Catastrophic Health Expenditure and household Impoverishment: a Case of Prevalence of Non-Communicable Diseases in Kenya

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ABSTRACT

Background: Non-Communicable Diseases (NCDs) have become one of the leading causes of morbidity and mortality in Kenya. Their claim on financial and time resources adversely affects household welfare. Households predominantly pay healthcare costs for NCDs in Kenya as Out of Pocket expenditure (OOP). Health expenditure on NCDs stands at 6.2% of total health expenditure, which is 0.4% of the total gross domestic product of the country. This expenditure scenario has implications on household welfare through catastrophic expenditure in Kenya. Most studies done on catastrophic expenditure in Kenya have not looked at the effect of NCDs on poverty.
Methods: This paper has investigated the determinants of catastrophic health spending and its effect on household welfare with special focus on NCDs. National household level survey data on expenditure and utilization is used. Controlling for endogeneity, the results revealed that NCDs and communicable diseases (CDs) contribute significantly to the likelihood of a household incurring catastrophic expenditure.
Results: Although all types of diseases have negative effects on household welfare, NCDs have more severe impacts on impoverishment. For example, by comparison, the odds of a household being impoverished due to NCDs are about 5.4% greater compared to all illnesses regardless of the type (i.e. NCDs or CDs).
Conclusion: It is notable that households afflicted by NCDs have a high chance of being impoverished and driven into poverty due to healthcare and treatment costs. Policy-wise, government and development partners should put in place a health financing plan as a mean towards social protection.

Key words: Non-Communicable Diseases (NCDs), Catastrophic Health Expenditure, Endogeneity Impoverishment

INTRODUCTION

Like in high-income countries, Non-Communicable Diseases (NCDs) are increasingly posing a major healthcare challenge in middle and low-income countries. For centuries, communicable diseases were the main causes of death around the world when life expectancy was often limited by uncontrollable epidemics. However, medical research achievements in vaccines and antibiotics, coupled with improvements in living standards, ushered in a new era of managing communicable diseases [1,2]. Unfortunately, NCDs began building up within the new era and they are

posing a huge healthcare burden particularly in developing economies. NCDs erode a household's current income and reduce the future productivity of the patients [3]. By lowering households' incomes, spending power and production capacity, NCDs slow down economic growth, besides negatively affecting household ability to survive.

NCDs have a distinctively slow progression, such that patients do not die immediately. Affected individuals may go down in health for a long time before they die. Even with treatment, rarely do patients of chronic NCDs regain optimal health and productivity. Though most NCDs are curable if detected early, rarely do patients seek early treatment [4]. Households are increasingly bearing the burden of NCDs without the benefit of insurance or support from employers. The costs of treatment and care thin out disposable incomes, leaving families with less to spend on other crucial needs such as food and education [5,6,7]. There is a direct relationship between prevalence of disease and household health expenditure [8,9].

The treatment of NCDs is expensive in terms of medication and care for the patients, and this usually places low-income families at a disadvantage since, when affected, they are more likely to slide into poverty [10]. A household's expenditure on care and treatment of diseases, including NCDs, is directly determined by its income, wealth level and existing social networks [11]. In developing countries, most poor households forego spending on healthcare to cater for other crucial needs such as food, thereby placing themselves at higher risks of fatalities when the diseases become untreatable [12]. Consequently, most of the poor households sink deeper into poverty as the productivity of the sick members in a family declines, coupled with low survival rate [13]. Some studies have found that, on average, approximately 75% of individuals who slide into poverty in small and medium income economies of Africa and Asia are as a result of catastrophic health spending [14,15]. It should also be noted that between 2-10% of households worldwide face unmanageable healthcare spending, and the situation could be worse in Southern Asia and Sub-Saharan Africa [16]. The two regions contribute nearly half of the deaths and Disability Adjusted Life Years (DALYs) experienced globally [17,18]. This burden hurts economic growth in these regions through diversion of resources to healthcare, and especially so due to healthcare spending on NCDs [19].

It is argued that when households are faced with these huge healthcare costs, they often adopt coping strategies to meet the costs associated with seeking care [12]. These strategies, although useful as they enable households to access healthcare, lead to impoverishment and deepening of poverty among households [12,14]. Since health costs raise household expenditures above the poverty threshold, households driven to poverty by these huge health costs may not be included in the national poverty estimates [12].

