Original Article

OPEN ACCESS

Cost Out-of-Pocket Expenses with Cardiovascular Diseases at PMCH Nawabshah – COUP Study

Qurban Ali Rahu[1], Ghulam Fareed[2], Jagdesh Kumar[3], Mashooque Ali Dasti[4], Imran Elahi Soomro[5], Shahnawaz Panhwar[6]

[1,3,5]Professor of Cardiology, PUMHS, Shaheed Benazirabad,
[2]Assistant Professor of Cardiology, PUMHS, *Shaheed Benazirabad*
[4]Associate Professor of Cardiology, SICVD Sehwan, [6]Senior Registrar Cardiology, *PUMHS, SBA*

Author`s Contribution

[1,4]Substantial contributions to the conception or design of the work; or the acquisition, [5]Drafting the work or revising it critically for important intellectual content, [2]Final approval. [3,6]Active participation in active methodology,[3]analysis, or interpretation of data for the work,

Funding Source: None
Conflict of Interest: None

Received: May 06, 2025
Revised: Nov 19, 2025
Accepted: Jan 24, 2026

Address of Correspondent
Dr Ghulam Fareed
Assistant Professor of Cardiology, PUMHS, Shaheed Benazirabad
drfareedshah66@gmail.com

ABSTRACT

Objectives: To evaluate out-of-pocket (OOP) healthcare expenditures and associated factors among patients with cardiovascular diseases (CVDs) presenting at PUMHS Nawabshah.

Methodology: This cross-sectional study was conducted among 200 diagnosed CVD patients attending inpatient and outpatient cardiology services at PUMHS SBA from October 2023 to March 2024. All adult patients of both genders presenting with any cardiovascular disease at the cardiology department were enrolled. Patients were assessed for sociodemographic characteristics, type of cardiovascular disease, duration of illness, and direct medical and non-medical expenses, including consultation fees, medications, diagnostic tests, transportation, and hospital stay. Descriptive statistics were used to calculate the mean and median OOP costs. Appropriate statistical tests were applied using SPSS version 23, with a p-value of <0.05 considered statistically significant.

Results: The overall mean age of participants was 59.3 ± 14.36 years, and the majority were males (67.6%). The mean annual medication cost was 117,735.31 PKR. Patients were hospitalized an average of 2.02 times per year, with a mean total of 9.63 inpatient days annually, incurring a mean annual hospitalization cost of 68,191.50 PKR. Yearly transportation-related expenses averaged 35,946.04 PKR. Collectively, the overall mean annual out-of-pocket expenditure per patient was 259,908.06 PKR. Out-of-pocket spending exceeding 10% of household income was observed in all patients, indicating that every participant in the study faced financially catastrophic healthcare costs. Additionally, a significant majority of patients (97.2%) reported borrowing money to meet their treatment expenses, and 73.8% were compelled to sell household assets to finance their care.

Conclusion: Individuals with CVDs faced a considerable out-of-pocket financial burden, primarily driven by medication and diagnostic costs, which adversely influenced treatment adherence and health outcomes.

Key words: CVDs, OOP cost, Healthcare expenditures, Comorbidity,

Cite this article as: Rahu QA, Fareed G, Kumar J, Dasti MA, Soomro IE, Panhwar S. Cost Out-of-Pocket Expenses with Cardiovascular Diseases at PMCH Nawabshah – COUP Study. Ann Pak Inst Med Sci. 2026; 22(1):97-102. doi. 10.48036/apims.v22i1.1140.

