BMJ Global Health

Out-of-pocket expenditures for prevention and treatment of cardiovascular disease in general and specialised cardiac hospitals in Addis Ababa, Ethiopia: a cross-sectional cohort study

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To cite: Tolla MT, Norheim OF, Verguet S, *et al*. Out-of-pocket expenditures for prevention and treatment of cardiovascular disease in general and specialised cardiac hospitals in Addis Ababa, Ethiopia: a cross-sectional cohort study. *BMJ Glob Health* 2017;**2**:e000280. doi:10.1136/bmjgh-2016-000280

Received 30 December 2016
Revised 7 April 2017
Accepted 16 April 2017

► Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/bmjgh-2016-000280)

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ABSTRACT

Background Cardiovascular disease poses a great financial risk on households in countries without universal health coverage like Ethiopia. This paper aims to estimate the magnitude and intensity of catastrophic health expenditure and factors associated with catastrophic health expenditure for prevention and treatment of cardiovascular disease in general and specialised cardiac hospitals in Addis Ababa.

Methods and findings We conducted a cross-sectional cohort study among individuals who sought cardiovascular disease care in selected hospitals in Addis Ababa during February to March 2015 (n=589, response rate 94%). Out-of-pocket payments on direct medical costs and direct non-medical costs were accounted for. Descriptive statistics was used to estimate the magnitude and intensity of catastrophic health expenditure within households, while logistic regression models were used to assess the factors associated with it. About 27% (26 .7;95% CI 23.1 to 30.6) of the households experienced catastrophic health expenditure, defined as annual out-of-pocket payments above 10% of a household's annual income. Family support was the the most common coping mechanism. Low income, residence outside Addis Ababa and hospitalisation increased the likelihood of experiencing catastrophic health expenditure. The bottom income quintile was about 60 times more likely to suffer catastrophic health expenditure compared with the top quintile (adjusted OR=58.6 (16.5–208.0), p value=0.00). Of those that experienced catastrophic health expenditure, the poorest and richest quintiles spent on average 34% and 15% of households' annual income, respectively. Drug costs constitute about 50% of the outpatient care cost.

Conclusions Seeking prevention and treatment services for cardiovascular disease in Addis Ababa poses substantial financial burden on households, affecting the poorest and those who reside outside Addis Ababa more. Economic and geographical inequalities should also be considered when setting priorities for expanding coverage of these services. Expanded coverage has to go hand-in-hand with implementation of sound prepayment and risk pooling arrangements to ensure financial risk protection to the most needy.

Key questions

What is already known about this topic?

- Out-of-pocket payments for healthcare impose catastrophic financial burden on households especially affecting those with chronic conditions such as cardiovascular disease.
- In Ethiopia, out-of-pocket payments constitute about one-third of the total health spending.
- No evidence exists on the magnitude of financial burden related to accessing cardiovascular disease care in Addis Ababa, Ethiopia.

What are the new findings?

- Seeking care for cardiovascular disease presents substantial financial burden on households in Addis Ababa, Ethiopia.
- Poorer households face a multifold higher financial risk compared with the richer.
- Hospitalisation and seeking care in private facilities were among the factors that increased the likelihood of catastrophic health expenditure.
- Households largely depended on support from family members to cope with high out-of-pocket payments.

Recommendations for policy

- Drug costs constitute about half of out-of-pocket payments. This might encourage practitioners to increasingly prescribe generic drugs.
- Additionally, findings could inform the design of benefit packages for health insurance mechanisms.

INTRODUCTION

Universal health coverage (UHC) calls for ensuring that all people receive quality health

services they need without exposing them to financial hardship.[1–3] Countries that overly rely on out-of-pocket (OOP) payments to finance their health system pose a huge financial burden on households,[4] forcing them to receive healthcare at the expense of other essential needs such as food and education.[1] In addition, OOP payments at the point of service delivery may force households to delay or abandon some or all health services that people need.[2 5]

Major sources of financial burden include spending on direct medical costs (eg, consultation fees, drugs, laboratory and hospital bed days), direct non-medical costs (eg, transportation) and indirect costs (eg, lost income due to lost productivity by patients and their attendants).[5 6] Households resort to various coping strategies to ensure other essential needs in the face of high OOP payments. Commonly used mechanisms include use of personal savings, borrowing, seeking support from family or friends and asset sale.[5 7 8] At times, household members may be forced to adjust work schedule, downgrade living conditions and disrupt children's schooling.[5–12] Low socioeconomic status, rural residence, not having health insurance, long inpatient days and having a chronic disease were associated with increased risk of catastrophic health expenditure (CHE) in Asia and Africa.[4 6 11 13]

Globally, millions bear catastrophic financial burden due to OOP payments related to seeking healthcare.[3 14] Patients with chronic diseases such as cardiovascular disease (CVD) face higher financial risk due to the need for long-term treatment and care, loss of productivity as a result of long-term illness and disability, and high costs when acute episodes occur.[15–18] In a large study from India, households with a member suffering from CVD spent 17% more of the total households' expenditure for healthcare compared to households without CVD.[6] High rates of CHE related to CVD have also been reported in various low-income and middle-income countries. Among patients with a recent history (15 months) of hospitalisation for CVD, 80% in Tanzania, 55% in China[13 19] and up to 84% in India[11 13] experienced CHE. In another study from seven Asian countries, 66% of patients with a history of admission for acute coronary syndrome experienced CHE.[20]

Addis Ababa, being the capital city and a home to about a quarter of the urban population in Ethiopia, is heavily affected by CVD and its risk factors.[21–25] During the period 2002–2010, CVD was among the leading causes of mortality accounted for 11%–24% of all deaths in Addis Ababa.[22 23] A significant reduction in financial burden related to CVD care could be attained through scale-up of cost-effective prevention and treatment strategies[26–28] through prepayment financing arrangements.[1 5] However, coverage of such interventions is low in Addis Ababa.[21 29] The Ethiopian health system is severely underfinanced (US$27 per capita in 2015) and highly dependent on OOP payments by households.[30 31] The coverage of health insurance is very low (about 1% in 2012), although plans are underway for expansion.[32] As a result, 59% and 88% of those who sought outpatient and inpatient care covered cost of care fully through OOP payments, respectively.[32]

