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RESEARCH ARTICLE

THE ECONOMIC COSTS ON END-STAGE RENAL DISEASE PATIENT'S UNDERGOING HEMODIALYSIS IN PRIVATE HOSPITALS IN SUDAN

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ABSTRACT

Background: Chronic Kidney Disease is a major public health problem worldwide with enormous cost burdens on the patients' in developing countries. The study aims to provide a detailed analysis of the costs of hemodialysis on patients in private hospital in Sudan and provide the different classification of HD costs, and explain to what extent HD patients are able to cover this costs.
Methods: This study is an exploratory study, the primary data are obtained from a questionnaire directed to a sample of patients undergoing hemodialysis in private hospital in Khartoum State for six months during August 2015 to February 2016.The cost analysis includes the following types of costs: direct medical costs, indirect medical costs, and indirect costs.
Results: The total cost of hemodialysis on patient per session in private hospitals in Sudan was 1648.8 SDG equivalents to ($ 257.6). The annual cost of HD on patient is 158284.8 SDG equivalents to ($ 24732).The direct medical costs (Drugs and investigations costs) have the largest percentage to total HD costs on patients(67.6 percent),10.7 percent of HD costs on patients are direct non-medical costs, while 21.7 percent of HD costs are indirect costs. Many families monthly income is not enough to cover HD cost, these families use various strategies to cope with the high costs of HD.

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INTRODUCTION

The incidence and prevalence of end-stage renal disease has significantly increased in recent years in developing countries. This disease is consuming a huge of health care finances in developed countries, while contributing significantly to morbidity, mortality and decrease expectancy of life in the developing world (Mushi *et al.*, 2015). In 2007, Africa's dialysis population constituted only 4.5% of world's dialysis population. The total dialysis population of Africa was estimated at 69,800 patients in 2007, this equates to a prevalence of 74 per million population (PMP), compared to a global average of 250 PMP. The total number of hemodialysis 67,700, this equates to HD prevalence of 71.6 PMP, compared to a global prevalence of 223 PMP (Abu-Aisha and Elamin, 2010). In 2008, there were 1.75 million patient worldwide who regularly received renal replacement therapy in the form of dialysis, of which 89% or 1.55million were on hemodialysis (HD).Out of 1.55 million patient on HD, 62% of the patients were being treated in developed countries and the remaining 38% in developing countries (Jain *et al.*, 2012).

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In Sudan, increasing attention has been focused on Chronic Kidney Diseases (CKD) and its treatment recently due to the rapid increase in prevalence. The annual report of Federal Ministry of Health (FMH) in Sudan stated that there is a significant increase in cases of Acute Kidney Failure (AKF) and deaths during 2011-2014. In 2011, inpatients of AKF cases were 7074 persons and deaths were 979 persons, while outpatients of AKF cases were 8541 persons. In 2014, inpatient cases of AKF were 6054 persons, while outpatient cases of AKF were 177316 persons. The report proved that the majority of cases and deaths were in the age (25-44) year and above 45 year, that proved AKF affects patients in the most productive years in their lives, and these patients are the backbone of their families. (Annual Health Statistics Report, 2011-2014)

The Problem of the Study

Hemodialysis is not only a medical problem, but also an economic problem, as it consumes a lot of resources and materials which are quite expensive. The result is a continuous increase of costs value of the resources consumption for producing hemodialysis services and a high burden of costs on patients. As there are few review studies conducted to

determine the cost of hemodialysis on patients in Sudan, the main problem of this study is to explain this matter so as to support health care planners, decision makers and other interested partners to make more decision regarding cost minimization.

Research Questions

- What are the types of economic costs of diseases generally?
- What is the size and the spread of Acute Kidney Failure (AKF) in Sudan?
- What are the economic costs of hemodialysis (HD) on patients in Sudan?
- What are the components of economic costs of hemodialysis (HD) on patients in Sudan?
- Are patients income is enough to pay the costs, and what are the coping strategies used by patients to cover the costs?

The Study Objectives

The general objective of the study is to analyze the health care costs on patients undergoing hemodialysis HD in private hospitals in Sudan.

More specifically the objectives of this study are

- To explain the different types economic costs of hemodialysis on patients in private hospitals in Sudan.
- To explain to what extent patients are able to pay this costs and what are the different alternatives for patients to cover this cost.