Introduction

Cardiovascular diseases (CVDs) remain the leading cause of morbidity, mortality, contributing to around 185 million disability-adjusted life years (DALYs) throughout the world.[1] Corresponding to the Global Burden of Disease (GBD) 2023 Collaborators, around 20 million people died from CVDs globally in 2023, with 437 million DALYs lost a 1.4-fold increase since 1990.[2] The ischemic heart disease, intracerebral hemorrhage, ischemic stroke, and hypertensive heart disease were the leading cardiovascular causes of DALYs, with the highest burden concentrated in the low and lower-middle socio-demographic index regions.[2] The CVD in LMICs has a large economic impact and this disproportionate distribution of cardiovascular burden across income settings has reflective implications not only for health systems but also for the financial wellbeing of affected households, predominantly in lower

and middle-income nations. This disproportion can also be explained by the unproductive healthcare systems and limited financial accessibility for patients, contributors, and the representatives. In several such settings, each person healthcare spending amounts to only 1–9% of that in high-income nations, with over one-third of total healthcare costs taken directly by patients through out-of-pocket payments.[3]

However, for the reason that of very low rates of coverage of the costs of guideline-directed CVD therapy by the mechanisms of health insurance, out-of-pocket and catastrophic spending occur, contributing to the cycle of poverty and CVD, subsequent in patients presenting to health facilities with irreversible heart or lung impairment, and preserving major disparities in outcomes in LMICs versus high-income countries.[4]

As well as Pakistan, one of the most populated LMICs in South Asian countries, faces a specifically acute intersection of rising CVD burden and unstable mechanisms of the financial protections. There is one in four adults is hypertensive, and one in four individuals aged 40 or above suffers from a cardiovascular disease.[5] This country is simultaneously be subjected to an epidemiological transition, with CVDs now among the foremost causes of deaths prematurely. In proportion to a recent global health report, around 60% of the deaths in Pakistan are may be **due to** noncommunicable diseases, including cardiovascular diseases, diabetes, mental health disorders, chronic airway diseases and the cancers.[6,7] This rising burden is occurring within a healthcare system ill-equipped to absorb it. The Pakistani healthcare system consists of a private sector around (70%) and a public sector around (30%), and only approximately 27% of the population advantages from full healthcare coverage, while 73% depend on out-of-pocket payments.[8]

The financial consequences of this structural gap are severe. With the annual household income of Pakistani per person is approximately 587 US dollars, a diagnosis of cardiovascular disease could be similar to a death sentence for poor families, given the enormous out-of-pocket expenses that treatment demands.[9] Reports examining medication costs for hypertension, a key CVD risk factor have demonstrated significant household pressure. According to a study conducted in Karachi reported that the total treatment costs of stage 1 and stage 2 hypertension were calculated to be 217,869.7 PKR and 17,545,457.6 PKR correspondingly, with antihypertensive management imposing a higher burden on the household budget and serving as a major cause for non-adherence of treatment, as a result increasing risks of the cardiovascular events.[10] Similarly, at an extensive household level, a nationally representative analysis from Pakistan's Household Integrated Economic Survey 2018–19 observed that 28.5% of households faced a double disease burden, with families having members suffering from both communicable and noncommunicable diseases at the higher risk of disadvantage because of massive out-of-pocket payments.[6]

Regardless of these alarming trends, evidence on the direct costs of out-of-pocket specifically related with the full spectrum of cardiovascular diseases in Pakistan remains incomplete and disintegrated. According to a systematic review on the economic burden of CVD in LMICs revealed that the existing evidence is not aligned with policy significances in terms of volume of research, pathologically studied, and quality of the methodology, asking for national-level studies with suitable sample sizes and adequate incorporation of both direct and indirect costs.[12] However this study, therefore, conducted to determine the out-of-pocket expenses borne by patients with cardiovascular diseases, evaluate their contribute evidence to inform health financing policy and universal health coverage strategies in the country

Methodology

This descriptive cross-sectional study was conducted at the Cardiology Department of Peoples University of Medical and Health Sciences (PUMHS), Nawabshah, from October 2023 to March 2024. Ethical approval was obtained from the Institutional Review Board (IRB) / Ethical Review Committee (ERC) of PUMHS Nawabshah (Ref No: PUMHSW/SBA/PVC/ERC/2023/345).

