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An evaluation of the impacts of health insurance coverage on wealth stratification in some selected sub-Saharan countries

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Abstract

Background Health is a crucial component of an economy, influencing the performance of various sectors. As a result, nearly every country has implemented health policies to achieve the United Nations Development Goals and Universal Health Coverage (UHC) targets, which focus on providing universal access to necessary, sufficient, and quality healthcare without financial barriers. Implementing such policies in the sub-Saharan region led Burundi, Gabon, Ghana, and Rwanda to emerge as the only four countries in the region to have healthcare coverage over 20%. This study sought to investigate whether the health insurance policies implemented impact the wealth stratification of households in these countries.

Methods The study used data from the sub-Saharan region section of the Demographic and Health Surveys (DHS) Program by the U.S. Agency for International Development (USAID) with Robust Ordered Probit Estimation Technique.

Results The results show that health insurance negatively impacts the Wealth levels of those in the poorest, poorer, and middle-income levels in Burundi and Rwanda more than those in the wealthiest group. Community-based insurance in Gabon and national health insurance in Ghana positively impact the income of lower households.

Conclusions The government should improve social amenities, especially in rural areas. Also, the study identified limited information as one reason for the outcome. We propose increasing education on the importance of health and the benefit package when one subscribes to a health insurance scheme to encourage patronage and decrease out-of-pocket expenditure.

Keywords Community-based health insurance, Health insurance, Health policies, Households, Sub-Saharan Africa, National health scheme

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Background

Health is an essential component of an economy as it is intertwined with the performance of most sectors of a country. The United Nations Development Goal 3 aims at ensuring a healthy lifestyle and promoting the well-being of all. This aligns with the WHO's Universal Health Coverage targets, which focus on providing everyone with the ability to access required, sufficient, and quality health care without financial barriers. To achieve these goals, the health sectors of almost every country worldwide have seen at least one health policy or more to improve their health sector. The health sectors in the sub-Saharan region are no exception to this development [1]. Most countries in the area are progressively bending their policies towards public financing of healthcare access through health insurance schemes. Healthcare

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financing is a crucial component of the functioning and development of a health system. A country's arrangement of health financing determines who and what type of health services can be provided. This is influenced by the history of the country, the political status, and the socio-economic nature [2, 3]. Generally, health financing consists of revenue collection (through levies, insurance or social security systems, loans, grants, etc.), risk pooling, where members share a pool of collective health risks, and acquiring health services [4]. Though all countries face health financing challenges, lower and low-middle-income countries (LLMIC) encounter these challenges the most. These countries are in most need of health care, but their resources are scarcer. With low GDP growth and income from many LMICs, which is translated into lower spending on health, the countries rely majorly on out-of-pocket payments (OOPP) for healthcare access [4]. This limits and even prevents a lot of people from accessing health care as well as the increase in self-diagnosis and drug abuse. As a result, most of the health policies in the twenty-first century in the sub-Saharan region focused on reducing OOPP and increasing health coverage through revenue collection and risk pooling [2].

Countries like Ghana, Nigeria, Uganda, South Africa, and Zambia implemented a national health insurance scheme policy, while some countries implemented community-Based Health Insurance schemes like Rwanda and Ethiopia. Others, like Kenya, Tanzania, and Senegal, created national funds to support and promote health access [5]. These policies help reduce barriers to healthcare access and provide a pool of financial risk protection for the population. Regardless of these policies, only four countries in the region have achieved health insurance coverage above 20 percent (Rwanda- 78%, Ghana- 58.2%, Gabon- 40.8%, and Burundi- 22.0) [5–7]. A study conducted to assess the level of inequality in health insurance coverage across 36 sub-Saharan countries reveals that Rwanda, Ghana, Gabon, and Burundi are the only nations with coverage levels exceeding 20% [6]. This outcome was determined using health insurance coverage, health outcomes, access to essential health services, and equity in health coverage, among other indicators [5].

This study examines how the implemented health insurance schemes in these four countries have impacted the wealth status of the households, the female and male members between the ages of 15–49. The relation between health and family wealth status is a meaningful way the individual and the family contribute to the economic growth of a country. A healthy population means higher labor productivity and income as labor experience fewer sick leaves and leave to care for other ill family members [8]. Labor also invests in capacity building, making them mentally more robust. So, the question of this study is how the improvement in the health sectors of these countries has impacted the income level of the people at the micro level.

There are many reasons to believe that health insurance coverage influences household income levels. Health insurance coverage helps reduce Out-of-Pocket expenditures and possible catastrophic expenditures on health care services. This frees up the household income on healthcare, increasing disposable income for other needs [9]. Also, health insurance coverage can significantly improve access to preventive care. Most health insurance plans include no cost in accessing preventive health services like vaccinations, screening, and counseling. This helps detect and prevent chronic conditions early, which helps avoid potential financial burdens in the long run [10, 11]. Lastly, health insurance can enhance productivity and potentially impact the choices in the labor market [12]. Healthier individuals are more likely to be productive and supply more labor, which will, in turn, increase income. However, subsidized or non-contributory health insurance can decrease the incentive to work and possible job lock [12].

Empirically, studies show inconclusive outcome results on whether private or public insurance is more effective and impacts wealth more. For example, countries like the USA, which rely heavily on private insurance, experience uneven access to health care. In contrast, countries with universal health coverage, like Canada and Britain, see more equitable access [13, 14]. Voluntary schemes to reduce the number of uninsured individuals may not always be practical. In the USA, reduced premiums did not significantly increase insurance uptake among the uninsured [10, 11]. In developing regions, policies aiming to increase universal health coverage (UHC) through Community-based and health insurance schemes have shown promise in reducing out-of-pocket payments and improving access to health care. Still, issues like trust and service quality remain, leading to a more negative impact on household wealth [15–19]. Overall, the impact of health insurance on household wealth needs further study to understand its effects fully. Most studies in the sub-Saharan region often examined how income or socioeconomic status impacts a specific health component. Some study how income impacts life expectancy [20–23], and others on maternal health and care [9, 24, 25]. The studies made to assess policies and reforms regarding Universal Health Coverage are also done mainly by analyzing how national or household-level income affects these policies [1, 15, 16, 26]. However, very few studies have examined the opposite relation in the context of sub-Saharan Africa [25, 27]; therefore, there is a need to fill this gap.

As a result, we set out to ascertain how health insurance and other demographic factors affect the income status of selected sub-Saharan countries. The countries we are interested in are Burundi, Gabon, Ghana, and Rwanda. These countries are selected to be among the top four regarding health coverage in the region in the twenty-first century [6, 7]. The study has three main questions:

(1) How does each health insurance type impact household wealth?
(2) Which wealth group is more responsive to insurance policies?
(3) Which gender is more responsive to insurance policies?

After reviewing the literature, we found fewer studies about health policies and income in the sub-Saharan region. Conversely, most studies on this topic typically examine how these policies impact health outcomes. As a result, this paper fills the gap by looking at how the national health insurance schemes and the community-based insurance implemented in Burundi, Gabon, Ghana, and Rwanda have affected the socio-economic status of the families in these countries. Against this backdrop, the study will analyze the following hypothesis based on the literature review above.

H01: Health insurance positively impacts the household's wealth level of both males and females.
H02: Private health insurance payment negatively impacts total household wealth.
H03: Public health insurance payment positively impacts household wealth.

The findings in this study are used to recommend policies to help improve the health sector of these countries and other countries. The remaining part of the study is structured as follows: The next section reviews the health sectors in our countries of interest. The third section introduces and analyzes data and methodology. Lastly, Sect. 4 discusses key findings and concludes the study.

Review of the health sector of the selected countries

This section focuses on some health sector reforms and policies implemented in Burundi, Gabon, Ghana, and Rwanda. Almost all economies in the world have implemented reforms and policies in the twenty-first century targeting the poor, especially to achieve universal health coverage [28]. This trend results from Sustainable Development Goal 3, which aims to achieve universal health coverage by 2030.

The health sector of Burundi has seen different policies. The economy of Burundi was unstable after its independence in 1962 until the early twenty-first century. The country faced civil wars between the period of 1993 and 2005. This affected all sectors of the economy, including the agriculture sector, which is the central sector for highest employment and growth. As a result, the country is exposed to the international community, with foreign aid estimated to be about 50 percent of the national budget [29, 30]. In collaboration with international partners, the government has been working to improve infrastructure, reduce corruption, and improve the health sector to attract foreign direct investment.

The government manages the health sector of Burundi with an increasing service delivery from the private sector [29]. The country gets support from international entities such as WHO, the World Bank, USAID, the European Union, and the Netherlands Development and Cooperation. These countries and organizations provide policies, finance, and technical support. Among the transforming health policies in the twenty-first century are the 2005–2015 national health policy and the national development plans, including the Burundi Vision 2025, the poverty reduction strategic framework, adherence to the International Health Partnership (IHP), and the Millennium Development Goals targets.

The main components of these policies include the decentralization of the health sector, the development of health districts, and the access to health care for about 50 percent of the population through the inception of health insurance cards accrued to the local industry. It also includes providing a free health care policy for pregnant women and children under 5 and enhancing the results-based approach for financing health through a public–private partnership.