Despite varying definitions, there is a common understanding that when households incur huge out of pocket health expenses on care and treatment, their ability to pay for other basic goods and services is greatly affected, thus increasing their likelihood to sliding into poverty. Also, majority of available literature do not show the potential effect of illness by disease category (NCDs and CDs) on household incomes in poor countries [20,8, 9].

The cost on healthcare and treatment in Kenya often forces households to incur catastrophic expenditures that impoverish them, thus pushing these households into poverty [4]. But, as noted in other literature, the studies look at the whole spectrum of healthcare costs. Households predominantly pay healthcare costs for NCDs in Kenya as Out of Pocket (OOP). According to Ministry of Health, in Kenya, health expenditure on NCDs stands at 6.2% of total health expenditure, which is 0.4% of the total gross domestic product of the country [21]. Again, the same report shows that households contribute close to 30% of this expenditure. While treatment of communicable diseases is subsidised by the government, or covered by health insurances, this is not the case for NCDs, leaving the household to shoulder the whole cost of care and treatment for NCDs. With this kind of expenditure attribution, it is important to assess the likelihood of NCDs pushing households to catastrophic expenditure in Kenya. Evaluating the effect of healthcare expenditure on poverty is critical for policy formulation and health programming. Evaluating specific healthcare costs plays a significant role in designing targeted effective poverty reduction programmes that would ensure that health financing systems provide households with financial risk protection to cushion them from catastrophic health expenses.

Using household level survey data, the study uses various econometric tools to estimate the incidence and intensity of catastrophic healthcare expenditure attributable to presence of NCDs. The key objective of this paper is to evaluate the extent to which households are pushed into poverty due to OOP payments on care and treatment of diseases with specific bearing to NCDs.

The study has used an analytical framework that builds on work by Berki, who pioneered the work on catastrophic health expenditures [22]. Since then, various definitions of catastrophic health expenditure have come up [22]. An expenditure on medical care becomes financially catastrophic when it endangers the family's ability to maintain its customary standard of living [22]. When healthcare costs and expenditures are too large, they may constitute a large portion of a household's budget. This may in turn affect the consumption of other household goods and services. The approach, therefore, relates to the opportunity cost of health expenditure. However, there is no scientific consensus on what proportion constitutes catastrophic. Three studies have estimated anything above 40%, 10% and 30%, respectively, of a household's ability to pay as catastrophic [22,9,23].

METHODS

Data source

This study makes use of the 2007 Kenya Household Expenditure and Utilization Survey. This survey collected information on a wide spectrum of socio-economic indicators designed to monitor, analyze and measure the progress made in improving living standards. The sample consisted of 8,844 households, 6,072 of them rural and 2,772 urban. Of these 8,453 were successfully interviewed, giving a response rate of 96%. The survey reported observations on 39,798 individuals who belonged to 8,423 households out of 8,844 households sampled. The survey covered all provinces, with a total of 737 clusters selected and divided into 506 (68.7%) rural and 231(31.3%) urban.

Ethical consideration: No ethical committee approval was needed for this study as the data used in this research was obtained from public use data set.

This study adopted the methodology by Mahal *et al.* and Xu *et al.* to estimate the contribution of NCDs to catastrophic expenditure [23,16]. Catastrophic spending occurs when health expenditure exceeds a household's ability to pay. Ability to pay is defined as household consumption spending less combined survival income for all household members. Equation 1 is an expression for catastrophic expenditure.

$$M_j = \frac{th_j}{T_{cj} - n_j p} \quad (1)$$

Where M_j is the proportion of health spending to total household consumption less combined survival income for all household members. An M_j above 30% indicates catastrophic spending. The numerator th_j is the total health spending for household. In the denominator, T_{cj} is total household consumption, n_j is household size and p is a poverty line indicator. Household poverty line is defined as income equal to household size multiplied by one dollar per day.

The study also assessed the extent to which presence of NCDs affects the probability of a household incurring catastrophic expenditure. Equation 2 estimates this relationship. A policy variable proxied by household acquisition of a health insurance is included in the model. An insured household has a lower probability of incurring a catastrophic expenditure in the event of a non-communicable disease. The estimable model for catastrophic spending is expressed as:

$$c_{sj}=\alpha_0+\alpha_i ncd_j+\beta ins_j+\lambda_j h_j+\nu_j \quad (2)$$

Where c_{sj} is a dummy variable taking the value of 1 for households that have incurred catastrophic spending, ncd_j is a dummy variable for presence of NCD, ins_j is a dummy variable of whether a household has acquired a health insurance policy, h_j is a vector of household characteristics, α_i, β are λ parameters to be estimated, and ν_j is the disturbance term.