All patients aged ≥18 years, of both genders, diagnosed with any type of cardiovascular disease (CVD)—including coronary artery disease (CAD), heart failure, hypertension, ischemic heart disease, myocardial infarction (MI), and stroke—were eligible for inclusion. Patients who had received any form of treatment (inpatient or outpatient expenses, including medications or investigations) within the preceding three months were included in the study.

Patients who were critically ill and unable to provide information, those with incomplete medical or financial records, patients diagnosed with CVD as a secondary complication of another primary disease, and those unwilling to participate were excluded.

A non-probability consecutive sampling technique was used, whereby all eligible patients presenting to the

cardiology department during the data collection period were enrolled until the required sample size was achieved. Written informed consent was obtained after explaining the purpose of the study. All patients underwent face-to-face interviews conducted in their preferred language.

Sociodemographic information was collected, including age, gender, marital status, educational level, monthly household income, household size, employment status, residential status, and socioeconomic status (SES). Clinical information included type of CVD diagnosis, duration of disease, comorbidities, number of hospital admissions, and type of treatment (medical, surgical, or interventional).

Patients were also assessed for direct medical costs, including consultation fees, prescribed medications, diagnostic investigations, procedure costs, and hospitalization charges. Direct non-medical costs included transportation expenses, food and accommodation during hospitalization, and informal caregiving costs. Indirect costs were assessed in terms of income loss due to absenteeism from work by the patient and/or accompanying caregiver.

All information was recorded using a structured study questionnaire developed after a comprehensive review of the existing literature. Data were entered and analyzed using IBM SPSS Statistics version 26.0.

Results

Overall mean age of 145 patients with CVD was 59.3+14.36 years and males were in majority (67.6%). Mostly patients belonged to rural areas (77.2%), with only 22.8% were from urban areas. According to the educational status, a large proportion were uneducated (38.6%), while according to occupational status, daily wage workers (31.0%) and housewives (24.8%) constituted the largest groups, followed by farmers (21.4%) and small shopkeepers (11.0%), whereas retired individuals (8.3%) and those without any work were only (3.4%). Majority of the patients (57.9%) had a disease duration of 1–3 years, while 24.1% had 3–5 years and 17.9% had more than 5 years duration of disease. Table I.

According to the risk factors, hypertension was the most prevalent condition, affecting 74.8% of study population, followed by smoking 49.7%, 35.2% of patients had diabetes mellitus, while dyslipidemia and family history were reported in 19.3% and 18.6% of the cases, respectively, as presented in figure 1.

Table I: Patients' demographic and clinical information. (n=145)

		N	%
Gender	Male	98	67.6
	Female	47	32.4
Residential status	rural	112	77.2
	urban	33	22.8
Educational level	Un-educated	56	38.6
	Primary	39	26.9
	Middle	26	17.9
	Matric	15	10.3
	Graduate	9	6.2
Occupational status	Daily Wager	45	31.0
	Farmer	31	21.4
	Housewives	36	24.8
	Retired	12	8.3
	Small Shopkeeper	16	11.0
	No any work	05	03.4
Duration of disease	1-3 years	84	57.9
	3-5 years	35	24.1
	>5 years	26	17.9

According to the CVD diagnoses, hypertension was the most prevalent condition, affecting 74.80% of patients, followed by CAD 55.10%, arrythmias were the third most common diagnosis at 18.60%, while HF was reported in 17.20% of cases. Additionally, IHD noted in 11.00% cases, and Valvular Heart Disease (VHD) was the least frequent, observed in only 5.50% of patients, as shown on figure 2.