In 2005, the government identified a prioritised list of basic Essential Health Services Package (EHSP) that the country can afford to offer its citizens at public primary care settings.[33] The EHSP offers only a basic package of services free of charge to all, such as immunisation, child delivery and tuberculosis/HIV treatment . Except for treatment of hypertension, which is subsidised, CVD care is largely offered on the basis of high (full) cost recovery, even in public facilities that households pay on use of services.[33] With the aim of protecting the poorest households from financial risk related to seeking healthcare, the fee-waiver scheme reached out to nearly 1.5 million people (1.5% of the Ethiopian population) with free healthcare access at an average spending of less than US$2 per capita in 2015/2016.[34] In addition to its suboptimal coverage, less effective targeting further compromises the effectiveness of the scheme.[32]

According to the World Health Survey (2003), 27% of households in Ethiopia faced financial catastrophe—defined as OOP payments of more than 10% of household's consumption expenditure.[35 36] Little is known about CVD-related CHE in Ethiopia. Given the high and increasing burden of CVD and its risk factors in Addis Ababa[21–24] and the fact that OOP payments by households contribute to about 34% of the total health expenditure in Ethiopia,[32] it is crucial to document the magnitude of financial burden households face related to seeking prevention and treatment services for CVD in Addis Ababa. Lack of such information has been identified as one of the gaps that needs to be addressed for better monitoring of the progress towards UHC in Ethiopia.[37]

The objective of this paper is to estimate the magnitude and intensity of CHE and factors associated with CHE for prevention and treatment of CVD in general and specialised cardiac hospitals in Addis Ababa.

MATERIALS AND METHODS

Study design and population

We conducted a cross-sectional cohort study among individuals who sought prevention and treatment care for CVD in a sample of general and specialised cardiac hospitals in Addis Ababa, Ethiopia. All adults with a diagnosis of ischaemic heart disease (IHD), stroke, hypertension and dyslipidaemia were included in the study. Newly diagnosed patients who were on their first outpatient visit were excluded.

Study site and sample selection

We estimated a sample size of 625, assuming 27% CHE among the richest quartile (Q4),[35 36] 15% point difference with the poorest (Q1) and 1.5% non-response rate using the formula[38]:

$n = (Z\alpha/2+Z\beta)^2 * (p1\ (1-p1)+p2\ (1-p2))\ /\ (p1-p2)^2$, where n is the sample size required in each quartile, p1 and p2 are the expected sample proportions of any two quartiles, $Z\alpha/2$ is the critical value of the normal distribution at $\alpha/2$ for a confidence level of 95%, α is 0.05, Z is 1.96, $Z\beta$ is the critical value of the normal distribution at β for a power of 80%, β is 0.2 and the critical value is 0.84.

There were 11 public and 38 private hospitals in Addis Ababa at the time of the data collection, including one public and three private specialised cardiac hospitals.[39] In general, public facilities are major providers of outpatient and inpatient care in urban settings in Ethiopia.[32] We anticipated public and private facilities to have an equal role in the provision of CVD care, given the large number of private facilities in Addis Ababa. Therefore, we used a purposive sampling technique to select eight hospitals—in consultation with experts—where individuals having the diagnoses of interest were expected to concentrate. Four specialised cardiac hospitals (one public and three private) and four general hospitals (three public and one private) were selected.

To ensure representativeness at a hospital level, we used a stratified sampling technique and distributed the sample quota equally between public and private facilities overall and allocated 70% of the sample for the specialised cardiac centres taking one-third of this share from the only public cardiac centre. To adjust for this sampling variation, each observation was weighted according to the inverse of its probability of being selected.

In each hospital, all eligible individuals were sequentially recruited from cardiac or chronic disease outpatient follow-up clinics and inpatient wards by hospital nurses based on the diagnosis on respective medical charts until the sample quota for that particular facility was met.

Data collection

The data collection period ran from February to March 2015 with a range of 4–8 weeks, depending on the time needed to recruit the allocated sample quota in specific hospitals. Data were collected through face-to-face interviews by trained enumerators using a structured questionnaire (see online supplementary annex 1). The questionnaire was developed building on an instrument used in a study on 'microeconomic impact of CVD hospitalisation in four low- and middle-income countries' including Tanzania.[13] The questionnaire was prepared in English and then translated to Amharic (national language) for ease of administration and then back translated to English to ensure consistency. It was pilot-tested in one public hospital and one private hospital in Addis Ababa prior to the actual data collection. Strong data quality assurance measures were employed including, random on-site visits during the interviews, random verification checks using hospital records, and random phone calls to patients for data validation.

Outpatients were interviewed on exit from the follow-up visits, while interviews with inpatients were completed on discharge from the hospitals so as to fully capture the expenditures during the data collection period. The interviews were conducted in nurses' rooms or other dedicated rooms and were to a large extent (82%) informed by the care-seekers themselves, followed by accompanying relatives attending to 15% of the interviews. On average, respondents took 24 min to complete the interviews with a range of 14–52 min and SD of 7 min.

Among others, data on participants' sociodemographic characteristics, medical history, households' income and OOP payments for outpatient and inpatient care and the number of outpatient follow-up visits were collected. Households' income was defined as the average reported monthly earnings of all economically active household members' net of tax through formal employment, self-employment, in exchange of goods or services as well as cash transfers from any sources including family and friends. OOP payments constitute fees for consultations, drugs, laboratory tests, imaging and hospital bed days as well as direct non-medical expenses on transportation, accommodation and food for patients and accompanying caregivers. We found no report of informal payments to service providers. We also collected information on sources of financing that households used to cope with OOP payments.