This has led to an increase in access to health care irrespective of the economic status of the people. The health sector of Burundi consists of three main parts: The central level, the provincial level, and the district level. The central level deals with policy designs and the overall direction for strategies in the health sector. Each province has an institution coordinating and executing the national health policies enacted at the central level. The unit also provides health technical assistance and training to personnel and facilities at the district level. Lastly, the district level provides its services through hospitals and health centers in the district [29].

Rwanda, just like Burundi, also faced an unstable economy through civil wars and insufficient political regimes and was crowned with the 1994 genocide, leading to loss of life, destruction of properties, ruin to the health system, and the unsuccessfulness of all policies implemented during this period [31]. To revamp the

health sector, the Ministry of Health, with support from WHO, enacted a reform in 1995. The main aims of the reform were to rebuild the whole system by increasing the community's involvement through managing and financing health services. This was done through the pay-as-you-go method through user fees for health services and facilities. However, due to the higher number of poor people in the populace, the country recorded poor health indicators owing to low service utilization. As a result, the Rwandan government implemented a Community-Based Health scheme (CBHS) in 1999 with only three districts as pilot. The success of the initial study led to almost all districts following suit with district-specific schemes [32]. The parliament of Rwanda implemented a policy in 2006 to standardize the CBHS scheme and formally put free premiums for the poor in place. The premium payment for the scheme's membership is categorized into three according to their economic and financial status (poorest, middle, and higher). The individual makes payment at the beginning of each year, allowing access for all family members throughout the year. The government pays for those in the poorest category. As a result, access to health has increased from 7 in 2003 to 74 percent in 2013 and 78 percent in 2023 [32, 33].

Like other African countries, Ghana relied on out-of-pocket to access health services in the mid-90s, resulting in poor health coverage. To ensure universal health coverage, the parliament of Ghana, under Act 650 in 2003, implemented the National Health Insurance Scheme (NHIS) to reduce the burden of out-of-pocket payments of the population and to upgrade the services and infrastructure of the health sector. The scheme was upgraded in 2012, 2018, and 2023 with a theme of 'Everyone in Ghana having access to quality health regardless of their ability to pay.' [34–36]. The populace pays a premium to register for the scheme, which is renewable every year. This premium constitutes only a tiny portion of the revenue from NHIS, though subscribers can access many health services. The primary source of financing health services comes from the public through revenue pooling, such as taxes and levies, and not just the premium paid. The benefits package includes over 95% of disease conditions and services like outpatient and inpatient services, maternity, eye care, and oral health. Access to healthcare and services occurs in both private and public health facilities. However, about 60 percent of the scheme members are exempted from paying the premium [37]. This includes those working in the formal sector and contributing indirectly to the scheme through the Social Security and National Insurance Trust (SSNIT), children under 18 years of age, pregnant women, indigents below a certain wealth level, and those over 70. As a result, Ghana was named the second country in the sub-Saharan region with health coverage above 20 percent.

Ghana's health sector is governed by the Ministry of Health (MoH), which is in charge of policymaking in the sector, the main body for health-related decision-making, and oversees the responsibilities allocated to all the units under the health sector. The Ghana Health Service (GHS) is the MoH's central agency for implementation purposes. It comprises representatives from MOH and their agencies, the private health sector, development partners, and other collaborators.

Similarly, Gabon, in the late 90s, initiated Public Financial Management Reforms involving all the ministries, including health, which gave priority to budgetary programs for better accountability. However, the reform could not efficiently increase health coverage, leading to the implementation of the Gabon Health Financing System Reform in 2007. The reform is a compulsory health insurance scheme enacted through the National Health Insurance Program (NHIP) and the National Health Insurance and Social Coverage Fund (NHISCF) [38]. The significant component of the reform is the allocation of funds for the health care needs of the poor named Gabon Indigents Scheme (GIS), which is funded through the Compulsory Health Insurance Tax (Relevance Obligatoire à l'assurance Maladie (ROAM)); a 10 percent levy on the revenue of mobile phone companies excluding tax and a levy of 1.5 percent on international transfers. The insurance policy of Gabon allows children between the ages of 0 and 16 years to be beneficiaries of their insured parents. As a result, the populace whose income is below a certain level and above 16 years old (mainly informal workers) are eligible for support within the scheme [37]. Beneficiaries are fit to access equal health services and care as insured people by making a copayment of just 20 percent for services. The poor are entitled to 100 percent free maternity services and 90 percent and 80 percent coverage for chronic and common diseases, respectively [39].

With guidance from the WHO to fund social health insurance publicly to achieve UHC, the policies of these countries were designed to support that goal. The figures below illustrate how each of our four countries of interest finances its health sector. Figure 1 indicates that the governments of all the countries are the main sponsors of their health sectors, with Gabon having the highest funding and Burundi having the lowest. However, as shown in Fig. 2, total expenditure as a percentage of GDP has remained stable over the years and falls less than 12 percent of GDP. As anticipated, private spending, including out-of-pocket costs as a proportion of total health expenditure, has been declining since the early twenty-first century, as shown in Fig. 3, with Burundi and

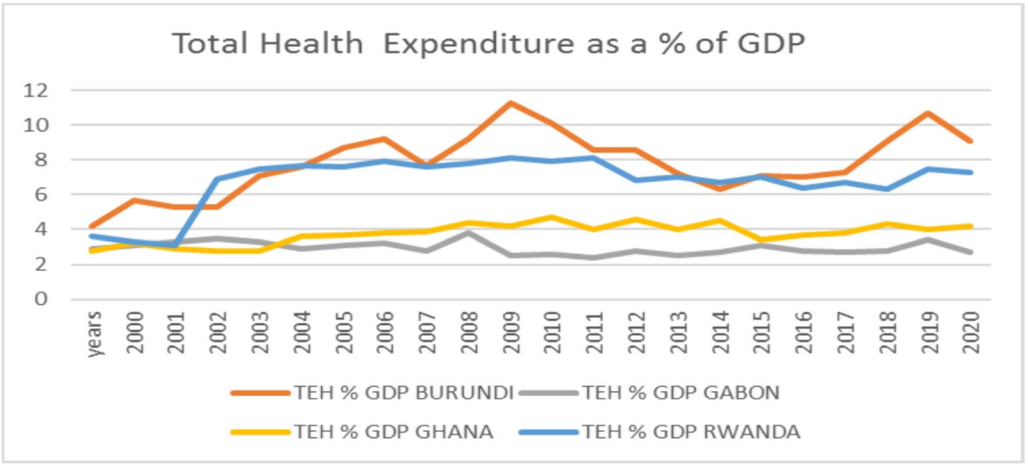

Fig. 1 General government expenditure as a percentage of Health Expenditure

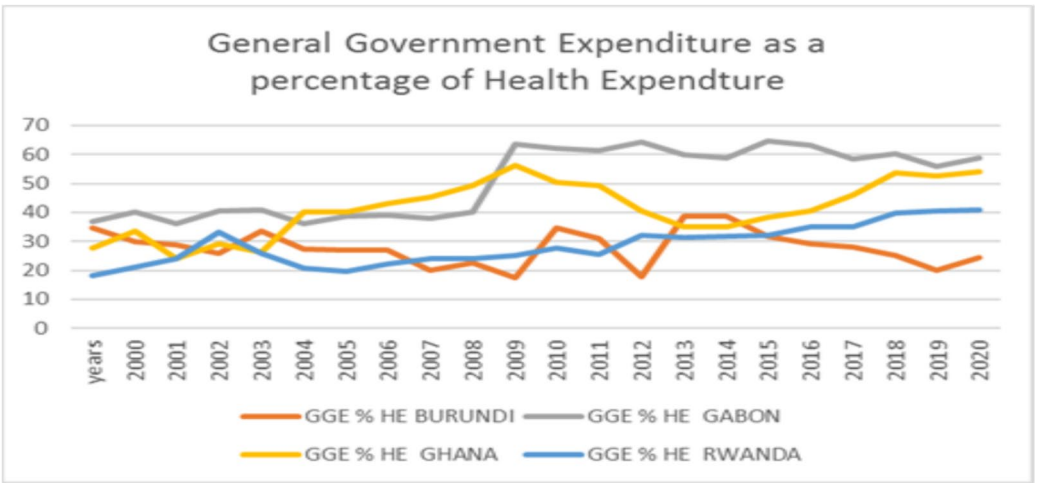

Fig. 2 Total Health Expenditure as a percentage of GDP

Rwanda having the lowest levels among the rest. Additionally, Burundi and Rwanda exhibit the highest external expenditures compared to the other countries.

Data and methodology

Theoretical framework

The importance of human capital as a factor of production has been studied extensively in economic theory. For instance, [40] extended the Solow model to include human capital as a factor of production. Their model suggested human capital investment as a significant factor in country income level differences. Similarly, studies like [41, 42] emphasized the need to improve a country's human capital and productivity. They concluded that investments in research and development, education, and general human capital improvement drive prolonged economic growth.