The Importance of the Study

The costs issues affect the ability of many consumers to access and use goods and services, so using hemodialysis may decrease when its costs are high. The study will help to provide a wide depiction of the costs of hemodialysis in Sudan to support health care planner, decision makers and other interested partners to make more decision regarding cost minimization and reducing the burden on patients.

MATERIALS AND METHODS

Methodology of the Study

The study is an exploratory study, the primary data were obtained from a questionnaire that was prepared carefully and distributed to a sample of patients' undergoing hemodialysis in Khartoum state.

The Population of the Study

The population of this study is patients undergoing hemodialysis in private hospitals in Khartoum state.

The Sample of the Study

Method of data collection: The study will adopt a non-probability purposive sampling method, following multi-stage design. In the first stage, some private hospitals includes hemodialysis unit were selected. In the second stage, a number of patients were purposively selected as research participants.

Sample Size

This study selected a number of thirty five patients, this fulfill the minimum statistical requirements for the questionnaire part which is appropriate since the study is an exploratory study not seeking any level of generalizability and also according to the budget available and time framework..

Data Collection

Secondary data

Were obtained from references, journals, articles and websites.

Primary data

Were obtained from a questionnaire conducted with patients undergoing routine hemodialysis.

Data collection tools: the study utilized quantitative data obtained using a questionnaire, about thirty five questionnaire distributed to patients undergoing hemodialysis in private hospitals in Khartoum state during the period August 2015 to February 2016.

Time Framework of the Study

Fulfillment of this study was intended during the period from August 2015 to February 2016 in Khartoum State, Sudan. Patients' data as well as cost details were collected for a period of six months.

Literature review

Health-economics using cost analysis evaluation have become a significant tool in health decision making especially in chronic illness. Levey *et al* in 2003, stated that chronic renal failure become one of the public health problems worldwide because of its incidence and prevalence, economic burden and poor quality of life (Levey *et al*., 2003). The worldwide incidence of chronic renal failure has doubled in the last 15 years (Dash and Agarwal, 2006). And its progression to end stage disease has been expected to double during next 15 years (Minneapolis: USRDS; 2007. US Renal Data System USRDS 2007 annual data report: Atlas of end stage renal disease in the United States, National Institute of Health). In recent years, health economists have made significant advances in calculating the cost of diseases and there is now generally accepted cost of illness estimates for all common diseases in many areas in the world. Cost of illness estimated usually comprise direct heath care costs including hospital, nursing, home care, prescription drugs, home care and physicians and other services ,and indirect cost associated with lost productivity due to morbidity and premature mortality (Davies, 2005). The WHO identified a defined conceptual framework within which the economic impact of disease or injury can be consider and appropriately estimated, it is mainly through two channels:

Microeconomic level of households, firms or government such as the impact of ill- heath on a household's income or a firm's profit–while others relate to macroeconomic level, including the aggregate impact of a disease on a county's current gross domestic product or its future growth prospects. (WHO guide to identify the economic consequence of disease and injury, 2009, WHO). The microeconomic impact of disease or injury, focusing in particular on the impoverishing and other effects that ill-health or injury can have on the consumption possibilities of households. Illness typically leads to increased household expenditure on health services and goods, and may also reduce time spent producing income that allows them to consume market good. (Ibid)

HD in the Sudan

In Sudan the incidence of ESRD is increasing and the option for the treatment of ESRD is either dialysis or transplantation. Due to the high cost people can prefer hemodialysis. In 1995, there were two HD centers in Sudan with six working machines, all of them in the capital Khartoum, dialyzing 56 patient per week (Suliman *et al.*, 1995). In June 2009, there were 41 working HD centers in Sudan: 25 governmental centers serving 1,789 patients and 16 private centers serving 1,069 patients. Thus governmental and private HD centers served 62.6% and 37.4% of the HD population respectively. In 2014, there were 53 working HD centers in Sudan, 26 HD centers of them located in Khartoum State.16 centers were private centers having 152 working machines, while 10 of them were public centers having 257 working machines. HD services in Sudan are funded by government including services provided by private centers. Patients do not pay for their HD sessions in public centers, the majority of HD patients (83.8%) in Sudan are offered twice-weekly HD for economical reasons. According to the NKF/KDOQI guideline, twice-weekly HD is not appropriate for patients without significant residual renal function. (National Kidney Foundation. The National Kidney Foundation Kidney Disease Outcome Quality initiative (NKF/KDOQI) (Internet). Available at: http://www.kidney.org/professionals/KDOQI). In June 2009, there were 2858 kidney failure patients undergoing HD in Sudan, 122 patients undergoing Continuous Ambulatory Peritoneal Dialysis (CAPD), and 1168 patients living with functioning kidney allograft. (Elamin S, Obeid W, Abu-Aisha H, 2010). In study by ElSharif *et al*., the annual cost of hemodialysis was found to be US $6.847 and they concluded that hemodialysis in Sudan is less expensive than transplantation.