The study investigated whether health spending on NCDs impoverishes households. Equations 3 and 4 establish this relationship.

$${}^{pc}T_{sj} = \frac{T_{sj}}{n_j} \quad (3)$$

$${}^{npc}T_{sj} = \frac{T_{sj} - h_j}{n_j} \quad (4)$$

Where ${}^{pc}T_{sj}$, T_{sj} and ${}^{npc}T_{sj}$ are per capita household spending, total household spending, and net per capita household spending, respectively. h_j is health spending and n_j is household size.

Household health expenses will be considered impoverishing if the gross household per capita spending exceeds household poverty line level[1] of expenditure and net household per capita spending[2] is less than the household poverty level of expenditure.

Equation 5 estimates household impoverishment due to NCDs. Health insurance variable is included as an institution factor that could reduce household risk of impoverishment.

$$I_{sj}=\alpha_0+\alpha_i ncd_j+\beta ins_j+\lambda_j h_j+\nu_j \quad (5)$$

Where I_{sj} is a dummy variable indicative of whether a household experienced impoverishment, ncd_j is a dummy variable indicating catastrophic spending (above the 30% threshold) due to NCD in a household, ins_j is the insurance dummy, h_j are other household characteristics, α_i, β *and* λ are parameters to be estimated, and ν_j is the disturbance term.

In estimating equations 2 and 5 on determinants of catastrophic expenditure and household impoverishment, endogeneity was a likely problem arising from bi-directional causality, omitted variables and selection bias. An episode of disease or NCD can affect the likelihood of catastrophic health expenditure and impoverishment in a household by affecting household productivity and income. An increase in income may reduce the likelihood of a household developing NCD as well as increasing the household's ability to seek prompt treatment or to adopt preventive measures.

This paper has used Two Stage Residual Inclusion (2SRI) and control function method to control for endogeneity and heterogeneity problem in the estimation.

1. Household size multiplied by one dollar per day (one dollar per day was used to define the poverty line).
2. Net household per capita spending is defined as household total expenditure less health expenditure divided by household size.

The validity of the instruments was assessed in line with Staiger and Stock [24]. Several diagnostic tests for significance of probable instruments were conducted. The F-test result for distance to the nearest health facility was (1, 26541) = 19.93 Prob. > F = 0.000), indicating a strong instrument. The distance to the nearest health facility is a proxy for a bundle of health or medical services available to a household. It includes health information[3], and was used to identify equation 2 and 5. It possessed three characteristics of a valid and strong instrument. A good instrument is highly correlated to the endogenous variable, has no direct casual effect on the outcome measure, and is exogeneous in the model specified [5,31,32,33].

To address the problem of heterogeneity, the study has applied the control function approach [25,26]. This involves adding interaction terms of the variables of interest (NCD), and their respective residuals in the second stage regression. The interaction term controls for the interaction effects of the unobserved factors on covariates. It therefore includes the coefficients in the structural equation of the unobservable [27,28].

RESULTS AND DISCUSSION

Descriptive statistics for the catastrophic expenditure model

A threshold of 30% of total household income was applied in determining catastrophic expenditure. The incidence of catastrophic expenditure varies across income level and residence. About 29.9% of households in the lowest income quintile experienced catastrophic expenditure compared to 9.2% in the highest income quintile. Rural areas have the highest number of households incurring catastrophic expenditure at 20.80% compared to 13.59% in urban areas.

The results also indicate that 4.9% of the households that seek healthcare services become impoverished. The lowest income quintile has the lowest incidence of impoverishment at 2.9%. This is explained by the fact that households in this quintile are already poor. Their income is below the poverty line, even before making health payments. Middle income households in the third income quintile have the highest incidence of impoverishment at 7.3%. Rural households are the most impoverished by health expenditures at 6.24% compared to 4.18% in urban households. The findings are similar to those obtained in the literature [23,29,30].The distribution of NCDs showed marginal variation by sex, with 48% of the patients being male and 52% female. These descriptive statistics are reported as Appendix Table A1.