For each individual, OOP payments for CVD care was estimated over a 12-month reference period retrospectively from the day of data collection. Outpatient care expenditures were reported at two data points: for outpatient care received at the day of data collection and for the outpatient visit prior to the day of data collection. The time elapsed between these two visits ranged from 1 to 6 months for 95% of the participants with a range of 2 weeks to 12 months. Whereas, inpatient care expenditures were reported separately for each hospitalisation over the same reference period. OOP payments and income data were measured in Ethiopian birr (ETB) and then converted to 2015 US$ using the prevailing official exchange rate for the study period (1 US$ = ETB 20.33).[40] An exchange rate of 4.92 ETB per unit $ purchasing power parity (PPP)) in 2011 was used for the poverty analysis.[30]

Six hundred and twenty-five individuals were recruited for the study. Of them, five refused to participate and 31 were excluded due to missing data on OOP payments and or household's income, as these participants did not report such data or inconsistent diagnosis with the inclusion criteria. In the end, 589 were included in the final analysis, making the response rate 94%. Of these 589, 69% (n=406) and 52% (306) were recruited from specialised centres and from public facilities, respectively. Whereas 94% (n=553) were recruited from outpatient units, 6% (n=36) were hospitalised on emergency basis at the time of the survey, 65% of which in private facilities.

The subjects that were excluded due to poor data quality were fairly comparable with the remaining study subjects with respect to place of residence and gender. However, excluded subjects tend to be younger and more in the private hospitals (data not shown). The potential

impact of this exclusion on our results is minimal given their small number.

Analysis

Data were cleaned and processed using Stata V.14. Households were used as the unit of analysis. As CVD is a chronic condition, estimation of annual OOP payments was needed to allow a reasonable assessment of the financial burden on households. Accordingly, annual OOP payments were estimated as the sum of annual OOP payments for outpatient care and annual OOP payments for inpatient care for those who received inpatient care. Annual outpatient care expenditures were estimated as a product of the mean OOP payments per outpatient visit and the number of outpatient follow-up visits over the 12-month period. Mean OOP payments per visit, in turn, were estimated from OOP payments for outpatient care received at the day of data collection and the outpatient follow-up visit prior to that date. For individuals that received inpatient care, annual inpatient care expenditures were derived as the sum of OOP payments for each hospitalisation over the same reference period. Although only 6% of the study participants were hospitalised at the time of the survey, another 11% had received inpatient care historically.A smaller proportion (2% of all subjects) that had two hospitalisations. Accordingly, all these expenditures were taken into account in estimating annual OOP payments. On a related note, only OOP payments directly related to prevention and treatment of CVD were included in our analysis. Nearly 10% of study participants had diabetes as comorbidity. However, participants were asked to exclusively report on OOP payments pertaining to CVD care and hence only such reported expenditures were included in the analysis.

Descriptive statistics was used to quantify the magnitude and intensity of CHE based on previously published methods (details are provided in online supplementary annex 2.1).[5 41] We used a 10% threshold to define CHE: a given household is said to have experienced CHE when the estimated annual OOP payments exceed 10% of the household's annual income. The magnitude of CHE is then given by the proportion of households that experienced CHE. Households used various means other than current income to cover OOP payments. We therefore explored the impact of using these coping mechanisms on CHE by deducting OOP payments financed through such means from the total OOP payments as recommended by Leive and others[7 9] and presented respective results for comparison. To assess the intensity of CHE among households that faced CHE, we estimated the average amount by which such households exceeded the 10% income threshold. This is known as mean positive overshoot, and it is expressed in percentage relative to household's' income over the given CHE threshold.[5 41] In order to assess the distribution and intensity of CHE across income quintiles, households were divided into quintiles based on households' income and were designated as Q1 (the poorest) to Q5 (the richest). We used t-test to assess the significance of the differences in the magnitude of CHE across income groups. Given the nature of the study population (secondary and tertiary hospital-level study in the capital), the income level of households in our study is higher compared with the national figure.[30] Only 11% of households in our study were below the poverty line of $1.9 per day (in 2011 PPP) compared with 33% for the whole country in 2011 and 36% for Addis Ababa in 2000.[30 42]

Logistic regression models were used to examine factors associated with CHE. Potential covariates were chosen mainly guided by existing literature and scientific relevance[7 13 18] and include income level, residence, type of hospital, hospitalisation for CVD over the past 12 months, having developed a CVD event (stroke or IHD), age of patient, time elapsed since diagnosed, occupation and household size. Each covariate was first assessed in bivariate models, followed by a multivariate analysis controlling for all covariates that were significantly associated with CHE at p value of less than or equal to 0.1 in bivariate models taking Q5 (the richest) as the reference group. p -Values of less than or equal to 0.05 and 95% CIs were used as cut-off points to classify respective ORs as statistically significant.

Ethical considerations

The research protocol was reviewed and approved by the Scientific Ethical Review Committee of the Ethiopian Public Health Institute (005-02-2015/EPHI 6.13/65) and exempted by the Norwegian Regional Research Ethics Committee. We acquired written informed consent from the study participants before administering the questionnaire. The consent form was translated to Amharic (local language) before use.

Sociodemographic characteristics of study participants

With a mean age of 58 years, about half (48%) of the study subjects were engaged in an economically productive job at the time of data collection. One-in-five resides outside of Addis Ababa (table 1), with an average distance of 254 km (range: 10–1000 km) from the respective hospitals (data not shown).

Fifty-four per cent of the participants had developed a CVD event (IHD and stroke), and the rest were still on primary prevention. Although only 6% of the participants were hospitalised during the data collection period, 17% in total have received inpatient care for CVD during the 12-month reference period (table 1).