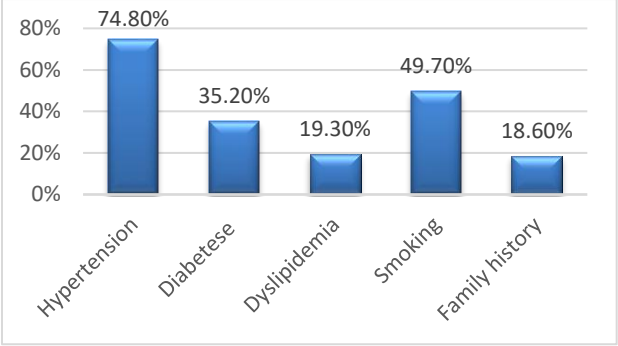

Figure 1. Risk factors of heart disease. (n=145)

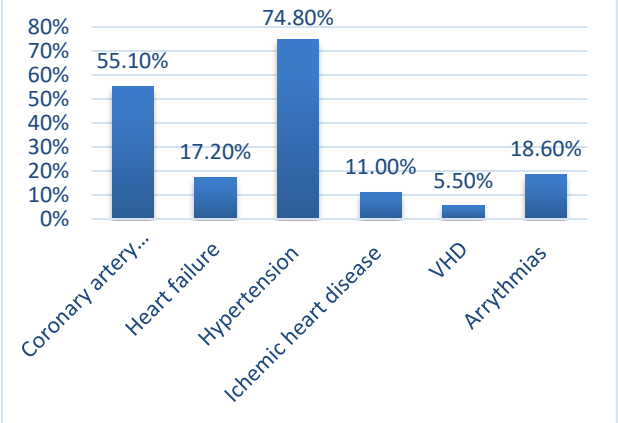

Figure 2. Diagnosis of cardiovascular disease. (n=145)

Overall estimated treatment-related costs among CVD patients revealed a substantial financial burden as the mean annual medicine cost of 117,735.31 PKR. Patients were hospitalized an average of 2.02 (±1.13) times per year, with a mean total of 9.63 (±11.86) inpatient days annually, incurring a mean annual hospitalization cost of 68,191.50 PKR. Additionally, yearly transport-related expenses averaged 35,946.04 PKR. Collectively, the overall mean annual out-of-pocket expenditure per patient was 259,908.06 PKR, emphasizing a severe and recurring financial strain on patients, as shown in table II.

Table II: Mean treatment related monthly and annual costs. (n=145)

Estimated treatment related monthly and annual costs	Mean +SD
Approximated monthly cost of medicine (Mean± SD)	9811.27±3495 PKR
Approximated annual cost of medicine (Mean± SD)	117735.31 ± 41940.73 PKR
Overall mean annual number of hospitalizations	2.02+1.13 yearly
Mean total days of admission annually	9.63±11.86
Approximated annual cost of hospitalization (Mean± SD)	68191.50±9639.94 PKR
Approximated annual transport related cost (Mean± SD)	35946.04±2935 PKR
Overall annual approximated cost (Mean± SD)	259908.06±110273.78 PKR

The out-of-pocket spending exceeding 10% of household income, was found in all of the patients, indicating that every participant in the study faced financially devastating healthcare costs. Additionally, the significant majority of patients (97.2%) reported borrowing money to meet their treatment expenses, and (73.8%) were compelled to sell household assets to finance their care, are collectively indicating that the catastrophic and deeply impoverishing financial consequences of CVD among low-income patients seeking care at government Hospitals. Table III

Table III: Financial Impact and coping strategies Due to Out-of-Pocket Expenditure in patients of CVD. (n=145)

		N	%
Catastrophic Health Expenditure (>10%)	Yes	145	100.0
	No	--	--
	Total	145	100.0
Borrowed Money for Treatment	Yes	141	97.2
	No	4	2.8
	Total	145	100.0
Sold Assets for Treatment	Yes	107	73.8
	No	38	26.2
	Total	145	100.0

