description of Khartoum State Health

2.1.1. Characteristics of the Population:

Khartoum the capital of the Sudan is one of the northern states of the country. Khartoum is the most populous state of the Sudan with an estimated population of about 6 millions people with an average growth rate of 3.67 %. It constitutes about 16.6 % of the total population of Sudan. Khartoum state is predominantly urban area with about 87.2 % of the population live in urban areas .The 1993 census documented a crude birth rate of 28.9 per 1000 population and cautioned that these figures might be an under estimation .

The age structure of the population indicates very young populations about 36.18 percent of the total population of the area under the age less than 15 and 14.5 % of population are less than 5 years old. The sex ratio is 106 males to 100 females and on an average base every household has 6.1 members. Among females at age of reproductive years, there are 741 thousands currently married.

The literacy rate is moderately high, only 26.4 % of the population age 10 and above has no formal education, and the literacy rate is higher among the males than females. (Ministry of Health, Khartoum State, 2005)

This demographic structure has a double burden on the health system and it's financing. The very significant share of children and women in child bearing age include very high needs in terms of maternal and children health care. Concomitantly, the magnitude of the active people creates a high pressure on the labour market.

Since the economy by virtue of its character is relatively hermetic, it's low capacity of investment attraction and its low GDP per capita which

hardly started to exceed 6848249.3 SDG millions, the large part of population (60%) work in the private and formal sectors. This situation limits considerably the social financing in general, and health insurance, in particular, which firmly has adverse impacts of health services.

Given this macroeconomic situation, and the weak allocation of resources for social sectors has not reduced significantly the illiteracy rate (47% of population total and 59% of women). Poverty level has increased since the independence up to the 1990 (52% in 1956 and 92% in 1996 of population living below the poverty line).

Accordantly the health indicators that are weakened due to the distorted macroeconomic environment and social factor that of relation to health, the examinations of the health indicators (WHO – EMRO, 2006) shows that Sudan must make big efforts to align these indicators, at least up to the standard set for intermediate economy countries, they are:

1. Life expectancy at birth does not exceed 56 year.
2. Disability – adjusted life expectancy is around 43 years.
3. Maternal mortality rate is more than 36 deaths per 10000 live births.
4. Infant mortality rate per 1000 live births is 108.
5. Under five years mortality rate per 1000 live births reaches 157.

Analysis of the health system need the resources and available indicate limited capacity to improve substantially the health status to maintain these indicators.

On the human resources and infrastructure levels, the ratios show the low capacity of the care offered vis a vis the very high population needs (malaria, respiratory diseases, sexually communicable infections, AIDS, maternal and children health …)

According to (WHO–EMRO, 2006) the available human and infrastructural resources are:

*1.8 physicians per 10000 persons

*0.07 Dentists per 10000 persons

*0.11 pharmacists per 10000 persons

*5.1 nursing and midwifery personnel per 10000 persons

*7.1 Hospital beds per 10000 persons

*1.7 primary health care units and centers per 10000 persons

As such, Sudanese health system mobilizes few resources. For instance, for the year 2005, the annual expenditure is estimated to be around 472974.6SDG millions.

The public or collective financing participation is low, only 36% (14.5 % by MOH, 4.5% by other ministries and 17% through health insurance). The weaknesses of the Ministry of Health budget and the health insurance schemes are the principal explanatory element, of little resources mobilized towards heath sector.

The overall conclusion to this discussion, it appears that the public resources allocated to health sectors and health services provision is lacking behind what is supposed to be.

The macroeconomic environment has important implications in conducting healthy policy.

This is clear, since macro–environment influences the demand that is likely to place on the healthy sector.

On the other hand, macro–investment has a financial repercussion on the supply of health services both by private and public sectors.

Macroeconomic adjustment usually refers to elimination of macro problems such as inflation, unemployment, government budget deficits, trade balance deficits or unsustainable international debt level. However in addition to achieving the intending objectives of macroeconomic policy,

some serious side (adverse) effects may occur in some other sectors of the economy.

For instance reduction of government expenditure as a mean of reducing the budget deficit definitely affects resources allocated to health sector and hence provision of health services.

Some leading economic theorists suggest that, contrary to the case in many other parts of the national economy, government should intervene in the health sector because of the presence of (market failure) i.e., reasons why the actions of produces and consumers alone will not yield a socially optimal or economically efficient result. One important way in which government can and do intervene is by implementing policies for health sector finance. Nevertheless, in practice many problems are set such intervention efforts. For example, the declining economic for tunes of some countries resulted in decrease in government support to health. In some other countries, the rapid escalation of health services cost. Sudan being one of these countries has been engaged in adjustment policies since the beginning of the 1980s and intensified its further involvement and implementation of the policy presentation in these policies.

2.1.2 Liberalization Policy and Reduction of Health Expenditure:

The aims of liberalization policies, implied reduction of government expenditure allocated to different activities. the health sector is not an exemption from this policy implementation, where stabilization and structural adjustment program's has led to adverse impacts on health expenditure and consequently health status of people the implementation of liberalization policy with regard to health sector can be reflected in table below:

Table :(2-1) Actual government expenditure on health sector 2000/ 2003 year

Year	Actual Health Exp (million SDG)	Actual percentage of health exp	%change
2000	8,265,1	2.5	-
2001	11,317,8	2.5	37.0
2002	17,234,3	3.0	34.3
2003	17,339,.0	2.5	0.6

Source: Central Bank of Sudan, Central Berau for Statistics

The table shows central government per capita health expenditure and its growth patterns.

2.1.3 Utilization of Health Services:

Utilization of health services are an important policy concern in most developing countries, reflecting both efforts to improve health outcomes and to meet international obligations to make health services broadly accessible.

Early policy and research initiatives focused on the need to improve physical access through an expansion of the network of facilities. However, a growing literature on health care demand has pointed out that individuals are not passive recipients of health services, but make active choices about whether or not to make use of provided services.

Actual utilization of health services will differ in accordance with demand factors such as income, cost of care, education, social norms and traditions, and the quality and appropriateness of the services provided. Hence, if we interested in not merely providing physical access, but also ensuring the effective and appropriate health services are used by the population, we need now to understand what factors affect health care decisions and why low levels of utilization persists among certain socioeconomic groups or geographic regions.

2.1.4Health Care Quality:

Health care quality is currently receiving increasing attention in both developed and developing countries.

It is customary to distinguish two domains of quality:

(i)Technical or clinical aspects of health care,

(ii)The psycho-social interaction between patient and providers.

The general premise of health care quality is that specific set of clinical, ethical, and cultural norms can be established for the effective and appropriate management of potential or existing health problem, and those departures from these norms or standards result in reduced clinical effectiveness, or a failure to meet the legitimate demands and needs of the client.

Along these lines, the Institute of Medicine in the US has defined quality as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge".(Institute of Medicine 1990).

In developed countries, quality has become one of the central pillars in efforts to measure and improve health system performance. The issue of health care quality has also received a considerable amount of attention in developing countries.

In this context, debates about health care quality were originally linked to the issue of user fees. In particular, it was argued by some that clients were both willing and able to pay for services, and that low demand in the public sector was primarily due to low quality. Hence, if increased user contributions could be channeled into quality improvements – an idea that was promoted explicitly through the Bamako initiative – the lingering

problems of poor quality and low utilization in the public sector could be resolved.

More recently, as health systems seek to move beyond merely ensuring access, health care quality has become an important policy concern in its own right.

The measurement of quality:

The most direct approach to assessing of health care quality is to focus on the "process" of care –i.e. the activities of the health care provider and evaluate this against established technical, ethical, and cultural norms and criteria.

An alternative is to assess quality indirectly, through analysis of the "structure outcome" of health care.

Structural dimensions of health care include the tools and resources that health care providers have at their disposal, the physical and organizational setting in which care is delivered, and qualifications and characteristics of the providers themselves.

These dimensions are relevant through their impact on the probability of a good process and outcome. In contrast, outcome refers to the change in patients current or future health statues that can be attributed to health care, as well changes in patient attitudes (including satisfaction), health knowledge, and health – related behavior.

The "structure–process outcome" trilogy has been influential in guiding both health sector research and operational approaches to assessing and improving the quality of health care.

Each of the three approaches to assessing quality has its merits. However, the main problem of the "trilogy" approach lies in the tenuous links between different dimensions of quality. For example, quality of structural input by no means assures good process.

Similarly, outcomes are only linked to process in a probabilistic sense, and the relationship many only be observable with considerable leg. For these reasons, assessments and operational monitoring of quality in developed countries have tended to focus explicitly on process – through the evaluation of clinical practice against established norms or criteria (direct observation or administration records). For example, a recent, large - scale study in the US reveals substantial gaps between agreed upon standards of care and care actually provided. The focus on the process of care is however needed both skill and data intensive. In developing countries, resources and administration records do not in general permit the same form of detailed assessment of quality. As consequence, there are only few examples of attempts to measure process quality in developing countries. These studies have tended to rely on vignettes (tests or hypothetical cases) to perform quick and low cost assessments of the clinical competence of providers. In contrast, much of the research on health care quality in developing countries has focused on simple structural indicators – e.g. concerning the quality and characteristics of staff, and the availability of essential input. Many studies in developing countries have also focused on patient perceptions and satisfaction. There are however considerable problems in interpreting subjective perceptions of health care quality. In part this due to "courtesy bias "whereby that individuals may provide responses that may deem socially acceptable, in particular in response to general questions. But it is also the case that subjective perceptions of quality are based on client beliefs and views about health care norms and standards. Insofar as there are systematic differences across demographic and socio–economic groups in respect of these views, client perceptions may be poor proxies for objective assessment of different dimensions of quality. Moreover, in certain respects, clients may not be well informed about their own medical needs, in which case there may be

conflict between technical quality and patient perceptions. In both developed and developing countries, efforts to measure health care quality suffer from a general problem of reducing the many dimensions of quality to manageable number, quality assessments tend to generate large volumes of highly specific information that cannot be easily summarized into a general assessment or provider quality. (Magnus Lindelow, 2003).