However, these theoretical models did not include health-affecting productivity. The human capital model developed by Michael Grossman's is a necessary frame when looking at health and human capital. This model is portrayed as an adjunct to Becker's human capital theory, which models human capital as an investment in education, health, and training [43, 44] viewed health as a lasting capital stock used to produce healthy periods. An individual inherits a quota of this capital stock, which can be increased or improved by health-related activities. However, the stock diminishes with aging. As a result, having access to better health improves physical and mental capabilities, which leads to higher productivity, better job performance, and increased earnings.

Additionally, cumulative advantage theory shows the advantage of having better healthcare access and nutritious food over time. This leads to higher educational

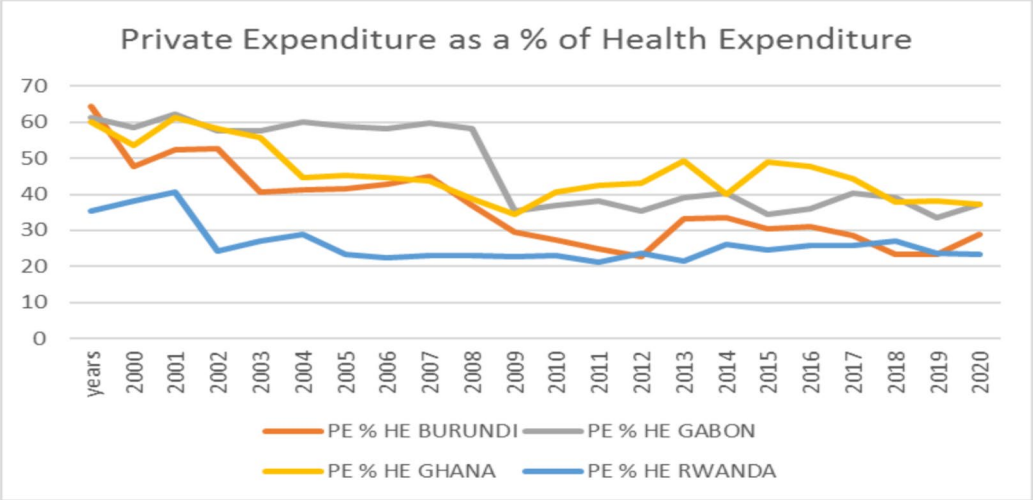

Fig. 3 Private expenditure as a percentage of Health Expenditure

attainment, chances of better jobs, and higher remuneration. Inversely, higher income levels give way to better living conditions, access to nutritious food, and the ability to pay for healthcare. This will likely reduce chronic diseases and improve overall health, supporting sustained or increased income [45]. This conclusion is also very similar to the health selection hypothesis, which posits that improving an individual's health status leads to a higher socioeconomic status due to improved physical and mental capabilities.

A summary of the current survey results for each country is provided in Table 1 below. The table shows the health insurance type, and their percentages patronized by each wealth quintile. Health insurance coverage is consistent across the four countries, each having a different relationship. Each country has a different type of insurance coverage that dominates. The percentage of people covered increases with wealth, from the poorest group to the wealthiest group in Burundi and Rwanda, with the opposite in Gabon and Ghana. The most common insurance type in Burundi in 2016 is the employer-provided type, CNAMGS for Gabon in 2020, National/district health insurance for Ghana in 2022, and mutual/community organization for Rwanda in 2020. In Burundi, employer-provided insurance is the most patronized type, though those in the wealthiest quintile most patronize mutual/community organizations. Regarding Ghana and Gabon, National health insurance and CNAMGS are uniformly distributed with a slight fall in the wealthiest quintiles. The poorer quintile in Rwanda, on the other hand, has the highest coverage in the community insurance category.

Data

The study's main aim is to assess how the improvement in health insurance policies has impacted the income level of the male and female members of the household between the ages of 15 and 49 at each income level. The data for this study was generated from the sub-Saharan region section of the Demographic and Health Surveys (DHS) Program, collected by the U.S. Agency for International Development (USAID). The dataset from this website consists of more than 90 countries with data related to the socio-economic level of households, like women's status, men's status, child mortality, household wealth status, and literacy, among others. The survey design is classified into four questions: household, woman, man, and biomarker questionnaires, which include basic family information, female maternal health, employment, and literacy, among others. This study used the household, men's, and women's files for the analysis. The data sampling is done using probability techniques and a multistage stratified cluster sampling design approach to ensure the presentation of the whole population. This sampling design, coupled with the sample size, makes the dataset the right choice for comparative analysis of different countries at the family level. However, one must be careful when analyzing and generalizing an outcome from such data due to selection bias and other data collection issues discussed in the next section.

The study used the latest DHS survey data conducted in Burundi (2016), Gabon (2020), Ghana (2022), and Rwanda (2020). The selected years include all the main variables of the study. In the literature, household income is determined by a couple of factors. Still, due to data availability, we focused on the variables presented in

Table 1 Income level and type of Insurance patronized

Burundi 2016					
Insurance type	**Poorest**	**Poorer**	**Middle**	**Richer**	**Richest**
Covered by Health Insurance	472 (8.1%)	734 (12.6%)	942 (16.2%)	1213 (20.9%)	2451 (42.2%)
Mutual/Community Organization	7 (0.4%)	20 (1.2%)	36 (2.2%)	180 (10.9%)	1410 (85.3%)
Provided by employer	442 (11.8%)	684 (18.3%)	850 (22.7%)	957 (25.6%)	806 (21.6%)
Private/Commercially purchased	12 (4.2%)	18 (6.3%)	34 (11.8%)	58 (20.2%)	165 (57.5%)
Religious/Mutual Insurance	4 (12.9%)	2 (6.5%)	10 (32.3%)	5 (16.1%)	10 (32.3%)
Gabon 2020					
Insurance type	**Poorest**	**Poorer**	**Middle**	**Richer**	**Richest**
Covered by health insurance	4560 (42.1%)	1835 (17%)	1533 (14.2)	1461 (13.5%)	1431 (13.2%)
CNAMGS	4426 (43.6%)	1742 (17.2%)	1439 (14.2%)	1349 (13.3%)	1189 (11.7)
CNSS	101 (34.4%)	51 (17.3%)	42 (14.3%)	43 (14.6%)	57 (19.4%)
Private/Commercially purchased	30 (8.0%)	42 (11.2%)	52 (13.8%)	67 (17.8%)	185 (49)
Ghana 2022					
Insurance type	**Poorest**	**Poorer**	**Middle**	**Richer**	**Richest**
Covered by health insurance	4427 (23.1%)	4174 (21.8%)	3800 (19.8)	3511 (18.3%)	3241 (16.9%)
Mutual/Community organization	5 (12.2%)	2 (4.9%)	2 (4.9%)	6 (14.6%)	26 (63.4)
Provided by employer	2 (1.5)	1 (0.7)	10 (7.4%)	20 (14.8%)	102 (75.6%)
Private/Commercially purchased	2 (2.2%)	2 (2.2%)	6 (6.5%)	16 (17.2%)	67 (72%)
National/District health insurance	4418 (23.4)	4169 (22.1%)	3782 (20%)	3469 (18.4%)	3046 (16.1%)
Rwanda 2020					
Insurance type	**Poorest**	**Poorer**	**Middle**	**Richer**	**Richest**
Covered by health insurance	2645 (14.9%)	3154 (17.8%)	3476 (19.6%)	3807 (21.5%)	4660 (26.3%)
Mutual/Community organization	2642 (16.1%)	3137 (19.1%)	3453 (21%)	3617 (22%)	3580 (21.8%)
Provided by employer	0	3 (10%)	1 (3.3%)	7 (23.3%)	19 (63.3%)
Social Security/ RSSB/RAMA	1 (0.2%)	6 (1%)	13 (2.1%)	96 (15.7%)	496 (81%)
Private/Commercially purchased	1 (0.2%)	7 (1.5)	7 (1.5%)	59 (12.9%)	382 (83.8%)
MMI	1 (0.5%)	1 (0.5%)	2 (0.9)	28 (13.1)	181 (85%)

Table 2, which includes the variables, description, and measurement.

Descriptive of data

This section analyses the type of health insurance patronized by all quintiles of wealth level in each country, along with other demographic components used in the study. A summary of the current survey results for each country is provided in Table 3 below. Health insurance coverage is consistent across the four countries, each having a different relationship. Each country has a different type of insurance coverage that dominates. The percentage of people covered increases with wealth, from the poorest group to the wealthiest group in Burundi and Rwanda, with the opposite in Gabon and Ghana. The most common insurance type in Burundi in 2016 is the employer-provided type, CNAMGS for Gabon in 2020, National/district health insurance for Ghana in 2022, and mutual/community organization for Rwanda in 2020. Unemployment is higher in Burundi than in the rest of the countries. Additionally, more than 50 percent of the respondents from each country are married. More than half of the respondents in Gabon and Ghana obtained secondary school education. The data is collected relatively across each wealth quintile. This confirms our Heckman findings that there is no selection bias.