Discussion

This study evaluates the clinical burden, and out-of-pocket (OOP) financial costs among 145 CVD patients attending a government hospital, with overall mean age of 59.3 ± 14.36 years and a clear male predominance (67.6%). This is broadly consistent with findings from Siddique et al., who studied CVD knowledge and practices among rural adults in Bangladesh and reported a male majority of 60.8% with a mean age of 71.21 ± 9.21 years, noting that older males in rural settings bear a disproportionately high CVD burden.[12] This is also broadly consistent with findings from Siddique et al., who studied CVD knowledge and practices among rural adults in Bangladesh and reported a male majority of 60.8% with a mean age of 71.21 ± 9.21 years, noting that older males in rural settings bear a disproportionately high CVD burden.[12] In this study preponderance of uneducated patients (38.6%) and low-income occupational groups daily wage workers (31.0%), housewives (24.8%), and farmers (21.4%) reflects the epidemiological reality that CVD disproportionately burdens marginalized socioeconomic status. Naz L et al[6] corroborated this in their nationwide quantile regression analysis, finding that households with uneducated heads and rural residents faced significantly higher OOP expenditures for non-communicable diseases in Pakistan.[2]

The hypertension was the most prevalent condition in the current study, affecting 74.8% of patients, followed by coronary artery disease (CAD) at 55.1%. This is consistent with global and regional literature underscoring hypertension as the most prevalent CVD risk factor in South Asia. A study from Ethiopia on hypertensive patients similarly identified hypertension as the dominant diagnosis among CVD outpatients, reporting considerable financial burdens on affected households.[13]

In India, cardiovascular diseases particularly hypertension account for more than one-third of household health expenditure, mirroring the pattern seen in the present study.[14]

The mean annual OOP expenditure per patient in this study was 259,908.06 PKR, comprising medicine costs (117,735.31 PKR), hospitalization costs (68,191.50 PKR), and transportation costs (35,946.04 PKR). Medication emerged as the single largest cost component, a finding echoed across regional literature. Elahi et al[8] reported total OOP costs for stage 1 and stage 2 hypertension in Karachi reaching 217,869.7 PKR and 17,545,457.6 PKR respectively at the population level, further emphasizing the staggering pharmaceutical burden imposed by

cardiovascular conditions. On the other hand, a systematic review of the economic burden of CVD in LMICs indicate that annual treatment costs for hypertension range between $500 and $1,500 per episode, while costs for coronary heart disease and stroke are considerably higher and more variable.[15] In Ethiopia, the mean annual cost of hypertension ranged from $91.72 to $267.6, which, though lower in absolute terms, represents a similar or greater proportional burden relative to per capita income.[13]

One of the most alarming findings of this study is that all participants (100%) had OOP expenditure exceeding 10% of household income the internationally accepted threshold for catastrophic health expenditure (CHE). This is substantially higher than CHE rates reported in comparable settings. Adeniji and Obembe reported that CVD significantly increased the risk of CHE among households in Ghana and South Africa, where low health insurance coverage compounded financial vulnerability.[16]

Similarly, a modeling study across 34 low- and lower-middle-income countries found CVD to be among the disease categories most strongly associated with household CHE risk.[17] The globally WHO noted that the, more than 996 million people face catastrophic health payments, with the majority concentrated in LMICs, and that individuals having CVD are specifically exposed due to the care of lifelong nature.[18]

Additionally, the higher rates of borrowing (97.2%) and distress asset sales (73.8%) documented in this study paint a deeply troubling picture of impoverishment driven by CVD-associated healthcare costs. Such figures are broadly consistent with evidence from other developing country situations. Through 15 African countries, approximately 50% of households with a hospitalized family member resorted to borrowing and asset selling to finance healthcare, with this behavior being most pronounced among the poor.[19] In the country of Bangladesh, average OOP expenditures for chronic illness households increased significantly between 2016 and 2022 even after adjusting for inflation, reflecting the escalating burden of long-term disease management without adequate insurance protection.[20] Naz et al consistently found that Pakistani households with double disease burden—combining communicable and non-communicable conditions faced disproportionately high OOP costs, with rural and older members being specifically susceptible.[6]

The findings of this study are highly significant in the context of Pakistan's healthcare financing landscape, where out-of-pocket (OOP) spending constitutes a substantial proportion of total health expenditures and universal health coverage remains limited. Despite the government's *Sehat Sahulat* healthcare initiative, which offers eligible family's coverage of up to 1 million PKR per year for hospitalization related to chronic conditions, including coronary heart disease (CHD), many low-income patients—particularly those residing in rural areas—remain outside the safety net or are unaware of the available benefits.