RESULTS

Magnitude of catastrophic household OOP payments

The magnitude and distribution of CHE across income quintiles is presented in table 2. Overall, about 27% of the households experienced CHE. Regarding the distribution of CHE, 28% was among the poorest quintile (Q1) compared with 14% among the richest quintile (Q5) (table 2). p Value from t-test comparing the two proportions was found to be 0.02, indicating a statistically significant

Table 1 Sociodemographic characteristics

Characteristics		n=589	%
Age (in years)	25–44	88	15
	45–64	281	48
	65–79	192	32
	>=80	28	5
Gender	Female	298	51
	Male	291	49
Marital status	Single	51	9
	Married	428	73
	Divorced	26	4
	Widowed	84	14
Residence	Addis Ababa	470	80
	Outside Addis Ababa	119	20
Education	No formal education	115	20
	Grade 8 or less	163	28
	Grade 9–12	146	25
	Diploma	85	14
	Bachelor degree+	80	13
Occupation	Government employee	119	20
	Private employee	38	6
	Private business	109	19
	Stay home mum	162	28
	Retired	135	23
	Other	26	4
Diagnosis	Ischaemic heart disease	233	40
	Stroke	83	14
	Hypertension	235	40
	Dyslipidaemia	38	6
Number of hospital admission(s) over the last 12 months	0	489	83
	1	90	15
	2	10	2
Type of hospital visited	Public	306	52
	Private	283	48

higher magnitude of CHE among the poorest households. However, the increase in the magnitude of CHE across income quintiles was not monotonic. The magnitude of CHE dropped to about 8% when OOP payments financed through sources other than households' current income were deducted from the total OOP payments. Absolute amount of OOP payments across quintiles is presented in figure 1, showing steady increase in the mean annual OOP payments with increasing income level. Further details regarding absolute OOP payments are provided in table A.2.2.1 in online supplementary annex 2. Here we focus on relative measure of financial burden—CHE.

Factors explaining catastrophic OOP payments

Results from multiple logistic regression model are shown in table 3. After adjustment for available covariates, the odds of facing CHE among hospitalised subjects was about eight times that of the non-hospitalised subjects (OR=8.39, 95% CI (4.24, 16.59) p value<0.001). Seeking care in private hospitals increased the odds of CHE by 20 fold (OR=20.7, 95% CI (10.2, 42.04) p value<0.001) compared with public hospitals. Moreover, travelling to Addis Ababa for CVD care and having developed stroke substantially increased the likelihood of facing CHE. In contrast, the odds of facing CHE went down the longer the duration since diagnosed (table 3). Age and occupation were not significantly associated with CHE.

Income level was strongly negatively associated with CHE. The odds of facing CHE among the poorest quintile was about 60 times that of the richest (OR=58.62, 95% CI (16.2, 208.0) p value<0.00). ORs increase steadily going down the income strata (table 3).

Intensity of catastrophic OOP payment

Households in lower economic strata experienced higher magnitude of CHE and suffered a more intense degree of CHE. The share of OOP payments relative to households' income increased as we go down income strata. Among households that faced CHE, the bottom two quintiles overshoot the CHE threshold on average by 24% of households' income compared with an overshoot of only 5% for the richest quintile (table 4). In other words, households that experienced CHE in Q1 spent 34% of households' income on average for CVD care compared with a share of 15% among those in Q5. This indicates a more intense financial risk among the economically disadvantaged groups.

Cost items

About 80% (n=475) of the participants were able to report outpatient care expenditures disaggregated by cost items. Accordingly, direct medical costs constitute 65%–83% of OOP payments, while direct non-medical costs, mainly transport, contribute to 16%–34% of outpatient care cost. Drug costs were the major cost drivers comprising about 50% of outpatient care costs (figure 2). Disaggregating inpatient care expenditures was challenging to respondents and hence data are not presented.

Sources of financing

Households resort to various coping mechanisms to deal with high OOP payments for CVD care. The commonly used coping strategies other than current income were support from family members and savings (table 5). Dependence on coping strategies was more pronounced for inpatient care compared with outpatient care. We found that 39% fully financed inpatient care through support from family members compared with 27% for outpatient care. A percentage of 11–27 tapped into their savings and another 2%–8% had to borrow to cover part or all of outpatient and inpatient care costs (table 5).

Table 2 Proportion of households that faced catastrophic out-of-pocket (OOP) payments for prevention and treatment of cardiovascular disease in general and specialised cardiac hospitals in Addis Ababa, Ethiopia, 2015.

	Without adjustment			Adjusted*		
	Proportion (%)	SE†	95% CI‡	Proportion (%)	SE†	95% CI‡
Total	26.7	1.9	23.1 to 30.6	7.9	1.2	5.8 to 10.5
Q1	27.9	4.4	20.0 to 37.3	8.0	2.7	4.1 to 15.1
Q2	28.5	3.8	21.7 to 36.6	7.1	2.2	3.8 to 13.0
Q3	32.2	5.0	23.3 to 42.6	9.3	3.1	4.7 to 17.3
Q4	28.3	4.1	21.0 to 37.0	7.7	2.4	4.1 to 14.0
Q5	13.9	3.8	7.9 to 23.1	7.7	3.0	3.5 to 15.9

*The amount of OOP payments financed through means other than current income is deducted from the total OOP payment, p value comparing proportion without adjustment among Q1 an Q5 =0.015.
SE is standard error of the mean.
‡95% CI for the proportion.