2.1.5 Health Indicators:

Health indicators are variables that help to assess health status of a particular society. Health indicators can be used to monitor the progress of the outrall socio–economic development. (WHO) suggested number of indicators which can be classified into four board categories as follows: (Azhari Ahmed Taha, 1994)

1-Health policy Indicators: This include a declaration of high–level commitment which can be measured by the extent to which socially relevant development strategies such as primary health care are actually been implemented. Policy indicators can also be examined by budgetary commitment that means the allocation of adequate resources for health sector and health related activities. The degree of equal distribution of health resources also can be used as measurement of policy indicators, health resources include financial resources, man power, and health facilities. Another policy indicators represented by the degree to which the community is allowed to participate in selling up and implementing the health policies. Finally health policy can be tested by the effectiveness and efficiency of organizational framework and managerial process which provide for an effective communication between different organizational levels and department within the health sector and the other relevant sectors. Some of health policy indicators are shown in tables (2.2) and(2.3).

Table (2.2) Manpower in Khartoum State (Doctors)

Doctors Cadres	2002		2003		2004		2005	
	No.	%state doctor	No.	%state doctor	No.	%state doctor	No.	%state doctor
Specialist	168	10	119	2	127	2.3	160	2.8
General	450	9	588	9	650	11.7	629	10.9
Dentist	43	1	37	1	55	1.0	68	1.2
Pharma	235	5	26	5	46	0.8	66	1.1

Source: Annual Health Statistics Report, Ministry of Health, Khartoum State 2005

The accepted percentages for manpower according to the strategy on health policy indicators are:

∗3 specialized doctor for 100000 persons.

∗10 general practitioners for 100000 persons.

∗1dentist for 100000 persons.

∗1 pharmacist for 100000 persons.

∗The general percentage for doctors is 1 doctor for 1500 persons (WHO).

Table (2.3) Distribution of Health Facilities by Localities in Khartoum State (2005)

Locality	Pop.	State Hosp.	Health Centre		Dispensary	Federal Hospital
			Ministry	Organ	Ministry	
Khart	671968	3	26	15	-	10
J. Awlia	1084244	4	14	43	8	-
Omdur	594870	5	21	19	36	5
Karary	680866	5	14	39	21	-
Umbada	1069714	1	18	70	11	1
Bahry	699961	4	27	18	40	2
E. Nile	950803	3	24	45	64	-
Total	5752425	25	144	249	180	18

Source: Annual Health Statistics Report, Ministry of Health, Khartoum State 2005

2-Social and Economic Indicators: these indicators are including the demographic aspects such as population growth rate and its age and sex structure. they also include the size of the national economy i-e gross national product (GNP) or gross domestic product (GDP) these figures can serves as a measure of changes in the total national output from which the share of health (however defined) must be drawn. The validity of (GDP) as measurement, however, should be further secured by the degree of equality in income distribution. Working conditions, adult literacy rate, housing and food availability, all these aspects can also be used as social indicators.

3- Indicators of the Provision of Health Care: these indicators are directly related to the performance of health delivery system. Two variables can be tested as indicators of the provision of health care, these are:

- Availability: ratio between population of an administration unit (e.g. state, province, district...etc) and the health facilities and personnel assigned to it. This is shown in table (2.4) below:

Table (2.4) Distribution of Hospitals and Beds 2005

Locality	Pop.	hospital			beds			% per pop.	
		St.	Fed.	tot	St	Fed	tot	hosp	Bed
Kh	671968	3	10	13	445	2255	2700	1/52	1/249
J. A	1084244	3	0	3	325	-	325	1/36	1/3336
Omd	594870	5	5	10	364	996	1360	1/59	1/437
Kara	680866	5	0	5	266	-	266	1/136	1/2560
Umb	1069714	1	1	2	208	157	365	1/535	1/2931
Bah	699961	5	2	7	366	508	874	1/100	1/801
E.N	950803	3	0	3	256	-	256	1/317	1/3714
Total	5752425	25	18	43	2230	3916	6146	1/134	1/936

Source: Annual Health Statistics Report, Ministry of Health, Khartoum State 2005

- Accessibility: number or proportion of a given population that can be expected to use specified facility, services...etc. given certain barriers to access which many be physical, distance, transportation(time), economic (travel cost, fee charged, or social and cultural barriers).

Table (2.5) Percentage of Coverage of State Health centre

Locality	Pop.	Centre	organ	Centre+organ	Percentage of unit per 1000 pop
Khartoum	671968	26	15	41	1/16
Jabal Awlia	1084244	14	43	57	1/19
Omdur	594870	21	19	40	1/15
Karary	680866	14	39	53	1/13
Umbada	1069714	18	70	88	1/12
Bahry	699961	27	18	45	1/16
East Nile	950803	24	45	69	1/14
All state	5752425	144	249	393	1/15

Source: Annual Health Statistics Report, Ministry of Health, Khartoum State 2005

4- Basic Health status indicators: many indicators can be used here for the measurement of health status of certain community or group of people such as mortality rate, child mortality rate, life expectancy at a given age and maternal mortality rate.

It is obvious that health indicators of a given group of people include a wide range of activities and sectors which affect directly or indirectly the health status of those people. The fact implies that health promotion is not the responsibility of health institutions only but almost all other sectors take their share in this process, for this reason much of the failure in the field of health is usually attributed to the fact that health plans have been conducted in isolation from other health related activities such as education, agriculture…etc, in absence of a comprehensive socio-economic development strategy.

However, out of these various and somewhat complicated indicators, attempts have been made to reach composite indicators, for example a physical quality of life index (PQL*1*) has been proposed, it is a combination of the infant mortality rate, the life expectancy at the age of one year and the literacy rate.

The implications of these indicators vary from one country to another according to the differences in social and economic conditions and stage of development, but a minimum life expectancy of 60 or more at birth and a maximum infant mortality rate of 50 per 1000 life birth, are suggested as indicators that the health status of the population becoming a decreasing burden on individual, family and community development.

2.1.6 Population and Health

It has been argued that medical technology and environmental sanitations has influenced population growth. So as the time passes, health influences the stage of demographic transition from high birth rates and death rates.

Most of the developing countries have passed a century before high percentage of children below 15 years age, low density of population and increasing rate of internal migration are the dominant features of population patterns in most developing countries. These demographic

trends have a direct effect on the health status and health delivery system, a high population growth rate means that health plans faces variety of demographic problems. For one thing population increase impedes the governmental efforts to supply adequate health facilities. Moreover, rapid population growth means that the amount of resources available to each citizen are continuously inadequate, the situation will be more and more worsening if the rate of population growth is faster than the growth rate of (GNP). Fertility on the other hand, contributes to high child and maternal morbidity. Internal migration, which is usually rural urban migration, is not than "more exchange of the squalor of rural poverty for that of urban poverty" so most of them life in shortly towns where there is a lack of the minimum standard of health conditions. Lastly, low density, which can clearly be illustrated in large countries such as Sudan, creates considerable problems with regard to coverage and geographical accessibility. So the governments are likely to face many difficulties in order to provide an effective health delivery system. It is quite obvious from the above illustrations that the population patterns have a dramatic input on health, so any realistic health plan must take into account the demographic treads and characteristics.

2.1.7 The Components of Health System

The international development Research center (IDRC) defined the health system as "asset of cultural beliefs about health and illness forms.

The bases for health seeking and health promotion behaviour, the institutional arrangement within which that behaviour occurs, and the socio-economic, political, physical context for those behaviours and institutions.

These institutional arrangements may differ from society to another but usually covering the following components: (Azhari Ahmed Taha, 1994)

1-Individual, family and community: All of them assume a vital responsibility for health as well as for the care of its member.

2-Health Care Services: this includes the public sector as wells private sector. Public sector includes, health manpower, health facilities at central, regional and local levels and health institutions responsible for health personnel, health finance and physical infrastructure. The number, type, distribution and quality of services provided by these institutions influence health status and well being of population concern. Private sector, on he other hand includes wide range of activities such as private clinics and hospitals, traditional, medicine, and non–governmental organizations

3-The health Related Sector: this sector has no direct relation with health services but it was considered to be a health related activity. This activity includes agriculture and food distributions, education, (formal and informal), water supply and sanitation, and transport and communication.

4-The International Sector: this sector includes bilateral and multilateral donor agencies (e.g. UNICEF, WHO…etc.) That may support health as well as development activities.

All these sectors contribute to health either directly or indirectly. However one can add to these sectors other important aspects that affect the over all atmospheres within which health system are likely to operate One of these important aspects is the political ideology i.e. The political commitment to development strategy aims at providing for the basic needs of the people, the economic condition and the stage of development. All these aspects influence the efficiency and effectiveness of health system as described above and determine, to a large extent, the role of each sector within the health system itself.

