Catastrophic Healthcare Expenditure and Coping Strategies among Patients Attending Cancer Treatment Services in Addis Ababa, Ethiopia

CURRENT STATUS: UNDER REVIEW

Gebremicheal Gebreslassie Kasahun
Aksum University

gebremicheal.kassahun@gmail.com Corresponding Author
ORCID: https://orcid.org/0000-0002-8981-1832

Gebremedhin Beedemariam Gebretekle
Addis Ababa University School of Pharmacy

Yohannes Hailemichael Gecho
Addis Ababa University School of Public Health

Aynalem Abraha Woldemariam
Addis Ababa University School of Medicine

Teferi Gedif Fenta
Addis Ababa University School of Pharmacy

DOI:
10.21203/rs.2.15467/v2

SUBJECT AREAS
Health Economics & Outcomes Research Health Policy

KEYWORDS
Catastrophic health expenditure, coping strategy, out-of-pocket expenditure, cancer
Abstract

**Background:** With the rapid increase in magnitude and mortality of cancer, which is a costly disease to manage, several patients particularly in developing countries are facing a huge financial burden.

**Objective:** The purpose of the study was to examine the level of catastrophic health expenditure (CHE), identify associated factors and coping strategies among patients attending cancer treatment services in Addis Ababa, Ethiopia.

**Methods:** A hospital based cross-sectional survey of patients with cancer was conducted in public and private hospitals between January and March 2018. Data was collected using a structured questionnaire. All direct medical and nonmedical expenditures were measured and reported as expenditure (US$) per patient (1US$ equivalent to 23.41 Ethiopian Birr). The CHE was estimated using a threshold of 10% of annual household income.

**Results:** A total of 352 (response rate of 87.1%) participants were interviewed. Majority (73.3%) of the respondents were females; most (94%) from public hospitals and their mean (±SD) age was 48±13.2 years. The distribution of cancer was mostly concentrated among 35-44 (30.4%) age group category. Breast (36.9 %) and Cervical (16.5%) cancers accounted the largest proportion. Vast majority (74.4%) of patients experienced CHE with mean overall expenditure of $2366 per patient (median: $1708). Medical expenditure shared the highest overall expenditure (83.6%) with mean medical and nonmedical costs of $1978 (median: $1394) and $388 (median: $222), respectively.

Patients who took greater than six cycles of chemotherapy (AOR: 3.64; 95% CI: 1.11-11.92), and age (AOR: 1.03; 95% CI: 1.01-1.06) were significantly associated with CHE. Household saving (85.5%) followed by financial support (43.0%) were the main coping strategies.

**Conclusion:** A substantial number of patients with cancer are exposed to CHE with considerable medical expenditure. Hence, efficient mobilization of the health insurance scheme is urgently needed to ensure financial risk protection and realize universal health coverage for patients with cancer.

**Background**

Catastrophic health expenditure (CHE) is defined as health care spending that exceeds some
specified critical level of tolerance or threshold from the household total income in a given specified period [1-4]. According to Wagstaff and Van Doorslaer [3], the incidence of CHE is estimated from the fraction of out of pocket (OOP) payments, which exceeds a certain threshold usually 10% of total household annual income, usually for one-year interval. It occurs when the available health service is mainly dependent on OOP payment, households have low capacity to pay, and if there is no prepayment [5]. Predominantly, OOP health care financing leaves households exposed to the risk of unanticipated catastrophic financial expenditures that absorb a large share of the household budget. This payment is highly pronounced when the diseased household member is at productive age and when the individual is the main source of household income [6].

Cancer is one of the chronic non-communicable diseases with high likelihood of imposing CHE [7]. It is a collection of diseases in which cells change, multiply and metastasize out of control in the body. Lung, cervical, prostate, stomach, colorectal, liver and breast are among the most prevalent cancer types in the world [8]. Cancer is known for high morbidity and mortality and according to the WHO global cancer report, about 14.1 million new cancer cases and 8.2 million deaths occurred in 2012 globally. The global burden of cancer is projected to continue, particularly in the developing countries. It is projected to increase to 19.3 million new cancer cases per year by 2025 worldwide [9].

Cancer imposes the most devastating economic impact where in 2010 alone about 808 million people had incurred catastrophic health spending worldwide [10]. Moreover, due to the premature death and disability of cancer, $895 billion of economic impact was debited in 2008 globally without including the direct medical cost which could further increase the economic cost [11].

Similar to any other countries especially low-middle-income countries [12], there are rapid increase in magnitude and mortality of the disease in Ethiopia. Besides, it is believed that cancer is costly to manage and several patients are facing a huge financial burden. With the intention of sharing financial risks and improving access to essential services, the government of Ethiopia had developed a strategic plan for establishment and expansion of mandatory health insurance [13]. Cancer is among the services covered by the insurance scheme but its coverage remains very low and in pilot phase [14]. As a result, majority of the population are still dependent on OOP payment for healthcare
service. On the other hand, there is limited evidence about the level of CHE and OOP health care expenditure for the diagnosis and treatment of cancer in Ethiopia. Therefore, the purpose of the study was to examine the level of CHE, identify associated factors and coping strategies among patients attending cancer treatment services in Addis Ababa, Ethiopia.