Cost Analysis

The majority of the literature about HD costs did not clearly mention the analytic perspective, as we know costs perspective can be from provider perspective, patient perspective and societal perspective. This study analyses HD costs from patient perspective or the burden of HD cost on patients. The item included in the calculation of dialysis costs on patients varied from one study to another, but the cost items included in this study is divided into the following details of patient costs:

- Direct medical costs
- Direct non-medical costs
- Indirect costs

Direct medical costs include

- Cost of hemodialysis session
- Cost of laboratory investigation and radiological investigation
- Cost of medication
- Cost of AV Fistula
- Cost of central venous line

Direct non-medical costs include

- Cost of food
- Cost of transportation
- Cost of extra family care

Indirect costs include

- Cost of absent of work (cost of last wage)

Other costs as intangible costs and opportunity costs were excluded.

RESULTS AND DISCUSSION

Analysis of the Questionnaire

From Table (1), it is clear that males have the high percentage of patients (66%) compared to females (34%). The majority of patients are in 30 – 49 years age group (48.6%), while (22.9%) are of age group 59 – 69 years, about (74.3%) are unemployed while (25.7%) employed. Duration of dialysis vary, but about (45.7%) of patients range from one to 3 years, while (40%) of patients range from 3 – 5 years. The total cost of HD session on patients in private hospitals in Sudan is 1648.8 SDG equivalent to ($ 257.6). The annual cost of HD on patients in private hospitals in Sudan is 158284.8 SDG which is equivalent to ($ 24732).Keep in mind the differences in the study perspective (patients perspective) and the items of costs included the results of this study demonstrates that the cost of HD in Sudan private hospitals is higher than that in developing countries such as India which is $ 3000 (*Khanna U, 2009)* and Sri Lanka IN 2010 which is between $ 5869 – 8804 (Ranasinghe *et al*., 2011), but remained considerably less than that of developed countries such as Japan in 2001 which is $ 46000 (*Nakajima I et al; 2001)*, Canada in 2002 is between $ 42,057 - 51,252(*Lee H et al*; 2002) and USA in 2010 is $ 77,506(*U.S. Renal Data System: USRDS 2010 Annual Data Report.)* 67.6% of total cost of HD on patient are direct medical costs, 10.7% are direct non-medical costs, while 21.7% are indirect costs. This result is consistent with Ranasinghe *et al*; 2011 study in Sri Lanka where direct medical costs (drugs and consumables cost) constituted 70-85% of overall expenses of dialysis in Sri Lanka, but in Iran and Greece it accounted for 12% and 53% of the cost respectively. About 57 percent of the patients assumed that their income not enough to cover HD costs, 11 percent assumed it is firstly enough but gradually become not enough, while 31 percent assumed that it is enough to satisfy HD costs.

Table 1. Characteristics of the study patients

Variable		Number	Percentage
Gender	Male	23	66%
	Female	12	34%
	Less than 15	2	5.7%
	15 – 29	5	14.3%
Age distribution	30 – 49	17	48.6%
	50 – 69	8	22.9%
	Above 70 years	3	8.6%
Occupation	Employed	9	25.7%
	Unemployed	26	74.3%
	Less than I year	2	5.7%
Duration of HD	One to 3 years	16	45.7%
	3 to 5 years	14	40%
	More than 5 years	3	8.6%

Table 2. Costs of HD

Items		Cost per HD session (SDG)
	Cost of dialysis session	700 – 750
	Cost of drugs	100 – 150
	Cost of lab. Investigation and radiology	100 – 150
Direct medical costs	ELISA	1000 per year (10.4 per session)
	RFT test	250 – 300 monthly (34.4 per session)
	Cost of AV Fistula	5000 per year (52.1 per session)
	Cost of Central Venous Line (price and insertion)	2500 – 6500 per year (46.9 per session)
Direct non-medical costs	Cost of transportation	100 – 120
	Cost of food	40 – 50
Indirect costs	Cost of absent of work (cost of last wage)	2000 – 4000 monthly (375 per session)
Total		1558.8 – 1738.8 on average = 1648.8

SDG=Sudanese Pound(1 US $= 6.4 SDG according to Central Bank of Sudan, March 2016)
Cost per month (2 sessions per week) 1648.8 × 8 = 13190.4
Cost per year 13190.4 × 12 = 158284.8
Cost per years in US $ (at I US$= 6.4 SDG) = 24732 US $

Table 3. Is your income enough to cover HD costs?