2.1.8 Links between Heath and Economy:

The macroeconomic evidence across the world confirms that countries with the weaker conditions of health and education have a much

harder time achieving sustained growth than countries with better conditions. In healthier economies, individuals live much longer on average and their lifetime economic earning is therefore higher. Longer-lived household also invest a higher fraction of their income in education and financial saving, because they are at an advantage to make use of the enhanced lifetime and reap the benefits of such investments. Economic growth requires not only healthy individuals but also education and other complementary investment, such as appropriate division of labour between the public and private sectors, well functioning markets, good governance and institutional arrangements that foster technological advance. The other way to link health with economic growth is to recognize a simple fact that healthiness of people increases with the increase in personal income. It is empirically found that the income elasticity for the health and nutrition related products are positive and more than one. As levels of personal income rise, a relatively higher share is spent on consumption of health care products and products enhancing and sustaining better nutrition. At the same time, a person who is healthy devotes quality energy for work and thereby can earn a living. In this context, it can be mentioned that poverty or inadequate income levels contributes to the persistence of ill health as the person concerned is not able to finance his treatment. This in turn contributes to greater loss of working hours, culminating in the decline in the growth of GDP of entire economy.

The burden of morbidity from a number of untreated, debilitating but rarely fatal diseases in developing countries, including sexually transmitted infections, has a substantial impact on productivity. Deaths associated with diarrhea and respiratory infections are rare in industrialized counties but are the major killers of children in developing countries. Diseases that do not occur in industrialized countries, such as, malaria,

tuberculosis and schistosomiasis impose a very heavy burden in less developed countries .HIV/AIDS has caused havoc on both adults and children in the developing world. Furthermore, the aging of the population in the developing world can be expected to bring increase in the absolute burden of non-communicable diseases as well. Thus a commonly used indicator of health- life expectancy at birth ,is inadequate to highlight the costs associated with morbidity that do not lead to death but cause substantial financial and social stress. Disability adjusted life years (DALYs), a newly found indicator is a better measure but it is difficult to estimate these frequently at the national and sub-national level.

The pattern of disease prevalence among the global poor is quite different from that of the population of the world as a whole. Evaluation of global data for the 1990s suggests that communicable diseases are posing considerably higher threat to world's poor than the global averages suggest.

Extension of primary and critical clinical services are essential, a long with easy and cheap access to appropriate drugs to achieve substantial health gains. Pharmaceuticals already exist that can treat most and prevent many of the diseases causing the bulk of morbidity and mortality in the poor countries. However, improvements in vaccines for tuberculosis and inventions for HIV/AIDS and malaria are urgently required. It also appears much of the disparity in health status and outcomes are due to differential access to drugs that are already available; and access to sanitation and safe water, which influence the transmission of certain types of diseases. Another dimension to achieve success in improving health amongst the global poor is to deal with associated conditions, such as maternal health and malnutrition, and to combat reemerging diseases, such as tuberculosis, which spread particularly among the downtrodden. Thus one expects such a number of associations among aspects such as safe drinking water,

environmental sanitation and even economic growth of the population at risk of diseases and sickness. (Abusaleh Shariff, 2004)

2.1.9 Multi Prong Strategic Investments Promoting Health:

It is interesting to note that health is crucially linked with the economic, political, environmental, cultural and social characterizing the region. It is therefore essential to ensure the efficient functioning of these sectors to realize major breakthrough in the health sector achievements. In most of the countries the health care system lays a lot of emphasis on primary care. Together with this health approach, it is essential to ensure that the people have access to high and improved quality of life in terms of clean drinking, improved sanitation, hygienic.

Living conditions, reduced levels of pollution and so on. Health and environment is linked inextricably with each other and in turn are affected and influenced by other external factors. For instance, development projects meant to bring socio-economic and health related benefit to the people and community at a large is associated with unintended impacts that amplify existing hazardous conditions in the countries in the African region. Together with achievements in the health sector it is also essential to ensure that the people have access to other basic needs. It is identified that the people should have food to eat, as it is already emphasized that lack of nutritious diet renders a person more susceptible to diseases. Herein one can argue that country should have enough supply of food grain, which is the best attainable through an increase in the production of food grains. Hence the agricultural sector needs to be strengthened which is of relevance to the economies which are heavily dependent on the agricultural sector. Education and health are considered as assets for promoting economic development. Education itself has an essential impact on the health of the individual's. It results to increased awareness among masses, which is one of the most effective means of controlling the spread of diseases, speaking

broadly. A part from this aspect, education also improves the quality of life, which has a positive impact (through individual efforts) on improving the health standards.

In addressing the various issues related to health care, it is often experienced that in spite of availability of all the components of health care like health, the people have limited access to these health services primarily due to lack of infrastructural facilities. Lack of infrastructure make conditions worse and the services are not delivered to the people in need. It is essential to provide efficient infrastructure in order to deliver the services. Another problem quite exclusive to the low-income countries is the lack of life saving drugs. Even if the people mange to purchase the drugs, often drugs are not available, which in case of serious concern. (Abusaleh Shariff, 2004)

The above discussion tries to hint on the fact that the conditions of poor health prevailing in any country are the fallout of a host of reasons some of which are controllable while the others require global consensus. It is not difficult to cite the fact that health of an individual is linked to social, economical, geographical as well as the political environment in which he exist. Therefore in addressing the issue of health and devising ways to improve the conditions of health, it is neither worthwhile nor practical to concentrate on health alone and neglect other sector. Herein it is important to identify the linkage between health sector and other social as well as economic sectors. A multi pronged strategy as is commonly referred to is perhaps a desirable and result oriented method which can be undertaken in order to achieve a substantial gain in improving the standards of health care and providing better health for one and all. Often, a policy which recommends pulling out of resources from the education and finance health needs is not advisable. Health care as it exists of two types:

1.Curative health care where in efforts are directed to help the ailing individual recover and preventive/promotive health care wherein the focus is to develop and improve the living and working conditions such that the people do not fall victim to these deadly diseases. Keeping in view the later strategy it will be advisable to provide certain basic standards of living to the people such that they are in a position to defend them. This calls for investment in the educational sector, sanitation and family welfare together with health. The hierarchy of health in social sector programmes is often damaging in sustaining health standards for the people living in low-income countries. It is often realized that providing medical relief to a large proportion of people in need is burdensome for the government with limited budget. It is also equally true that the cost of treatment falls heavily on the economically worse off sections. Therefore concerted efforts which help prevent the spread of endemic diseases such as HIV/AIDS, Tuberculosis, Malaria and others are likely to be less expensive and hence less burdensome for both the government and the people. Herein the thrust lies on a multi-sector strategy, which in turn broadens the horizons of health care. (Abusaleh Shariff, 2004)

2.1.10 Water Resources and Sanitation:

The interaction between health and water cannot be over stressed, for provision of safe drinking water has the most visible impact on public health as well as national development than any other invention. Pathological conditions of human beings associated with unsafe and inadequate water are classified under the rubric of water-borne diseases (i.e., cholera, Typhoid, amoebic and bacillary dysentery and other diarrheal diseases) caused by ingestation of contaminated water, water-washed diseases like scabies, trachoma and flea; water-based diseases that includes dracunculiasis and schistosomiasis; and water-related diseases (i.e., dengue, filarisis, malaria, typonomiasis and yellow fever). Improved water and

hygiene can reduce the morbidity and mortality rates of some of the most serious diseases by a factor of 20 to 80 per cent. However, provisioning of water is one of the national objectives of many nations in the region that has been difficult to be fulfilled. Lack of resources to develop, maintain and sustain water related infrastructure has proved to be difficult due to inadequate budgetary allocation. The rapidly increasing population and the shortage of resources (financial and physical) in providing clean drinking water and sanitation, it is worthwhile to assert the validity of multi pronged strategy. Together with the allocation of resources in provision of clean drinking water and better standards of sanitation it is also essential to restrict the increasing growth population. Similar strategies will be counterproductive and complementary rather than been contradictory. Thus achieving health needs a multi-sectoral approach. Multi-sectoral interactive links of health with education, environment, water, sanitation, public hygiene, food and nutrition is important. Therefore, the federal planning must ensure that there are associated investments in all interrelated sectors and any assessments in other sectors as well.

2.1.11Food and Nutrition:

Overall inadequacy of food intake to meet the needs of growth, immune function, cognitive development and reproduction affects30 percent of children and 25 percent of women, while 56 percent of all under-5 deaths indirectly associated with some form of malnutrition. Malnutrition is the result of an interaction between food intake, disease risk factor and behavior. Disease is the result of exposure to disease, resistance and treatment at home and medical interventions. Frequent diseases associated with anoxia, fever and diarrhea have the greatest effect of disease on nutrition involves immunization, improved water supply and sanitation, improved hygiene and access to minimum nutrition inputs in the context of health care. (Abusaleh Shariff, 2004)

The highest levels of malnutrition and under-nutrition have been found to be present in the south-Asian and Sub-Saharan Africa regions. The high levels of anemia among women, especially those pregnant, reveal the high degree of nutritional deficiency in lees developed countries. Women are found to have inadequate intake of iron supplemented diet. Practically in all countries in Sub-Saharan Africa, health of women and children in particular are neglected. Often social norms and practices contribute to the low health and nutritional status of women. Poor health conditions of children and the prevalence of malnutrition are reflected by the prevalence of underweight among the children and also incidence of stunting and wasting. The main cause of malnutrition among infants is identified as low levels of breast-feeding and poor methods of weaning. The widespread prevalence of anemia increases incidence of a host of diseases. Diarrheal diseases and respiratory infections constitute the major killers and are also sources of morbidity and malnutrition among children in Sudan. Thalassaemia is also a major problem. Worm infection, nutritional deficiency and malaria seen most common causes of anemia among the people in Sudan. Another puzzle notices in some less developed countries are that even when the per capita energy consumption levels have increased in the last two decades there is no improvement in the nutritional levels as manifest in wasted and stunned children. Much of the problem of malnutrition is related to that of Protein Energy Malnutrition (PEM) and micronutrient malnutrition.