Methods

**Study area and study design**

A hospital based cross-sectional study design was employed. The study was conducted in Addis Ababa, the capital city of Ethiopia (the second most populous country in Africa) and headquarters of African Union. Addis Ababa has 13 public hospitals, 32 private hospitals and 93 health centers. About 150-200 new cases of cancer are registered monthly which is compiled from ten cancer diagnostic and treatment service providing hospitals. About 1200 cancer patients visit these health facilities either for follow up or treatment monthly. From the public hospitals, Tikur Anbessa Specialized Hospital (TASH) is the largest teaching and referral public hospital with the highest number of cases. The study was conducted in TASH and three private hospitals (Hallelujah, Bete-Zata and Leghar General Hospitals) between January and March 2018.

**Study population and sampling procedure**

The source population was all cancer patients attending treatment service in Addis Ababa health care facilities. Patients with cancer confirmed on histological and/or pathological exam, patients who took at least one of the oncologic treatment options (either chemotherapy, radiotherapy or hormonal/others), had regular follow up for the last one year, who are volunteer to participate and have no co-morbid conditions were the eligible study participants.

Sample size was determined using single proportion population formula [15] and a total of 404 participants were recruited from one government hospital (TASH) and three private hospitals. TASH was included as it is the sole oncology referral and radiotherapy center in the entire country and it has also the highest number of cancer patients. Private hospitals were also selected based on their voluntariness to be enrolled and patient load. Participants were recruited using a convenience sampling technique and the number of participants to be drawn from each hospital was decided
based on proportion to patient load.

**Data collection and management**

A structured questionnaire (S1 Table 1 Data collection instrument) was developed from the WHO SAGE (Study of Global Ageing and Adult Health) study [16] and other relevant literatures [17-19]. This English version of the questionnaire was translated into Amharic (national language) and back translated to English to ensure its consistency. The questionnaire was pretested before the commencement of the data collection process. Appropriate modification and validation process were made according the pretest result of the questionnaire.

The data collection tool was consisted of six parts: (1) socio-demographic characteristics (age, gender, occupation, marital status, education level and household size); (2) medical information (type of cancer, time of first diagnosis, treatment initiated, type of treatment taken and private health facility visit history); (3 and 4) OPD and IPD service expenditures including (consultation, investigation, medicine and other relevant costs); (5) household essential consumption and income (weekly food and others spending, monthly house rent, cloths, transport and other cost, annual education payment, durable materials e.g., television, phone, furniture, vehicles, ceremonies and others spending, overall household annual expenditure and income and patient income if available); and (6) households financial situation outlook (rate of financial burden, coping mechanisms taken and its amount). In addition, a total of 352 patient medical charts were reviewed to collect clinical information of patients, investigations sought and treatments taken which also helped in estimating patient treatment/diagnostic expenditure.

Data was collected in a face-to-face exit interview and daily supervision was made by the principal investigator to ensure its completeness and consistency.

**Measurements**

Magnitude of CHE was estimated using Wagstaff and Van Doorslaer [3] approach and we considered catastrophic when previous one year patient households OOP expenditure for cancer care exceeded 10% of total annual household income. The overall, outpatient and inpatient cancer diagnostic and treatment service expenditures of the last twelve months were estimated and presented as average
expenditure per patient. Therefore, these households incurred a catastrophic expenditure assumed as catastrophic payment head counts ($H_{\text{cat}}$).

Health care service OOP expenditure is direct payment made to health-care providers on receiving a service excluding prepayment, reimbursement, and other sources of payment mechanisms [3, 4, 20]. However, households can use different mechanisms of compensation strategies to solve their financial burden. Coping mechanisms were assessed by asking study participants to explain any strategy used to cover their treatment/diagnostic cost during their treatment course. This includes any means of income obtained from household member and other savings including Eqqub and Iddir; any financial support from relatives, religious organization and other sources which are nonrefundable; any income obtained from selling household assets like land, property, livestock, jewellery and other household items; and any types of borrowing from financial institutions taken as a debt including from individuals. This was later rearranged as; savings, financial support, selling assets and borrowings (7, 19). Households had used different coping strategies and classified into two as expenditure covered by themselves and by other mechanisms to figure out the overall expense covered by the household themselves only and to estimate the CHE level of cancer care.

To see households’ subjective rate of self-reported financial burden, respondents were asked to rate their current household economic situation outlook due to cancer care imposed financial burden up on the household compared to the past; as very good, good, medium/similar, bad and very bad. Later, it was reclassified as “manageable” for very good, good and medium/similar and “unmanageable” for bad and very bad.

Expenditure was estimated as all expenditures spent for cancer care prior to the interview time in the last year of medical service upon possible probing approaches to minimize recall bias. This expenditure includes both medical and nonmedical expenditures. Medical expenditures were all expenditures related to consultation, investigation, medicine, bed and traditional medicine expenditure. On the other hand, nonmedical expenditure includes transportation, food, and other accommodation expenditures associated with the disease care. Expenditures were also categorized as outpatient expenditures (consultation, investigation, medicine, and other spending associated with
outpatient care), and inpatient expenditures (consultation, investigation, medicine, bed and other expenditure associated with inpatient care). There are controversies on estimating cost data especially when the data have a skewed nature. Some studies reported mean is a reasonable choice although it could be affected by skewed distribution of cost [21, 22]. Others studies, however, preferred to report using median since it is not affected by skewness although it only shows the position of the distribution [23]. Hence, we used both mean and median measurements to provide a full picture of the estimation which might help in the ease health policy decision making and resource allocation.

