

ORIGINAL RESEARCH ARTICLE

Long-term financial sustainability of Rwanda's universal health coverage model: Challenges and solutions (2011 – 2021) and Vision 2050

Médard Nyandekwe^{1*} and Jean Baptiste Kakoma^{1,2}

¹Department of Health Policy, Economics, and Management, School of Public Health, College of Medicine and Health Sciences, University of Rwanda, Kigali, Rwanda

²Department of Health Policy and Management, Schools of Medicine and Public Health, University of Lubumbashi, Haut-Katanga, Democratic Republic of Congo

Abstract

Since 2000, Rwanda has prioritized universal health coverage (UHC) and universal health insurance, achieving significant health gains. Its UHC model – centered on Community-Based Health Insurance (CBHI) and supported by public and faith-based providers – now faces financial sustainability challenges. Under Vision 2050, Rwanda aims to meet upper-middle-income country health-care standards by 2035 and high-income country (HIC) standards by 2050. This study assesses the financial sustainability of Rwanda's UHC model from 2011 to 2021, with projections through 2041 under four scenarios: Scenario I (status quo, fee-for-service): Projects growing deficits reaching Rwandan Franc (RWF) 89.71 billion and a cumulative RWF 913.03 billion by 2040/2041. Scenario II (Fully Active Strategic Purchasing): Project net income of RWF 81.61 billion and cumulative reserves of RWF 516.94 billion by 2040/2041. This approach supports near-free health care, aligns with SDG 3.8 and WHO's UHC Cube, and promotes reforms such as tariff adjustments, medical tourism, dual practice, and a comfortable package integrated with Ejo Heza Pension benefits. Strategic purchasing could eliminate 56.89% of undue costs, enabling 70% prepayment for facility plans: 45% for health service delivery, 10% for prior co-payments, and 15% for staff incentives. The remaining 30% (post-verification) would fund additional essential medicines, inpatient nutrition, financial sustainability, and resilience initiatives. Scenario III (1% UHC-HRV 2050 tax): Forecasts RWF 849.41 billion in net income and RWF 6,985.66 billion in reserves. Scenario IV (equity and modernization): Aims to expand clinical capacity 12-fold by 2041. Leveraging a strengthened CBHI system and a modest 1% levy for UHC and HRV 2050, Rwanda could promote clinical capacity strengthening up to 12-fold by 2041, retention and repatriation of specialized professionals, health infrastructure modernization, and meet HIC health-care standards by 2036 – 2040, ahead of 2050 initial milestone, saving up to USD 922.86 per capita in health expenditure. Rwanda's robust UHC commitment provides a replicable model for sustainable health reform across Africa.

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*Corresponding author:

Médard Nyandekwe
(nyandekwem@gmail.com)

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1. Introduction

1.1. Background

The background in the current study extends that of our previous study (Nyandekwe *et al.*, 2020). Rwanda, a small, landlocked country in east-central Africa, suffered the 1994 genocide against the Tutsi ethnic group in 1994, during which 1 million people were killed, and the health-care system was destroyed. At that time, all socioeconomic and development indicators were among the lowest in sub-Saharan Africa and low-income countries (Sekabaraga, 2005).

Since 2000, Rwanda has made universal health coverage (UHC) and universal health insurance a national priority, leading to significant progress in the health-care system, epidemiological profile, economy, and social health sector. These improvements are demonstrated by evidence-based policies, laws, decrees, health gains, and outcomes (Government of Rwanda, 2017; Kabagwira *et al.*, 2000; National Institute of Statistics of Rwanda and Rwanda Ministry of Health, 2016; 2019; Nyandekwe *et al.*, 2008; Rwanda Ministry of Health, 2009; 2018).

In 2000, Rwanda developed Vision 2020, a long-term strategy aiming to provide universal access to quality health care by 2020 (Government of Rwanda, 2012). The essence of Rwanda's UHC lies within this strategy. In 1999/2000, Rwanda launched “*Mutuelles de santé*” (now the Community-Based Health Insurance [CBHI]) with support from the Partnerships for Health Reform project under the United States Agency for International Development (Schneider & Diop, 2000). This initiative aimed to improve access to health services and reduce inequalities in the health-care system. The 2003 Constitution of Rwanda, revised in 2015, outlines in Article 45 (p.16) the state's duty to promote public health: “The State has the duty to mobilize the population for activities aimed at good health, and every Rwandan must take part in them.”

The prepayment scheme transitioned from voluntary mutual health to the current mandatory CBHI, which covers the informal sector, especially the rural uninsured population, as per Law N° 62/2007 (République du Rwanda, 2007). The CBHI evolved through policies, laws, and a strong legal framework aimed at achieving UHC and ensuring the financial viability of the scheme.

In 2009/2010, the government of Rwanda (GOR) introduced the 2010 CBHI Policy, which was implemented on July 01, 2011. The policy addressed key challenges, including (i) institutional capacity-building, (ii) financial sustainability, (iii) equitable access to health care, and (iv) protection against financial risks.

By 2011/2012, over a decade after CBHI's introduction, reports showed Rwanda was close to achieving UHC (Carrin *et al.*, 2008; Evans & Etienne, 2010; Higashi *et al.*, 2011; Lagomarsino *et al.*, 2012; OECD, 2009). According to Nyandekwe *et al.* (2014), the target of effective UHC in Rwanda became a reality by 2012.

Twenty-four years after the CBHI scheme began in 1999/2000, Rwanda's UHC performance remains impressive, aligning with six of Stuckler *et al.* (2010) interim metrics as detailed in previous studies (Nyandekwe *et al.*, 2020). A seventh metric, CBHI self-financing capacity and/or cost-recovery ratio (CRR), was added, indicating its financial viability (Nyandekwe *et al.*, 2014).

According to Nyandekwe *et al.* (2014; 2018; 2020), the evidence-based updated UHC performance is impressive, except for the CRR, as detailed below:

- (i) CBHI coverage: Coverage reached 90.7% in 2022/2023, up from 83.2% in 2017/2018, with total coverage (including other insurers) at 97.1% in 2022/2023.
- (ii) Other health insurance: These providers covered 6.4% of the population, maintaining a total coverage of 97.1% since 2010/2011.

Health facility network and geographical access: The CBHI system.

- (iii) Supported by community health workers, ensures access at all administrative levels from cells, sectors, districts, provinces, and national/central levels
- (iv) Comprehensive UHC: Rwanda offers UHC across all health levels, from village care to tertiary hospitals
- (v) Utilization rate: Health visits increased from 0.31 visits per person in 2003 to 1.46 visits in 2020 – 2021 in the general population, whereas CBHI beneficiaries averaged 2.1 visits annually in 2020/2021, as triangulated and adjusted by the current study
- (vi) Skilled birth attendants as proxy health services utilization (%) metric: The percentage of deliveries with skilled attendants rose from 39% in 2000 to 94.8% in 2019/2020
- (vii) Patient roaming system: CBHI members can access services at public and faith-based facilities nationwide
- (viii) Governance and integration: Good governance and the integration of public and faith-based health facilities have contributed to these successes
- (ix) Out-of-pocket spending: Spending was 4.5% in 2020/2021, well below the 10% threshold
- (x) CRR: The metric declined from 138.46% (calculated as $27.97 \times 100 / 20.20$) in 2011 – 2012 to 67.92% (calculated as $22.95 \times 100 / 39.68$) in 2015/2016. It then

increased to 74.40% (calculated as $57.16 \times 100 / 76.83$) in 2020/2021 after the GOR's financial top-up, which was valued at Rwandan Franc (RWF) 22.63 billion. Had the complement granted by GOR not been provided, the CRR would have worsened to 44.94% (calculated as $34.53 \times 100 / 76.83$).

The literature review of key developments since 2000 also highlighted significant advancements in health impacts, as illustrated in the following paragraphs.

Rwanda has made significant progress in improving key health indicators since 2000. Under-five stunting decreased from 47.4% in 2000 to 33.0% in the most recent Rwanda Demographic and Health Survey in 2019/20. Similarly, infant mortality rates dropped dramatically, from 107 deaths/1,000 live births in 2000 to 33/1,000 in 2019/2020. Under-five mortality also saw a marked decline, falling from 196 deaths/1,000 live births in 2000 to 45/1,000 in 2019/2020. Maternal mortality has improved significantly as well, decreasing from 1,071 deaths/100,000 live births in 2000 to 203/100,000 in 2019/2020. These statistics reflect the country's continued efforts and progress in improving public health over the past two decades.