DISCUSSION

This is the first study to quantify the magnitude and intensity of CHE related to seeking CVD care in Ethiopia. Our analysis revealed seeking CVD care at hospitals in Addis Ababa exposes households to substantial financial risk, with about 27% of those that do so face CHE. Low economic status, residence outside Addis Ababa, hospitalisation and seeking care in private hospitals were among factors that increased likelihood of CHE. Poorest households suffered greater intensity of CHE compared with the richest. The magnitude of CHE in our study was lower than what others reported in various low-income and middle-income settings,[6 11 13 18] although direct comparison is not straightforward due to differences in study populations and criteria for CHE. For example, Huffman *et al* reported CHE that ranges from 55% in China to 80% in Tanzania.[13] Nevertheless, 27% is still much higher than what Memirie *et al* reported (about 11%) among households that sought inpatient care for severe pneumonia and diarrhoea among children under 5 years in Ethiopia.[43]

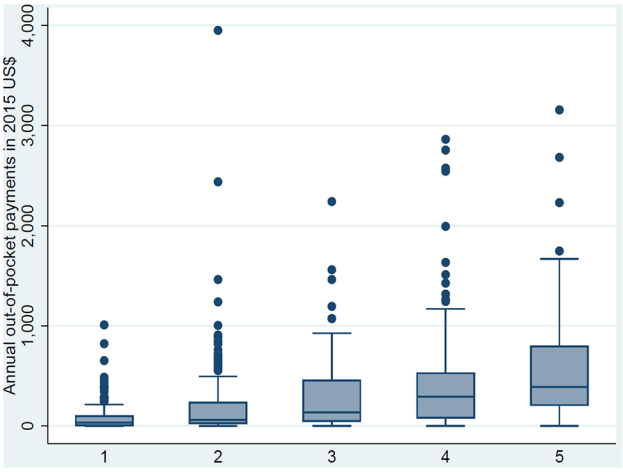

Figure 1 Annual out-of-pocket payments across income quintile for prevention and treatment of cardiovascular disease in general and specialised cardiac hospitals in Addis Ababa, Ethiopia in 2015 US$.

Several factors could have contributed to the seemingly lower magnitude of CHE in Addis Ababa. First, poorest households that are more prone to CHE were under-represented in our study resulting in possible underestimation of CHE. This is because direct OOP payments at the point of care are well-established barriers to access healthcare, disproportionately affecting poorer households.[1 32] This could have been further exacerbated by a low utilisation of CVD care in Ethiopia (approximately 12% according to the latest STEPwise approach to NCD risk factor surveillance (STEPS))[24 29 44] and the fact that hospitals are more accessible to richer people compared with poorer.[36 42 45] This is one of the limitations of hospital-based cross-sectional cohort study designs, warranting cautious interpretation of our results. Due to the deceptive nature of parameters such as CHE, the WHO and World Bank recommended their use along with coverage indicators to get a fuller picture.[46]

However, differences in composition of study subjects could also offer a partial explanation. Only 14% of our study participants were hospitalised for an acute CVD event, while 46% were still on primary prevention whereas the other studies were largely based on data from recently hospitalised patients for acute CVD events that are costlier (eg, percutaneous coronary intervention) than basic pharmaceutical prevention and treatment packages available in Ethiopia.[11 13 47] Still, on a subgroup analysis of our data, we found higher CHE especially among those that developed stroke (close to 50%). We did not present those results as our study was not powered to allow detailed analysis by specific diagnostic categories.

CHE was shown to be inversely related with income level. Nevertheless, the increase in magnitude was not monotonic going down income strata (table 3). This is possibly due to suboptimal utilisation of needed services among the poorest, for example, skipping some of prescribed drugs or tests due to inability to pay, though we do not have data to validate this. Consequently,

Table 3 Logistic regression analysis of factors associated with catastrophic out-of-pocket payments for prevention and treatment of cardiovascular diseases in general and specialised cardiac hospitals in Addis Ababa, Ethiopia, 2015

Covariates		OR	95% CI	p Value
Income quintiles	Q1	**58.6**	16.52 to 208.0	0.00
	Q2	**39.0**	11.87 to 128.24	0.00
	Q3	**20.9**	6.97 to 62.92	0.00
	Q4	**6.9**	2.4 to 19.99	0.00
	Q5	1		
Residence	Addis Ababa	1		
	Outside Addis Ababa	**3.25**	1.79 to 5.90	0.00
Type of hospital visited	Public	1		
	Private	**20.71**	10.21 to 42.05	0.00
Received inpatient care for CVD over the past 12 months	No	1		
	Yes	**8.39**	4.24 to 16.59	0.00
Diagnosis*	IHD	1.15	0.65 to 2.06	0.63
	Stroke	**4.10**	1.82 to 9.18	0.01
	Hypertension or Dyslipidaemia	1		
Household size	Household size	**1.20**	1.06 to 1.36	0.04
Age of participants	Patient's age	1.00	0.98 to 1.02	0.02
Duration since diagnosed	Duration since diagnosed	**0.99**	0.98 to 0.99	0.05
Occupation of participants	Employed†	1.07	0.44 to 2.58	0.88
	Private business	0.91	0.38 to 2.17	0.84
	Housewife/househusband	1.34	0.67 to 2.65	0.41
	Retired	1		
	Others	1.23	0.36 to 4.14	0.73

*IHD stands for ischaemic heart disease, Q1 for poorest quintile and Q5 stands for richest quintile. †Includes government and private employees.
CVD, cardiovascular disease.

Table 4 Intensity of catastrophic out-of-pocket payments for prevention and treatment of cardiovascular disease across income group in general and specialised cardiac hospitals in Addis Ababa, Ethiopia, 2015.

	Mean positive overshoot over the 10% income threshold (%)					
	Baseline			Adjusted*		
Income group	Mean†	SE‡	95% CI§	Mean	SE‡	95% CI§
Total	17.6	2.2	13.1 to 22.1	12.9	3.3	6.3 to 19.5
Q1	23.6	5.2	13.4 to 33.9	14.5	5.9	2.6 to 26.4
Q2	23.9	6.7	10.6 to 37.1	25.2	11.8	1.5 to 48.9
Q3	14.0	2.6	8.8 to 19.2	9.3	3.0	3.3 to 15.3
Q4	12.9	2.4	8.2 to 17.6	9.3	3.8	1.7 to 16.9
Q5	4.8	1.2	2.4 to 7.1	3.0	1.0	0.9 to 5.1

*Amount of OOP payments financed through means other than current income is deducted from the total OOP payment.
†The average amount by which households that experienced catastrophic OOP payments within the total population, Q1, Q2, Q3, Q4 and Q5 exceeded the 10% household income threshold expressed as in % as a share of household income.
‡SE of the mean.
§95% CI for the mean.
OOP, out-of-pocket.

