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Effect of Community-Based Health Insurance on The Population Health Status in Rwanda

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Research Article

Keywords:

Posted Date: May 29th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9516384/v1

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Additional Declarations: No competing interests reported.

Abstract

Since 1999, the Rwandan government has actively promoted community-based Health insurance (CBHI) to enhance healthcare access. Despite these efforts, some citizens still experience poor quality services in certain health centers. Research indicated that the growing number of individuals covered by health insurance has improved healthcare accessibility in recent years. This study evaluated the impact of Community-based health insurance on Rwanda's health outcomes from 2015 to 2023, focusing on factors influencing Community-based health insurance, key determinants of population health indicators like infant mortality and maternal health, and the link between Community-based health insurance and overall health status. Utilizing cross-sectional data from the World Development Indicators, the study employed logistic regression analysis to examine the relationship between Community-based health insurance coverage and predictors such as maternal mortality ratio, life expectancy at birth, and out-of-pocket expenditure. The results showed a significant 99.8% correlation, revealing that Community-based health insurance had improved healthcare access, reduced out-of-pocket costs, and enhanced health outcomes, including increased life expectancy and decreased infant mortality. The findings highlighted the crucial role of financial protection in improving maternal and infant health outcomes. The study underscored the complex interplay between health insurance coverage, health outcomes, and socioeconomic factors in Rwanda's healthcare system. It advocated for the continued support and expansion of Community-based health insurance programs to achieve broader health and economic benefits across the country. Additionally, it recommended further research to develop manuals for monitoring and strengthening the Community-based health insurance program, aligning with Rwanda's healthcare initiatives. This study contributed valuable insights into the effectiveness of community-based health insurance in improving health outcomes and the importance of sustaining and expanding such programs for comprehensive healthcare improvements.

1. Introduction

Universal Health Coverage (UHC) is a priority in global health, representing one of the three strategic priorities outlined in the World Health Organization's (WHO) general program of work for 2019–2022 (Bayarsaikhan et al., 2022).

According to the WHO, healthcare insurance has played a crucial role in promoting equitable health development in the region by reducing out-of-pocket health (Bolongaita et al., 2023). Across the African continent, many countries have recognized the importance of improving access to essential healthcare services for their populations. Several initiatives have been undertaken to expand healthcare insurance coverage as a means to achieve this goal (Wang et al., 2023). Rwanda, a country known for its resilience and forward-looking policies, has been at the forefront of this endeavor. The health landscape in Rwanda has witnessed a significant transformation, moving from a system struggling to provide adequate health care to one that aims for universal coverage and equitable access(Shrank et al., 2021).

The government’s commitment to achieving sustainable development goal (SDG3) Good health and well-being- is evident through innovative approaches, notably the establishment of the community-based health insurance (CHBI) scheme, widely known as “Mutual Health Insurance” (Ercia, 2021).This initiative, launched in 1999, aims to ensure that every Rwandan has access to essential healthcare without facing financial

hardship. The CBHI is considered the vehicle for UHC and universal health insurance in Rwanda (Nyandekwe et al., 2020a). Healthcare insurance, through the CBHI scheme, has not only increased access to medical services but has also contributed to improving the overall health outcomes of the population(Mulat et al., 2022). Healthcare insurance plays a crucial role in promoting equitable healthcare development and reducing out-of-pocket expenses for healthcare services across the world (Muremyi et al., 2023). The current study intends to examine the existing literature and show how the community-based health insurance and population health status changed over time in Rwanda. Despite the commendable progress, Rwanda faces several challenges in its mission for improved population health and well-being. One of the central issues is the burden of out-of-pocket health expenses, which historically has deterred individuals, particularly those from low-income backgrounds, from seeking necessary medical care. Before the implementation of the CBHI organization, many Rwandans faced the dilemma of choosing between healthcare and other necessities, a choice that often resulted in complete avoidance of medical services(Adebisi et al., 2022).