Regarding the United Nation's Sustainable Development Goal (SDG) Target 3.8.2 (UHC index), which measures the proportion of the population spending more than 10% of household consumption or income on out-of-pocket payments as a proportion of total income or expenditure, the indicator has remained low and fluctuating between 24.46% in 2000 and 26% in 2015 for the total population (Muremyi *et al.*, 2020); 10.8% in 2011/2012 within CBHI members (Nyandekwe *et al.*, 2014); 4.9% in 2018 and 4.5% in 2020 – 2021 according to the Fourth Health Sector Strategic Plan (HSSP IV) 2018 – 2024 and its midterm review, respectively; compared to 10.1% down from 11.67% in 2019 according to Index Mundi Country Facts, reflecting improved financial protection mechanisms in the health sector. Rwanda's projected OOP health expenditure in 2024/2025 would be approximately 9.7% of current health expenditure, assuming a continued annual decline of 1.01%.

Regarding the same indicator, after an individual premium contribution averaging RWF 3,000 (equivalent to USD 2.56, based on the exchange rate of USD 1 = RWF 1,170.6 as of July 21, 2023), prepaid annually, a symbolic flat fee of RWF 200 (USD 0.17) is co-paid at the health centers and/or primary health-care level by non-poor patients as a deductible. At the hospital level, 90% of billable health-care services are paid collectively through the CBHI central risk pooling, with 10% co-paid by non-poor patients. This demonstrates strong protection for CBHI beneficiaries against financial hardship at the point of use.

According to Nyandekwe *et al.* (2020), despite the third-party payment mechanism at the hospital level through CBHI, the 10% co-payment is unaffordable for the majority of Rwandans. The Integrated Household Living Conditions Survey 5 reports that 44.1% of Rwandans faced at least one health shock in 2018, relying on savings or borrowing to access health-care services (National Institute of Statistics of Rwanda, 2018).

As an ultimate positive impact of the well-coordinated CBHI and public/agree (P/A) health-care system (also known as the faith-based health-care system) illustrating health status, life expectancy at birth has increased from 47.22 years in 2000 to 62.33 years in 2010, 69.06 years in 2020, 69.38 years in 2021, 69.69 years in 2022, 70.00 years in 2023, 70.27 years in 2024, and is anticipated to reach 70.54 years in 2025. (Macrotrends, n.d.).

The efficient management of resources, coordinated aid efforts, mutual accountability, and transparency among stakeholders have all contributed to the performance of Rwanda's remarkable health-care system.

However, both the CBHI and health-care systems face persistent financial uncertainty. According to the CBHI Annual Reports from 2011/2012 to 2018/2019, as well as the revised budgets for 2019/2020 and 2020/2021, Rwanda's CBHI – the foundation of the country's UHC and universal health insurance programs – has consistently faced financial deficits. In 2020/2021, the GOR allocated RWF 22.63 billion to CBHI, with annual increments, through the prime minister's Order No.034/01 of January 13, 2020, to supplement CBHI's finances. Despite this financial support, the deficit has worsened nominally compared to the previous year, with no significant changes in CBHI or health-care utilization (Tables S1–S4).

On the supply side, i.e., P/A health-care system, literature reviews reveal health-sector budget and funding constraints. The health sector saw a budget reduction in the last 2 fiscal years (FYs) after an increase in 2021/2022 due to COVID-19. Indeed, according to the United Nations Children's Fund (2023), Rwanda's health sector budget allocations showed notable fluctuations over recent years, with RWF 245.41 billion allocated in 2019/2020, increasing to RWF 282.3 billion in 2020/2021 and peaking at RWF 432.2 billion in 2021/2022, before declining to RWF 367.1 billion in 2022/2023 and RWF 363.7 billion in 2023/2024.

The health sector represented 8.1%, 8.1%, 9.9%, 7.8%, and 7.2% of the national budget in these years, respectively. As a percentage of gross domestic product (GDP), the allocations were 2.5%, 2.9%, 4.2%, 2.1%, and 2.4%, respectively.

Despite global fluctuations, Rwanda has sustained and improved its health-care system, surpassing countries

with similar income levels and those in the middle- and upper-middle-income groups. In the post-COVID-19 era, amid global inflation, Rwanda has continued to prioritize health care, contrasting with many countries that have reduced health care spending. According to Sabiiti (2024), Rwanda has made significant investments in health care since 2023. Key initiatives include the introduction of BioNTech's mRNA vaccine manufacturing facility, the Research Institute Against Digestive Cancer, and the 4 × 4 Reform, aiming to increase the health care workforce from 1.15 to 4.45 workers per 1,000 people within 4 years. Additional projects include the USD 12 million Regional Pharmaceutical Project and the expansion of King Faisal Specialty Hospital from 167 to 600 beds. These investments highlight Rwanda's commitment to improving health-care access and infrastructure, positioning it as one of the leading countries in health-care development in Africa.

Inspired by the success of Vision 2020, the GOR launched health-related Vision 2050 (HRV 2050) in 2020. This long-term development plan outlines the nation's goal to become an upper-middle-income country (UMIC) by 2035 and a high-income country (HIC) by 2050. In terms of health care, HRV 2050 aspires to elevate Rwanda's health-care system to the standards of current UMIC systems by 2035 and to HIC standards by 2050, offering universal access to specialty and super-specialty care, respectively. However, achieving these goals appears unlikely based on the initial analysis.

According to a meta-analysis, Rwanda will need an additional 22.65 years from 2024/2025 to reach UMIC health-care standards instead of the initial target of 11 years. Similarly, the timeline for meeting HIC standards extends to 49.14 years instead of the original 26-year goal (see costing framework section) from 2024/2025. To bridge the gap, Rwanda would need to invest significantly more funds. For example, to meet the UMIC standard, an additional USD 149.83 per capita is required, and to meet the HIC standard, an additional USD 569.83 per capita is needed. This gap is beyond Rwanda's current financial reach.

The *ex ante* analysis suggests that Rwanda can close this gap by emulating Thailand's health-care system under normal conditions, applying the international macroeconomic health expenditure per capita metric. Another viable approach is to build on the existing CBHI system, which has already produced remarkable results in achieving Vision 2020. Researchers are confident in this approach based on supporting factors, such as the GOR's prioritization of health. Indeed, according to the 2021 HSSP IV Midterm Review, the factors enabling Rwanda's health sector success include strong national leadership

prioritizing health in national development, alignment and harmonization of interventions by key stakeholders (both national and international), and intersectoral collaboration.

Other contributing factors include the wide coverage of priority health programs, infrastructure expansions, and improved geographical access to health care. Public and community awareness, which is fundamental to the primary health-care system, also plays a crucial role. In addition, the information and communication technology, the strong network of public/agree (faith-based) health infrastructure across the country, along with robust financial access and high CBHI coverage, are key drivers for success. Other hidden factors contributing to Rwanda's UHC success are presented in the discussion section.

1.2. Aim of the study

This study aims to address the persistent financial sustainability challenges of Rwanda's UHC model (CBHI and health-care system) by identifying additional funding primarily from internal resources while contributing to the achievement of Rwanda's UHC goal and the effective implementation of HRV 2050.

1.3. Study significance

The significance of this study includes:

- (i) Achieving financial sustainability for Rwanda's UHC model (CBHI and the health-care system) by 2030/2031
- (ii) Ensuring full compliance with the WHO's UHC CUBE and SDG Target 3.8 (UHC Index) by 2030/2031
- (iii) Modernizing Rwanda's UHC model from 2030/2031
- (iv) Achieving the effective implementation of HRV 2050 by 2040/2041, ahead of the initial 2050 target.