The present findings strongly reinforce the need to expand financial risk protection mechanisms, subsidize essential cardiovascular medications, and invest in primary care–based CVD prevention strategies to reduce catastrophic health expenditures and prevent further impoverishment of vulnerable households.

This study documents a severe, pervasive, and impoverishing financial burden among CVD patients at a government hospital at local level. The worldwide occurrence of catastrophic health expenditure, extensive borrowing, and distress asset selling highlight the urgent need for policy interventions targeting both the direct costs of CVD treatment and the broader social determinants that render low-income populations especially susceptible.

Although the findings align closely with and are reinforced by a growing body of national and international evidence on the financial toxicity of cardiovascular disease in low-resource regions. Conversely, with advantages this study possesses several limitations like cross-sectional design and single-center sampling may restrict the ability to draw causal inferences or extrapolate results to the broader Pakistani population. Moreover, reliance on self-reported cost data may be subject to recall bias, potentially affecting the precision of expenditure estimates. Hence, the present findings cannot be considered finally conclusive, and further large-scale, multi-center studies with robust sampling frameworks are warranted to validate and strengthen the evidence base in this region.

Conclusion

This study revealed that cardiovascular diseases (CVDs) impose a catastrophic financial burden on low-income patients in Pakistan, with medication costs, hospitalization, and transportation emerging as the major cost drivers. Nearly all patients experienced catastrophic health expenditure, and the overwhelming majority were compelled to borrow money or sell household assets to finance their treatment, reflecting severe and progressive financial distress at the household level.

Overall, these findings underscore critical gaps in health financing and insurance coverage in Pakistan and call for urgent policy reforms. These should include the expansion of public health insurance schemes, subsidization of essential cardiac medications, and strengthening of preventive healthcare services to protect vulnerable low-income households from the impoverishing consequences of CVDs.

However, due to certain limitations and the lack of a more comprehensive cost analysis, future large-scale, multicenter studies encompassing all cost-related aspects of CVD management in this population are strongly recommended.