The model specification

The study's main aim is to assess how the improvement in health insurance policies has impacted the wealth stratification of the male and female members of the household between the ages of 15 and 49. This work's dependent variable is categorical with a Likert scale of 1–5 (1 = poorest, 2 = poorer, 3 = middle, 4 = Richer, 1 = Richest). Using a Likert scale to stratify wealth status makes it possible to quantify the data and makes interpretation easier. However, the information provided by the respondents may not accurately reflect the actual situation as responses are subjective [46, 47]. Also, due to the data collection method, household data oversteps most key assumptions of most linear regression, such as ordinary least squares (OLS). Most of the variables in the data are highly correlated, increasing

Table 2 Data description

Variable Name	Description	ID	Measurement
Dependent Variable			
Wealth			
Household	Total wealth of a household irrespective of the type of job and property	Wealth	Likert scale (1–5) 1 = poorest, 2 = poorer, 3 = middle, 4 = Richer, 1 = Richest
Male	The total wealth of an eligible woman in the household, irrespective of the type of job and property	Wealth	Likert scale (1–5) 1 = poorest, 2 = poorer, 3 = middle, 4 = Richer, 1 = Richest
Female	The total wealth of an eligible man in the household, irrespective of the type of job and property	Wealth	Likert scale (1–5) 1 = poorest, 2 = poorer, 3 = middle, 4 = Richer, 1 = Richest
Independent variables			
Health insurance type			
Mutual/community organization	A mutual or community-based organization provides health insurance through the collective pooling of resources	Community	Binary scale (0–1). 0 = No, 1 = Yes
Provided by employer	The respondent's employer provides health insurance coverage as part of employment benefits	EMP	Binary scale (0–1). 0 = No, 1 = Yes
CNAMGS	Health insurance provided by the Caisse Nationale d'Assurance Maladie et de Garantie Sociale, a national health insurance scheme in Gabon	CNAMGS	Binary scale (0–1). 0 = No, 1 = Yes
CNSS	The Caisse Nationale de Sécurité Sociale, a social security institution in Gabon, provides health insurance	CNSS	Binary scale (0–1). 0 = No, 1 = Yes
Private/commercially purchased	Health insurance purchased by an individual from a private insurance company	PCP	Binary scale (0–1). 0 = No, 1 = Yes
Rreligious mutual insurance	A mutual aid society or religious organization provides health insurance	RMI	Binary scale (0–1). 0 = No, 1 = Yes
National/district	district or national government	NDH	Binary scale (0–1). 0 = No, 1 = Yes
Social Security/ RSSB/RAMA	Health insurance is provided by the Rwandan Social Security Board (RSSB) or RAMA	RSSB	Binary scale (0–1). 0 = No, 1 = Yes
MMI	Health insurance is provided by the Military Medical Insurance in Rwanda	MMI	Binary scale (0–1). 0 = No, 1 = Yes
Sex of head of household	Gender of the person recognized as a household's primary decision-maker or leader	Sex	Binary scale (0,1). 1 = Male, 2 = Female
Owns land usable for agriculture	Household that possesses land which can be utilized for farming or other agricultural activities	Land	Binary scale (0–1). 0 = No, 1 = Yes
Type of place of residence	Whether a respondent resides in the urban or rural centre	Urban	Binary scale (0,1)1 = URBAN AND 0 = RURAL
Educational level			
Household	The highest level of education attained by eligible members of the household	Education	Likert scale (0–3), 0 = No education, 1 = Primary, 2 = Secondary, 3 = Higher
Female	The highest level of education attained by female respondents	FE	Likert scale (0–3), 0 = No education, 1 = Primary, 2 = Secondary, 3 = Higher
Male	The highest level of education attained by male respondents	ME	Likert scale (0–3), 0 = No education, 1 = Primary, 2 = Secondary, 3 = Higher
Working status			
Household	The current employment status of eligible respondents in the household	WS	
Male	The current employment status of male respondents in the household	MW	Likert scale (0–3), 0 = No education, 1 = Primary, 2 = Secondary, 3 = Higher
Female	The current employment status of women respondents in the household	FW	Binary scale (0,1). 0 = No, 1 = Yes
Marital status			
Household	The current marital status of eligible household members	Marriage	Binary scale (0,1). 0 = never married, 1 = Married
Male	The current marital status of male respondents	MM	Binary scale (0,1). 0 = never married, 1 = Married
Female	The current marital status of female respondents	FM	Binary scale (0,1). 0 = never married, 1 = Married

the chances of multicollinearity and heteroscedasticity, as shown with the Breusch-Pagan-Godfrey's heteroskedasticity test presented in the appendix. Also, due to the high heterogeneity of the data, especially in wealth status, it is hard to provide accurate model specification and accuracy of OLS outcomes. The data may also contain outliers, leading to bias in the OLS estimation as it is susceptible to outliers. Additionally, considering the difference and impact of

Table 3 Demographic variables and Health insurance type in each country in percentage

	Country	Burundi	Gabon	Ghana	Rwanda
Working status	**Not employed**	24.33	50.41	23.41	27.26
	Employed	75.67	49.59	76.59	72.74
Marital status	**Never married,**	24.66	34.73	35.92	42.48
	Married	75.35	65.28	64.07	57.52
Education	**No education**	37.82	5.86	19.67	9.15
	Primary	41.48	19.77	13.72	58.94
	Secondary	19.14	64.63	55.75	27.05
	Higher	1.56	9.73	10.86	4.86
Sex of head of household	**Male**	71.18	65.77	65.7	67.79
	Female	28.82	34.23	34.3	32.21
Owns land usable for agriculture	**With land**	81.52	34.66	55.95	39.8
	Without land	18.48	65.34	44.05	60.2
Type of place of residence	**Urban**	19.01	37.05	49.77	22.72
	Rural	80.99	62.95	50.23	77.28
Wealth Status	**Poorest**	16.32	39.49	23.76	18.51
	Poorer	17.55	18.79	22.24	18.51
	Middle	18.38	16.09	19.95	19.1
	Richer	19.35	13.87	18.15	20.28
	Richest	28.39	11.76	15.9	23.61
Health Insurance Type	**Mutual/community organization**	N/A	N/A	0.18	77.69
	Employer	15.02	N/A	0.61	0.14
	CNAMGS	N/A	66.87	N/A	N/A
	CNSS	N/A	2.05	N/A	N/A
	Private/Commercially	1.24	2.74	0.42	2.89
	Religious mutual	0.13	N/A	N/A	N/A
	National/District	N/A	N/A	73.24	N/A
	RSSB/RAMA	N/A	N/A	N/A	4.05
	MMI	N/A	N/A	N/A	0.81

N/A means the health insurance type is not applicable in that country

each type of health insurance on the specific wealth level, a linear model such as OLS that assumes each group is the same is not applicable. Household data may also contain a probability of selection biases. As a result, we conducted a Heckman selection test to check for this feature. The results in the appendix show no selection bias in the Gabon, Burundi, and Ghana data. The result, however, showed a significant sigma term indicating that the model is appropriate and that there is meaningful unexplained variation in the data. On the other hand, the data for Rwanda showed a variation and a selection bias. As a result, we used the Robust Ordered Probit Regression Model (ROPRM), a model that uses a latent variable y^* for a multiple-grouped dependent variable. Compared with the standard Ordered Probit Model, ROPRM provides more reliable outcomes by controlling for heteroskedasticity and outlier issues, which best fit our case. The ROPRM analyses each insurance type's impact on each category's income level separately [48].

Following [49], the model is written as follows.

Given the index model for a single unobserved latent variable

$$y_{i=}x_i\beta + \mu_i, \text{where} - \infty < y_i < \infty \tag{1}$$

Then, the threshold variable equation will be

$$y_i = \{1\ if\ \sigma_1 < y*_i \le \sigma_2 2\ if \sigma_2 < y*_i \le\ \sigma_3 3\ if\ \sigma_3 < y*_i \le \sigma_4 i = 1,2 \ldots\ldots\ldots, n$$
$$y_i = j\ if\ \sigma_{j-1}\ < y*_i\ \le \sigma_j \tag{2}$$

where $\sigma's$ are the thresholds or cutoffs values that show the answers to be estimated where $\sigma_1 < \sigma_2 < \sigma_3 \ldots\ldots\ldots < \sigma_j$, and they rely on the dependent variables. y_i is the dependent variable (income) y* a specific income level, and j is the number of categories of the dependent variable [5]. n is the sample size of each country's data. The probability of the observation of a particular result says, $1 \le i \le j$ can be summarized as

$$p(y_i = j/x_i) = F(\sigma_j - x_i\beta; 0) - F(\sigma_{j-1} - x_i\beta) \quad (3)$$

where β represents the explanatory variables, F is the cumulative distribution function, $\sigma_0 = \sigma_{1-1} = -\infty$ and $\sigma_j = \infty$. The inclusion of F leads to the estimation of the parameters by using the maximum log-likelihood with function below

$$log\ log\left[\frac{F_j(x_i)}{1 - F_j(x_i)}\right] = \sigma_j - (\beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + ...\beta_k x_{ki}) \quad (4)$$

where j = 1,2……,5 groups; i = 1,2……n, which is the sample size for each country and each gender. K is the number of explanatory variables, and x's are the explanation variables, including country-specific health insurance, educational, working status, and married status. $\beta\prime s$ are the parameters to be estimated.