1.4. Study statements

The statements of this study include:

- (i) Rwanda's UHC model (CBHI and P/A health-care facilities) can achieve financial sustainability without additional CBHI financing through reforms and the adoption of cost-control measures
- (ii) Effective implementation of HRV 2050 requires substantial additional funding for the UHC model through CBHI as a third-party payer
- (iii) Based on their expertise in Rwanda's health-care system and global practices, the researchers believe HRV 2050 is achievable, provided that funding is scaled up to 4 times the adjusted 2024/2025 CBHI spending capacity (RWF 72.51 billion) for UMICs and 8 times for HICs. Two higher funding targets, 12 times for self-reliance and 16 times for

sovereignty, are proposed to show that the HRV 2050 goals are attainable rather than aspirational.

1.5. Objectives

1.5.1. General objective

The objectives of this study are to address the persistent financial deficit of Rwanda's UHC model and to modernize it by promoting resilience and ensuring long-term institutional and financial sustainability while also contributing to the effective implementation of HRV 2050.

1.5.2. Specific objectives

The specific objectives of this study include:

- (i) To assess the financial sustainability of CBHI from 2010/2011 to 2020/2021 and derive the lessons learned
- (ii) To identify gaps and deficiencies during UHC implementation and propose solutions
- (iii) To evaluate the necessary reforms and alternative financing mechanisms required to modernize Rwanda's UHC model, ensuring its long-term financial sustainability and sovereignty
- (iv) To design a long-term financial sustainability plan for HRV 2050 (2021/2022 – 2040/2041), based on the lessons learned from the CBHI system and the completion of HRV 2020
- (v) To highlight the study's contribution to economic gains, social health benefits, and overall impacts.

2. Materials and methods

The methods used in this study were built upon those from the previous study (Nyandekwe *et al.*, 2020), with the current focus primarily on quantitative aspects.

2.1. Study setting

2.1.1. Study area

This study was conducted across Rwanda, including Kigali City, and all four provinces: Southern, Northern, Eastern, and Western Provinces. Initially, the research focused on 481 CBHI structures, consisting of 450 mutual sections in rural areas, 30 district “*Mutuelles*”/CBHI at the intermediate level, and the national risk pooling system in 2014. Upon completion of the study, the number of CBHI structures has increased to 558, with 527 mutual sections, 30 districts “*Mutuelles*,” and the national risk pooling system, which is managed by the Rwanda Social Security Board (RSSB) headquarters.

In the near future, the implementation of the HRV 2050 plan will enhance mutual accountability and transparency between the two interconnected systems. Indeed, the

restructuring of CBHI and the health-care system into a unified Community and Health-care Financing Plan (CHFP) – harmonizing risk pooling between the demand side (CBHI) and the supply side (health-care providers) – necessitates their joint oversight.

2.1.2. Study time frame

The survey for primary data collection was conducted from June to July 2014, focusing on FYs 2011/2012 and 2012/2013. From 2013/2014 to 2023/2024, longitudinal tracking and secondary data collection were carried out.

2.1.3. Study design

The study design was mainly quantitative, cross-sectional (June – July 2014), analytical, documentary, comparative, longitudinal (2011/2012 – 2020/2021), prospective, and modeling (from 2021/2022 to 2040/2041).

2.2. Sampling framework

A stratified simple random sampling technique was applied using the 2014 database from the “*Cellule Technique d'Appui aux Mutuelles de Santé/CTAMS*.” The national pooling risk (100%) was automatically selected at the central/national level. Since there is no CBHI structure at the provincial level, a first simple random sampling was conducted at the intermediate district level.

2.2.1. Sample size and selection criteria

The inclusion and exclusion criteria for enrolment in the survey required that the CBHI schemes have coverage and operational status for at least 2 years. A total of 30 CBHI/*Mutuelles* districts were grouped into five sets, with six districts in each set, numbered sequentially from one to 30. Fifteen districts (50%) were selected for inclusion in the survey by randomly choosing three districts from each set, corresponding to the first, third, and sixth positions within each stratum.

A second simple random sampling was conducted using the 2011/2012 CBHI coverage status to select 60 CBHI sections (13.33%) from a total of 450 CBHI sections located in rural or peripheral areas. This selection corresponds to four CBHI sections per district. To choose the four CBHI sections from each district, the first, last, and two sections located at the median position of all listed CBHI sections (based on the 2011/2012 CBHI coverage status) were selected. This process resulted in a total of 60 CBHI sections across 15 districts, all of which were initially eligible for enrolment in the survey. After data cleaning, one CBHI district and nine CBHI sections were excluded due to incomplete questionnaires for one or both FYs 2011/2012 and 2012/2013.

2.2.2. Geographical distribution

The geographical distribution of the CBHI entities retained in the study was as follows: one unique risk pooling entity at the national level and 14 (93.33%) of the 15 selected CBHI districts. The distribution of these districts was as follows: 1 (6.67%) in Kigali City, 3 (20.00%) in the Eastern Province, 2 (13.33%) in the Northern Province, 6 (40.00%) in the Southern Province, and 2 (13.33%) in the Western Province. Out of the 60 selected CBHI sections, 51 (85.00%) were retained in the study, distributed as follows: 5 (8.33%) in Kigali City, 12 (20.00%) in the Eastern Province, 11 (18.33%) in the Northern Province, 11 (18.33%) in the Southern Province, and 12 (20.00%) in the Western Province.

2.3. Data collection

The online Lime Survey software (<https://www.limesurvey.org/>) was used to develop the questionnaire template and for online self-administration. This followed a 1-day training focused on the survey's objectives, as well as the explanation of both general and detailed information. The training also covered how to fill out, save, and reopen the questionnaire in case of a postponed exercise and submit the completed questionnaire once it was correctly filled out.

2.4. Data analysis

The data analysis in this study includes:

- (i) The net income, i.e., total income minus total expenditure (surplus or gap), was the core metric utilized to analyze, assess, and track progress and performance on CBHI's financial sustainability
- (ii) Financial thresholds defined by the researchers for respective UMIC and HIC health-care standards were used to quantitatively and financially monitor and track the trend toward their attainment.

2.5. Techniques

2.5.1. Management techniques applied

The research applied modern and traditional management techniques, such as management by objective strategy, streamlining/rationalization, optimization, prioritization, sustainable budget equilibrium (more than 5 successive years), allocative efficiency, effective usage, transparency, accountability, and the learning-by-doing approach (Reese, 2011).

2.5.2. Conceptual framework for ensuring long-term financial sustainability in Rwanda's UHC and HRV 2050

Five approaches were leveraged to achieve long-term institutional and financial sustainability for Rwanda's UHC and HRV 2050. These strategies include:

- (i) Applying a combination of traditional and modern management techniques
- (ii) Complementing these methods with Rwanda's UHC radical reforms, which focus on transitioning from a fee-for-service (FFS) model to a "fully active-strategic purchasing (FASP) mechanism." This strategy, renamed "inputs-based financing," is designed to ensure the long-term financial sustainability of Rwanda's UHC within existing or similar circumstances and contributory financing mechanisms
- (iii) Transforming the political vision into a macroeconomic health expenditure per capita, aligning it with the required clinical capacity, and translating it into actionable health interventions in line with HRV 2050
- (iv) Revaluing national social capital by reintroducing solidarity through the compulsory "minimum 1% specific tax for UHC and HRV 2050," which acts as a home-grown national read health and social protection risk-equalizer tool? This strategy, renamed "target-based financing," integrates Rwanda's UHC and HRV 2050 contributory financing mechanisms, benefiting from additional financial resources derived from the "minimum 1% specific tax for UHC and HRV 2050." These complementary resources are intended to accelerate the implementation and achievement of HRV 2050
- (v) Strengthening CBHI spending capacity per capita, prioritizing internal resources over the international macroeconomic health expenditure per capita option to effectively implement and accelerate the achievement of HRV 2050 in a sustainable manner.

The study consolidated these five approaches into two main dual-track strategies, presented as follows:

Strategy A: Cost-Neutral and Efficiency-Oriented Reforms for Innovation and Sustainability (Input-Based Approach)

This strategy prioritizes enhancing operational efficiency and system governance without necessitating additional financial resources. It involves the adoption of Fully Active Strategic Purchasing (FASP), which replaces the conventional fee-for-service model with performance-based payments based on Diagnosis-Related Groups (DRG) pricing, thereby ensuring alignment between service reimbursements and actual service delivery outputs. Additionally, it eliminates co-payments for all members of the Community-Based Health Insurance (CBHI) scheme to enhance access to and utilization of health services, reduce financial barriers, and promote resilience initiatives.