Sudan also seems to have high levels of Vitamin A Deficiency (VAD) and Iodine Deficiency Disorder (IDD). Low levels of iodine consumption have resulted in the prevalence of IDD and VAD among children. Although some health programs may exist but they are not accessible to those in need. Lack of adequate funds to sustain the

programmes and geographical bottlenecks hinder programmed implementation. Also, lack of survey reports and adequate data on the nutritional profile have resulted in the under representation of the international status of the population under consideration. (Abusaleh Shariff, 2004)

2-2 Previous Empirical Studies

(1) Duraisamy Study:

In this study, an attempt has been made to examine the determinants of health status and curative health care of children, adults and the elderly in rural India.

Health can be looking through of as a stock of human capital. At a point in time, an individual's health stock depends upon the behavioral decisions concerning health such as food intake, tobacco or alcohol consumption habit, use of medical care, nature of work, physical exercise, besides the inherited genetic health endowments and the health environment in which the individual is placed. The change in the health status of a person, over a time period, is determined through a health production function:

$$H_t = f(H_{t-1}, X_t, M_t, E_t, \varepsilon_t) \qquad (2.1)$$

Where: H_t is the health at time t, X_t is a vector of health-related inputs such as nutritious diet, exercise, preventive care, etc., M_t is curative care, E_t is a vector of individual, family and community characteristics, and ε_t is the unobserved initial endowments.

The household or family utility at any time period (U_t) depends upon the stock of health of each member(H_t), leisure of family members (L_t) and a composite consumption commodity (C_t), given household environment δ_t.

$$U_t = U(H_t, C_t, L_t; \delta_t) \qquad (2.2)$$

The family was assumed to be maximizing the weakly time separable utility function (2.2) subject to the health production function (2.1), budget (2.3) and time (2.4) constraints:

$$Y_t = P_x X_t + P_c C_t = wW_t + V_t \quad (2.3)$$

$$T_t = L_t + W_t \quad (2.4)$$

where: Y_t is real income in period t, V_t is the current annual household wealth income, P_c and P_x are relative prices of health inputs and consumption goods, w is the wage rate, T_t is the total available time, L_t and W_t are leisure and work time.

Based on the optimization process, the reduced-form demand functions for health demand (H_t) and health care (M_t) can be derived as:

$$H_t = H_t(P_c, P_x w, V_t, H_o E_t; \varepsilon_t \delta_t) \quad (2.5)$$

$$M_t = H(P_c, P_x, w, V_t H_0, E_t; \varepsilon_t \delta_t) \quad (2.6)$$

The subscript 0 in the above equations refers to the initial period.

Depending on the availability of data one can estimate the health production function or the reduced form demand function or mixture of both. Most of the studies use the reduced form approach and include both demand and production function variables to analyze the determinants of health. Due to data constraints and absence of adequate identifying instruments the reduced form approach has been adopted to estimate health demand functions.

The reduced form health demand function (2.5) can be specified as:

$$H_i^* = \alpha_1 + \alpha_2 P_i + \alpha_3 V_i + \alpha_4 E_i + u_i, \quad i = 1,2,..., N \ \textit{individuals} \quad (2.7)$$

Where P= (P_x,P_c, w) is a vector of prices and wage rate, H*is the health status of an individual which is unobservable. When the health status of an individual falls below a threshold level (Z), the person reports being ill. What we observe is a health status indicator (H) which takes the value of 1 if the person reported being ill during the reference period of 30 days and 0 otherwise. That is,

$$H = \begin{cases} 1 & if\ H^* \le Z \\ 0 & otherwise \end{cases} \quad (2.8)$$

Health status can also be measured using some functional limitations such as days ill, bed- ridden, work lost, hospitalization, etc. In this case, the health status variable is

$$H = \begin{cases} y\ , & if\ H^* < Z \\ 0 & otherwise \end{cases} \quad (2.9)$$

Where, y is a continuous variable.

Seeking treatment depends upon the sickness tolerance level which varies from person to person. Similarly, the type of care demanded also depends upon the severity of the illness. The conditional demand for curative care (one of the inputs in the health production (2.6) can be specified as:

$$\left[M_i / H = 1_i\right] = \beta_1 + \beta_2 P_i + \beta_3 V_i + \beta_4 B_i + e_i, i = 1,2,..., m\ sick\ persons \quad (2.10)$$

where: B is a vector of individual, household and community variables and M is the choice of health-care provider which takes discrete values:

M=0, if taking no treatment, or taking self treatment and other care (other than public and private facilities)

=1, if public health facilities are used for treatment

=2, if private health care is utilized. (P Duraisamy, 2000)

(2) Study of Magnus Lindelow:

The model had used an a static framework of health care demand, the choice between used and non-use of health services can be cast in simple random utility model. The utility of service use(s) and non-use(ns) are

$$U^s = U(h_s, x_s, \varepsilon_s; \varphi_s) \quad (2.11)$$

And $U^{ns} = (h_{ns}, x_{ns}, \varepsilon_{ns}; \varphi_{ns})$ (2.12)

where, h is health status, x is a vector of non-health(residual) consumption, ε is a random error term, and φ is a parameter vector. Non-

health consumption, x, is a function of c, health status (hs and hns), in turn, can be represented as a health production function,

$$h_s = h(z,q;\beta_s) \; and \; h_{ns} = h(z,q;\beta_s), \tag{2.13}$$

where z is a vector of individual, household, community and health care provider characteristics, q is a vector of variables that represent different dimensions of health care quality. The health care choice is represented by the indicator function

$$S = I[U_s > U_{ns}] \tag{2.14}$$

The essential feature of the model concerns the trade-off between health and non-health consumption. This trade-off arises so long as xs<xns. Insofar as the costs of care are unaffected by quality, and noting that

$$\frac{\partial h_s}{\partial q} > 0, q \in q \quad and \quad \frac{\partial U^s}{\partial h_s} > 0, \tag{2.15}$$

would expect better quality of care at the local health facility to lead to greater probability of utilization.

In order to operationalize this general framework, we must be more specific about functional form. Following the early literature on health care demand in developing countries, the empirical specification is based on a linear utility and health production function, such that:

$$\begin{aligned} U^s &= \varphi_{s1} h_s + \varphi_{s2} x_2 + \varepsilon \\ U^{ns} &= \varphi_{ns1} h_{ns} + \varphi_{ns2} x_{ns} \varepsilon_{ns}, \end{aligned} \tag{2.16}$$

$$h_s = \beta_s{}^{z'} z + \beta_s{}^{q'} q$$

$$h_{ns} = \beta_{ns}{}^{z'} z + \beta_{ns}{}^{q'} q$$

Finally, we assume that non-health consumption is a function of exogenous income and travel time, such that

$$x_s = \gamma_{s1} y - \gamma_{s2} time \quad and \quad x_{ns} = \gamma_{ns1} y - \gamma_{ns2} time$$

Using the linear functions for h and x, and with an appropriate reparametrization, the indirect utility function can be written as

$$U^s = U[\alpha_s{}' w + \varepsilon_s] \quad and \quad U^{ns} = U[\alpha_{ns}{}' w + \varepsilon_{ns}]$$

$$where \qquad w = \begin{bmatrix} z \\ q \\ y \\ Time \end{bmatrix}$$

On this basis, the probability that the women use the particular health service is

$$\Pr[S = 1|w] = \Pr[U^s > U^{ns}] = \Pr[(\alpha_s - \alpha_{ns})w > \varepsilon_{ns} - \varepsilon_s] = \Pr[\alpha w > \varepsilon], \qquad (2.17)$$

Where

$$(\alpha = \alpha_s - \alpha_{ns} \; and \quad \varepsilon = \varepsilon_{ns} - \varepsilon_s)$$

Under the assumption that, $\varepsilon \sim N(0,1)$

$$\Pr[S = 1|w] = \Pr[\alpha' w > \varepsilon] = \Pr[\alpha' w < \varepsilon] = \phi(\alpha' w), \qquad (2.18)$$

Where ϕ is the standard normal distribution. This is the probit model. Under appropriate regularity conditions, the parameter vector α can be estimated consistently using maximum likelihood techniques. This approach will further permit us to perform a series of hypothesis tests concerning single and joint restrictions on the coefficients of interest. Specifically, the empirical section will address whether process and structure measure of health care quality are separately and jointly significant determinants of health service utilization. Moreover, the estimates will provide the basis for an assessment of the relative importance of different factors on the probability of using curative and delivery health services.

In respect of curative health services, it should be noted that, due to a lack of individual-level morbidity data, we estimate the probit model over the entire sample. The estimation hence refers to the unconditional demand for health care. However, it is important to remember that:

$$\Pr(care) = \rho \Pr(care|ill), \qquad (2.19)$$

Where ρ is the probability of falling ill in the respective period. For example, if we find that the unconditional probability of seeking care is the

same for individuals in rich or poor households, this may simply reflect the fact that richer households are less likely to be ill. The distribution between the conditional and unconditional probability of seeking care may however be more than an issue of scaling. In particular, we would expect ρ itself to be a function of individual, household, and community characteristics, i.e. $\rho = \rho(z, q, y, Time)$. We therefore have

$$\frac{\partial \Pr(care)}{\partial s} = \frac{\partial \rho}{\partial s}\Pr(care|ill) + \rho\frac{\partial \Pr(care|ill)}{\partial s} \qquad (2.20)$$

In other words, marginal effects from the unconditional model reflect both the effect on illness incidence and on conditional care seeking behavior. In consequence, unconditional estimates of marginal effect are not necessarily good (scaled) proxies for conditional estimates, and the validity should be assessed by considering the expected effect of the variable in question on the probability of illness.(Maqnus Lindelow , 2003)

(3) Study of John Mackinnon

In his model of the determination of health, he treated health as a good demanded be the household. It is assumed that the household achieves a Pareto-optimal allocation internally. At all times, the household is therefore maximizing some implicit additive function of members, utilities. Utility function. However, the relative weight placed on the utility different members depends on those factors which determine bargaining power. For simplicity, it is assumed that these factors can be summarized by a vector of gender differentials, G; this vector can be seen as determining the form of the utility function which the household maximizes. Mathematically this is equivalent to making G an argument in the utility function, while imposing no restrictions on functional form.