References

1. Shakya S, Shrestha A, Robinson S, Randall S, Mnatzaganian G, Brown H, et al. Global comparison of the economic costs of coronary heart disease: a systematic review and meta-analysis. BMJ Open. 2025;15(1):e084917. https://doi.org/10.1136/bmjopen-2024-084917
2. Bizzozero Peroni B. Global, regional, and national burden of cardiovascular diseases and risk factors in 204 countries and territories, 1990–2023. J Am Coll Cardiol. 2025;86(2):2167-2243.
3. Hendriks ME, Bolarinwa OA, Nelissen HE, Boers AC, Gomez GB, Tan SS, et al. Costs of cardiovascular disease prevention care and scenarios for cost saving: a micro-costing study from rural Nigeria. J Hypertens. 2015;33(2):376-684. https://doi.org/10.1097/HJH.0000000000000402
4. Mocumbi AO. Cardiovascular health care in low- and middle-income countries. Circulation. 2024;149(8):557-559. https://doi.org/10.1161/CIRCULATIONAHA.123.065717
5. Datta BK, Husain MJ, Asma S. Assessing the relationship between out-of-pocket spending on blood pressure and diabetes medication and household catastrophic health expenditure: evidence from Pakistan. Int J Equity Health. 2019;18(1):9. https://doi.org/10.1186/s12939-018-0906-x
6. Naz L, Sriram S. Out-of-pocket expenditures associated with double disease burden in Pakistan: a quantile regression analysis. BMC Public Health. 2024;24(1):801. https://doi.org/10.1186/s12889-024-18320-4
7. World Health Organization. Noncommunicable Diseases Progress Monitor 2022. Geneva: World Health Organization; 2022.
8. Elahi A, Ali AA, Khan AH, Samad Z, Shahab H, Aziz N, et al. Challenges of managing hypertension in Pakistan: a review. **Clin** Hypertens. 2023;29(1):17. https://doi.org/10.1186/s40885-023-00245-6
9. Farooq M, Arshad MI, Usman M. Towards universal health coverage in Pakistan: challenges ahead. Lancet Reg Health Southeast Asia. 2022;1:1-2. https://doi.org/10.1016/j.lansea.2022.03.003
10. Aslam N, Shoaib MH, Bushra R, Farooqi FA, Zafar F, Ali H, et al. Out of pocket (OOP) cost of treating hypertension in Karachi, Pakistan. Pak J Pharm Sci. 2018;31(3 Suppl):1039-1044.
11. Gheorghe A, Griffiths U, Murphy A, Legido-Quigley H, Lamptey P, Perel P. The economic burden of cardiovascular disease and hypertension in low- and middle-income countries: a systematic review. BMC Public Health. 2018;18(1):975. https://doi.org/10.1186/s12889-018-5806-x
12. Siddique AB, Hosen MS, Akter H, Hossain SM, Al Mamun M. Assessment of knowledge, attitudes, and practices regarding cardiovascular diseases among older individuals of rural Bangladesh: findings from a face-to-face interview. Front Public Health.2024;12:1336531. https://doi.org/10.3389/fpubh.2024.1336531
13. Alemayehu YK, Mesfin AB, Gebreyesus SH, Taddele T. Direct cost of hypertension and associated factors among hypertensive patients in Ethiopia. Front Public Health. 2023;11:1014364. https://doi.org/10.3389/fpubh.2023.1014364
14. Prinja S, Bahuguna P, Pinto AD, Sharma A, Bharaj G, Kumar V, et al. Understanding out-of-pocket expenditure on healthcare for cardiovascular diseases in India. PLoS One. 2024;19(3):e0299874.
15. Gheorghe A, Griffiths U, Murphy A, Legido-Quigley H, Lamptey P, Perel P. The economic burden of cardiovascular disease and hypertension in low- and middle-income countries: a systematic review. BMC Public Health. 2018;18(1):975. https://doi.org/10.1186/s12889-018-5806-x
16. Adeniji AO, Obembe TA. Cardiovascular disease and catastrophic health expenditure in sub-Saharan Africa: evidence from Ghana and South Africa. J Health Econ Outcomes Res. 2023;10(2):110-119. https://doi.org/10.36469/001c.70252
17. Murphy A, Palafox B, O'Donnell O, Stuckler D, Perel P, AlHabib KF, et al. Inequalities in the use of secondary prevention of cardiovascular disease by socioeconomic status: evidence from the PURE observational study. Lancet Glob Health. 2018;6(3):e292-e301. https://doi.org/10.1016/S2214-109X(18)30031-7
18. World Health Organization. Cardiovascular diseases (CVDs) fact sheet [Internet]. Geneva: World Health Organization; 2024 [cited 2024 Dec 15]. Available from: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)
19. Tur-Sinai A, Bentur N. Out-of-pocket expenditure on community healthcare services at end-of-life among decedents from cardiovascular disease in six European countries and Israel. Health Econ Rev. 2023;13(1):37. https://doi.org/10.1186/s13561-023-00449-4
20. Rahman MM, Islam MR, Rahman MS, Hossain F, Alam A, Rahman MO, et al. Forgone healthcare and financial burden due to out-of-pocket payments in Bangladesh: a multilevel analysis. Health Econ Rev. 2022;12(1):5. https://doi.org/10.1186/s13561-021-00348-6
21. Adeniji FI, Lawanson AO, Osungbade KO. The microeconomic impact of out-of-pocket medical expenditure on the households of cardiovascular disease patients in general and specialized heart hospitals in Ibadan, Nigeria. PLoS One. 2022;17(7):e0271568. https://doi.org/10.1371/journal.pone.0271568