Through this approach, Rwanda promotes health equity by subsidizing healthcare costs for members of the Community-Based Health Insurance (CBHI) scheme, affiliates of other insurance programs, and the general population. Consequently, public and faith-based health facilities operate as providers of nearly free healthcare services. The CBHI is managed efficiently and is positioned to absorb previous co-payment obligations through a third-party payer mechanism.

To shield CBHI members from catastrophic health expenditures, the annual individual premium of RwF 3,000 (equivalent to USD 2.56 as of July 21, 2023) will be maintained at its current level through to 2050.

Strategy B: Cost- and HRV 2050-Conscious, Modestly Financed Reforms for Innovation and Long-Term Sustainability (Target-Based Approach)

This strategy introduces a minimum 1% specific tax levy to support the effective implementation of Universal Health Coverage (UHC) and the Health Resilience Vision (HRV) 2050. The funding will support the modernization of the healthcare system, ensure universal access to specialized care, upgrade infrastructure and equipment, and strengthen clinical capacity. It also promotes career development, the retention and repatriation of specialized professionals, broader health resilience measures, vertical health equity, and the targeted inclusion of vulnerable groups. Finally, Strategy B emphasizes addressing any emerging priority programs, objectives, or unmet needs within the health sector through to the year 2050.

The implementation of these two complementary dual-track strategies is expected to facilitate the achievement of the study's three initial objectives ahead of schedule and with outcomes exceeding expectations.

2.5.3. Simulated scenarios

The simulated scenarios in this study include:

- (i) The first scenario is based on the current FFS provider payment mechanism (PPM)
- (ii) The second scenario is based on the FASP PPM
- (iii) The third scenario simulates HRV 2050 financial preparedness by mobilizing funds throughout the HRV 2050 era before allocating them to P/A health-care facilities
- (iv) The fourth scenario simulates the gradual strengthening of clinical capacity through an upward tariff-setting system in line with HRV 2050 requirements.

2.6. Equations and formulas

This study applied the Mongolia model, which is accepted in the scientific literature on health costing analyses (Asian

Development Bank, 2002), based on the CBHI coverage criteria. This model is helpful when the costing and/or financing analysis requires the application of a weighted mean based on coverage criteria to infer the weighted average from the study group to the national (entire) target group, specifically the CBHI structure per CBHI structure in this case.

2.6.1. Weighted mean

This study used the following equation to derive the weighted mean unit cost and/or unit income:

$$\text{Weighted mean} = \frac{\sum_{i=1}^n (x_i \times c_i)}{\sum_{i=1}^n c_i} \quad (\text{I})$$

This implies that the weighted mean is $(x_1 \times c_1 + x_2 \times c_2 + \dots + x_n \times c_n) / (c_1 + c_2 + \dots + c_n)$, where denotes the summation, c is the coverage (weight), and x is the value (income or expenditure).

Based on the weighted mean, this study extrapolated the findings nationally across similar CBHI structures by multiplying the mean with the total number of relevant entities in 2014, i.e., 450 CBHI sections in 2014/2015 versus 510 in 2020/2021, along with 30 CBHI districts and one national pooling risk for national referral hospitals and patient rooming system data. At present, the weighted mean is no longer relevant because the CBHI system shifted from fragmented pools to one central pool in the RSSB/CBHI head office.

2.6.2. Compound annual growth rate

According to the Provider for Health Network (P4H Network), "SimIns is a computerized tool that facilitates health financing policy decisions by projecting health expenditure and funding for 10 years. It can be applied to both existing and planned schemes" (P4H Network, 2023).

As the annual growth rates (AGRs) for the past 10 years are known, they were named $AGR_1, AGR_2, AGR_3, \dots, AGR_n$, where AGR_1 refers to the AGR of the first period and AGR_n refers to the AGR of the final period. The equation applied to calculate the compound AGR (CAGR) from 2011/2012 to 2020/2021 is:

$$\text{CAGR} = \frac{AGR_1 + AGR_2 + AGR_3 + \dots + AGR_n}{9} \quad (\text{II})$$

The mathematical linear regression equation is:

$$V_n = V_0 \times (1 + r)^{n-1} \quad (\text{III})$$

Where V_n is the value at the n year (year 10 in this case), V_0 is the initial value, n is the number of years (10 years in this case), and r is the CAGR calculated for each specific key variable.

2.6.3. Derived logarithmic equation

The above equation is supported by the derived logarithmic equation used to determine one of the unknown elements of the following formula:

$$\frac{\ln \frac{V_n}{V_0}}{r} = n - 1 \quad (IV)$$

Where \ln designates the natural logarithm.

2.7. Concepts and operational definitions

This section provides the details for the concepts and operational definitions used in this study.

2.7.1. Financial viability and sustainability

According to Hayes (2013), an organization is considered viable when, under normal service conditions, it generates sufficient resource inflows to at least offset all operational costs, strategic expenditures, and anticipated risks, thereby enabling it to achieve its strategic objectives and meet stakeholder expectations in the short to medium term. Viability becomes sustainable when the organization can reasonably maintain its balance of inflows and outflows over the long term, typically beyond 5 years, despite changing conditions.

2.7.2. Net income

According to Investopedia (<https://www.investopedia.com>, accessed April 03, 2025), net income, also known as net profit, is a key profitability metric that represents a company's overall earnings after deducting all expenses and costs from total revenue. It may also include additional income sources, such as interest from investments or income from asset sales. Net income provides insight into a company's financial performance and operational efficiency, helping investors and managers evaluate profitability and identify areas of financial strength or weakness.

2.7.3. Health-care system

According to the WHO, a health-care system consists of all organizations, people, and actions primarily aimed at promoting, restoring, or maintaining health. This includes efforts to address health determinants as well as direct interventions to improve health outcomes. A health-care system, therefore, encompasses more than just publicly owned facilities that deliver personal health services; it also includes the institutions, people, and resources involved in delivering health-care services to individuals. Similarly, Wikipedia defines a health-care system as an organized structure of people, institutions, and resources that deliver

health-care services to meet the health needs of specific populations.

2.7.4. Health sector reform

According to Roberts *et al.* (2004), reform involves a significant and purposeful effort to enhance the performance of a health-care system. Reforms differ in at least two dimensions: (i) the number of health-care system components being modified and (ii) the extent to which these changes deviate from established practices. The authors emphasize that successful reform often involves introducing a set of interdependent and mutually supportive interventions, particularly when significant changes are made to a single component of the system. Additional definitions are provided in Section 1 of the Supplementary File.

2.8. Ethical considerations

The ethical considerations of this study are:

- (i) Scientific approval for the study, required as a prerequisite for ethical review, was obtained from the Public Health (Ref: 037/UR/CHMS/SPH/2013) on January 11, 2014
- (ii) Ethical approval (Ref: 001/UR/CMHS/SPH/2014) was obtained from the UR/CMHS/SPH Institutional Review Board (IRB) on February 11, 2014
- (iii) Research authorization was granted by the Rwanda Ministry of Health (Letter No. 20/1522/PHIS/ME&R/2014)
- (iv) Finally, all managers of CBHI structures participating in the survey signed informed consent forms before their enrolment.

2.9. Tools

Four self-administered questionnaires were developed for different levels: CBHI-section level (60 participants), CBHI-district level (district's "*Mutuelles de santé*") (15 participants), national pooling risk (one participant), and for qualitative primary data collection from CBHI-section key informants and CBHI-district levels.

The questionnaires were developed in French/English, completed (transcribed) in either language and ultimately, all were retained or translated into English.

The Cleeland, J. (2012). LimeSurvey (Version 1.92), Company of manufacturing: Jason Cleeland and Country: Australia was used for data recording and entry. Quantitative data were exported to IBM Corp. (2012). IBM SPSS Statistics for Windows, Version 21.0. IBM Corp. IBM (International Business Machines Corporation), Country: United States, for statistical analysis of data on the following key variables: demographic data (population), health services utilization/consumption, and financial data (CBHI income and expenditure).