Hence the household maximizes its expectation of a utility function given by:

E(U(D,C,H,L,G,HP)\B) (2.21)

Here D is a vector of demographic variables; C is consumption; H is health; and L is labor supplied to the market, HP is a vector of health practices; the practice of hygiene is assumed to affect utility directly, for instance by requiring inputs of non-marketed labor, but the way in which it does so is left flexible. G is represented in what follows by including community-level data on male-female differentials in the labor market (wags and job availability), because an improvement in the female differentials will probably improve child health.

However, an alternative possibility is that an increase in female wages will draw female time out of child care. (It is hard to find a usable variable which capture effects on relative bargaining power without also affecting allocation through relative prices). Finally, the subjective expectation of utility is conditional on the beliefs of household members a bout illness, B. Note that the maximization is modeled as taking place ex ante, i.e. before the random component of illness is known. Equation (2.21) is maximized subject to the constraints in (2.22) to (2.25):

$$PC \leq w(E)L + Y \tag{2.22}$$

Here Y is unearned income; C is the consumption vector; w is a vector of wage rates which are assumed to depend on the vector of educational levels E; and L is labor supplied to the market. This form of budget constraint assumes either that there is no subsistence production or that the family farm can be modeled as a price-taker in labor and product markets which buys family and outside labor indifferently.

$$H = f(HG, HP, V) + e \tag{2.23}$$

Here health depends in a stochastic fashion on vectors of marketed health goods, HG; these are a subset of consumption C and would include both food and medical services: on HP, health practices within the household, and on V, a vector of environmental variables.

$$C \le \overline{C} \tag{2.24}$$

And

$$L \le \overline{L} \tag{2.25}$$

(2.24) and (2.25) represent quantity constraints on consumption, notably of health services, and on marketed labor supply. Note that since the model can be interpreted intertemporarlly, the quantity constraints may include a liquidity constraint; this justifies the use of data on informal insurance as a determinant of demand.

The maximization problem yields demand functions for goods and services as follows:

$$C = C(P, w, Y, E, D, G, B, \overline{C}, \overline{L}) \tag{2.26}$$

$$HP = HP(P, w, Y, E, D, G, B, \overline{C}, \overline{L}) \tag{2.27}$$

These demand functions and the health production function (2.23) yield the reduced form model of health:

$$H = H(P, w, Y, E, D, G, C, L, V) + e \tag{2.28}$$

(John MacKinnon, 1995)

(4)Study of Indrani Gupta and Purnamita Dasgupta

The basic premise on which this study analysis is based is derived from the standard behavioral model in which utility depends on health and consumption of other goods besides health care. The conditional utility function is given by:

$$U_j = \alpha_0 H_j + \alpha_1 C_j + \alpha_2 C_j^{\,2} + u_j \tag{2.29}$$

where H_j is expected health status after receiving treatment from provider j, C_j is income net of price paid to provider (P_j) and transport costs, which is distance traveled T_j times the opportunity cost of time w(i.e. $C_j=Y-P_j-wT_j$).

The error term u_j is distributed with a zero mean and a finite variance.

Let the health care production function be defined as $H_j=Q_j+H_0$, where Q_j is the quality of provider j′s care and H_0 is health status without care.

Substituting the production in equation (2.29) gives the conditional utility function as,

$$U_j = \alpha_0 H_0 + \alpha_0 Q_j + \alpha_1 (Y - P_j - wT_j) + \alpha_2 (Y - P_j - wT_j)^2 + u_j \quad (2.30)$$

The identification of the parameters in (2.30) requires that the values of expected health and consumption differ across alternatives. The alternative that the household chooses is the one that yield the highest utility. In a linear specification, the contribution of income to utility would reduce to $\alpha_1 Y$, which is constant across alternatives, and therefore cannot influence which alternative is chosen. The quadratic consumption term includes a price-income interaction whose value is not constant across alternatives, and therefore allows price effect to vary by income.

Quality (Q_j) cannot be observed directly and therefore needs to be specified as a function of observables. The expected quality of provider j′s care is the expected improvement in health over the health status with no care.

The expected improvement in health could be thought of as a health production function, which includes characteristics of the provider as well as characteristics of the individual, including his/her health status. In general, the value of health may vary with variables like age, gender, education, severity of illness etc. A reduced form model of utility from quality is

$$\alpha_0 Q_j = \beta_{0j} + \beta_{1j} X + \eta_j \quad (2.31)$$

where X is a vector of demographic variables. The coefficients in (2.31) can vary by alternatives, to make the specification general. Substituting (2.31) into (2.29) and ignoring α0H0, we get

$$U_j = V_j + u_j + \eta_j \quad (2.32)$$

where

$$V_j = \beta_{0j} + \beta_{1j} X + \alpha_1 (Y - P_j - wT_j) + \alpha_2 (Y - P_j - wT_j)^2 \quad (2.33)$$

The intercept and coefficients on the demographic variables vary by alternative, but the coefficients on the economic variables are constant alternatives. (Indrani Gupta and Purnamita Dasgupta, 2002)

Finally, the specification of the stochastic distribution enables estimation of the demand function. The demand function for a provider is the probability that the utility from the alternative is higher than the utility from any other alternative. Thus the indirect conditional utility function derived from the behavioral model is the basis of deriving the demand function.

The demand function can take on a multinomial logit (MNL) form or nested multinomial logit (NMNL) form. The MNL suffers from the assumption of the Independence of Irrelevant Alternatives, which assumes that the stochastic portions of the conditional utility function are uncorrelated among alternatives. The NMNL allows for correlation across sub-groups of alternatives and therefore, non-constant price elasticities across sub-groups.

In our analysis we use the Nested Multinomial Logit Model (NMNL) which does not suffer from the assumption of the independence of irrelevant alternatives. The NMNL also provides a summary way of testing whether the grouping or nesting used is valid. The inclusive value parameter for different branches should lie between 0 and 1 to be consistent with utility maximization.

In his specification, he uses a two-level decision tree:
The individual chooses between formal and informal care. Let m=1, 2, 3….M index a branch of a choice model. Let n=1, 2, 3….N index the sub-choice of that branch. In the present analysis, m=formal and informal.

An inclusive value parameter (D_m) is a dissimilarity parameter, which summarizes the observed information of a particular branch:

. $$D_m = \ln \sum_{n-1}^{N_j} \exp\ (V_{mn}) \qquad (2.34)$$

where V is the indirect utility function.

Choice probabilities can then be written as:

$$P_{mn} = P_{n\backslash m} P_m \tag{2.35}$$

$$P_{n\backslash m} \exp(V_{mn}) / \exp(D_m)$$

$$P_m = \exp\left[V_m + (1-\sigma_m) D_m\right] / \sum^{M}{}_{t=1} \exp\left[V_t + (1-\sigma_t) D_t\right] \tag{2.36}$$

The parameter σ on the inclusive value is the correlation between the unobservable of the choices within a sub-group.

CHAPTER THREE

ECONOMETRIC MODEL

3.1 Model Specification:

The probability of individual receiving treatments modeled as a reduced form function of exogenous variables. We allow for a correlation between the unobserved determinants of being ill and the unobserved determinants of being treated if ill. Furthermore, both sets of unobservable are allowed to be correlated with the determinants of the duration of illness, which depends directly on whether treatment was received. The structure of the model can be set out formally as follows:

Let I_i and T_i be one-zero dummy variables for individual i falling ill and seeking treatment if ill respectively, both are modeled using a latent variable formulation. The latent variables, $I_i^*$and T_i^*, are each a linear function of a vector of exogenous variables and normally distributed error terms.

$$I_i = \begin{cases} 1 & if \quad I_i^* > 0 \\ 0 & otherwise \end{cases} \tag{3.1}$$

where $I_i^* = \beta_i X_{1i} + u_{1i}$

if Ii=1, the following is also observed:

$$T_i = \begin{cases} 1 & if \ T_i^* > 0 \\ 0 & otherwise \end{cases} \tag{3.2}$$

Where $T_i^* = \beta_2 \ X_{2i} + u_{2i}$

And, for the sick, the duration of illness, D_i, is modeled as:

$$D_i = \beta_3 X_{3i} + u_{3i} \tag{3.3}$$

The stochastic determinants, u_{ji}, of the three endogenous variables were assumed to follow a trivariate normal distribution (allowing them to be correlated).The model will be estimated using a two-stage process. In the

first stage, the two dichotomous equations were estimated using maximum likelihood methods, this stage is essentially a bivariate probit.

Equation (3.3) is estimated in the second stage will be estimated using ordinary least squares. In the case of the treatment effect, it is assumed, that the effect of treatment upon the duration of illness can be identified by the distance from health facilities. Distance to health facilities can be regarded as a proxy for the price of health care and as such is widest viewed as an appropriate identifying instrument.