Therefore, the probability of changes in the dependent variable (wealth) because of changes in the explanatory variable is calculated by using the marginal effect regression. This allows us to analyze how a change in the independent variables decreases/ increases the probability of being in a particular income group, which can be expressed below.

$$\partial pij/\partial x_i = \left[F\prime(\sigma_j - X_i\prime\beta) - F\prime(\sigma_{j-1} - x_i\beta)\right]\beta_j \quad (5)$$

Result and discussion

Econometrics analysis

This study session presents the result and the discussion of the relationship between income and health insurance stipulated by Eqs. 1– 5 above for the household as well as the male and female members of the household aged between 14 and 49 years. All the estimations made in this study used Stata 17.0 MP—Parallel Edition. Table 4 highlights the relationship between income and the insurance type with other factors for households and gender, respectively, using the Robust Ordered Probit model for Burundi, Gabon, Ghana, and Rwanda. Each data file, households, men and women, were used separately to estimate each category. The table provides the cutoffs and other associated estimates using ROPRM analysis. The outcome shows how each independent variable affects our categorical wealth variables. A positive coefficient indicates that an increase in the independent variable increases the likelihood of the dependent variable moving to the wealthiest group. In contrast, a negative coefficient moves the likelihood toward the poorest category.

From Table 4, a person patronizing any health insurance is associated with the highest household income category in Burundi and Rwanda. In the case of Gabon, those patronizing CNAMGS health insurance are more likely to be in the lowest-income household category. In contrast, those patronizing CNSS and private insurance are likelier to be in the highest-wealth household. Lastly, in Ghana, aside from employer-provided health insurance and private insurance, those using any other type of insurance shift the likelihood of being in the poorest household.

Household demographic variables also showed different results for each country. However, those educated and living in urban centers will likely be in the wealthiest households in all the countries. Additionally, while the sex of the household head does not matter for the wealth levels in Burundi and Gabon, those with males as the head are primarily associated with being in the highest-income household in Ghana and Rwanda. In Burundi, those employed are more likely to be in the highest income household, while those married and own land are more likely to be from the lowest income household. Those who are married, own land, and are employed are more likely to be in the lowest-income households, while those in the urban center are more likely to be in the wealthiest category in Gabon.

Furthermore, in Burundi, a person with every insurance type is more likely to be shifted into the most affluent wealth category than the poorest category, except for those with the religious mutual insurance type for both males and females. In Gabon, those using the CNSS, and private insurance are more likely to be shifted to the wealthiest, while those in the least group are likely to patronize CNAMGS. There is a conflicting case in Ghana where, except for the privately provided health insurance, those using other types of health insurance are likely to be in the least category for females while those patronizing the community-based insurance (MCO), and National health insurance (NHIS) are in the least category for male. Lastly, Rwanda has all the insurance types, having the likelihood of being in the wealthiest category.

Additionally, following Eqs. 1, 2, and 3, the outcome shows 4 cutoff variables as a threshold for income categories. Aside from Burundi, the estimated cutoff points indicate a positive probability associated with each predicted outcome, with the values increasing from wealth level 1 to 4, respectively. This also means the probabilities warrant the usage of a marginal effect for each outcome.

Ordered probit regression result

After establishing the model fit for the data, we estimated the marginal means outcome for each household and wealth level. Tables 5 and 6 show the marginal effects for

Table 4 Ordered probit regression estimates for household and gender

Burundi					
Household		**Female**		**Men**	
Wealth	**Coefficient**		**Coefficient**		**Coefficient**
Commu. Insurance	1.56***	**MCO**	1.7***	**Commu. Insurance**	1.16***
Employer-Insurance	0.15***	**EMP**	0.25***	**Employer-Insurance**	0.18***
Private-Insurance	0.79	**PCP**	0.69***	**Private-Insurance**	0.71***
Rmi	0.33	**Rmi**	0.28	**Rmi**	0.28
Urban	0.04**	**Fm**	-0.05***	**Mw**	-0.02
Sex	0.02	**Fw**	-0.25***	**Me**	0.61***
Land	-0.02	**Fe**	0.52***	**Mm**	0.01
Marriage	-0.15***	Cutoff point			
Ws	0.37***	/cut1	-0.73	/cut1	-0.4475
Education	0.30***	/cut2	-0.08	/cut2	0.1826
		/cut3	0.48	/cut3	0.7207
		/cut4	1.12	/cut4	1.3305
Gabon					
Household		**Female**		**Male**	
Wealth	Coefficient		Coefficient		Coefficient
Cnamgs	-0.15***	**Cnamgs—.10**		**Cnamgs**	-0.13***
Cnss	0.15**	**Cnss**	0.17	**Cnss**	0.19**
Private-insurance	0.99***	**Private-insurance**	1.24***	**Private-insurance**	0.89***
Urban	0.04*	**Fe**	0.57***	**Me**	0.46***
Sex	0	**Mw**	0.24***	**Mm**	-0.07***
Land	-0.05**	**Fm**	-0.07***	**Mw**	-0.0046
Ws	-0.06***	Cutoff point			
Education	0.51***	/cut1	0.57	/cut1	0.4448
Marriage	-0.04***	/cut2	1.11	/cut2	0.9305
		/cut3	1.6	/cut3	1.414
		/cut4	2.21	/cut4	1.9832
Ghana					
Household		**Female**		**Male**	
Wealth	**Coefficient**		**Coefficient**		**Coefficient**
Commu. Insurance	-0.54**	**Commu. Insurance**	-0.76***	**Commu. Insurance**	-0.04
Employer-insurance	0.24**	**Employer-insurance**	-0.1	**Employer-insurance**	1.26***
Private-insurance	0.51***	**Private-insurance**	0.14	**Private-insurance**	1.27***
District-insurance	-0.02	**District-insurance**	-0.06**	**District-insurance**	0.13**
National- insurance	-0.10***	**National- insurance**	-0.08***	**National- insurance**	-0.09***
Urban	0.03*	**Fm**	0.02***	**Mm**	0.05***
Sex	-0.06***	**Fw**	0.13***	**Mw**	-0.11***
Land	0.12***	**Fe**	0.65***	**Me**	0.66***
Ws	0.06***	Cuts off points			
Education	0.65***	/cut1	0.07	/cut1	0.2178
Marriage	0.04***	/cut2	0.8	/cut2	0.9242
		/cut3	1.41	/cut3	1.5119
		/cut4	2.11	/cut4	2.1907
Rwanda					
Household		**Female**		**Male**	
Wealth	**Coefficient**		**Coefficient**		**Coefficient**
Commu. Insurance	0.39***	**Commu. Insurance**	0.42***	**Commu. Insurance**	0.44***
Employer-insurance	0.84***	**Employer-insurance**	0.65**	**Employer-insurance**	1.21***
Private-insurance	0.40***	**Private-insurance**	1.77***	**Private-insurance**	1.86***

Table 4 (continued)

Rama	1.19***	**Rama**	1.55***	**Rama**	1.43***
Mmi	2.01***	**Mmi**	2.06***	**Mmi**	5.18
Urban	-0.01	**Fm**	-0.06***	**Mw**	0.19***
Sex	0.05***	**Fw**	-0.09***	**Me**	0.69***
Land	-0.01	**Fe**	0.69***	**Mm**	0.01
Ws	-0.04**	Cutoff points			
Education	0.72***	/cut1	0.13	/cut1	0.2388
Marriage	-0.05***	/cut2	0.77	/cut2	0.9098
		/cut3	1.33	/cut3	1.5162
		/cut4	*2*	*/cut4*	*2.2453*

the poorest (*dy/dx 1*), poor (*dy/dx 2*), middle (*dy/dx 3*), higher (*dy/dx 4*), and the highest (*dy/dx 5*) respectively for each country and each gender. The marginal effects values (dy/dx) show the marginal probability of each independent variable on a specific outcome group while other variables are held constant. Positive values increase the likelihood of being in that category, while negative values decrease. The household file, women's and men's files were used to estimate each category separately.

Burundi

Burundi's government has made massive efforts to achieve universal health coverage for especially the most vulnerable groups (pregnant women and children under five years) and those in the informal sector through its social protection programs like the Health in All Policies (HiAP) Strategy. The main components of these policies include the decentralization of the health sector and the development of health districts, the access to health care of about 50 percent of the population through the inception of health insurance cards accrue to the local industry, and the provision of free health care policy for pregnant women and children under the age of 5. It also includes enhancing the results-based approach for financing health through public–private partnerships.