Table 1. Ten-year (2011/2022 – 2020/2021) assessment of community-based health insurance income statement

Parameters	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021
Total income	27.97	22.87	20.22	25.19	26.95	29.61	30.46	38.26	38.85	57.16
Contributions of CBHI members	17.58	16.84	16.73	22.09	23.72	28.63	30.08	32.77	33.38	34.53
Other incomes	10.39	6.03	3.49	1.39	3.23	0.98	0.38	5.49	5.46	-
Income from GOR (since 2020/2021)	-	-	-	-	-	-	-	-	-	22.63
Total expenditure	20.20	27.58	31.69	41.34	39.68	42.22	48.14	58.17	58.06	76.83
Total claims	17.01	22.51	26.07	36.31	34.18	35.67	41.77	48.60	48.68	69.00
Other expenses	3.19	5.07	5.62	5.04	5.50	6.55	6.37	9.57	9.38	7.83
Net income	7.78	(4.71)	(11.47)	(16.15)	(12.74)	(12.61)	(17.68)	(19.91)	(19.21)	(19.67)
Cumulative net income	7.78	3.07	(8.40)	(24.55)	(37.28)	(49.89)	(67.57)	(87.48)	(106.69)	(126.36)

Notes: All values are in billion RWF, where USD 1: RWF 1,170.6 as of July 21, 2023. Data from the fiscal years (FYs) 2011/2012 and 2012/2013 were from primary sources, data from FYs 2013/2014 to 2018/2019 were from CBHI annual reports, and data from FYs 2019/2020 and 2020/2021 were from RSSB/CBHI administrative data. Values in parentheses indicate negative amounts/deficits.

Abbreviations: GOR: Government of Rwanda; RSSB: Rwanda Social Security Board; CBHI: Community-based health insurance.

Microsoft Excel 2007, released as part of the Microsoft Office 2007 suite in January 2007, Company: Microsoft Corporation, Country: United States, was used for spreadsheet management.

3. Results

This section presents the results of this study.

3.1. Assessment of the CBHI system's financial sustainability from 2011/2012 to 2020/2021 (Specific Objective 1)

This section outlines the results of CBHI's financial sustainability.

3.1.1. Key quantitative variables

The key quantitative variables are demographic data, health services utilization, and financial data.

(i) Demographic data

The target population of CBHI refers to the segment of the population that is not insured or affiliated with social/public health insurance institutions or private insurance companies. This group currently represents approximately 94% of the total population.

(ii) Health services utilization

This variable indicates the health services utilization per CBHI structure (primary health care, district, and provincial hospitals, national referral hospitals, specialized health service levels, and the national level).

(iii) Financial data

The financial data includes:

a. Income data: contribution premiums, subsidies from

the government, development partners, other health insurance schemes, the private sector, and other revenue resources;

b. Expenditure data:

- Claims: health-care costs per CBHI structure (primary health care, district and provincial hospitals, national referral hospitals, specialized health service levels, and at national pooling risk)
- Other expenses: administrative and other non-health-care costs.

Table 1 presents the data from the 10-year period of 2011/2012 – 2020/2021 for the current FFS providers. During this period, CBHI experienced persistent financial deficits, accumulating a total of RWF 126.36 billion by 2020/2021 – up from RWF 4.71 billion in FY 2012/2013 to RWF 19.67 billion in FY 2020/2021. These deficits persisted despite regular financial support from the GOR to cover debts owed to contracted public, private, and faith-based health facilities.

The most recent financial top-up – RWF 22.63 billion – was allocated by the GOR under the Prime Minister's Order No. 034/01 of January 13, 2020, for FY 2020/2021. This funding is subject to annual increases and aims to address CBHI's financial gaps, preventing bankruptcy and the collapse of the public and faith-based health-care system. However, the deficit continued to worsen, rising from RWF 19.21 billion in FY 2019/2020 to RWF 19.67 billion in FY 2020/2021. Notably, these deficits occurred despite stable CBHI utilization rates, unchanged national and global epidemiological trends before the COVID-19 pandemic, and economic constraints, including current global inflation.

3.2. Identification of the challenges and its solutions during the implementation of CBHI system (Specific Objective 2)

The assessment of the 2011/2012 – 2020/2021 income statements revealed gaps and deficiencies in the implementation of the 2010 CBHI policy and the FFS PPM.

3.2.1. Institutional capacity-building gaps of the CBHI system (2010 CBHI policy Objective 1)

Deficits in management, financial, and actuarial risk analysis skills hindered the achievement of this goal.

The recommended solutions for objective 1 include (i) providing institutional support through technical assistance and capacity-building services and (ii) integrating relevant budget lines into the CBHI expenditure component.

3.2.2. Financial sustainability gaps of the CBHI system (2010 CBHI policy Objective 2)

The 2010 CBHI policy highlights incomplete legal revenue mobilization and recovery. A shortfall of RWF 62.13 billion was identified, including RWF 25.43 billion from 1% of domestic resources (FY 2022/2023) and RWF 36.70 billion from 13% of the Ministry of Health (MOH) budget. In addition, over-billing of health services led to an overpayment of RWF 39.25 billion, exacerbated by inefficiencies in the FFS PPM, causing cost escalation. This resulted in a total gap of RWF 101.38 billion, which represented 131.95% of the CBHI total expenditure in 2020/2021. If the two basic policies are effectively implemented, CBHI could achieve self-sufficiency, enhance operational efficiency, and offer specialized care to all, as outlined in HRV 2050.

The study also identified other deficiencies on the CBHI demand side, including: (i) replacing the 13% MOH budget with indigent enrolment subsidies, (ii) CBHI's 2020 – 2023 strategic budget, which included excessive common expenses of RWF 5,595,598,987 (omitted from the FY 2020/2021 revised budget), (iii) RWF 500 million incorrectly budgeted for returns on investment alongside investment expenses, (iv) the “interest on current accounts” budget line was removed in FY 2020/2021, (v) excessive time was spent on claims verification and reconciliation, (vi) an AGR of 48 – 50% in staff costs was observed, and (vii) the lack of a cost-control culture led to ongoing financial distress.

Suggested solutions to address CBHI's implementation gaps in financial sustainability include: (i) granting administrative and financial autonomy to CBHIs, (ii) establishing technical assistance and capacity-building services, (iii) effectively managing the additional RWF

22.63 billion granted in FY 2020/2021, (iv) preserving existing financial resources instead of requesting additional funds, (v) reforming the purchasing and claims payment policy from FFS PPM to FASP PPM, (vi) implementing a Diagnosis-Related Groups (DRG)-based billing system, (vii) integrating clinical and community performance-based financing into routine CHFP management, (viii) utilizing Health Management Information System (HMIS)-reported data for billing, (ix) improving access to HMIS for CBHI staffs, (x) fostering a culture of cost control, and (xi) automating the billing system to facilitate financial management and strengthen financial sustainability.

3.2.3. Equitable quality health-care access for all (2010 CBHI policy Objective 3)

Regarding equitable health-care access, the goal of providing equal domestic health-care access for all CBHI beneficiaries (approximately 94% of the population) has largely been met. However, challenges remain with specialized care access.

Suggested solutions to promote equitable quality health care and universal access include: (i) improving the AGR of community health workers from a negative growth rate of –5% to 206%, (ii) reducing fraud at health posts and providing performance-based incentives for community health workers, (iii) opening new health centers that meet new-generation facility standards and strengthening existing ones, (iv) formalizing specialist outreach nationwide – especially in district hospitals, (v) expanding provincial hospitals from four to eight, increasing their clinical capacity by raising AGR from 10% to 40%, and (vi) increasing contracted private specialty health establishments to improve access. The AGR of the related budget line increases from 10% to 20%.

3.2.4. Protection against financial hardship (2010 CBHI Policy Objective 4)

While the goal of protecting against financial hardship has largely been met, issues remain with specialized care access and the 10% co-payment. According to Nyandekwe *et al.* (2014), only 2.17% of the 94% CBHI target population can afford the co-payment for specialized treatments, such as kidney transplants, costing RWF 2.0 – 2.5 million. Without abolishing the co-payment, 91.83% of the CBHI members will be excluded.