CBHI has been pivotal in expanding access to healthcare in Rwanda. Enrollment grew rapidly from 7% of the population in 2003 to over 90% in 2010 (Makaka et al., 2012). This impressive achievement has contributed to the increased utilization of essential health services. For example, between 2005 and 2010, skilled birth attendance rose from 39% to 69% (Anoje et al., 2017).The schemes have also provided financial risk protection, with out-of-pocket health expenditures dropping from 28% of total health expenditures in 2000 to 10.4% in 2017 (WHO, 2020).To address this issue of financial access to healthcare, Rwanda has implemented various health insurance initiatives over the past couple of decades, most notably the community-based health insurance (CBHI) scheme known as “Mutual Health Insurance.” However, gaps in coverage persist. As of 2019, around 25% of the population still lacked effective health insurance (NISR, 2019). This study aims to provide a more holistic assessment of how Rwanda’s health insurance programs particularly the CBHI, have influenced healthcare access and utilization patterns, health outcomes, financial risk protection, and economic indicators like household consumption and income levels(Uwishema, 2023). Analyzing quantitative household survey data stakeholder insights can yield a deeper understanding to help guide toward achieving universal health coverage in Rwanda (Nyandekwe et al., 2020b). That is why the current study is needed to provide updates and remedies for the remaining issues.

2. Materials and Methods

2.1. Study Setting and Study Design

This study was conducted in Rwanda, focusing on the entire population to assess the impact of community-based health insurance (CBHI), known as Mutuelles de Santé, on health outcomes and financial protection. Rwanda's significant progress in implementing CBHI and commitment to improving healthcare access and affordability provided a suitable context for this comprehensive assessment. The research employed a predictive modeling approach to explore the effects of CBHI on healthcare access and health-seeking behavior. The specific research question was: "How has access to healthcare and health-seeking behavior been affected by the implementation of healthcare insurance schemes in Rwanda?" Additionally, the study aimed to investigate whether a larger number of insured individuals correlates with better economic standards and higher utilization of healthcare services.

2.2. Data source

The secondary data source for this study was the World Development Indicators (WDI) database, which provides comprehensive and reliable data on various population and health-related issues. The WDI dataset covers the period from 2015 to 2023 and includes detailed information on household characteristics, maternal and child health, infant mortality, maternal mortality, and other relevant health indicators. This data was chosen for its extensive coverage and consistency, making it a valuable resource for analyzing the impact of community-based health insurance in Rwanda.

2.3. Variables selection

2.3.1. Independent Variable

The primary variable is healthcare Insurance Status that measures participation in Rwanda's community-based health insurance scheme, which aims to provide universal health coverage and make healthcare services affordable and accessible.

2.3.2. Dependent variables

Health outcomes were evaluated using three indicators: infant mortality rate, maternal mortality rate, and life expectancy. The infant mortality rate measured the number of infant deaths per 1,000 live births, serving as an indicator of early childhood health and the effectiveness of healthcare services. The maternal mortality rate is measured by the number of maternal deaths per 100,000 live births, indicating the quality of maternal healthcare and outcomes during pregnancy and childbirth. Life expectancy at birth reflected the average number of years a newborn was expected to live, serving as a comprehensive indicator of overall population health and the effectiveness of the healthcare system. Financial protection was analyzed through two variables: out-of-pocket expenditure and poverty status. Out-of-pocket expenditure measured the amount of money individuals spent on healthcare from their own pockets, indicating the level of financial protection provided by CBHI. Poverty status assessed the economic impact of CBHI on households, examining whether participation in the insurance scheme helped reduce poverty by alleviating the financial burden of healthcare costs; where: p – Access is the probability of having access to healthcare. p – Outcome is the probability of having a positive healthcare outcome; p – Protection is the probability of having financial protection; CBHI is the independent variable representing Community-Based-Health-Insurance; and $\beta_0,\ \beta_1,\ \alpha_0,\ \alpha_1,\ \theta_0,$ and θ_1 are the coefficients