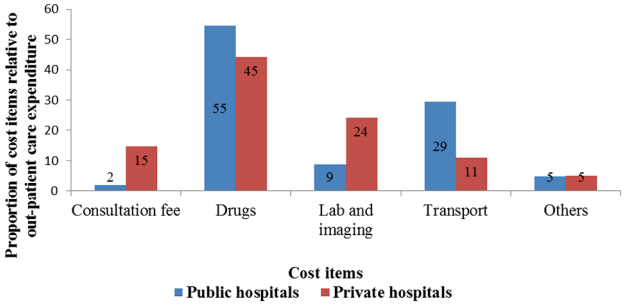

Figure 2 Contribution of cost items as a share of total outpatient expenditure for prevention and treatment of cardiovascular disease in general and specialised cardiac hospitals in Addis Ababa, Ethiopia, 2015.

poorest households might have incurred lower expenditures resulting in a relatively lower magnitude of CHE. Although with wide 95% CI due to smaller sample (169 developed CHE), results from multiple logistic regression models also confirmed this linear inverse relationship consistent with Huffman *et al*'s finding in Tanzania.[13] As might be expected, hospitalisation, patients who travel to Addis Ababa to receive CVD care and those who visited private settings experienced greater financial risk. This is due to the additional cost related to travel and higher prices of services in private settings. The significance of direct non-medical costs to CHE have also been identified by others.[41]

It is, however, worrisome that the poorest households who by large sought care in public hospitals (more than 80% of bottom 40%, Table A.2.2.2 in online supplementary annex 2) where services are offered at subsidised rate suffered a greater financial risk even after controlling relevant covariates.[48] This is possibly indicative of suboptimal implementation of ongoing healthcare financing reforms.[49] For example, even though drugs could have been purchased at a subsidised price in public facilities, promised benefits may not be realised unless sustained availability and use of generic drugs is ensured.[50] We found drug costs to be major drivers in outpatient care costs—a finding also reported elsewhere.[6 42] Therefore, ensuring effective implementation of ongoing reforms would be vital to attain the desired financial risk protection benefits. Conversely, poorest households' limited capacity to cope with an even small amount of OOP payments could also partly explain the greater financial risk among this subgroup.[5]

Table 5 Proportion of out-of-pocket payments financed through various sources by type of care for prevention and treatment of cardiovascular disease in general and specialized cardiac hospitals in Addis Ababa, Ethiopia.

		Type of care	
Sources of finance	**Proportion***	**Outpatient**	**Inpatient**
Current income	None	36.7	71.0
	100%	48.0	20.0
Saving	None	89.1	73.0
	100%	5.6	14.0
Family support	None	59.7	45.0
	100%	27.1	39.0
Borrowing	None	98.6	92.0
	100%	0.4	5.0
Asset sale	None	99.3	97.0
	100%	0.2	2.0
Insurance	None	90.5	98.0
	100%	0.2	0

*Proportion of out-of-pocket payment financed from each source.

The magnitude of CHE dropped remarkably on adjustment of OOP payments covered through sources of financing other than households' current income. Reliance on such coping mechanisms was higher among the poorest households as is the case elsewhere.[7 8 13] Though this might signal that households were able to temporarily cope with high OOP demand, it largely came at the expense of support from family members. The long-term impact of such expenditures on economic situation of the supporting families is questionable and worth further investigation.[9]

Now that the health infrastructure and human resource situation have greatly improved in Ethiopia,[51] expansion of health insurance and health services is a natural next step that could address part of the problem. Effective mechanisms need to be put in place to confine the unwanted financial consequences seeking CVD care for affected households and their families. To this end, the Ethiopian national health policy (draft, 2015/2016) identified financial risk protection as one of its main goals.[52] Accordingly, the draft national Health Care Financing strategy (2015–2035) proposed four reforms: (A) scale-up of community based health insurance for those in the informal sector (about 89% of the population), (B) launching of social health insurance for formal sector employees, (C) expanding the fee waiver system to the poorest households and (D) maintaining the general subsidy at public health facilities.[49 53–55]

Our results should be interpreted with caution in view of the study limitations. The study does not capture the prohibitive impact of OOP payments on utilisation of CVD care. Not capturing non-use and underutilisation of health services due to financial barriers is one of the major limitations of facility-based cross-sectional cohort studies—a limitation that has also been previously identified.[56] Another limitation is that we relied on self-reported data on OOP payments and household income with significant risk of reporting error.

Given the 12-month reference period used to measure OOP payments, respondents might not remember all expenditures correctly. To a large extent, this could have resulted in an under-reporting of OOP payments although one cannot rule out the possibility of over-reporting.[57]

In contrast, though shorter recall periods may help in minimising memory loss, one might fail to capture possible non-uniform expenditure patterns evident over longer time span.[57] Therefore, it is important to find the right balance between the appropriate recall period and risk of recall problem especially for chronic conditions such as CVD. Related to this, OOP payments were captured with a detailed breakdown of cost–items such as drugs, bed days and so on. Though these could be cited among the strengths of our study,[57 58] it was not always easy for respondents to provide all the details. In the future, alternative ways of real-time data collection mechanisms, for example, prospective mobile phone-based data collection systems could be explored. Additionally, we did not capture OOP payments for traditional treatment of CVD, if any. However, OOP payments to traditional providers constituted only to 2% of household OOP expenditures in Ethiopia in 2012.[32]

Although consumption expenditures are preferred measures of living standards especially in low-income settings, we used reported income. Nearly half of the study participants were in the formal sector and were men. Therefore, reporting income was relatively easier for them compared with consumption expenditures. However, we did not account for possible in-kind transfers to households. Given that Addis Ababa is a large urban centre, we do not anticipate this to introduce major bias. Moreover, as our main focus was assessing the impact of OOP payments, we did not include lost income in our analysis, but we have provided results on time lost in Table A.2.2.3 in online supplementary annex 2.