Household income and expenditure were measured based on respondents’ self-reported daily or monthly income and expenditure, respectively. This was then converted to annual household income and expenditure. Participants with in-kind incomes were approached for their type of income and amount. This was changed to monetary value based on the time of its exchange when it is supplied to the local market. Participants were also informed to include any type of income. All expenditures were measured and values are reported as expenditure (US$) per patient (1US$ equivalent to 23.41 Ethiopian Birr).

**Statistical analysis**

Data was coded, entered in to and analyzed using STATA version 14 (https://www.stata.com/stata14/). A descriptive statistics such as mean, median and frequencies were computed to present the data. Hosmer-Lemeshow test was employed for goodness of fit test of logistic regression model. Multivariable logistic regression was used to assess the relationship between CHE and the independent variables. The significance level was set at 95% confidence interval and p-value <0.05.

**Results**

**Socio-Demographic and Clinical Information**

A total of 404 participants were approached and 352 study participants were interviewed, with a response rate of 87.1%. Majority (73.3%) of the patients were females and 285 (81.0%) of them were married. Most (94%) of the respondents were from public hospitals, more than three-fourth (85.2%) of the study participants were in the productive age category and their mean (±SD) age was 48±13.2
years (ranged: 19-87 years) (Table 1).

The distribution of cancer was mostly concentrated among 35-44 (30.4%) category of age group followed by 45-55 (26.4%). More than one-third (36.9%) of the participants were breast cancer patients followed by cervical cancer 58 (16.5%) and colorectal cancer 46 (13.1%). Majority (89.0%) of patients have taken chemotherapy on their treatment course and 155 (44.0%) of them were on 4-6 cycles of chemotherapy. All patients have used supportive treatments. Majority (63.4%) of respondents had history of visit at private health facilities during the course of the disease (Table 2).

**Overall, Outpatient and Inpatient Services Expenditure**

The average overall expenditure per patient in the last one year was estimated to be $2366 (SD: $4262), median: $1709 (IQR: $1153-2424). The inpatient services accounted two-third of the total expenditure with mean cost of $1584 (SD: $4002), median: $1067 (IQR: $641-1580) per patient. The remaining expenditure was spent for outpatient service with mean of $782 (SD: $1468), median: $557 (IQR: $256-940)(Table 3).

The overall mean expenditure of patients with colorectal cancer, who attended at private hospitals, who had history of visit at private health facilities, and who were living out of Addis Ababa was higher compared to their counterparts (Table 3).

**Medical and Non-medical Expenditure**

The direct mean and median medical expenditures per patient in the last year was estimated to be $1978 (SD: $3554) and $1394 (IQR: $917-1982), respectively. On the other hand, the patients had a mean and median non-medical expenditure of $388 (SD: $993) and $222 (IQR: $122-461), respectively. The medical expenditure constituted the highest expenditure (83.6%), taking the huge share of the overall expenditure. The mean expenditure on traditional medicines was also estimated to be $7 (SD: $65).

**Magnitude of Catastrophic Healthcare Expenditure**

The average headcount adult equivalent income and expenditure was found to be $1821 (median: $1220) and $1111 (median: $949) per year, respectively. Moreover, the mean of annual unadjusted household income and expenditure was estimated to be $4997 (median: $3076) and $3006 (median: $1820).
$2563), per year respectively. The magnitude of CHE of cancer care was found to be 74.4% (95%, CI: 69.6-78.7). Patients in the fourth income quintile faced higher CHE. While, substantial CHE was observed for patients in the middle expenditure quintile (Table 4).

Based on participants self-report, it was estimated that 69% (95% CI: 64.0-73.7) of participants’ household were faced with unmanageable financial burden which could lead them to a financial crisis. In counterpart, 31% (95% CI: 26.3-36.0) of patients’ household faced with a manageable financial burden.

Factors Associated with Catastrophic Health Expenditure

The multivariable logistic regression analysis revealed that patients who took greater than six cycles of chemotherapy (AOR: 3.64; 95% CI: 1.11-11.92), and age (AOR: 1.03; 95% CI: 1.01-1.06) were factors statistically associated with CHE of cancer diagnosis and treatment. This is the tendency of incurring CHE was associated with older age and increased cycles of chemotherapy (Table 5).

Financial Burden Coping Strategies of Cancer Diagnosis and Treatment

Majority of households had used their own household savings (85.5%) for healthcare payment. However, a considerable percentage (43%) of households have received a substantial financial support from their relatives, religious and other nongovernmental organizations to cover for the financial burden imposed to the household. The remaining expenditure was covered by selling assets and borrowings as illustrated in Table 6.

Discussion

This study is the first to assess the magnitude of CHE, associated factors and its coping strategies for cancer care in Ethiopia. The average overall cancer care expenditure was half of the average unadjusted household annual income and nearly three-fourth of the average unadjusted household annual expenditure which is higher as compared to Australian patients [24]. This was; however, lower than the findings of other studies in which patients spent 59.9% of household annual income [18]. The overall expenditure was very high as compared to the per capital income of the population of Ethiopia [25] and this could be an indicative of the fact that uncountable number of patients are at home and are dying without getting any treatment and diagnostic services because of the catastrophic...
expenditure.