2.4. Statistical analysis

This study is quantitative in nature and will be analyzed quantitatively. Which enables comparison and testing of the relationship among the variables. There are both descriptive and inferential analyses. For a brief explanation, tables and graphs have been used. To outline the socio-economic and demographic traits of participants, descriptive statistics such as frequency distribution, mean, and standard deviation were utilized to summarize the variables. To examine disparities in health insurance and population health status, t-test statistics will be employed. Life expectancy is the dependent variable measured using problems related to access to healthcare insurance (distance to health facility and getting money for treatment). The quantity of healthcare is the dependent variable measured using problems related to accessing healthcare. To

examine how community-based health insurance impacts the health status of the population in Rwanda, the study will employ the following logistic regression model: For the dependent variable “Healthcare access”: Logit (p - Access) = $\beta_0+\beta_1(\mathrm{CBHI})$; For the dependent variable “Healthcare outcome”: Logit (p - Outcome) = $\alpha_0+\alpha_1(\mathrm{CBHI})\backslash$:; and for the dependent variable “Financial protection”: Logit (p - Protection) = $\theta_0+\theta_1(\mathrm{CBHI})$. In these logistic regression models, the coefficients $\beta_0,\ \beta_1,\ \alpha_0,\ \alpha_1,\ \theta_0$, and θ_1 capture the effects of the independent variable on the respective dependent variables (Healthcare access, Healthcare outcome, and financial protection).

3. Results

The result in Table 1 provides an overview of key healthcare and socioeconomic indicators for Rwanda, revealing critical aspects of the country's health system and economic priorities. The mean of current health expenditure per capita is $129.44, with a standard deviation of $24.10, indicating variability in health spending across different regions or demographics. The relatively low expenditure per capita highlights budget constraints that may affect healthcare quality and accessibility. The average out-of-pocket expenditure as a percentage of current health expenditure is 11.32%, with a standard deviation of 0.781%, showing that citizens contribute significantly to healthcare costs directly. This high reliance on out-of-pocket payments can cause financial hardship for families and impact healthcare accessibility and affordability. The maternal mortality ratio averages 298.42 per 100,000 live births, with a standard deviation of 44.01, underscoring variability in health outcomes. Despite efforts to improve maternal health, challenges persist due to limited access to quality health services, insufficient medical facilities in rural areas, and a need for more trained healthcare professionals. While Rwanda has made significant progress in healthcare through community-based insurance and infrastructure investment, these statistics reveal ongoing challenges in financing and delivering equitable healthcare services. Reducing out-of-pocket expenses and ensuring financial protection mechanisms are essential for improving overall health and well-being, particularly for vulnerable groups like mothers and infants.

Table 1
Summary statistics of key variables

Variable	Mean	Std. dev.	Min	Max
Out-of-pocket expenditure	11.323	0.781	10.109	12.307
Maternal mortality ratio	298.416	44.013	252	393
Life expectancy at birth	65.362	1.358	62.804	66.953
Current health expenditure per capita	129.442	24.082	101.948	181.791
Source: Researcher computation (2025)				

The regression analysis of Rwanda's healthcare data demonstrates that the model, with an R-squared of 0.942, accounts for 94.2% of the variance in health expenditure per capita. The analysis reveals that each unit increase in the maternal mortality ratio is associated with a $0.683 increase in health expenditure, highlighting the need for more investment in maternal health services. Additionally, each extra year of life expectancy correlates with a $36.26 increase in health expenditure, reflecting the higher costs of managing

chronic diseases and an aging population. Conversely, each percentage increase in out-of-pocket expenditure results in a $14.92 decrease in health expenditure per capita, suggesting that higher direct costs to individuals reduce healthcare utilization and overall spending. These findings emphasize the role of Rwanda's community-based health insurance (CBHI) in enhancing healthcare affordability and accessibility. By pooling resources and lowering out-of-pocket costs, CBHI schemes encourage greater use of healthcare services, leading to improved health outcomes and a more equitable distribution of care.