4.2 The Probit Model:

The Probit models are presented as convenient functional forms for models with binary endogenous variables. These models also have a "behavioral" interpretation that is instructive and often analytically convenient. We observe some variable y that takes on one of two values, 0 and 1. Define a latent variable y* such that

$$y^* = X_i \beta + \varepsilon_i \qquad (3.4)$$

We do not observe y*, but rather y, which takes on values of 0 or 1 according to the following rule

$$y_i = \begin{cases} 1 & if\ y^* > 0 \\ 0 & otherwise \end{cases} \qquad (3.5)$$

We also assume that $\varepsilon \sim N(0, \sigma_\varepsilon^2)$

Remember that in contrast with the linear probability model, y* (conditional on X) is distributed normally in the probit model, although its realization y is not. It is straightforward to show that the rule expressed in Equation (3.5) generates a probit.

First note that

$$\begin{aligned} Prob(Y=1) &= prob\ (Y^* > 0) \\ &= prob\ (X\beta + \varepsilon > 0) \\ &= prob\ (\varepsilon > -X\beta) \\ &= prob\ (\varepsilon/\sigma_\varepsilon > -X\beta/\sigma_\varepsilon) \qquad (3.6) \end{aligned}$$

Dividing by σ_ε in Eq. (3.6) is helpful because the quantity $\varepsilon/\sigma_\varepsilon$ is distributed as standard normal with mean zero and unit variance. The quantity $\varepsilon/\sigma_\varepsilon$ is standard normal because ε has been transformed by subtracting its mean, zero, and then dividing by its standard deviation σ_ε.

For the probit model the distribution is symmetric, so that eq. (3.6) can be written as

$$prob\,(Y_i = 1) = prob\left(\frac{\varepsilon_i}{\sigma_\varepsilon} > -X_i\frac{\beta}{\sigma_\varepsilon}\right)$$

$$= prob\left(\frac{\varepsilon_i}{\sigma_\varepsilon} < X_i\frac{\beta}{\sigma_\varepsilon}\right)$$

$$= \Phi\left(X_i\frac{\beta}{\sigma_\varepsilon}\right) \qquad (3.7)$$

Dividing the likelihood function is straightforward. Because

$$prob(Y_i = 1) = \Phi\left(X_i\frac{\beta}{\sigma_\varepsilon}\right)$$

It follows that

$$prob(Y_i = 0) = 1 - prob\,(Y_i = 1) = 1 - \Phi\left(X_i\frac{\beta}{\sigma_\varepsilon}\right)$$

If we have iid sampling, the likelihood for the sample is the product of the probability of each observation, denoting 1… m as the m observations such that y =0, and m+1… n as the n-m observations such that y=1, yields L = prob(y=0). Prob(y=o)…prob(y=0).prob(y=1)…prob(y=1) (3.8)

$$= \prod_{i=1}^{m}\left[1 - \Phi\left(X_i\frac{\beta}{\sigma_\varepsilon}\right)\right]\prod_{i=m+1}^{n}\Phi\left(X_i\frac{\beta}{\sigma_\varepsilon}\right) \qquad (3.9)$$

$$= \prod_{i=1}^{n}\Phi\left(X_i\frac{\beta}{\sigma_\varepsilon}\right)^{y_i}\left[1 - \Phi\left(X_i\frac{\beta}{\sigma_\varepsilon}\right)\right]^{1-y_i} \qquad (3.10)$$

Typically, one works with the log-likelihood function, which is

$$l\left(\frac{\beta}{\sigma_\varepsilon}\right) = \ln(L) \qquad (3.11)$$

$$= \sum_i\left\{Y_i\,\ln\left[\Phi\left(X_i\frac{\beta}{\sigma_\varepsilon}\right)\right] + (1 - Y_i).\ln\left[1 - \Phi\left(X_i\frac{\beta}{\sigma_\varepsilon}\right)\right]\right\} \qquad (3.12)$$

Notice that the log-likelihood is bounded above by 0. Because

$0 \le \Phi(.) \le 1$ implies that

$\ln[\Phi(.) \le 0] \le 0$ *and* $\ln[1 - \Phi(.)] \le 0$

Another important aspect of the likelihood function is that the parameters β and σ_ε always appear together. Therefore, they are not separately identified, only the ratio β/σ_ε matters. It is thus convenient to normalize σ_ε to be one, so we can just talk about β. Estimating the probit is straightforward even though the model is nonlinear and no closed-form expression for $\Phi(.)$ exists.

3.3 Variables of the Study:

The most important variables for the purposes of the present work are the three endogenous variables in equations (3.1) to (3.3). A person was defined as seeking treatment (T_i=1) for the most recent illness if he went to a medical facility. However, it does seem the most relevant simple definition available. Focusing on the act of seeking medical advice isolates a decision that is likely to be matter of individual or household choice. Other aspects of health demand, number of visits, place of treatment, type of health practitioner, total expenditures and type of treatment received- may be determined as much by health practitioners as by patients.

Defining treatment as a binary variable is more questionable, since going to a medical facility will not always have the same effect on the duration of illness. Some patients may visit a facility and receive no treatment at all; others are likely to receive treatment of greatly varying efficacy depending on the nature of the illness, the facility visited and other factors. Nonetheless, it is still interesting to try to estimate the average effect of using heath curative services and the simple formulation in equation (3.3) gives a rough and ready means of doing so. There is no attempt to distinguish between types of facilities visited because in the overwhelming majority of cases, they were public sector institutions. It would be possible to distinguish between different levels of facility –for example, health centres and hospitals. However, it was thought more

interesting to estimate the overall effect of seeking treatment than to disaggregate in this way (the level of facility being visited depends heavily on the severity of the illness).There was no information available on the quality or other aspects of the facilities.

Health outcomes were measured using information provided by household respondents. For each household member, the household respondent will be asked whether they experienced any of the following illness in the last three months: fever; diarrhea or vomiting; fever and diarrhea or vomiting; cough; and cough with blood in sputum. The five symptom categories were chosen to identify cases of ill health which were sufficiently common, obvious and distinct to be capable of accurate self – diagnosis. If any of the symptoms were reported, the member concerned was defined as having had an illness (I_i=1).

A key issue which arises later is the reliability of such data on illness. There are prima facie grounds for taking it seriously. If a person is reported to be suffering from a symptom of illness, there are grounds for concern. In medical terminology, the terms illness and symptoms are both subjective, referring to individuals' perceptions of their own well-being. Objective conditions are termed diseases and disorders, for which qualified practitioners may observe sign. Moreover; reviews of quality of subjective morbidity data have made favorable evaluations. Some researchers found that early studies of the reliability of self–reported measures of health found that there was generally a good correspondence with clinical data. Even where the two differed, they argued that this did not imply the subjective measures were inferior. Also, they were reported that recent studies have generally found self-reported data to be better predictor of morbidity than supposedly more objective measures. However; none of the studies reviewed was of a developing country.

There are at least three potential limitations with data on symptoms of illness. Firstly, people may differ in whether they report given objective medical conditions as symptoms of illnesses. If a household is relatively enured to coughs, high temperatures and stomach disorders, they may not mention the less severe occurrences. Conversely, another researcher states that maternal education is commonly known to increase the perception and early recognition of disease. Similar biases may arise from measures of household economic status, such as assets. The use of specific symptom categories was designed to minimize such problems, but they may still arise. Consequently, some variation in health measures used here may reflect differences in sensitivity to illness, whether real or illusory, rather than differences in illness itself. Second problem is that the information was provided by a household respondent, not necessarily each household member. The respondent may have a differing awareness of the symptoms of different household members. The third potential problem is recall error. The recall period covers three months, the length of the recall period may lead to some under reporting of illness. However, it may not introduce severe problems in modeling the determinants of illness.

Given these considerations a bout data quality, some favorable and some not, it is hard to make a general assessment of data quality. Given that no other data on health status was available; there does seem aprima facie case for analyzing the information provided. However, one must bear in mind the potential limitation noted above when interpreting the results. The duration of illness variable is the number of days a person was ill during the most recent illness. Since health care is only recorded for the most recent illness, it is more sensible to focus on that illness alone rather than all illness in the last three months. Days ill are analyzed rather than days too ill to work because only the former were recorded for the most recent illness. Moreover, days ill may be a better measure of health status

than days too ill to work, as the latter partly reflect an economic response to illness. Days too ill to work will be affected by income, preferences and the opportunity cost of time as well as objective health status.