Concur to other study [26], the present study also showed that the average overall expenditure of colorectal cancer patients was higher than in other cancer types. This might be due to the extended duration of treatment days and multiple combination regimen of treatment used which could result higher OOP expenditure [27].

As our study finding, the level of CHE was found to be very high (74.4%) as compared to the study conducted in Korean patients with cancer (39.8%) [28]. Although direct comparison seems infeasible because of the different threshold level of CHE, it was higher as compared to other Asian countries (47.8%-67.9%) [29-31]. But, this was lower compared to Indian breast cancer patients (84%) [32]. The high CHE might be due to the limited number of treatment/diagnostic centers which can increase its side expenditures and frequent stock out of prescribed medicines. A higher level of CHE was also documented when compared to cardiovascular patients in Ethiopia (27%) [19]. Limited geographic access to cancer care centers, and higher cost of medicines might the reasons for such difference.

The government is providing all oncology medicines in a fifty percent subsidized price but still there is an imbalance in the demand and supply of medicines. As a result, patients have no choice but to buy from the private retail outlets which might result patients’ household to face to other intolerable financial burden.

The level of CHE also showed variation among income quintiles although it was not statistically significant. Other studies revealed that the lowest income category was highly associated with catastrophic expenditure [31, 33, 34]. However, in the present study the fourth income strata were highly faced with CHE than the others. This could be due to patients with lower income status might not visit and purchase for expensive services not available with affordable price although the disease condition gets complicated but these fourth income quintiles might pay while facing catastrophic expenditure.

The level of CHE and self-reported financial pressure was simultaneously high and approximately parallel. This self-reported unmanageable rate of financial burden was lower compared to what was documented in China (75%) [18]. But, this was higher as compared to the finding of US which showed
that an overall financial distress level of 47% [35]. The presence of financial sharing policy and difference in income status of the population would influence the level of financial distress across countries, indicating the need to institute risk pooling and sharing mechanisms.

Similar to other studies, patient’ households use more than one coping strategies to overcome their financial distress with the most prevalent being borrowing, selling assets, spending savings and financial aid [40]. Among those, household saving was the main coping strategy used in our study which was similar to other studies [7, 19, 41]. However, some other studies indicated that borrowing and selling assets were the major coping strategies [26, 41-43]. This could be due to the varied economic income status and saving culture of households which can affect the coping mechanism of patients’ family [44, 45].

Although the study comes with those results it was not without limitations. First, due to the nature of data collection technique, recall bias could be a problem. Obtaining reliable information on the household annual income and expenditure was also another challenge. Since the study design was hospital based in which significant number of populations could not access because of affordability and limited availability; most patients’ households were more likely with relatively higher income status.

Conclusion

Based on a 10% threshold of annual household income, a substantial number of patients with cancer are exposed to a catastrophic level of healthcare expenditure with considerable medical cost. Predominantly, patients with increased cycles of chemotherapy and older age were incurring a catastrophic level of healthcare expenditure. Household saving was the main coping strategy however; significant number of patients’ household had enforced to look for other coping mechanisms. Hence, efficient mobilization of the health insurance scheme is urgently needed to ensure financial risk protection and realize universal health coverage for patients with cancer. Increased tax funding and/or other better prepayment mechanisms should also be considered while mobilizing the over introduced health insurance scheme.

Declarations
Ethical approval and consent to participate

The study was approved by the Institutional Ethics Review Committee of School of Pharmacy, Addis Ababa University (Ref: ERB/SOP/01/10/2018) and permission was sought from all study hospitals. Written consent form was provided before the beginning of the interview and their consent was assured before proceeding to the interview. Questionnaires were coded to prevent any identification so as to ensure participants anonymity and questionnaires were stored in lockable cabinet except for the study team to ensure participants confidentiality.

Consent to publish

Not applicable.

Availability of data and materials

The dataset should be accessible from the corresponding author on reasonable request.

Competing interest

The authors declare that they have no competing interest.

Funding

The study was funded by Addis Ababa University Graduate program. The funder had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Authors’ contribution

GGK, GBG and TGF conceptualized and designed the study. GGK made substantial contribution in the data collection, data analysis, data interpretation and writing of the manuscript. GBG, TGF, YHG and AAW contributed in the data analysis, data interpretation and evaluation of the manuscript. All authors read and approve the final version of the manuscript.

Acknowledgements

We would like to thank the data collectors (Nurses), Pharmacists and Physicians for their humbled support and involvement during the data collection process. In addition, we would like to extend our special gratitude to the study participants for their volunteered participation that supported for the easily realization of the work.

Authors’ information
School of Pharmacy, College of Health Sciences, Aksum University, Ethiopia.\textsuperscript{2} Social and Administrative Pharmacy Unit, Department of Pharmaceutics and Social Pharmacy, School of Pharmacy, College of Health Sciences, Addis Ababa University, Ethiopia. \textsuperscript{3} School of Public Health, College of Health Sciences, Addis Ababa University, Ethiopia. \textsuperscript{4} School of Medicine, College of Health Sciences, Addis Ababa University, Ethiopia.

Abbreviations

CHE: Catastrophic Health Expenditure; OOP: Out of Pocket; TASH: Tikur Anbessa Specialized Hospital; WHO: World Health Organization

References

1. Abul Naga R, Lamiraud K. Catastrophic health expenditure and household well-being. 2011;1-20.

2. Puteh S, Almualm Y. Catastrophic health expenditure among developing countries. Health Syst Policy Res. 2017;4:1-5.

3. Wagstaffa A, van Doorslaerc E. Catastrophe and Impoverishment in Paying for Health Care: With Applications to Vietnam 1993-98. Health Econ. 2003;12:921-34.

4. Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CJ. Household catastrophic health expenditure: a multicountry analysis. The Lancet. 2003;362:111-7.

5. O’Donnell O, van Doorslaer E, Rannan-Eliya RP, Somanathan A, Garg CC, Hanvoravongchai P, et al. Explaining the incidence of catastrophic expenditures on health care: Comparative evidence from Asia. Equitap. 2005;1-28.

6. Buigut S, Ettarh R, Amendah DD. Catastrophic health expenditure and its determinants in Kenya slum communities. International journal for equity in health. 2015;14:1-12.

7. Engelgau MM, Karan A, Mahal A. The economic impact of non-communicable diseases on households in India. Globalization and health. 2012;8:1-10.
8. DeSantis C, Naishadham D, Jemal A. Cancer statistics for African Americans, 2013. CA: a cancer journal for clinicians. 2013;63:151-66.

9. The World Health Report: Research for Universal Health Coverage. International Agency for Research on Cancer. World Health Organization. 2013;1-146.

10. Wagstaff A, Flores G, Hsu J, Smitz MF, Chepynoga K, Buisman LR, et al. Progress on catastrophic health spending in 133 countries: a retrospective observational study. The Lancet Global Health. 2018;6:1-11.

11. John R, Ross H. The global economic cost of cancer. Atlanta, GA: American Cancer Society and Livestrong. 2010;1-10.

12. Torre LA, Siegel RL, Ward EM, Jemal A. Global cancer incidence and mortality rates and trends an update. Cancer Epidemiology and Prevention Biomarkers. 2016;25:16-27.

13. Health insurance strategy, planning and programming department. Addis Ababa, Ethiopia. 2008;1-17.

14. Ethiopia’s Community-based Health Insurance: A Step on the Road to Universal Health Coverage. 2015;2-11.

15. Daniel WW. Biostatistics: a foundation for analysis in the health sciences. John Wiley and Sons. Inc, New York, NY. 1995. p. 192-3.

16. World Health Organization. SAGE Survey Manual: The WHO Study on Global AGEing and Adult Health (SAGE). Geneva, Switzerland: World Health Organization. 2006. p. 1-226.

17. Hailu A, Mariam DH. Patient side cost and its predictors for cervical cancer in Ethiopia: a cross sectional hospital based study. BMC cancer. 2013;13:1-8.

18. Huang HY, Shi JF, Guo LW, Bai YN, Liao XZ, Liu GX, et al. Expenditure and financial burden for the diagnosis and treatment of colorectal cancer in China: a hospital-
based, multicenter, cross-sectional survey. Chinese journal of cancer. 2017;36:1-15.

19. Tolla MT, Norheim OF, Verguet S, Bekele A, Amenu K, Abdisa SG, 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 global health. 2017;2:1-10.

20. Xu K, Evans DB, Carrin G, Aguilar-Rivera AM, Musgrove P, Evans T. Protecting households from catastrophic health spending. Health affairs. 2007;26:972-83.

21. Barber JA, Thompson SG. Analysis of cost data in randomized trials: an application of the non-parametric bootstrap. Statistics in medicine. 2000;19:3219-36.

22. White IR, Thompson SG. Choice of test for comparing two groups, with particular application to skewed outcomes. Statistics in Medicine. 2003;22:1205-15.

23. Manikandan S. Measures of central tendency: Median and mode. Journal of pharmacology and pharmacotherapeutics. 2011;2:214-5.

24. Newton JC, Johnson CE, Hohnen H, Bulsara M, Ives A, McKiernan S, et al. Out-of-pocket expenses experienced by rural Western Australians diagnosed with cancer. Supportive Care in Cancer. 2018;26:3543-52.

25. World Bank. Ethiopia Public Expenditure Review 2015. Washington, DC: World Bank Group. 2016.

26. Pourreza A, Harirchi I, Bazyar M. Differentiation of out-of-pocket expenditures in cancer patients; a case study in the cancer institute of Iran. Evidence Based Health Policy, Management and Economics. 2017;1:65-73.

27. Stintzing S. Management of colorectal cancer. F1000prime reports. 2014;6:1-12.

28. Choi JW, Cho KH, Choi Y, Han KT, Kwon JA, Park EC. Changes in economic status of households associated with catastrophic health expenditures for cancer in South Korea. Asian Pac J Cancer Prev, 2014;15:2713-7.
29. Azzani M, Yahya A, Roslani AC, Su TT. Catastrophic Health Expenditure Among Colorectal Cancer Patients and Families: A Case of Malaysia. Asia Pacific Journal of Public Health. 2017;29:485-94.

30. Delavari H, Keshtkaran A, Setoudehzadeh F. Catastrophic health expenditures and coping strategies in households with cancer patients in Shiraz Namazi hospital. Middle East Journal of Cancer. 2014;5:13-22.

31. Group AS. Catastrophic health expenditure and 12-month mortality associated with cancer in Southeast Asia: results from a longitudinal study in eight countries. BMC medicine. 2015;13:1-13.

32. Jain M, Mukherjee K. Economic burden of breast cancer to the households in Punjab, India. International Journal of Medicine and Public Health. 2016;6:13-8.