Items	Number	Percentage
Yes always enough	11	31.4%
No not enough	20	57.2%
Other, specify(firstly enough but gradually become not enough)	4	11.4%

Table 4. coping strategies by patients to cover HD costs

Items	Number	Percentage
Stay at home till the cost become available/ no treatment	8	22.9%
Traditional healers/remedies	7	20%
Borrowing money	6	17.1%
Have a support from neighbor,relatives and friends	6	17.1%
Selling assets	4	11.4%
Shift to public services and have the waiting list burden	4	11.4%
Total	35	100%

In a country where the GNI per capita, using Atlas method is US $ 1710 (http://data.worldbank.org/country/ Sudan) comparatively the annual cost of HD is US $ 24732 which is significantly high, that resulted as the study showed many families' monthly incomeis not enough to cover HD cost, so families use various strategies to cope with the high costs of HD. The most common coping strategy for people is to stay at home, have no treatment and wait till the cost of HD become available. Another coping strategy is to seek help from herbalists and traditional healers. Also other strategies include borrowing money, selling assets, and support from social networks (donations from neighbors, relatives and friends). Also shifting to public services and having the burden of waiting list is another coping strategy.

RESULTS

The total cost of HD on patient per session in private hospitals in Sudan is 1648.8 SDG equivalent to ($ 257.6). The annual cost of HD on patients in private hospitals in Sudan is 158284.8 SDG which is equivalent to ($ 24732). The direct medical costs have the largest percentage to total HD costs on patients(67.6 percent),10.7 percent of HD costs on patients are direct non-medical costs, while 21.7 percent of HD costs are indirect costs. Many families monthly income is not enough to cover HD cost, these families use various strategies to cope with the high costs of HD.

Recommendations: In order to reduce the significant burden of HD costs on patients in private hospitals in Sudan, the

health care system must did a great efforts for cost reduction and reduce the number of patients with ESRD, these goals can be achieved by supporting private hospitals that provide HD services by giving facilities such as reducing taxes and fees so as to reduce the cost of HD, also preventing the progression of renal disease and implementing strategies for early detection and optimal treatment of causative diseases. As the main contributor to HD cost in Sudan was the cost of direct medical costs (HD session, investigations, drugs and consumables), thus strategies must be used by FMH aimed at reducing these costs would help to reduce annual cost in the short term. Also expanding HD services in public sector by reducing waiting time and make access easy will reduce pressures in private hospitals.

Conclusion

This study demonstrated that the costs of hemodialysis on patients in private hospitals in less developed country remained high but significantly lower compared to developed countries. However, it still places a significant burden on the people of less developed countries, whilst possibility of further cost reduction exists by more efforts by Ministries of Health there.

List of Abbreviations

ARF: Acute Renal Failure; CKD: Chronic Kidney Disease; HD: Hemodialysis; SDG: Sudanese Pounds; FMH: Federal Ministry of Health; ESRD: End Stage Renal Diseases; GNI: Gross National Income; RFT: Renal Failure Test; A V Fistula: Arteriovenous Fistula; ELISA: Enzyme-Linked Immuno-sorbent Assay; CAPD: Continuous Ambulatory Peritoneal Dialysis; WHO: World Health Organization; PMP:per million population,

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Competing interests

The author declares that they have no competing interests.

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Appendix 1

Questionnaire Guide

Characteristics of the study patients: Gender - Age distribution- Occupation – Duration of HD

Cost of HD: Direct medical costs- indirect medical cost- indirect cost

Is your income enough to cover HD costs?

Yes always enough- no not enough- other, specify…

Coping strategies by patients to cover HD costs: Stay at home till the cost become available/ no treatment- Traditional healers/remedies- Borrowing money- Have a support from neighbor, relatives and friends- Selling assets- Shift to public services and have the waiting list burden

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