Suggested solutions to protect against financial hardship include: abolishing co-payments at all public health-care facilities and implementing free health care at the point of service, with CBHI reimbursing the co-payment to P/A health-care providers through a third-party payment mechanism. Failure to abolish the co-payment may result

in criticisms of the health-care system being exclusive to the wealthy.

Additional supply-side shortcomings that could not be quantified were also identified. These include: (i) fraudulent cases at the health-post level, where utilization increased by 1,645% between 2016 and 2019/2020, and (ii) at district hospitals, fewer patients are treated, while more are referred to university teaching hospitals, with 85% of district-hospital patients being sent to tertiary hospitals in FY 2019/2020, compared to 7% being sent to provincial hospitals. This indicates a clinical bottleneck at the provincial hospital level and a cost-inefficiency that risks undermining the Rwandan WHO organizational system. Excessive referrals to tertiary hospitals lead to unnecessary inpatient stays and increased costs, resulting in financial losses for CBHI.

Suggested solutions include (i) combating fraud at the health post-level and addressing clientelism through community health workers or ghost patients, (ii) strengthening the clinical capacity of district and provincial hospitals, and (iii) profiling provincial hospitals based on quality and quantity, with outliers potentially downgraded to district hospital status to reduce cost inefficiency.

3.3. Reforms and modernization of the CBHI and public/agree (faith-based) health-care system: Best practices, innovations, and alternative financing mechanisms (Specific Objective 3)

This involves modernizing the CBHI through results-based financing from a resilience perspective in the following way:

A business plan developed by P/A health-care facilities includes a 69% (Table S5) (rounded to 70%) prepaid

monthly amount from 43.11% + 25.89% (Table S6), reflecting overcharging. The monthly budget is as follows:

- (i) Prepayment of 70%: supports health-facility operations and improves health-care quality. This is divided into:
 - 45% for improved functioning and quality health care
 - 10% to cover co-payments unpaid by CBHI members
 - 15% for staff incentives, including support staff.
- (ii) The remaining 30% is paid after verifying and reconciling the invoice. This 30% comes from the 31% saved through avoided over-quantification of services (Table S5) and can be utilized in:
 - 10% for disability-related medications and other rare essential medicine shortages
 - 10% for patient feeding and diet services during inpatient stays
 - 10% for contributing to a mandatory 20% annual safety margin, aiding health facilities in their goal of self-sufficiency after 5 years of FASP PPM implementation.

Researchers ensured that the full 100% of the previous total bill, including the 56.89% that was overpaid, is used effectively, as outlined above.

3.3.1. Modernizing the faith-based health-care system and the partial cost-recovery system

Modernizing the P/A health-care system and the partial cost-recovery framework aims to strengthen Rwanda's CBHI and P/A health-care facilities while addressing challenges, such as the lingering effects of the 1994 genocide, the COVID-19 pandemic and global inflation, all from the HRV 2050 perspective. The revised tariff system seeks

Table 2. Baseline tariff rates (to be periodically updated)

Client/patient	Subsidized cost (%)	Prepaid or OOP paid (%)	DRG unit price
CBHI Category A (Ordinary)	97.00	3.00	(3.00/3)
CBHI Category B (Comfortable Package subscribers)	94.00	6.00	(6.00/3)
Public/social health insurance institutions	94.00	6.00	(6.00/3)
Private health insurance companies	92.80	7.20	(7.20/3)
Uninsured Rwandan citizens	91.00	9.00	(9.00/3)
Neighboring countries	85.00	15.00	(15.00/3)
EAC countries	80.00	20.00	(20.00/3)
SSA+Sudan and South Sudan	75.00	25.00	(25.00/3)
North Africa+South Africa	70.00	30.00	(30.00/3)
Rest of the world	65.00	35.00	(35.00/3)
Not identified	60.00	40.00	(40.00/3)

Source: Authors' illustration and creation.

to shift the supply side from non-profit to mixed-profit status, fostering industry self-reliance through enhanced internal revenue. It also modernizes the cost-recovery model (Bamako Initiative), originally reinstated by the government of national unity from a resilience perspective.

Equity in financial access is demonstrated by the DRG unit price for CBHI category A, with a base rate of 3.2% of costs recovered (USD 2.56 out of USD 81.17), following the removal of co-payments at P/A service points. The USD 2.56 represents the individual annual premium, whereas the USD 81.17 reflects Rwanda's per capita health expenditure.

3.3.2. Basic tariff rates

For CBHI category A, the minimum tariff rate is 3.2%, and the basic rate has been reduced to 3%, as shown in Table 2. This results in an annual individual premium of USD 2.56, down from USD 81.17 (previously USD 57.5 in 2020 with a 9% AGR) for Rwanda's per capita health expenditure in 2024/2025. The rates in Table 2 also reflect the updated co-payment structure and benefits from CBHI modernization, including food and dietetic services for both Rwandan and foreign patients. Luxury accommodation is excluded from these rates.

The authors demonstrate that ordinary members of Rwanda's CBHI contribute only 3% (USD 2.56 of the projected USD 81.17 per capita health expenditure for 2024/25), with the remaining 97% covered by government subsidies. Other Rwandan population groups contribute between 6% (with 94% subsidized) and 9% (with 91% subsidized). Although foreigners pay higher fees, their contributions remain substantially subsidized – on average, between 70% and 85% for individuals from neighboring countries, 75% for most African nationals, and 65% for individuals from other regions.

Rwanda's pricing system, as shown in Table 2, is designed to promote self-reliance (*kwigira/ubwihaze*) and sovereignty (*ubusugire*) while ensuring dignified, equitable health care for both Rwandan citizens and the global community. This acknowledges the significant contribution of the international community to Rwanda's health-care resilience since the 1994 genocide. With the health-care system now restored, Rwanda aims to provide affordable, high-quality health care to the global community.

3.3.3. Comfortable benefit package of the CBHI system

The study introduced a CBHI beneficiary Category B, with a premium set at twice the DRGs unit price of Category A. The annual individual premium for Category B is USD 35, which is more than approximately five times higher than the premium for ordinary, wealthier Category A members,

which is applicable to both wealthier Rwandans and the Rwandans in the diaspora.

Category B members can visit any public or agreed-upon health-care facility nationwide without the compulsory referral process, except for King Faisal Hospital (KFH). For KFH, a transfer note from the medical committee at each university teaching tertiary hospital is required. The referral process has shifted from the RSSB medical commission to a new committee at university teaching tertiary hospitals. This committee, consisting of three specialist doctors, aims to speed up decision-making in emergencies, avoiding delays by administrative staff without clinical expertise. Rwandans in the diaspora who wish to join CBHI Category A will pay USD 15 annually, which is more than approximately 5 times the premium for ordinary Category A members. This fee grants access to the CBHI system with the compulsory referral process from the district hospital level and treatment at no extra charge while vacationing in Rwanda. However, uninsured diaspora members will be treated as uninsured Rwandans and will pay the same subsidized rate (91%) as that paid by uninsured Rwandan citizens (9/3) (Table 2).

3.3.4. Medical tourism in the public/agree (faith-based) health care delivery system

The concept of medical tourism has been introduced in Rwanda's public health sector to promote and export the country's "equitable and dignified health-care provision," offering comprehensive quality care from self-reliance and self-esteem (*kwihesha agaciro*) perspective. This concept, part of a 2014 study by the Rwanda Development Board, primarily targeted the private sector, and its implementation is highly anticipated in P/A health-care sectors. Researchers have also proposed the following recommendations and advice, which extend beyond the scope of medical tourism and are applicable to the broader health-care system:

- (i) Rare or expensive medical procedures will be billed separately from the DRG unit price
- (ii) CBHI beneficiaries who opt for Income-Generating Activity-Health Service Related (IGA-HSR) treatment shall be responsible for covering the cost difference between DRG Category B and Category A. The CBHI scheme will reimburse up to the standard cost of Category A only
- (iii) Rwandan citizens abroad who are not enrolled in CBHI will be required to pay 3 times the CBHI Category A (ordinary) beneficiary rate, similar to the cost for uninsured residents
- (iv) Internal professional dualism is permitted; however, the regular workload remains the priority
- (v) Standard honorary fees will be set by the MoH and professional councils