33. Bernard DS, Farr SL, Fang Z. National estimates of out-of-pocket health care expenditure burdens among nonelderly adults with cancer: 2001 to 2008. Journal of Clinical Oncology. 2011;29:2821-6.

34. Tripathy J, Prasad B, Shewade H, Kumar A, Zachariah R, Chadha S, et al. Cost of hospitalisation for non-communicable diseases in India: are we pro-poor? Tropical medicine & international health. 2016;21:1019-28.

35. Meisenberg BR, Varner A, Ellis E, Ebner S, Moxley J, Siegrist E, et al. Patient attitudes regarding the cost of illness in cancer care. The oncologist. 2015;20:1199-204.

36. Mamo G, Worku A, Lemma S, Demas T. Cost of Illness of Breast Cancer Patients on Chemotherapy in Addis Ababa Public Hospitals, the Case of Tikur Anbessa Specialized Teaching Hospital-Cross-Sectional Types of Study. Health Economics and Outcome Research Open Access. 2017;3:1-5.

37. Blumen H, Fitch K, Polkus V. Comparison of treatment costs for breast cancer, by tumor stage and type of service. American health & drug benefits. 2016;9:23-32.
38. Kakushadze Z, Raghubanshi R, Yu W. Estimating cost savings from early cancer diagnosis. Data. 2017;2:1-16.

39. Kutikova L, Bowman L, Chang S, Long SR, Obasaju C, Crown WH. The economic burden of lung cancer and the associated costs of treatment failure in the United States. Lung Cancer. 2005;50:143-54.

40. Chakrabarty J, Pai MS, Ranjith V, Fernandes D. Economic burden of cancer in India. Indian Journal of Public Health. 2017;137-41.

41. Bogale T, Mariam DH, Ali A. Costs of illness and coping strategies in a coffee-growing rural district of Ethiopia. Journal of Health, Population and Nutrition. 2005:192-9.

42. Kruk ME, Goldmann E, Galea S. Borrowing and selling to pay for health care in low- and middle-income countries. Health Affairs. 2009;28:1056-66.

43. Leive A, Xu K. Coping with out-of-pocket health payments: empirical evidence from 15 African countries. Bulletin of the World Health Organization. 2008;86:849-56C.

44. Mirach TH, Hailu YM. Determinants of Household Saving In Ethiopia: A Case of North Gondar Zone Amhara Regional State. International Journal of Development and Economic Sustainability. 2014;2:37-49.

45. Zwane T, Greyling L, Maleka M. The determinants of household saving in South Africa: a panel data approach. Int Bus Econ Res J. 2016;15:209-18.

Tables
Table 1 Socio-demographic and economic characteristics among patients attending cancer treatment services in Addis Ababa, Ethiopia 2018.
| Characteristics                          | Frequency (N) | Percentage (%) |
|----------------------------------------|---------------|----------------|
| **Type of health facility**            |               |                |
| Public                                 | 331           | 21             |
| Private                                | 21            |                |
| **Gender**                             |               |                |
| Female                                 | 258           |                |
| Male                                   | 94            |                |
| **Age category**                       |               |                |
| <24                                     | 9             |                |
| 25-34                                   | 40            |                |
| 35-44                                   | 107           |                |
| 45-54                                   | 93            |                |
| 55-64                                   | 51            |                |
| >=65                                    | 52            |                |
| **Religion**                           |               |                |
| Orthodox                               | 255           |                |
| Muslim                                 | 69            |                |
| Protestant                             | 26            |                |
| Catholic                               | 2             |                |
| **Marital status**                     |               |                |
| Married                                | 285           |                |
| Single                                 | 34            |                |
| Divorced                               | 19            |                |
| Widowed                                | 14            |                |
| **Residence**                          |               |                |
| Out of Addis Ababa                     | 209           |                |
| Addis Ababa                            | 143           |                |
| **Education**                          |               |                |
| No formal education<sup>a</sup>        | 127           |                |
| College/certificate and above          | 122           |                |
| Grade 9-12                             | 69            |                |
| Grade 1-8                              | 34            |                |
| **Occupation**                         |               |                |
| Housewife/Husband                      | 139           |                |
| Employed (private/government)          | 102           |                |
| Own private business                   | 49            |                |
| Retired                                | 36            |                |
| Others<sup>b</sup>                     | 26            |                |
| **Household economic income quintile** |               |                |
| Lowest                                 | 74            |                |
| Second                                 | 74            |                |
| Middle                                 | 64            |                |
| Fourth                                 | 71            |                |
| Highest                                | 69            |                |
| **Household economic expenditure quintile** |           |                |
| Lowest                                 | 71            |                |
| Second                                 | 70            |                |
| Middle                                 | 72            |                |
| Fourth                                 | 85            |                |
| Highest                                | 54            |                |

<sup>a</sup>: include illiterates and individuals able to read and write due to informal education  
<sup>b</sup>: include individuals with no work/stopped to work.