Regression results

In this section, we present results from three Probit models as follows: Probit model results before controlling for endogeneity and heterogeneity; Two Stage Residual Inclusion Model (2SRI) controlling for endogeneity; and the control function model, which controls for endogeneity and heterogeneity issues in estimation as applicable. Depending on the strength and appropriateness of the model, we interpret the most reliable results in each table.

NCDs and catastrophic expenditure

Contribution of NCDs to household catastrophic spending relative to communicable disease

This section presents the results of the contribution of NCDs to catastrophic expenditure benchmarked against communicable diseases. The results indicate that endogeneity is a major issue in the estimation, while heterogeneity is not; hence the 2SRI specification is reliable. The results shows that among households affected by illness, those afflicted by NCDs have a relatively higher chance of incurring catastrophic expenditure; the odds of incurring catastrophic expenditure are 51.35 higher if the illness is an NCD than if it is a communicable disease (see Appendix,Table A2, column 3). This confirms that an NCD attack is more likely to drive a household to incur catastrophic expenditure much more than a CD. Therefore, the welfare loss from NCDs far outstrips the gains lost through communicable diseases.

Other results show that the odds of incurring catastrophic expenditure rise with age. A one year raise in an individual's age raises the odds of incurring catastrophic expenditure by 1.16%. This may be explained by the fact that as a person ages, the stock of health reduces, making him or her more prone to diseases and more so to NCDs. Since NCDs require lifetime care and treatment, they force households to commit resources in disease management for a long period. This increases the likelihood of a household to incur catastrophic spending. In addition, as one ages their productivity declines concomitantly with income. Declining income coupled with increased presence of NCDs explain the direct relationship between age and incidence of catastrophic expenditure.

NCDs and household impoverishment

Contribution of NCDs to household risk of impoverishment relative to communicable disease

The results of the models that were estimated illustrate that the favoured model is the 2SRI, which has controlled

3. Health information includes information on preventions, care and treatment of disease.

for the problem of endogeneity. The results indicate (see Appendix Table A3, column 3) that the odds of a household being impoverished due to OOP expenditures are 30.58 higher with NCDs than with communicable diseases. By comparison, the odds of a household being impoverished due to NCDs are about 5.4% greater compared to all illnesses regardless of the type (i.e. NCDs or CDs). These results strongly indicate that the risks of impoverishment associated with health spending on NCDs greatly increased the likelihood of falling into poverty than the risk imposed by communicable diseases.

The results of the estimated models in the three sub-samples indicate that poor health increases the likelihood of a household to incur catastrophic expenditure. Households affected by NCDs of any type have a higher chance of incurring catastrophic expenditures relative to households that are free of NCDs. Also, having an insurance policy increases the chances of impoverishment and catastrophic expenditure amongst the household. This could be explained by the fact that in Kenya and many other Sub-Saharan Africa countries, insurance companies do not insure NCDs and yet households pay insurance premium. Therefore, treatment of NCDs would imply an additional cost over the premium paid to the insurance companies.

CONCLUSION

The odds of being impoverished by NCDs are 48.97%. Also, among households with a sick member, the odds of being impoverished are 30.58% higher in cases of NCDs compared to communicable diseases. Again, although ill health increases the risk of impoverishment in a household, households afflicted by NCDs have a high chance of being impoverished and driven into poverty due to healthcare and treatment costs. This then implies that treatment and care for NCD patients has severe consequences to a household, particularly when the disease is chronic. When health spending is large and sustained for a long time, it subjects households to impoverishment. Communicable diseases have a lower likelihood of pushing a household into catastrophic spending or abject poverty on account of health spending in Kenya.

Since illness is not a choice variable, policy makers have to devise ways of cushioning households that are severely affected. There is also need to mitigate measures by addressing the factors that increase the likelihood of getting NCDs. This study has pointed out that health expenditure on NCDs has significant economic losses and poverty impacts on households in Kenya. The government and development partners should put in place measures to stem the rising prevalence of NCDs as an objective in the achievement of Vision 2030 and the Millennium Development Goals (MDGs). One such policy option is to put in place a health financing plan entailing health insurance and resource pooling as a mean towards social protection. As it is now, the level of insurance coverage is quite limited in Kenya. This aspect coupled with lack of other credible social safety nets denies households financial support in times of desperation. Without support, the burden of NCDs falls entirely on individuals, with devastating impact on their standards of living as observed in the estimation results and discussion of findings above.