The variables included in the vector of determinants X_{ji} where selected from a common set of explanatory variables. Given the large number of potential determinants of the demand for health care and health outcomes, a general to specific methodology was applied, beginning with estimates of models with very large number of variables and gradually rejecting those of low significance. As a rough rule of thumb, insignificance variables were usually not retained in the final models, only those which were significant were retained in the final forms. Definitions of the terms used for explanatory variables are given in table below:

Table (3.1) Variables definitions of the study model

Variable Description	Further Details
Age	in years
Distance to health facility	Distance to nearest dispensary or hospital in kilometers
Distance to market	Distance to nearest market in kilometers
Drink from borehole	1 if household drinking water source is borehole, 0 otherwise
Drink from communal pipe	1 if HH drinking water source is communal piped water, 0 otherwise
Drink from private tap	1 if household draws its drinking water from a private tap, 0 otherwise
Time needed to reach water source	Time needed to reach drinking water sources in minutes
Pit latrine	1 if household uses pit latrine, 0 otherwise
Household size	Total number of household members
Male	1 if individual is male, 0 otherwise
Female	1 if individual is female, 0 otherwise
Female headed HH	1 if HH is female headed, 0 otherwise
Son of HH head	1 if individual is son of the HH head, 0 otherwise
Daughter of HH head	1 if individual is daughter of the HH head, 0 otherwise
Wife of HH head	1 if individual is wife of HH head, 0 otherwise
No. of children in HH	No. of HH members aged under 15 years
No. of HH members under5 years	No. of HH members aged under 5 years
No. of women in HH	No. of HH members women age (15-49)
Primary schooling	Measure in years (excluding repetition)
Primary schooling of senior female	Senior female is head or eldest wife
Secondary schooling	Measured in years(excluding repetition)
Sought treatment	1 if individual sought treatment, 0 otherwise

Source: Simon Appleton 1993 and own suggestions

CHAPTER FOUR
STATISTICAL NALYSIS

4.1 Source of Data:

Data were collected mainly from primary source by a questionnaire designed to Khartoum State population and the number of population of Khartoum State was estimated from the projection of 1993 census. Khartoum State population was estimated of about 5963539 person and they were distributed to seven localities as in the following table:

Table (4.1) Khartoum State population by Locality

Locality	No. of population	Percentage
Khartoum	671968	11.68%
Jebel Awlia	1084244	18.85%
Omdurman	594870	10.34%
Karary	680866	11.84%
Umbada	1069714	18.60%
Bahry	699961	12.17%
East Nile	950803	16.53%
Total	5752425	100%

Source: Annual Health Statistics Report, Ministry of Health, Khartoum State 2005

4.2 Questionnaire Design:

The questionnaire had been designed to collect information about health services and other public services in Khartoum state to study the relation between them and to determine the variable that affect on the people to use the health services and health status. Information was collected on household composition and income together with data on access to government services and health, education, water and sewage.

Questions were asked about demographic variables (e.g., sex, age, marital status, education, occupation, household size, sex of household dead, number of children and females), type of water source, water cycle, distance to nearest market, time to reach health facility. Also there were

questions about short duration illness, whether seeking treatment, cost of treatment and the duration of recent illness.

The questionnaire had been tested for reliability and Cronbach′s Alpha equal to 0.7321 and this value is considered acceptable.

4.3 Sample Size:

The sample has been designed for Khartoum State population according to the projection from 1993.We use stratified random sampling to determine the sample size. It was designed to the seven localities and each locality was considered as a stratum. The sample size was determined according to Proportional allocation which given by the following formula:

$$n = \frac{z^2 \sum W_h S_h^2}{d^2}$$

where n is the sample size, and z is the value of z corresponding to 95% confidence level of significance, d is the marginal error, W_h is the weight of strata h and S_h is the standard error of strata h. So the sample size can be obtained according to: Z=1.96 for a 95% confidence level, d=0.05 and S_h=0.4

$$n = \frac{z^2 \sum W_h S_h^2}{d^2} = \frac{(1.96)^2 (0.16)}{(0.05)^2} = 245.86 \approx 246$$

Then the allocation for each stratum had obtained by the formula $n_h = nW_h$ and is shown on the following table:

Table (4.2) Sample allocation to stratums

strata	1	2	3	4	5	6	7	Total
N_h	671968	1084244	594870	680866	1069714	699961	950803	5752425
W_h	0.117	0.189	0.103	0.118	0.186	0.122	0.165	-
S_h	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-
$W_h S^2_h$	0.0187	0.0302	0.0165	0.0189	0.0298	0.0295	0.0264	0.16
n_h	29	47	25	29	46	30	41	246

Source: own calculations

4.4 Estimation Outputs:

Table (4.3) Outputs of the determinants of who fall ill

Dependent Variable: ILL
Method: ML - Binary Probit
Sample: 1 246
Included observations: 244
Excluded observations: 2
Convergence achieved after 6 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AGE	0.011795	0.012717	0.927494	0.3537
PR	-0.085624	0.136255	-0.628413	0.5297
SC	0.156245	0.164495	0.949844	0.3422
TR	3.118575	0.392099	7.953542	0.0000
DFPT	-1.793260	1.266415	-1.416013	0.1568
DFCP	-3.296920	1.539221	-2.141941	0.0322
PL	1.021294	0.587223	1.739193	0.0820
HHS	0.047223	0.064450	0.732715	0.4637
NOFCHH	0.038290	0.096010	0.398813	0.6900
TRHU	0.007168	0.012915	0.555048	0.5789
DTNM	0.308251	0.794406	0.388027	0.6980
Mean dependent var	0.778689	S.D. dependent var		0.415983
S.E. of regression	0.253179	Akaike info criterion		0.491283
Sum squared resid	14.93515	Schwarz criterion		0.648943
Log likelihood	-48.93658	Hannan-Quinn criter.		0.554780
Avg.loglikelihod	-0.200560			
Obs withDep=0	54	Total obs		244
Obs withDep=1	190			

Source: Outputs of E-views Package

The above table of E-views output for estimating the determinants of who falls ill by using maximum likelihood method (binary probit) shows:

1. The estimators of seeking treatment and drinking water from communal pipe are significant at 0.05 level of significance since the probability is less than 5% and the estimator of seeking treatment is also significant at 1%, the estimators of age, self primary schooling, self secondary schooling,

drinking water from private tape, using pit latrine, household size, the number of children in household, time needed to reach health unit and distance to nearest market are not significant at 5%. So that the determinants of an individual to fall ill are age, self primary schooling, self secondary schooling, drinking water from private tape, using pit latrine, household size and the number of children in household, time needed to reach health unit and distance to nearest market.

Table (4.4) Outputs of goodness-of-fit tests for illness

Dependent Variable: ILL
Method: ML - Binary Probit
Sample: 1 246
Included observations: 244
Excluded observations: 2
Andrews and Hosmer-Lemeshow Goodness-of-Fit Tests
Grouping based upon predicted risk (randomize ties)

	Quantile of Risk			Dep=0		Dep=1	Total	H-L
	Low	High	Actual	Expect	Actual	Expect	Obs	Value
1	0.0233	0.2103	19	20.1016	5	3.89844	24	0.37163
2	0.2121	0.2722	19	18.1286	5	5.87138	24	0.17121
3	0.2745	0.9096	14	13.7023	11	11.2977	25	0.01431
4	0.9359	0.9779	0	0.86309	24	23.1369	24	0.89529
5	0.9785	0.9839	1	0.46099	24	24.5390	25	0.64209
6	0.9839	0.9879	0	0.33429	24	23.6657	24	0.33901
7	0.9881	0.9929	1	0.22820	23	23.7718	24	2.63544
8	0.9930	0.9955	0	0.14695	25	24.8531	25	0.14782
9	0.9956	0.9990	0	0.05722	24	23.9428	24	0.05736
10	0.9990	1.0000	0	0.01049	25	24.9895	25	0.01050
		Total	54	54.0337	190	189.966	244	5.28465

H-L Statistic:	5.2847	Prob. ChiSq(8)	0.7268
Andrews Statistic:	114.2259	Prob.ChiSq(10)	0.0000

Source: Outputs of E-views Package

The table above shows that:

1. H-L statistic is 5.2847 and prob of chi squared is 0.7268 and is not significant at 5%.

2. Andrew statistic is 114.2259 and the prob of chi squared is 0.0000 which is not significant at 1% and 5% means that the model is correct.

Table (4.5) Outputs of the determinants of who seeks treatment

Dependent Variable: TR
Method: ML - Binary Probit
Sample: 1 246
Included observations: 244
Excluded observations: 2
Convergence achieved after 10 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.810791	0.889693	0.911316	0.3621
AGE	-0.014442	0.011715	-1.232736	0.2177
PR	-0.151959	0.140168	-1.084120	0.2783
SC	-0.259265	0.151303	-1.713540	0.0866
TRHU	-0.005250	0.012806	-0.409990	0.6818
HHS	-0.015509	0.017752	-0.873641	0.3823
IN	2.63E-06	2.95E-06	0.889454	0.3738
DUR	0.342215	0.081364	4.205989	0.0000
ILL	1.833140	0.416725	4.398915	0.0000
NOFCHH	-0.268288	0.098436	-2.725513	0.0064
NOFHH	-0.059331	0.086223	-0.688116	0.4914

Mean dependent var	0.721311	S.D. dependent var	0.449276
S.E. of regression	0.246680	Akaike info criterion	0.502255
Sum squared resid	14.17831	Schwarz criterion	0.659914
Log likelihood	-50.27510	Hannan-Quinn criter.	0.565751
Restr. log likelihood	-144.3773	Avg. log likelihood	-0.206045
LR statistic (10 df)	188.2045	McFadden R-squared	0.651780
Probability(LR stat)	0.000000		

Obs with Dep=0	68	Total obs	244
Obs with Dep=1	176		

Source: Outputs of e-views Package

The above E-views outputs for estimating the determinants of who seeks treatment for his recent illness using maximum likelihood method (binary probit) and these shows:

1. The estimators of duration of illness, a reported ill person and the number of children in household is significant at 1% level of significance since the probability is less than 0.01, the estimators age, self primary schooling, secondary education, time needed to reach health unit, household size, income and number of females in household are not significant at 5% and they are the determinants of a person to seek treatment.

2 .McFadden R-squared is 0.65 which means that 65% of the variations of the dependent variable explained by the independent variables and 35% of the variation explained by the residuals.

From the analysis above it appear that the determinants of whether people receive treatment are household income, the duration of illness and they have appositive effect because they have appositive coefficients when estimating the determinants of seeking treatment. By contrast, variables for age, education and time to reach health unit reduces the probability of seeking treatment because they have a negative coefficients. Among the other explanatory variables that are not directly of policy interest, such as household demographic characteristics had some significant effects. Higher number of female adults had a negative effect. Also household size had a negative effect on people seeking treatment.