Table 2 Clinical information of patients attending cancer treatment services in Addis Ababa, Ethiopia 2018.
### Clinical variables

| Type of cancer           | N    |
|-------------------------|------|
| Breast cancer           | 130  |
| Cervical cancer         | 58   |
| Colorectal cancer       | 46   |
| NPC<sup>a</sup>         | 13   |
| Others<sup>b</sup>      | 105  |

| Type of treatments taken<sup>c</sup> | N    |
|-------------------------------------|------|
| Supportive treatment                | 352  |
| Chemotherapy                        | 313  |
| Surgery                             | 201  |
| Radiotherapy                        | 176  |
| Hormonal                            | 80   |

| Cycle of treatment taken           | N    |
|-------------------------------------|------|
| 4-6 cycles                          | 155  |
| 1-3 cycles                          | 97   |
| >6 cycles                           | 61   |
| On other treatment options         | 39   |

| Private health facility visit history | N    |
|--------------------------------------|------|
| Yes                                  | 223  |
| No                                   | 129  |

### Distribution of cancer by age group category

| Type of cancer | Age group category | 0-24 | 25-34 | 35-44 | 45-54 | 55-64 | >6      |
|----------------|--------------------|------|-------|-------|-------|-------|---------|
| Breast cancer  | <=24               | 0    | 18    | 50    | 30    | 13    | 19      |
| Cervical cancer| 25-34              | 0    | 4     | 10    | 20    | 17    | 7       |
| Colorectal cancer| 35-44          | 1    | 7     | 15    | 11    | 7     | 5       |
| NPC<sup>a</sup> | 45-54             | 1    | 2     | 4     | 4     | 0     | 2       |
| Others<sup>b</sup> | 55-64             | 7    | 9     | 28    | 28    | 14    | 19      |
| Total          | >6                | 9    | 40    | 107   | 93    | 51    | 52      |

<sup>a</sup>: NPC = Nasopharyngeal cancer,
<sup>b</sup>: Other cancer types including (skin, oral, lung, liver, esophageal, bone, Hodgkin lymphoma, non-Hodgkin lymphoma, thyroid and other unspecified but pathologically and clinically confirmed tumors).
<sup>c</sup>: Frequencies and percentage will not be added up because multiple responses were possible.
Table 3 Mean overall expenditure per patient by different subgroups among patients attending cancer treatment services in Addis Ababa, Ethiopia 2018.

| Subgroup variables | Mean overall expenditure ($) per patient |
|--------------------|------------------------------------------|
| **By type of cancer** |                                          |
| Breast cancer       | 2325                                     |
| Cervical cancer     | 1308                                     |
| Colorectal cancer   | 2931                                     |
| NPC                 | 1652                                     |
| Others              | 2842                                     |
| **By type of health facility** |                                  |
| Private             | 5341                                     |
| Government          | 2177                                     |
| **By history of visit at private health facility** |                     |
| Visited             | 2870                                     |
| Not visited         | 1494                                     |
| **Have no history of visit at private health facility by type of cancer** |                         |
| Breast cancer       | 1658                                     |
| Cervical cancer     | 1074                                     |
| Colorectal cancer   | 2144                                     |
| NPC                 | ---                                      |
| Others              | 1446                                     |
| **Have a history of visit at private health facility by type of cancer** |                     |
| Breast cancer       | 2799                                     |
| Cervical cancer     | 1616                                     |
| Colorectal cancer   | 3150                                     |
| NPC                 | 1652                                     |
| Others              | 3454                                     |
| **By their catastrophic level** |                               |
| Not catastrophic    | 1990                                     |
| Catastrophic        | 2495                                     |
| **By gender**       |                                          |
| Male                | 2704                                     |
| Female              | 2243                                     |
| **By marital status** |                                      |
| Single              | 3751                                     |
| Divorced            | 2598                                     |
| Married             | 2244                                     |
| Widowed             | 1174                                     |
| **By residence**    |                                          |
| Addis Ababa         | 2223                                     |
| Out of Addis Ababa  | 2464                                     |
| **By educational level** |                              |
| No formal education | 1674                                     |
| Grade 1-8           | 1685                                     |
| Grade 9-12          | 2306                                     |
| College/certificate and above |                        |
|                      | 3310                                     |
| **By occupational status** |                             |
| Retired             | 3229                                     |
| Employed (private/government) |            |
| Own private business| 2455                                     |
| Housewife/Husband   | 2396                                     |
| Others              | 2164                                     |
|                      | 1842                                     |

---: There are no cases of NPC with any history of visit at private health facility
Table 4 CHE by household income and expenditure quintiles among patients attending cancer treatment services in Addis Ababa, Ethiopia 2018.

| Quintile                  | Proportion (%) | Std. Err. | [95% Conf. Interval] |
|---------------------------|----------------|-----------|----------------------|
| Household income quintile |                |           |                      |
| Lowest                    | 66.2           | 5.5       | 54.6-76.1             |
| Second                    | 78.4           | 4.8       | 67.4-86.1             |
| Middle                    | 78.1           | 5.2       | 66.2-86.1             |
| Fourth                    | 84.5           | 4.3       | 74.0-91.1             |
| Highest                   | 65.2           | 5.8       | 53.2-75.1             |
| Household expenditure quintile |          |           |                      |
| Lowest                    | 67.6           | 5.6       | 55.8-77.7             |
| Second                    | 72.8           | 5.3       | 61.2-82.2             |
| Middle                    | 86.1           | 4.1       | 75.9-92.1             |
| Fourth                    | 78.8           | 4.4       | 68.7-86.3             |
| Highest                   | 63.0           | 6.6       | 49.3-74.3             |
| Overall                   | 74.4           | 2.3       | 69.6-78.8             |