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APPENDIX

TABLE A1. Descriptive statistics of variables included in the model

VARIABLE	MEAN	STD. DEV.	MINIMUM	MAXIMUM
Log of household income (Dependent variable)	8.7437	1.1159	0	15.3853
Region (urban=1)	0.2833	0.4506	0	1
Household size	5.2117	2.3980	1	15
Age	29.4160	22.9161	15	108
Age squared	1,390.3800	1,721.6130	0	1,1664
Log years of experience	2.8020	1.1615	0	4.3171
Log years of experience squared	4.7508	1.2131	0	6.6374
Working status of head	0.2193	0.4138	0	1
Years of schooling	7.4886	4.7213	0	29
Married	0.3939	0.4886	0	1
Male	0.4432	0.4968	0	1
Distance to nearest health facility	1.4443	1.0403	0	6.6859
Health insurance	0.0999	0.0455	0	1
Sickness	0.3545	0.4784	0	1
Chronic illness	0.1227	0.4784	0	1

Number of observations = 6,747
Source: Authors' computation

TABLE A2. Estimates of the contribution of NCDs to catastrophic household spending relative to communicable disease

	ESTIMATION METHODS		
EXPLANATORY VARIABLES	**PROBIT (1)**	**2SRI (2)**	**CONTROL FUNCTION APPROACH (3)**
NCD	0.1682** [0.0137]	0.5135*** [0.1399]	0.5064*** [0.1409]
Household size	-0.0063** [0.0027]	0.0030* [0.0037]	0.0023 [0.0037]
Age	0.0021 [0.0016]	0 .0100** [0.0026]	0.0102** [0.0026]
Age squared	0.0025 [0.0002]	0.0016 [0.0002]	0.0015 [0.0001]
Years of schooling	-0.0055** [0.0016]	-0.0043** [0.0016]	-0.0041** [0.0016]
Health insurance	0.0281** [0.0143]	0.0198** [0.0147]	0.0188** [0.0146]
Urban residence	-0.0865*** [0.0134]	-0.0456*** [0.0178]	-0.0459** [0.0178]
Married	-0.0352** [0.0160]	-0.0562*** [0.0168]	-0.0546** [0.0168]
Male	0.0162* [0 .0127]	0.0153* [0.0127]	0.0133 [0.0127]
Ncd residual		0.7770*** [0.2051]	0.6069*** [0.2114]
NCD* residual			0.0660 [0.0820]
Sample size	4397	4397	4397

*Source: Authors' computation. Note: ***, ** and * show significance at 1%, 5% and 10% respectively. Standard errors are in parenthesis.*

TABLE A3. Estimates of the household risk of impoverishment due to NCDs relative to communicable diseases

	ESTIMATION METHODS		
EXPLANATORY VARIABLES	**PROBIT (1)**	**2SRI (2)**	**CONTROL FUNCTION APPROACH (3)**
Urban	-0.0730*** [0.0033]	-0.0489*** [0.0140]	-0.0490*** [0.0014]
Household size	-0.0048** [0.0024]	-0.0018*** [0.0033]	0.0018*** [0.0033]
Age	0.0007 [0.0015]	0.0069** [0.0026]	0.0069** [0.0027]
Age squared	-0.0001 [0.00002]	-0.0002 [0.00002]	-0.0002 [0.0002]
Years of schooling	-0.0048** [0.0017]	-0.0067** [0.0017]	-0.0036** [0.0017]
Employment	0.0044 [0.0043]	-0.0098** [0.0047]	-0.0098** [0.0047]
Health insurance	0.0141** [0.0106]	0.0109 [0.0107]	0.0109 [0.0107]
NCD	0.2268** [0.0172]	0.3058** [0.1619]	0.3045** [0.1619]
Married	-0.0176 [0.0127]	-0.0059 [0.0133]	-0.0060 [0.0134]
Male	0.0069 [0.0108]	0.0084 [0.0107]	0.0084 [0.0107]
NCD residual		-0.5716** [0.1987]	-0.5644** [0.2064]
NCD* residual			0.0099 [0.0763]
Sample size	6747	6747	6747

*Source: Authors' computation. Note: ***, ** and * show significance at 1%, 5% and 10%, respectively. Standard errors are in parenthesis.*