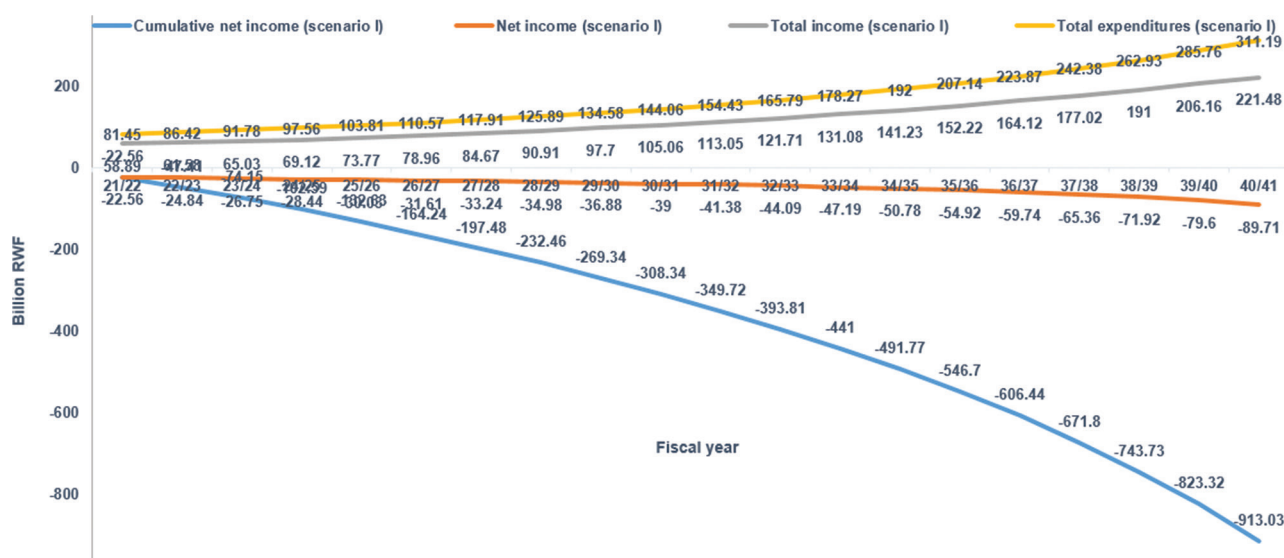


Figure 1. Forecast of the Community-Based Health Insurance system's income under the fee-for-service provider payment mechanism practice through 2040/2041, based on Scenario I simulation. Image created by the authors using data extracted from Table S7. The software used is Microsoft Excel 2016.

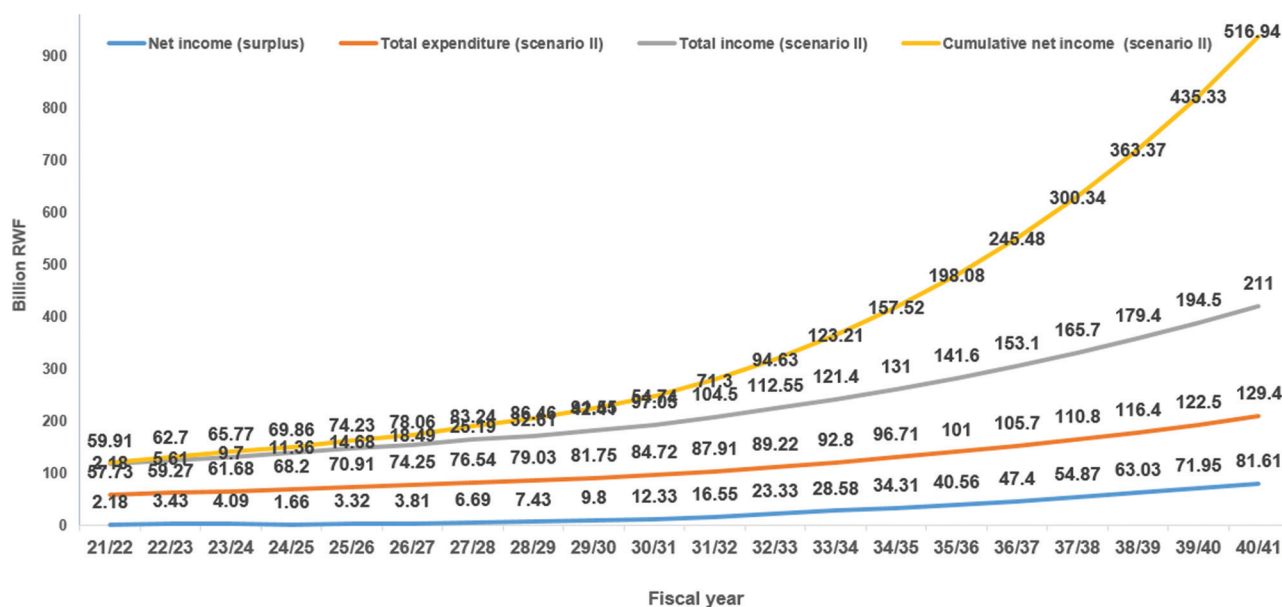


Figure 2. Forecast of the Community-Based Health Insurance system's income under the practice of the fully active strategic purchasing provider purchasing mechanism from 2021/2022 to 2040/2041, based on Scenario II. Image created by the authors using data extracted from Table S8. The software used is Microsoft Excel 2016.

- (vi) This study proposes a 50 – 50% shared remuneration system for health-care facility employers and professionals for honorary and overtime work.

3.4. Financial sustainability of the CBHI system: Feasibility from 2020/2021 to 2040/2041 (Specific Objective 4)

This section outlines the financial sustainability of the CBHI system from 2020/2021 to 2040/2041.

3.4.1. Continuation of the current practice of the fee-for-service PPM from 2021/2022 to 2040/2041

Figure 1 and Table S7 illustrate Scenario I, which simulates the continuation of the current FFS PPM practice from 2021/2022 to 2040/2041, primarily based on the data from the RSSB/CBHI's strategic budget 2020 – 2023. This scenario assumes the persistence of the issues highlighted in previous studies (Nyandekwe *et al.*, 2020), with no solutions

to address them. As a result, the GOR continues to pay accumulated arrears to health-care facilities dating back to 2015, straining the operations of health-care facilities and worsening relations between the CBHI system and the contracted facilities. The CBHI's financial deficit is projected to grow from RWF 22.56 billion in 2020/2021 to RWF 89.71 billion by 2040/2041. Cumulative losses are expected to reach RWF 913.03 billion by 2040/2041, indicating a persistent deficit that threatens CBHI's sustainability and could lead to the collapse of the P/A health-care system. For comparison, the first 10 years of the assessment serve as the baseline for all four scenarios, with projections beginning in July 2021 and ending in June 2040/2041. Given global inflation and declining external funding for the health sector, cost-control measures, budget cuts, and optimal practices for cost containment are essential. This research emphasizes the need for a FASP PPM to mitigate the risks of overbilling and to build a solid foundation for CBHI's financial sustainability and Rwanda's UHC, in line with WHO's UHC CUBE and SDG Target 3.8 (UHC index).

3.4.2. Projection of the CBHI system's income for the practice of a fully active strategic purchasing PPM under Scenario II (2021/2022 – 2040/2041)

Figure 2 and Table S8 illustrate Scenario II, which simulates the implementation of the FASP PPM practice. This includes reforms, innovative management techniques, optimal practices, such as the abolishment of 10% co-payment, and alternative financing mechanisms to address issues identified in this study. In the baseline FY 2021/2022, the CBHI income statement is forecasted to show a positive net income of RWF 2.18 billion, increasing to RWF 81.61 billion by FY 2040/2041. A cumulative reserve of RWF 516.94 billion is also expected from 2021/2022 to 2040/2041.

Scenario II demonstrates the significant benefits of the FASP PPM by addressing previous deficiencies and challenges. It achieves a 31% cost saving by preventing over-quantification (Table S5) and 25.89% by preventing overcharging (Table S6). This scenario ensures the long-term financial sustainability of Rwanda's CBHI and public health-care system through allocative efficiency and effective resource usage in both systems. The saved funds will be directed toward unmet services and the modernization of the CBHI and health-care delivery systems. A comparison of the cumulative net incomes from Scenario I and Scenario II shows that the government will earn a gross profit of RWF 1,429.97 billion (RWF 516.94 billion minus RWF 913.03 billion) due to the reforms, optimal practices, and innovations introduced by this study. This is one of the expected macroeconomic contributions of the FASP PPM.