Table 5 Factors associated with CHE and proportion of CHE among subgroups of patients attending cancer treatment services in Addis Ababa, Ethiopia 2018.
| Variables | Proportion of CHE N (%) | COR (95%CI) |
|-----------|-------------------------|-------------|
| Type of Health Facility | | |
| Private | 16 (76.1) | 1.11 (0.39-3.11) | 1.29 (0) |
| Public | 246 (74.3) | 1.00 | 1.00 |
| Type of cancer | | |
| Breast cancer | 94 (72.3) | 1.10 (0.55-2.14) | 0.72 (0) |
| Colorectal cancer | 32 (69.6) | 0.95 (0.41-2.21) | 0.68 (0) |
| NPC | 11 (84.6) | 2.28 (0.46-11.40) | 2.92 (0) |
| Others | 84 (80.0) | 1.66 (0.79-3.48) | 1.33 (0) |
| Cervical cancer | 41 (70.7) | 1.00 | 1.00 |
| Cycles of chemotherapy taken | | |
| ≤ 3 cycles | 71 (73.2) | 1.21 (0.54-2.74) | 1.25 (0) |
| 4-6 cycles | 113 (72.9) | 1.20 (0.55-2.57) | 1.31 (0) |
| > 6 cycles | 51 (83.6) | 2.27 (0.87-5.92) | 3.64 (1) |
| On other treatment options | 27 (69.2) | 1.00 | 1.00 |
| Private health facility visit | | |
| No | 97 (75.2) | 1.06 (0.65-1.75) | 1.19 (0) |
| Yes | 165 (74.0) | 1.00 | 1.00 |
| Age | | |
| --- | --- | 1.01 (0.99-1.03) | 1.03 (1) |
| Household size | | |
| --- | --- | 0.95 (0.87-1.04) | 0.95 (0) |
| Gender | | |
| Male | 72 (76.6) | 1.17 (0.67-2.03) | 1.01 (0) |
| Female | 190 (73.6) | 1.00 | 1.00 |
| Marital status | | |
| Single | 26 (76.5) | 1.14 (0.50-2.63) | 1.91 (0) |
| Divorced | 14 (73.7) | 0.98 (0.34-2.82) | 1.20 (0) |
| Widowed | 11 (78.6) | 1.29 (0.35-4.74) | 1.48 (0) |
| Married | 211 (74.0) | 1.00 | 1.00 |
| Residence | | |
| Out of Addis Ababa | 158 (75.6) | 1.16 (0.72-1.89) | 1.07 (0) |
| In Addis Ababa | 104 (72.7) | 1.00 | 1.00 |
| Level of Education | | |
| No formal education | 93 (73.2) | 0.93 (0.53-1.64) | 0.47 (0) |
| Grade 1-8 | 28 (82.4) | 1.59 (0.60-4.20) | 0.99 (0) |
| Grade 9-12 | 50 (72.5) | 0.89 (0.46-1.75) | 0.59 (0) |
| College and above | 91 (74.6) | 1.00 | 1.00 |
| Occupation | | |
| Own private business | 39 (79.6) | 1.40 (0.62-3.20) | 2.21 (0) |
| Housewife/Husband | 107 (77.0) | 1.21 (0.67-2.17) | 2.30 (0) |
| Retired | 22 (61.1) | 0.56 (0.25-1.26) | 0.48 (0) |
| Others | 19 (73.1) | 0.98 (0.37-2.58) | 1.17 (0) |
| Employed private/government | 75 (73.5) | 1.00 | 1.00 |
| Income quintile | | |
| Lowest | 49 (66.2) | 1.04 (0.52-2.09) | 0.85 (0) |
| Second | 58 (78.4) | 1.93 (0.92-4.06) | 1.30 (0) |
| Middle | 50 (78.1) | 1.91 (0.88-4.12) | 1.21 (0) |
| Fourth | 60 (84.5) | 2.91 (1.29-6.55) | 2.66 (0) |
| Highest | 45 (65.2) | 1.00 | 1.00 |
| Expenditure quintile | | |
| Lowest | 48 (67.6) | 1.27 (0.58-2.58) | 1.49 (0) |
| Second | 51 (72.8) | 1.58 (0.74-3.38) | 1.52 (0) |
| Middle | 62 (86.1) | 3.65 (1.53-8.68) | 3.04 (0) |
| Fourth | 67 (78.8) | 2.19 (1.02-4.67) | 1.49 (0) |
| Highest | 34 (63.0) | 1.00 | 1.00 |

Table 6 Coping strategies used by patients’ household for the financial constraints of cancer care in

22
Addis Ababa, Ethiopia 2018.

| Coping strategies       | Frequency (n) | Percentage |
|-------------------------|---------------|------------|
| Savings*                | 301           |            |
| Financial support**     | 151           |            |
| Selling assets***       | 42            |            |
| Borrowings****          | 30            |            |

*: It includes any method of household savings and sources from the household member (including Eqqub and Iddir).

**: Financial source from relatives, NGOs, religious organization and others source of payments which are nonrefundable.

***: Any means of payment made by selling any household assets like land, property, livestock, jewellery and other household items

****: Any types of borrowing from financial institutions taken as a debt including from individuals

NB: Frequencies and percentage would not be added up because multiple responses were possible.

**Supplementary Files**

This is a list of supplementary files associated with this preprint. Click to download.

S1 Table 1 Data collection instrument.docx