Though primary prevention services for CVD are available at health centres and clinics, the service provision for chronic conditions is not so organised in those settings making data collection a bit more challenging. Therefore, we excluded those facilities from our sample. In view of this, generalisability of our findings beyond hospital settings is deemed limited.

Moreover, although households were used as the unit of analysis in our study, we did not collect data regarding possible OOP payments on CVD care for household member(s) other than the primary participants. Though relevant, we do not anticipate this to have a major impact on the final results given the low prevalence of family history of CVD in our study (4.8% reported having a first degree relative with a history of CVD). Additionally, even though we have explored a number of potential predictors of CHE available in our data, problems of endogeneity and identification are always an issue when fitting logistic regression to cross-sectional cohort data. Our model might therefore be lacking other unobserved covariates relevant to the independent variables as well as CHE. However, the goodness-of-fit of the model was reasonably good based on Hosmer-Lemeshow test (p-value=0.3).

Finally, we limited the scope of the study to Addis Ababa due to high burden of CVD and the higher concentration of CVD specialised centers in the city compared with other regions in Ethiopia. Still about 20% of our study subjects travelled from outside Addis Ababa.

CONCLUSION

Seeking prevention and treatment services for CVD in Addis Ababa poses substantial financial risk on households, affecting the poorest and those who reside outside Addis Ababa more. Drug costs constitute about half of the outpatient care expenditures. Economic and geographical inequalities should also be considered when setting priorities for expanding coverage for these services. Expanded coverage has to go hand-in-hand with implementation of sound prepayment and risk pooling arrangements to ensure financial risk protection to the most needy.

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Funding This work was funded by NORAD and the Norwegian Research Council, through the Priority Setting in Global Health – 2020 grant (project no. 218694/H10) to the University of Bergen. Partial funding was received from the Bill & Melinda Gates Foundation through the Disease Control Priorities Network grant and the Disease Control Priorities – Ethiopia project. The funders had no role in the study design, data collection and analysis, decision to publish or preparation of the manuscript.

Competing interests None decared.

Ethics approval The Scientific Ethical Review Committee of the Ethiopian Public Health Institute (005-02-2015/EPHI 6.13/65).

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement Data are available from the corresponding author.

REFERENCES

1. WHO. Health Systems Financing: the path to universal coverage. 2010 http://www.who.int/topics/health_economics/en/ (cited 30 Dec 2015).