With many of the poorer and poorest in the rural areas and dominated by the informal sector, implementing and managing contributory insurance schemes has become a challenge. As a result, the poor incur more costs through out-of-pocket payments for health care access [50]. This can be seen from the results of the poorest, poor, and medium-level wealth groups in Tables 5 and 6. The result shows that health insurance is likely to decrease the wealth of those in the lower wealth quintile while increasing those in the higher quintile. For instance, membership in a mutual or community organization (MCO), which allows enrolment irrespective of wealth status, reduces the likelihood of being in lower-wealth categories and increases the probability of being in higher ones, possibly due to improved financial security or healthcare access. An increase in the patronizing of community health (MCO) leads to a likely decrease in the wealth of households in the low-wealth categories, with the poorest category experiencing the highest decline of 33 percent, as shown in Table 5. Table 6 also shows a similar result in terms of gender, with men and women experiencing a likely decline of 22.3 percent and 35.5 percent, respectively, in their wealth because of patronizing MCO. On the other hand, the wealth of the wealthiest categories is likely to be more positive with all insurance types. For instance, MCO is likely to increase their wealth level by 10.6 and 51.5 percent for the more prosperous and affluent households. This is because most people in this group are in the formal sector and live in urban centres with easy access to health facilities [50]. This finding aligns with the reports of [29, 30].

Gabon

Caisse National d'Assurance Maladie et de Garantie Sociale (CNAMGS) is a national health insurance scheme the Gabonese government implements to ensure all citizens achieve UHC [38]. This enrolment is irrespective of the individual's income level. CNAMGS is funded through taxes on mobile phone companies, money transfers, and contributions from private and public sector employers. From the results of this study, the patronization of CNAMGS leads to a likely increase in the wealth of households of the poorest and the poor by 0.6 percent and 0.01 percent, respectively. The scheme supports lower-income groups more, likely due to greater utilization or targeting policies. However, wealthier groups may rely less on this scheme. The main challenge CNAMGS faces is financial sustainability and copayment reduction, as most beneficiaries enjoy the services for free or make a copayment from

Table 5 Marginal effect estimates for all outcomes for household

Burundi					
Variable	**dy/dx1**	**dy/dx2**	**dy/dx3**	**dy/dx4**	**dy/dx5**
Mco	-0.33***	-0.22***	-0.07***	0.11***	0.52***
Emp	-0.03***	-0.02***	-0.007***	0.01***	0.05***
Pcp	-0.17***	-0.12***	-0.04***	0.05***	0.26***
Rmi	-0.07**	-0.05**	-0.02*	0.03**	0.11**
Urban	-0.01**	-0.001**	-0.002**	0.002**	0.012**
Sex	-0.014	-0.001	-0.001	0.001	0.001
Land	0.01	0.00	0.001	-0.002	-0.01
Marriage	0.03***	0.02***	0.007***	-0.01***	-0.05***
Ws	-0.08***	-0.05***	-0.017***	0.03***	0.12***
Education	-0.06***	-0.04***	-0.014***	0.02***	0.10***
Gabon					
Variable	**dy/dx1**	**dy/dx2**	**dy/dx3**	**dy/dx4**	**dy/dx5**
Cnamgs	0.06***	0.001***	-0.012***	-0.02***	-0.03***
Cnss	-0.06**	-0.001*	0.01**	0.02**	0.03**
Pcp	-0.38***	-0.01***	0.08***	0.14***	0.17***
Urban	-0.02*	-0.003	0.03*	0.01*	0.01*
Sex	0.001	0.00	-0.00	-0.0003	-0.0004
Land	0.02**	0.0004**	-0.004**	-0.01**	-0.01**
Ws	0.02***	0.001***	-0.004***	-0.01***	-0.01***
Education	-0.20***	-0.004***	0.04***	0.07***	0.09***
Marriage	0.01***	0.0003**	-0.03***	-0.01***	-0.01***
Ghana					
Variable	**dy/dx1**	**dy/dx2**	**dy/dx3**	**dy/dx4**	**dy/dx5**
Mco	0.15**	0.06**	-0.03**	-0.08**	-0.11**
Emp	-0.07**	-0.03**	0.01**	0.04**	0.05**
Pcp	-0.14***	-0.06***	0.02***	0.08***	0.10***
Nhis	0.03***	0.011***	-0.004***	-0.02***	-0.02***
Urban	-0.01*	-0.003*	0.001**	0.01**	0.01**
Sex	0.01***	0.006***	-0.002***	-0.01***	-0.02***
Land	-0.03***	-0.01***	0.005**	0.02***	0.02***
Ws	-0.02***	-0.006**	0.003**	0.01***	0.02***
Education	-0.18***	-0.07***	0.03***	0.10***	0.13***
Marriage	-0.01**	-0.004***	0.002***	0.01***	0.01***
Rwanda					
Variable	**dy/dx1**	**dy/dx2**	**dy/dx3**	**dy/dx4**	**dy/dx5**
Mco	-0.09***	-0.06***	-0.012***	0.04***	0.11***
Emp	-0.19***	-0.12***	-0.026***	0.09***	0.24***
Pcp	-0.09***	-0.06***	-0.013***	0.05***	0.12***
Rama	-0.27***	-0.17***	-0.037***	0.13***	0.34***
Mmi	-0.45***	-0.28***	-0.07***	0.23***	0.57***
Urban	0.001	0.01	0.0003	-0.0009	-0.0023
Sex	-0.01**	-0.01**	-0.002**	0.01***	0.01***
Land	0.002	0.002	0.0004	-0.001**	-0.003
Ws	0.009**	0.01**	0.001**	-0.0043	-0.01**
Education	-0.16***	-0.10***	-0.02***	0.08***	0.20***
Marriage	0.012***	0.01***	0.002***	-0.006***	-0.01***

*** $p<.01$, ** $p<.05$, * $p<.1$

their income [38, 51]. As a result, the scheme reduces the wealth status of the households in the middle class, the rich, and the wealthiest categories.

On the other hand, Caisse Nationale de Sécurité Sociale (CNSS) is a privately provided social security fund insurance for formal workers funded by an employer contribution of 16 percent and an employee contribution of just 2.5 percent [52]. The beneficiaries are entitled to health benefits for workers and their families, old age pension, and death benefits. Unlike CNAMGS, CNSS benefits higher-income groups more, potentially reflecting employment-based contributions. Consequently, Tables 5 and 6 show a positive likely impact of CNSS on the wealth of households and both genders in the higher category. The informal sector does not benefit from the financial stability and the services of this type of insurance, just like the private purchase health insurance (PCP). As a result, these insurance types increase the income level of those with the highest wealth levels and decline as wealth reduces. Residing in the urban center also increases access to opportunities and more advanced healthcare access, contributing to higher economic outcomes as presented in the results.

Ghana

The most popular insurance scheme in Ghana is the National Health Insurance Scheme. The government establishes the scheme to provide equitable and accessible basic healthcare coverage for all residents irrespective of financial status. It is financed through the National Health Insurance Levy, Social Security, and National Insurance Trust premiums from subscribers in the formal sector and government funding. NHIS has an extensive benefits package, including coverage of 95 percent of diseases, and some beneficiaries, like pregnant women, are excluded from premium payment [36]. National health insurance supports lower-income groups more, likely through targeted benefits or higher reliance on public health services. This can be seen from the results from both Tables 5 and 6. The patronage of health insurance is likely to increase the wealth of the poorest and poor households by 0.3 percent and 0.1 percent, respectively, while decreasing the wealth of those in the higher wealth category. This pattern is similar to community health insurance type MCO, which may likely reflect targeted policies or higher utilization. This results from the high out-of-pocket payment experienced by the insured clients due to the lack of health supplies and delayed reimbursement to the health centers [53]. Due to this situation, most providers prioritize patients who pay out of pocket, compelling the insured to pay for services initially