Table 2
Multiple linear regression model

Current_health_expenditure	**Coefficient**	**Std. err.**	**t-value**	**P-value**	**[95% conf.**	**interval**
Maternal_mortality_ratio	0.683	0.351	1.94	0.088	-0.127	1.493
Life_expectancy_at_birth	36.258	11.367	3.19	0.013	10.046	62.469
Out_of_pocket_expenditure	-14.919	2.716	-5.49	0.001	-21.182	-8.656
_cons	-2275.31	855.492	-2.66	0.029	-4248.082	-302.544
Number of obs	12		Source	SS	df	MS
F(3, 8)	43.53		Model	6011.25	3	2003.75
Prob > F	0.000		Residual	368.2825	8	46.03531
R-squared	0.942		Total	6379.532	11	579.9575
Source: Researcher computation (2025)						

Table 2 Community-Based Health Insurance (CBHI) schemes play a crucial role in offering financial protection and improving access to healthcare services, especially in low-income settings. As shown in Table 2 the finding of this study supports this relationship. The data from Rwanda between 2010 and 2021 illustrates significant declines in out-of-pocket expenditure, infant mortality rates, and maternal mortality ratios, reflecting the positive impact of CBHI. The reduction in out-of-pocket expenditure from 11.09% in 2010 to 10.10% in 2021 suggests a successful implementation of CBHI, alleviating the financial burdens on individuals and families when accessing health care. This financial relief likely facilitates better healthcare access, contributing to the decline in infant mortality rates from 42.2 per 1,000 live births in 2010 to 31.1 in 2021. Improved access to prenatal and postnatal care, vaccinations, and treatments for common childhood illnesses through CBHI may be driving these positive health outcomes. Similarly, the maternal mortality ratio decreased from 393 per 100,000 live births in 2010 to 254 in 2021, indicating enhanced maternal health services, such as prenatal care, skilled birth attendance, and emergency obstetric care facilitated by CBHI. The correlation analysis further underscores the significance of financial protection through CBHI, with a moderate positive correlation (0.522). Between reduced out-of-pocket expenditure and the decline in infant mortality, and a stronger correlation (0,680) with the decline in maternal mortality. These correlations suggest that CBHI's financial protection mechanisms have a substantial impact on health outcomes, particularly in maternal health. Overall, the data supports the effectiveness of CBHI in reducing financial barriers, improving healthcare access, and enhancing health outcomes for mothers and infants. This

underscores the importance of supporting and expanding CBHI programs to achieve broader health and economic benefits for communities, fostering more sustainable and equitable healthcare systems.

There is a strong correlation between some variables, such as life expectancy at birth and maternal mortality ratio (-0.9906), indicating potential multicollinearity. The correlation between out-of-pocket expenditure and infant mortality rate is -0.1063, this is a low correlation between reduced out-of-pocket expenditure and infant mortality suggests that CBHI schemes are improving access to essential healthcare services for infants, such as vaccinations, nutrition, and medical treatments, leading to improvement infant survival rates. CBHI schemes may enhance access to prenatal care, skilled birth attendants, and postnatal services, which are critical for reducing maternal deaths. The data shows encouraging trends in reducing infant and maternal mortality rates, accompanied by a decline in out-of-pocket healthcare expenses. The stronger association between out-of-pocket spending and maternal mortality underscores the significant impact of financial protection provided by CBHI schemes on maternal health outcomes.

Table 3
Correlation matrix provides insight into relationships between variables

Current health expenditure per capita	**Current health expenditure per capita**	**Life expectancy at birth**	**Maternal mortality ratio**	**Out-of-pocket expenditure**	**Infant mortality rate**
	1	**0.797**	**-0.7484**	**-0.509**	**-0.7175**
Life expectancy at birth	0.797	1	-0.9906	0.0249	-0.982
Maternal mortality ratio	-0.7484	-0.9906	1	-0.0609	0.9971
Out-of-pocket expenditure	-0.509	0.0249	-0.0609	1	-0.1063
Infant mortality rate	-0.7175	-0.982	0.9971	-0.1063	1
Source: Researcher computation (2025)					