Table (4.6): Outputs of goodness-of-fit tests for treatment

Dependent Variable: TR
Method: ML - Binary Probit
Sample: 1 246
Included observations: 244
Excluded observations: 2
Andrews and Hosmer-Lemeshow Goodness-of-Fit Tests
Grouping based upon predicted risk (randomize ties)

	Quantile of Risk			Dep=0		Dep=1	Total	H-L
	Low	High	Actual	Expect	Actual	Expect	Obs	Value
1	0.0004	0.0361	24	23.5677	0	0.43228	24	0.44021
2	0.0361	0.0986	21	22.5068	3	1.49318	24	1.62147
3	0.1105	0.7424	16	13.1319	9	11.8681	25	1.31956
4	0.7589	0.8631	2	4.30689	22	19.6931	24	1.50587
5	0.8693	0.9305	2	2.39481	23	22.6052	25	0.07198
6	0.9329	0.9674	2	1.16282	22	22.8372	24	0.63343
7	0.9682	0.9842	0	0.53989	24	23.4601	24	0.55231
8	0.9851	0.9942	1	0.24898	24	24.7510	25	2.28815
9	0.9945	0.9992	0	0.07189	24	23.9281	24	0.07210
10	0.9993	1.0000	0	0.00326	25	24.9967	25	0.00327
		Total	68	67.9350	176	176.065	244	8.50836

H-L Statistic:	8.5084	Prob. Chi-Sq(8)	0.3854
Andrews Statistic:	72.7863	Prob.ChiSq(10)	0.0000

Source: Outputs of E-views Package

Table (4.6) shows that:

1. H-L statistic is 8.5084 and probability of chi squared is 0.3854 and is not significant at 5%.

2. Andrew statistic is 72.7863 and probability of chi squared is 0.0000 and it is significant.

Table (4.7) Outputs of the determinants of the duration of individual illness

Dependent Variable: DUR
Method: Least Squares
Sample: 1 246
Included observations: 244
Excluded observations: 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AGE	0.069646	0.029229	2.382742	0.0180
PR	-0.338422	0.271833	-1.244962	0.2144
SC	0.272797	0.403293	0.676423	0.4994
HHS	-0.039104	0.074031	-0.528212	0.5979
POFHHH	-0.270285	0.199098	-1.357544	0.1759
NOFHH	0.592384	0.272582	2.173232	0.0308
TR	4.790573	0.955773	5.012251	0.0000
IN	-3.77E-06	8.15E-06	-0.462586	0.6441
DFPT	-2.621556	3.310039	-0.792001	0.4292
DFCP	-6.393189	3.962326	-1.613494	0.1080
PL	2.272269	1.128238	2.013998	0.0452
TRHU	0.092272	0.038745	2.381487	0.0181
DTNM	0.710917	2.350673	0.302431	0.7626
R-squared	0.829096	Mean dependent var		4.299180
Adjusted R-squared	0.789049	S.D. dependent var		7.006511
S.E. of regression	6.309560	Akaike info criterion		6.573816
Sum squared resid	9196.236	Schwarz criterion		6.760140
Log likelihood	-789.0055	F-statistic		6.926887
Durbin-Watson stat	2.017908	Prob(F-statistic)		0.0000

Source: Outputs of E-views Package

The above table E-views outputs for estimate the determinants of the duration of individual illness using ordinary least squares method shows:

1. The estimators of number of females in household, seeking treatment, using pit latrine and time taken to reach health unit are significant at 5% level of significance since each probability is less than 0.05 and the estimator of seeking treatment is significant at 1%. Looking for the estimators of age, self primary schooling, secondary education , household size, primary education of household head, income, drinking water from private tape, drinking water from communal pipe and distance to nearest market are not significant at 5% and 1%. So that the determinants of the duration of an individual illness are age, self primary schooling, secondary education, household size, primary education of household head, income, drinking water from private tape, using pit latrine and distance to nearest market.

2. R-squared is 0.83 means 83% of the variations in the dependent variables were explained by the independent variables and adjusted R-squared is 0.79.

3. Durbin-Watson statistic is 2.018 which mean there is no serial correlation in the model among errors.

4. F-statistic is 6.92688 and the prob (F-statistic) is 0.0000 which means that we reject the null hypothesis that all of the regression coefficients are zero.

From the analysis above for the determinants of the duration of illness, this shows that the duration of illness affected by, treatment and it had a positive effect on the duration of illness by reducing the duration. Other policy variables of interest like water supply variables and time to reach health unit had a negative effect on the duration of illness because they have a negative coefficients which means they increase the duration of illness.

CHAPTER FIVE
RESULTS & RECOMMENDATIONS

5.1Results:

Statistical analysis of the data from the respondents to the questionnaire that designed to Khartoum State residents on a sample survey. In general the analysis of the data used in this study shows that:

1. Distance to health facilities has a negative association with seeking treatment because it has a negative coefficient when estimating the determinants of who seeks treatment for his or her recent illness. Also distance to health facilities has greatest influence for people to seek treatment. That means the distance to health facilities reduced the probability of seeking treatment.
2. The water supply variables were found to have negative effect on the duration of illness even though the variable drinking water from communal pipe is not significant at 5%. So the water supply variables increase the duration of illness.
3. Seeking treatment for recent illness has a positive effect on the duration of illness and this means treatment has a positive effect on reducing the duration of illness.
4. Personal secondary schooling was found to have a positive effect on reporting illness, because a person with secondary schooling had know the importance of reporting his or her or household member illness.
5. Water supply variables were found to have a negative effect on the duration of illness since they had negative coefficients in the output when estimating the determinants of the duration illness. Also water supply variable has a positive effect on seeking treatment.

5.2 Recommendations:

Building a nation of health individuals, families and communities, served by a health system that is equitable, accessible, affordable, efficient,

technologically appropriate, environmentally appropriate and consumer friendly, with emphasis on quality, innovation, health promotion and in which the society participates actively. Emphases would be put to reduce morbidity and mortality, and more emphases would be put to improve policies supporting social, economic, environmental, developmental dimensions and to create an institutional environment for the health sector.

i) The following activities are important on the human resources for health:

- There should be a clear and effective policy for human resources based on situation analysis and taking into account the surrounding changes and health policies. This should be compiled in plans that insure balance between need and supply.

- Training should be community-based, with structured continuing education programmes.

ii) Promotion and protection of a healthy environment as an integral component of sustainable development:

- Providing adequate resources to ensure a supply of safe drinking water and pure air, safe food, proper elimination of waste products, prevention of chemical pollution and hazardous waste products and control of disease vectors.

- To prevent further increase in the prevalence of Malaria, Diarrhea and Tuberculosis.

There must be an action on the variable that give negative effect on the study model which are the act of seeking treatment and the water supply variables they must be improved so as to play apositive role in determining health status of an individual. The health facilities should be well

distributed proportionally to the number of population to reduce the distance to them and to achieve the national and international goals.

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Appendix

University of Khartoum

Faculty of Economic & Social Studies

Department of Econometrics & Social Statistics

We thanks you for your responding to this questionnaire and we promise that all your responses should be used for the purpose of MSc study only

Questionnaire

1/ Sex a- male ☐ b- female ☐

2/ Age …….

3/Residence a-Khartoum ☐ b-Jabel Awlia ☐ c-Omdurman ☐

d-Karary ☐ e-Umbada ☐ f-Bahry ☐ g-East Nile ☐

4/Marital status a-single ☐ b-married ☐ c-divorced ☐

d-widowed ☐

5/Education a-Illiterate ☐ b-Khalwa ☐ c-Primary ☐

d-Secondary ☐ e-University ☐ f-Post University ☐

g-not available ☐

6/Occupation a-government worker ☐ b-official ☐ c-free work ☐

d-student ☐ e-housewife ☐ f- literal ☐ g-not available ☐

7/ Monthly income (SDG)……..

8/Household size……

9/Head of household a-male ☐ b-female ☐

10/Relation to head of household a-wife ☐ b-son ☐ c-daughter ☐

d-mother ☐ e-father ☐ f-brother ☐ g-sister ☐

h-other (specify) ☐

11/Number of women in household (15-49)……..

12/Number of less than 5 years in household ……..

13/Nunber of between (5-15) years in household…….

14/Education of head of household a-Illiterate ☐ b-Khalwa ☐

c-Primary ☐ d-Secondary ☐ e-University ☐ f-Post University ☐

15/Education of wife of head of household a-Illiterate ☐

b-Khalwa ☐ c-Primary ☐ d-Secondary ☐

e-University ☐ f-Post University ☐

16/Distance to nearest market a-less than1/2kilometer ☐

b-(1/2-1) kilometer ☐ c-more than one kilometer ☐

17/Source of drinking water a-private tap ☐

b-communal pipe ☐ c-borehole ☐ d-water on tanker ☐

18/If water has been got from outside the house, how much it took (minutes)….

19/Type of water cycle: a-toilet ☐ b-hole cement roof ☐

c-pit latrine ☐ d-other (specify) ☐

20/Time to nearest health facility a- 15minutes ☐

b-(15-30) minutes ☐ c-(30-45) minutes ☐ d-one hour or more ☐

21/Do you had any of the following illness during the last 3months a-malaria ☐ b-diarrhea or vomiting ☐ c-fever with diarrhea and vomiting ☐ d-acute cough e-other(specify) ☐

22/In your recent illness did you went to a medical facility

a-yes ☐ b-no ☐

23/Do you had any treatment for your recent illness a-yes ☐

b-no ☐

24/What type of treatment did you take: a-medical ☐

b-traditional ☐ c- no treatment ☐

25/Did the medical treatment is available a-yes ☐ b-no ☐

26/The cost of treatment was a-high☐ b-suitable ☐c-little☐

27/Number of days you was ill during recent illness…..