Table 6 Marginal effect estimates for all outcomes of gender

Burundi											
Female						***Male***					
Variable	***dy/dx 1***	***dy/dx 2***	***dy/dx 3***	***dy/dx 4***	***dy/dx 5***	***Variable***	***dy/dx 1***	***dy/dx 2***	***dy/dx 3***	***dy/dx 4***	***dy/dx 5***
MCO	*-0.355****	*-0.247****	*-0.075****	*0.150****	*0.528****	***MCO***	*-0.223****	*-0.169****	*-0.071****	*0.069****	*0.394*
EMP	*-0.052****	*-0.036****	*-0.011****	*0.022****	*0.078****	***EMP***	*-0.035****	*-0.026****	*-0.011****	*0.011****	*0.061*
PCP	*-0.144****	*-0.100****	*-0.030****	*0.061****	*0.214****	***PCP***	*-0.137****	*-0.104****	*-0.044****	*0.042****	*0.243*
RMI	*-0.06*	*-0.042*	*-0.013*	*0.025*	*0.09*	***RMI***	*-0.054*	*-0.041*	*-0.017*	*0.017*	*0.095*
FM	*0.010****	*0.007****	*0.002****	*-0.004***	*-0.015****	***MW***	*0.004*	*0.003*	*0.001****	*-0.001*	*-0.008*
FW	*0.053****	*0.037****	*0.011****	*-0.022****	*-0.079****	***ME***	*-0.117****	*-0.088****	*-0.037****	*0.036****	*0.207*
FE	*-0.11****	*-0.08****	*-0.023****	*0.046****	*0.160****	***MM***	*-0.002*	*-0.002*	*-0.001*	*0.001*	*0.004*
Gabon											
Female						***Male***					
Variable	***dy/dx 1***	***dy/dx 2***	***dy/dx 3***	***dy/dx 4***	***dy/dx 5***	***Variable***	***dy/dx 1***	***dy/dx 2***	***dy/dx 3***	***dy/dx 4***	***dy/dx 5***
CNAMGS	*0.063****	*0.002***	*-0.013****	*-0.024****	*-0.029****	***CNAMGS***	*0.051****	*0*	*-0.010****	*-0.018****	*-0.023*
CNSS	*-0.039*	*-0.001*	*0.008*	*0.015*	*0.018*	***CNSS***	*-0.073***	*0*	*0.015***	*0.025***	*0.033*
PCP	*-0.467****	*-0.017****	*0.095****	*0.177****	*0.213****	***PCP***	*-0.343****	*-0.002*	*0.070****	*0.119****	*0.155*
FE	*-0.216****	*-0.008****	*0.044****	*0.082****	*0.098****	***ME***	*-0.179****	*-0.001*	*0.037****	*0.062****	*0.081*
MW	*-0.089****	*-0.003****	*0.018****	*0.034****	*0.041****	***MM***	*0.027****	*0*	*-0.005****	*-0.009****	*-0.012*
FM	*0.027****	*0.001****	*-0.005****	*-0.010****	*-0.012****	***MW***	*0.002*	*0*	*0*	*-0.001*	*-0.001*
Ghana											
Female						***Male***					
Variable	***dy/dx 1***	***dy/dx 2***	***dy/dx 3***	***dy/dx 4***	***dy/dx 5***	***Variable***	***dy/dx 1***	***dy/dx 2***	***dy/dx 3***	***dy/dx 4***	***dy/dx 5***
MCO	*0.213****	*0.090****	*-0.033****	*-0.120****	*-0.150****	***MCO***	*0.012*	*0.005*	*-0.002*	*-0.006*	*-0.009*
EMP	*0.028*	*0.012*	*-0.004*	*-0.016*	*-0.02*	***EMP***	*-0.357****	*-0.142****	*0.048****	*0.190****	*0.26*
PCP	*-0.04*	*-0.017*	*0.006*	*0.022*	*0.028*	***PCP***	*-0.360****	*-0.143****	*0.049****	*0.191***	*0.262*
NDI	*0.017***	*0.007***	*-0.003**	*-0.010***	*-0.12***	***NDI***	*-0.036***	*-0.014***	*0.005***	*0.019***	*0.026*
NHIS	*0.022****	*0.009****	*-0.003****	*-0.012****	*-0.015***	***NHIS***	*0.025****	*0.010****	*-0.003****	*-0.013****	*-0.018*
FM	*-0.007***	*-0.003****	*0.001****	*0.004****	*0.005****	***MM***	*-0.013****	*-0.005****	*0.002****	*0.007****	*0.01*
FW	*-0.036****	*-0.015***	*0.006****	*0.020****	*0.026****	***MW***	*0.030****	*0.012***	*-0.004***	*-0.016***	*-0.022***
FE	*-0.182****	*-0.077****	*0.028****	*0.102****	*0.195****	***ME***	*-0.186****	*-0.074****	*0.025****	*0.099****	*0.136****
Rwanda											
Female						***Male***					
Variable	***dy/dx 1***	***dy/dx 2***	***dy/dx 3***	***dy/dx 4***	***dy/dx 5***	***Variable***	***dy/dx 1***	***dy/dx 2***	***dy/dx 3***	***dy/dx 4***	***dy/dx 5***
MCO	*-0.098****	*-0.058****	*-0.012****	*0.047****	*0.120****	***MCO***	*-0.089****	*-0.065****	*-0.018****	*0.051****	*0.121****
EMP	*-0.150***	*-0.088***	*-0.018***	*0.072***	*0.184***	***EMP***	*-0.247****	*-0.182****	*-0.051****	*0.142****	*0.337****
PCP	*-0.409****	*-0.241****	*-0.049****	*0.196****	*0.503****	***PCP***	*-0.379****	*-0.280***	*-0.078****	*0.219****	*0.518****
RAMA	*-0.358***	*-0.211****	*-0.043****	*0.172****	*0.440****	***RAMA***	*-0.292****	*-0.215****	*-0.060****	*0.169****	*0.399****
MMI	*-0.475***	*-0.280****	*-0.057****	*0.228****	*0.584****	***MMI***	*-1.057*	*-0.779*	*-0.217*	*0.61*	*1.442*
OTHER	*0*	*0*	*0*	*0.000****	*0*	***OTHER***	*0.018****	*0.014****	*0.004****	*-0.011****	*-0.025****
FM	*0.014****	*0.008****	*0.002****	*-0.007****	*-0.017****	***MW***	*-0.038****	*-0.028****	*-0.008****	*0.022****	*0.052****
FW	*0.021****	*0.013****	*0.003****	*-0.010****	*-0.026****	***ME***	*-0.141****	*-0.104****	*-0.029****	*0.081****	*0.192****
FE	*-0.159****	*-0.094****	*-0.019****	*0.076****	*0.128****	*MM*	*-0.003*	*-0.002*	*-0.001*	*0.002*	*0.004*

**** p < .01, ** p < .05, * p < .1*

supposed to be enjoyed as part of their benefit package, such as consultation and provision of drugs [54].

Just like women in other parts of the world, the women in Ghana pay more for this catastrophic expenditure due to the increased need for healthcare services, irrespective of their exemption in premium payment when pregnant. Table 6 shows that aside from privately purchased insurance, all the remaining types of insurance are likely to positively impact the wealth level of females in the poorest and poorer income categories. The male income, on the other hand, is likely to be negatively affected by employer-provided health insurance (EMP), private

insurance (PCP), and those holding district health insurance (NDI) at the poorest and poor wealth levels. However, the relationship becomes positive as income levels grow.

Rwanda

Rwanda has a health insurance policy that is mandatory for all citizens. It includes many schemes that ensure comprehensive coverage for everyone [55]. The Military Medical Insurance (MMI) serves military personnel and their families, while the Rwandaise d'Assurance Maladie (RAMA) is for civil servants and employees of public institutions. With these two types of insurance, the premium is taken from the gross income of personnel and a percentage from the employers. As a result, the impact of the premium payment is not directly felt by the individual. However, due to the nature of these types of insurance, the poorer, poorest, and middle-class households do not enjoy many benefits, which is likely to impact their income negatively, as shown in the results.

On the other hand, community-Based Health Insurance (MCO) aims at the general public, especially the informal sector. This scheme categorizes subscriptions according to income type. Those in the first group, basically the poor, are exempted from premium payments and are supported by the government, while the remaining category pays according to income level [33]MCO requires the populace to pay a premium directly from their income. It covers an extensive range of healthcare services at an affordable price, promoting UHC, but it decreases the income for the poorer and poorer groups, as shown in Tables 5 and 6. This is because the poor have difficulties accessing healthcare services.

Diagnostic test

This section checks for how reliable our model is by looking at the relationship between the predictors. Variance Inflation Factor (VIF) estimates how multicollinearity inflates the regression coefficients. A value of 1 shows no correlation, while between 1 and 5 indicates the existence of moderate multicollinearity. These are acceptable. However, a value above 10 indicates a strong relationship between the dependent variables and can influence the outcome. 1/VIF represents the proportion of variance a predictor explains. From our result in Table 7, all the variables have a VIF of below 5, indicating no to mild multicollinearity. Also, the mean VIFs are below 2, indicating the outcomes of the Robust Ordered Probit can be trusted as the dependent variables do not influence each other.

Discussion

Generally, women need more healthcare than men due to their biological, behavioral, and social factors. Women may need healthcare in terms of reproductive health, from gynecological examination to prenatal and postnatal care, preventive care like regular screening for breast and cervical cancers, and mental health issues due to the changes in hormones leading to depression and anxiety. Also, women tend to live longer than men, meaning they are more likely to require medical care because of age-related health issues [56]. As a result of these factors and more, women access healthcare services more often and incur higher costs than men. The findings of this study show that female wealth is mostly responsive to any form of health insurance irrespective of the wealth level of their male counterpart, though the relationship is not the same throughout the countries as each country has different health policies.