These findings in Table 3 underscore the effectiveness of CBHI in improving access to healthcare services, mitigating financial barriers, and enhancing health outcomes for mothers and infants. They highlight the importance of ongoing support and expansion of CBHI programs to achieve broader health and economic benefits for communities. However, the persistence of high out-of-pocket costs remains a challenge, emphasizing the need for continued efforts to strengthen financial safeguards within the healthcare system. Rwanda's experience aligns with global evidence, illustrating the positive impact of CBHI schemes in low-income countries. This study adds to existing literature by specifically examining the evolution of community-based health insurance and its effects on population health in Rwanda, facilitated by effective governance and stakeholder involvement.

4. Discussions

The findings of this study are consistent with global research indicating that Community-based health insurance (CBHI) schemes have a positive impact on both health outcomes and financial security(Ekman, 2004). Studies conducted in countries like Ghana and India have demonstrated that CBHI reduces out-of-pocket expenses and increases the use of healthcare services(Muremyi et al., 2020), resulting in improved health outcomes. Research in Ghana has shown significant reductions in out-of-pocket costs and improved healthcare access for disadvantaged populations through CBHI. Similarly, studies in India have highlighted that CBHI schemes reduce catastrophic health expenditures and improve access to maternal and child health(A Review M. KENT RANSON, 2003). The observed relationship between life expectancy and health expenditure in Rwanda is consistent with findings from other countries, where increased life expectancy is associated with higher healthcare costs due to the need for more extensive healthcare services for aging populations. Studies have also documented the negative effect of high out-of-pocket expenditures on healthcare utilization and health outcomes, highlighting the negative effects of financial barriers on access to essential health services. The reduction in out-of-pocket expenditures, coupled with improvements in life expectancy and reductions in infant and maternal mortality rates, highlight the critical role of CBHI in promoting population health and socio-economic development. These findings contribute to the existing literature on health insurance and population health, providing valuable insight for policymakers, healthcare providers, and researchers

5. Conclusions and recommendations

5.1 Conclusions

The finding underscores the importance of life expectancy and out-of-pocket costs in determining health expenditure per capita. The positive relationship between life expectancy and health expenditure indicates that investments in healthcare that increase longevity also determine spending. Conversely, higher out-of-pocket costs discourage healthcare utilization, leading to lower health expenditure. The analysis highlights the effectiveness of CBHI schemes in reducing financial barriers and improving health outcomes for both mothers and infants.

By pooling resources and sharing health costs across the community, CBHI schemes help mitigate the financial burden on individuals, making healthcare more affordable and accessible, particularly for vulnerable populations. Rwanda’s efforts in improving healthcare outcomes through CBHI schemes and investment in healthcare infrastructure have led to significant improvements in life expectancy and reductions in infant and maternal mortality rates. However, the variability in health spending and outcomes across different regions or demographics within Rwanda suggests ongoing challenges in financing and delivering equitable health services. The findings from this study emphasize the importance of continuous support for CBHI programs to achieve broader health and economic benefits for communities.

5.2 Recommendations

The healthcare system in Rwanda is undergoing significant improvements, with the government and citizens benefiting from the implementation of data-driven health policies. The strategic distribution of more health posts and the empowerment of community health workers will enhance access to healthcare, leading to

better health outcomes. This will reduce morbidity and mortality rates, especially in remote and underserved areas. The quality of care provided through community health insurance will increase satisfaction and trust among insured citizens, leading to greater utilization of health services. Data-driven approaches will optimize resource allocation, ensuring that healthcare funds are directed to areas with the most significant need. Economically, these policies can reduce healthcare costs by focusing on prevention, early detection, and efficient treatment. The quality of care will improve, leading to better management of chronic diseases, lower hospital readmissions, and overall better health outcomes. Addressing disparities in healthcare access is crucial for promoting social equity, and ensuring that all citizens have access to high-quality healthcare services.

Declarations

6. Funding Declaration

The authors declare that there is no funding received for this study.

7. Human Ethics and Consent to Participate declaration: not applicable

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