2. WHO. *Making fair choices on the path to Universal Health Coverage. Final report of the WHO consultative Group on equity and Universal Health Coverage*: WHO, 2013.
3. Boerma T, Eozenou P, Evans D, *et al*. Monitoring progress towards universal health coverage at country and global levels. *PLoS Med* 2014;11:e1001731.
4. Xu K, Evans DB, Kawabata K, *et al*. Household catastrophic health expenditure: a multicountry analysis. *Lancet* 2003;362:111–7.
5. Wagstaff A. Measuring financial protection in health. *World Bank Policy Research Working Paper Series, Vol* 2008.
6. Karan A, Engelgau M, Mahal A. The household-level economic burden of heart disease in India. *Trop Med Int Health* 2014;19:581–91.
7. Leive A, Xu K. Coping with out-of-pocket health payments: empirical evidence from 15 African countries. *Bull World Health Organ* 2008;86:849–56.
8. Kruk ME, Goldmann E, Galea S. Borrowing and selling to pay for health care in low- and middle-income countries. *Health Aff* 2009;28:1056–66.
9. Flores G, Krishnakumar J, O'Donnell O, *et al*. Coping with health-care costs: implications for the measurement of catastrophic expenditures and poverty. *Health Econ* 2008;17:1393–412.
10. Asfaw A, Braun Jvon, Von Braun J. Is Consumption insured against illness? evidence on vulnerability of households to Health Shocks in Rural Ethiopia. *Econ Dev Cult Change* 2004;53:115–29.
11. Daivadanam M, Thankappan KR, Sarma PS, *et al*. Catastrophic health expenditure & coping strategies associated with acute coronary syndrome in Kerala, India. *Indian J Med Res* 2012;136:585.
12. Wagstaff A. *The Economic Consequences of Health Shocks*: World Bank, 2005.
13. Huffman MD, Rao KD, Pichon-Riviere A, *et al*. A cross-sectional study of the microeconomic impact of cardiovascular disease hospitalization in four low- and middle-income countries. *PLoS One* 2011;6:e20821.
14. Xu K, Evans DB, Carrin G, *et al*. Protecting households from catastrophic health spending. *Health Aff* 2007;26:972–83.
15. Yip W, Hsiao WC. Non-evidence-based policy: how effective is China's new cooperative medical scheme in reducing medical impoverishment? *Soc Sci Med* 2009;68:201–9.
16. Selvaraj S, Subramanian SV. Financial risk protection & chronic disease care. *Indian J Med Res* 2012;136:544.
17. Waters HR, Anderson GF, Mays J. Measuring financial protection in health in the United States. *Health Policy* 2004;69:339–49.
18. Bhojani U, Thriveni B, Devadasan R, *et al*. Out-of-pocket healthcare payments on chronic conditions impoverish urban poor in Bangalore, India. *BMC Public Health* 2012;12:1.
19. Ranasinghe I, Rong Y, Du X, *et al*. System barriers to the Evidence-Based Care of acute coronary syndrome (ACS) Patients in China: a qualitative analysis. *Heart, Lung and Circulation* 2011;20:S217.
20. Jan S, Lee SW, Sawhney JP, *et al*. Catastrophic health expenditure on acute coronary events in Asia: a prospective study. *Bull World Health Organ* 2016;94:193–200.
21. Misganaw A, Mariam DH, Ali A, *et al*. Epidemiology of major non-communicable diseases in Ethiopia: a systematic review. *J Health Popul Nutr* 2014;32:1.
22. Misganaw A, Mariam DH, Araya T. The double mortality burden among adults in Addis Ababa, Ethiopia, 2006-2009. *Prev Chronic Dis* 2012;9.
23. Misganaw A, Mariam DH, Araya T, *et al*. Patterns of mortality in public and private hospitals of Addis Ababa, Ethiopia. *BMC Public Health* 2012;12:1007.
24. Tesfaye F, Byass P, Wall S. Population based prevalence of high blood pressure among adults in Addis Ababa: uncovering a silent epidemic. *BMC Cardiovasc Disord* 2009;9:39.
25. Ethiopia_Central_Statistics_Agency. Population and Housing Census Report-Conutry-2007. 2007 http://www.csa.gov.et/index.php/2013-02-20-14-51-51/2013-04-01-11-53-00/census-2007 (cited 10 Mar 2016).
26. Murray CJ, Lauer JA, Hutubessy RC, *et al*. Effectiveness and costs of interventions to lower systolic blood pressure and cholesterol: a global and regional analysis on reduction of cardiovascular-disease risk. *Lancet* 2003:361:717–25.
27. Ortegón M, Lim S, Chisholm D, *et al*. Cost effectiveness of strategies to combat cardiovascular disease, diabetes, and tobacco use in sub-Saharan Africa and South East Asia: mathematical modelling study. *BMJ* 2012;344:e607.
28. Abegunde DO, Mathers CD, Adam T, *et al*. The burden and costs of chronic diseases in low-income and middle-income countries. *Lancet* 2007;370:1929–38.
29. Alemayehu CM, Birhanesilasie SK. Assessment of Stoke Patients: occurrence of unusually high number of Haemorrhagic Stroke Casesin Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. *Clin Med Res* 2013;2:94–100.
30. WorldBank. Ethiopia country profile 2014. http://www.worldbank.org/en/country/ethiopia (cited 16 Feb 2016).
31. Federal Democratic Republic of Ethiopia MoH. *Ethiopia's Fifth National Health Accounts, 2010/2011*: Addis Ababa Ethiopia, 2014.
32. FMOH-USAID. National Health Accounts-V 2010/11. http://hfgproject.org/./Ethiopia-NHA-Household-Survey./ (cited 03 Sep 2015).
33. Federal Democratic Republic of Ethiopia MoH. *Essential Health Service Package for Ethiopia*, 2005.
34. Federal Democratic Republic of Ethiopia MoH. *Health Sector Transformation Plan-I: Annual Performance Report_2015/16*, 2015/16.
35. World_Bank. *Health Equity and Financial Protection Data Sheet-Ethiopia*. Washington DC: World Bank, 2012.
36. WHO. The World Health Survey. 2003 http://apps.who.int/healthinfo/systems/surveydata/index.php/catalog/37/report (cited 28 Jan 2015).
37. Alebachew A, Hatt L, Kukla M. Monitoring and evaluating progress towards Universal Health Coverage in Ethiopia. *PLoS Med* 2014;11:e1001696.
38. services Ss. Sample size calculation comapring two prortions. http://select-statistics.co.uk/sample-size-calculator-two-proportions (cited 15 Nov 2014).
39. Ethiopia_Federal_Ministry_of_Health. Health and Health related indicators. 2012;13 http://www.moh.gov.et/documents/26765/0/Health+and+Health+Related+Indicators+2005+E.C/1b5b2a9f-a960-4024-8d92-519195364023?version=1.0.
40. National_Bank_of_Ethiopia. Inter-bank daily foreign exchange rate in (USD)- archive. 2015 http://www.nbe.gov.et/market/searchdailyexchange.html (cited 20 Oct 2015).
41. Wagstaff A, van Doorslaer E, Ev D. Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993-1998. *Health Econ* 2003;12:921–33.
42. World_Bank. A country status report on health and poverty. 2005.
43. Memirie ST, Metaferia ZS, Norheim OF, *et al*. Household expenditures on pneumonia and diarrhoea treatment in Ethiopia: a facility-based study. *BMJ Global Health* 2017;2:e000166.
44. The_Ethiopian_Public_Health_Institute. Ethiopia STEPS survey_Fact Sheet. 2015.
45. The Central Statistics Agency E. Demographic and Health Survey_2011. 2011.
46. Group TWB. Universal Health Care in Africa: A framework for action. 2015.
47. Tolla MT, Norheim OF, Memirie ST, *et al*. Prevention and treatment of cardiovascular disease in Ethiopia: a cost-effectiveness analysis. *Cost Eff Resour Alloc* 2016;14:1.
48. Project HSFR. Financial Sustainability Study for Social Health Insurance in Ethiopia. 2008.
49. Agency EHI. Evaluation of Community-Based Health Insurance pilot schemes in Ethiopia: final Report. 2015.
50. Ali EE, Gilani A-H, Gedif T. Pharmaceutical pricing in Ethiopia. *Pharmaceutical Prices in the 21st Century: Springer* 2015:79–91.
51. Federal Ministry of Health E. Annual Performance Report. 2006 http://www.moh.gov.et/resources (cited 2015 20 Feb 2015).
52. Ethiopia FDRo. Ethiopian Health Policy. 2015.
53. Federal_Ministry_of_Health E. Health Sector transformation plan. 2015.
54. Federal Ministry of Health E. HSDP-IV Annual Performance Report. 2014.
55. Ethiopian_Health_Insurance_Agency. National Health Care Financing Strategy 2015-2035. 2016.
56. Saksena P, Hsu J, Evans DB. Financial risk protection and universal health coverage: evidence and measurement challenges. *PLoS Med* 2014;11:e1001701.
57. WHO. Validity and comparability of out-of-pocket health expenditure from household surveys: a review of the literature and current survey instruments. 2011.
58. Lu C, Chin B, Li G, *et al*. Limitations of methods for measuring out-of-pocket and catastrophic private health expenditures. *Bull World Health Organ* 2009;87:238–44.