The relationship between wealth and health policies regarding insurance and access is ambiguous and generally dependent on many factors [13]. Wealth inequality, especially in the sub-Saharan region, significantly impacts

Table 7 Variance inflation factor

Burundi			Gabon		
Variable	VIF	1/VIF	Variable	VIF	1/VIF
Urban	1.24	0.8069	Land	1.18	0.8478
Land	1.24	0.8070	Urban	1.18	0.8493
Education	1.09	0.9160	Education	1.04	0.9600
Working status	1.07	0.9321	Cnmags	1.03	0.9710
Mco	1.07	0.9372	Pcp	1.02	0.9810
Marriege	1.04	0.9593	Emp	1.01	0.9856
Emp	1.02	0.9849	Cnss	1.01	0.9857
PCP	1	0.9963	Sex	1.01	0.9942
SEX	1	0.9990	Marriage	1.01	0.9948
RMI	1	0.9996	Mean vif	1.05	
Mean VIF	1.08				
Ghana			**Rwanda**		
Variable	VIF	1/VIF	Variable	VIF	1/VIF
LAND	1.13	0.8852	Rama	2.64	0.3792
URBAN	1.11	0.8975	Pcp	2.42	0.4131
MARRIEGE	1.06	0.9428	Mco	1.23	0.8153
Working status	1.05	0.9513	Education	1.21	0.8277
Education	1.03	0.9710	Land	1.11	0.8982
SEX	1.02	0.9760	Urban	1.11	0.8982
NHIS	1.01	0.9853	Working status	1.06	0.9409
NDI	1.01	0.9915	Marriege	1.06	0.9431
EMP	1.01	0.9934	Mmi	1.05	0.9558
PCP	1	0.9958	Emp	1.01	0.9901
MCO	1	0.9980	Sex	1	0.9991
Mean VIF	1.04		Mean vif	1.35	

health access and coverage [6]. The insurance types in the area are primarily pro-rich because of the challenges faced in accessing health care. The governments in our focus countries have implemented policies that include the poor in the health care benefit. However, the result of our study shows it decreases income levels. The first reason is associated with the lack or limited healthcare infrastructure. Most people in the poorest to middle-income category live in rural areas. The rural areas in these countries are associated with underdevelopment. From the data description provided in Table 2, around 81%, 63%, 50%, and 77% of the sample size selected live in the rural centers of Burundi, Gabon, Ghana, and Rwanda, respectively. Consequently, irrespective of the measures put in place by the government, these groups cannot access health care as needed. This leads to paying out of pocket and incurring additional costs even after subscribing to the health schemes to utilize the few facilities or self-medicate.

Additionally, these countries have a vast number of their workers in the informal sector. The informal sector is characterized as not having any or less formal arrangements for working, like contributions towards pensions, employer-provided health insurance, and the entitlement to sick or annual leave. Most of the workers in this sector are entrepreneurs or self-employed with unlimited liability. The informal sector constitutes about 90% in Ghana,95% in Burundi, 40% in Gabon, and 88% in Rwanda [45–48]. This number leads to many challenges for the health sector through limited health insurance coverage and straining the health system, leading to increased out-of-pocket payment expenditure. This affects people's wealth negatively, although a health policy is ongoing.

Furthermore, the income of those in the lower category is impacted by the indirect taxes imposed by the governments of these countries to finance health. For instance, Gabon placed an additional 10% levy on the mobile phone companies aside from their tax, and Ghana has a levy of 2.5% as part of VAT for the support of healthcare [6, 57]. Rwanda also has a VAT rate of 18%, contributing to national revenue for public expenditure, including health. Though these levies help finance the health sector, it puts an additional burden on those in the lower category. The levy, coupled with out-of-pocket payment due to difficulties in healthcare access, leads to a further decrease in the income level of those in the lower category. Though the health schemes in our focus countries exclude the poor, pregnant women and children (Ghana, Rwanda, and Burundi), other factors like lack of or limited health infrastructure led individuals in this category to incur additional costs, leading to a likely decline in their wealth.

Lastly, lack of information can also be the reason for the result we had in this study. Gabon, Ghana, and Rwanda have more developed health information systems that store records and information on health-enhancing monitoring and evaluation of health programs. Burundi faces a challenge regarding health information, though efforts are being made to help bridge the gap [58]. Many people in all four countries, especially those in the lower wealth category, lack awareness about the benefits of enrolling in health insurance schemes, even when these schemes are mandatory. Additionally, current subscribers often do not fully understand the benefits they are entitled to. Some are also rooted in their cultural belief about some illnesses and cures [6]. This lack of information leads some to avoid subscribing to the scheme, opting instead for self-medication. Unfortunately, this increases the likelihood of catastrophic health expenses when their conditions worsen.

Conclusion

Health is a crucial element of an economy, significantly influencing the performance of several sectors within a nation. Consequently, practically every country globally has seen at least one health strategy or more to enhance their health system. This study set out to find how the health insurance in Burundi, Gabon, Ghana, and Rwanda impacted the wealth level of households in these countries. We used household data from the Demography and Health survey for the current year available for each country. Our results indicate that, besides the community-based health insurance established in Burundi (CNAMGS) and the national health insurance scheme (NHIS) in Ghana, all publicly provided health insurance decreases the income levels of individuals in the lower income bracket. This situation arises from the additional payments made by these groups to obtain healthcare services, which are necessitated by the unavailability of pharmaceuticals at service providers' facilities, as well as a consultation fee intended to offset administrative costs.

Although the governments in these countries have enacted health policies that have improved the healthcare sector, our results indicate that these policies negatively affect the income of many in the lower category due to increased healthcare access costs. To address this, we suggest that all countries enhance education regarding the importance of health and the benefits of health packages upon enrollment. This can be achieved through public initiatives such as community outreach and school instructional programs to encourage enrollment

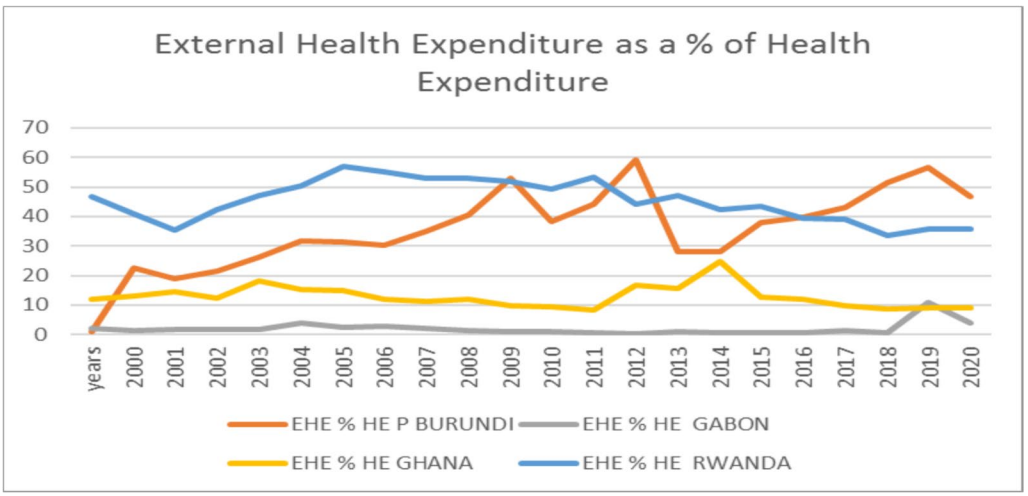

Fig. 4 External Health Expenditure as a percentage of Health Expenditure. Source: authors' compilation with data from WHO

and reduce out-of-pocket expenses. The findings from the study reveal that private health insurance positively affects wealth in the upper-income category. The government could incentivize private health insurance holders or collaborate with the private sector through public–private partnerships. This collaboration would help lower costs by minimizing redundancy and reducing administrative overhead, allowing for reallocating resources toward improvements in infrastructure and other essential facilities. Involving the private sector will ensure a more efficient allocation and utilization of resources.

It is also recommended that the government enhance social amenities, particularly in rural regions. As noted in the study, a significant proportion of the population within the sample resides in rural areas characterized by inadequate health facilities. The government should construct hospitals and provide healthcare personnel in these regions to facilitate a universal health impact on economic status. Furthermore, the study has identified insufficient information contributing to the observed outcomes. The government can promote the engagement of the informal sector, especially in Burundi and Rwanda, through awareness campaigns, the simplification of enrolment processes, the integration of health insurance with other social programs, and the implementation of flexible payment options.

The proposed policies can enhance the health sector in these countries, although the government may encounter challenges. The most significant challenge is financial constraints. Given the economic conditions in these countries, the proportion of government spending on health is insufficient. As presented in Fig. 2, none of the countries has health expenditure per GDP above 12 percent. Indicating the need to finance health care through other means. As shown in Fig. 4, most governments in the region depend on external financing, which results in economic consequences. For instance, heavy external borrowing has increased each country's GDP-to-debt ratio, leading to liquidity crises, debt distress, and weakened fiscal positions.

Furthermore, individuals' cultural beliefs concerning illness and healthcare may significantly impact their willingness to engage in health initiatives.

This study used household data with Robust Ordered Probit Model in the analyses. We acknowledge several potential limitations of using household data and the methodology to examine the relationship between wealth status and health insurance type in Ghana, Burundi, Gabon, and Rwanda. These include issues with the quality of data, such as bias in self-reporting and incomplete responses, the cross-sectional nature of the data, which limits causal inferences, and sampling biases that may affect the generalizability of our findings. Also, measurement errors in creating the index for wealth and classification of the health insurance types and household composition heterogeneity further complicate the analysis. Finally, ROPM used in the study is a probabilistic method that identifies potential influences rather than directly observing income transitions.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13561-025-00629-4.

Supplementary Material 1.

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Authors' contributions
AAM wrote the main manuscript, data curation, and interpretation. MK was responsible for Supervision, software analysis, validation, and reviewing.

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Data availability
All the data used in this study is acquired from the sub-Saharan region section of the Demographic and Health Surveys (DHS) Program, collected by the U.S. Agency for International Development (USAID). It is available to the public domain per request on their website. The datasets used during the current study are not publicly available due to copy right issues but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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