3.4.3. Costing framework for implementing HRV 2050 in the health sector

This section outlines the framework for implementing HRV 2050.

a. Introduction

This research paper focuses on Rwanda's UHC model and HRV 2050 long-term institutional and financial aspirations, with an emphasis on achieving effective health universalism in the 1st year of the FASP PPM implementation. It also examines health-care standards for UMIC by 2035 and HIC by 2050. The analysis suggests that the original targets were unrealistic, considering Rwanda's current limitations in securing additional financing for CBHI resources, the health sector, and its projected economic and health-care expenditure capacities.

b. Context of Rwanda's GDP per capita, health expenditure per capita, and health system score

In addition to the literature reviewed, relevant meta-analyses and ex ante assessments within the HRV 2050 costing framework indicates that Rwanda's GDP per capita rose significantly—from USD 255 in 2000 to USD 826.39 in 2020, USD 948.27 in 2022, and USD 1,004.22 in 2023 (World Bank, 2020; Macrotrends, 2025). However, alternative estimates from Statista report a GDP per capita of USD 966 for 2022 (Statista, 2023).

Rwanda also increased its health expenditure per capita from USD 9 in 2000 to USD 57.5 in 2020. Currently, Rwanda's per capita health expenditure is USD 57.50, projected to reach USD 81.17 by 2024/2025.

In 2023, Rwanda ranked 70th globally for health-care quality, with a score of 58.2, improving from 172nd among 190 WHO member states in 2000.

c. Context of Rwanda's HRV 2050 targets

The HRV 2050 targets include:

- The UMIC target by 2035: The goal is for Rwanda to achieve a health-care system with standards comparable to the current UMIC standards, which require a per capita GDP between USD 4,256 and USD 13,205, and a per capita health expenditure of approximately USD 569.67 (World Bank on Health)
- The HIC target by 2050: The objective is to achieve health-care standards comparable to those of current HIC systems, which have a per capita GDP exceeding USD 13,205 and a per capita health expenditure of USD 6,180.35 (World Bank, 2020). Currently, Rwanda's per capita health expenditure is USD 57.50 (World Bank, 2020) projected to reach USD 81.17 by 2024/2025.

d. Analysis of funding challenges

Rwanda's per capita health expenditure in 2024/2025 is predicted to be USD 81.17, far below the required levels for both the UMIC and HIC targets. Achieving the UMIC standard by 2035 would take about 22.65 years instead of 11 years from the 2024/2025 base year, and achieving the HIC standard would require about 49.14 years instead of 25 years. To bridge the gap, Rwanda would need to mobilize significantly more funds. For example, to meet the UMIC standard, an additional USD 149.83 per capita is required, and to meet the HIC standard, an additional USD 569.83 per capita is needed. This gap is beyond Rwanda's current financial reach.

e. Home-grown resources

This paper highlights the importance of Rwanda leveraging its tangible resources (men, money, and material) and intangible resources (methods, research, and innovations) to address the challenges of financing health care. Given that external aid is declining, particularly following the COVID-19 pandemic and global inflation, Rwanda must rely on internal resources to meet the ambitious HRV 2050 goals.

f. Performance comparisons among global, Thailand, and Rwanda

Rwanda has made significant progress in the health sector, moving from a per capita GDP of USD 255 in 2000 to USD 826.39 (World Bank, 2020) in 2020, USD 896.27 in 2021, USD 948.38 in 2022, and USD 1,004 in 2023 (World Bank, 2023), see The country ranked 70th globally for health-care system performance in 2023.

Interestingly, Thailand, with a per capita GDP of USD 7,067 and health expenditure per capita of USD 305.09, has achieved impressive health-care outcomes, ranking 13th globally, higher than several HICs:

- Norway (15th), per capita GDP USD 89,242 and health expenditure USD 9,020 (2020)
- New Zealand (16th), per capita GDP USD 48,824 and health expenditure USD 4,201.68 (2020)
- Germany (17th), per capita GDP USD 51,073 and health expenditure USD 5,503.36 (2020)
- Switzerland (18th), per capita GDP USD 93,525 and health expenditure USD 10,309.76 (2020)
- United States (30th), per capita GDP USD 63,530.63 and health expenditure USD 12,530
- The world registered an average per capita GDP of USD 10,898.7 and per capita health expenditure of USD 1,177.15 (2020).

If the global average reached a per capita GDP of USD 12,688 (World Bank, 2020) from USD 5,717.1 in 2000 and recorded a health expenditure per capita of USD 1,177.15

(World Bank, 2020), it is noteworthy that Rwanda's health-care system, with a score of 58.2, already exceeds the global average health care score of 54 (Wisevoter, 2023). This is a notable record despite Rwanda operating at a lower expenditure level.

This study predicts that if Rwanda's health expenditure per capita reaches Thailand's current level of USD 305.09, its health-care system will surpass the current UMIC's health-care system standards and may even exceed those of some current HICs health-care system standards, as Thailand achieved in 2020. Therefore, a feasible approach involves using Thailand's health-care system as a benchmark under normal circumstances, applying the health expenditure per capita as a key metric. Indeed, under normal conditions and based on the current predicted per capita health expenditure of USD 81.17 (up from USD 57.5 in 2020, with an AGR of 9%), Rwanda would need approximately 15/16 years ($\ln [305.09/81.17]/0.09$) to reach Thailand's current health-care system standard, i.e., by 2040/2041.

g. Feasibility assessment of achieving Rwanda's UHC model and HRV 2050 targets with the CBHI system

Rwanda faces challenges in achieving high-quality health-care and meeting the HRV 2050 targets. Transitioning from an FFS model to a sustainable FASP PPM model, leveraging internal resources, and reinforcing the CBHI system through a compulsory "minimum 1% specific tax for UHC and HRV 2050" will be critical to driving progress. Key outcomes and impacts include:

- (i) Overcoming delays from COVID-19 and global inflation
- (ii) Rwanda's UHC model meeting WHO's UHC CUBE and SDG Target 3.8 (UHC index) by 2030/2031
- (iii) Near-free health care at public and faith-based services
- (iv) Maintaining individual premiums (RWF 3,000 – 7,000) until 2040/2041
- (v) Revised milestones for 2040/2041, ahead of the 2050 target
- (vi) Achieved the HRV 2050 targets 10 years ahead of schedule
- (vii) Improved welfare and health status
- (viii) Enhanced productivity and economic growth.

Inspired by countries such as Thailand, Rwanda can achieve effective health universalism by 2030 at the latest, surpassing UMIC and HIC standards by 2040/2041. This progress will depend on strong governance, political commitment to UHC and HRV 2050 goals, and the adoption of the recommendations outlined in this study.

h. Health financing model

The researchers advocate for utilizing CBHI as a sustainable funding model. The adjusted 2023/2024 CBHI funding threshold is set at RWF 72.51 billion, aiming to cover 94% of the population, which corresponds to an adjusted per capita amount of USD 4.47 (RWF 5,233, based on an exchange rate of 1 USD = RWF 1,170.6 as of July 21, 2023). This adjustment is illustrated by Scenario II with strategic cost-control measures applied.

The decision to prioritize CBHI funding, financially strengthened by the “minimum 1% specific tax for UHC and HRV 2050,” over broader international macroeconomic health expenditure per capita options is based on Rwanda's past success in achieving HRV 2020 with CBHI. This approach has the potential to advance UHC toward the HRV 2050 target.

i. Revised milestones and projections

Instead of focusing on the original 2050 goals, this study proposes more achievable milestones based on Rwanda's progress, context, and the potential of leveraging CBHI. These milestones include:

- (i) Achieve UMIC standards by 2030/2031, ahead of the original 2035 target
- (ii) Achieve HIC standards by 2035/2036 – or by 2040/41 at the latest – well ahead of the original 2050 target, enabling a 10-year HRV 2050 implementation period (excluding a 5-year lag)
- (iii) Achieve, under a pessimistic scenario, self-reliance between 2040 and 2045 at the latest
- (iv) Achieve health-care sovereignty by 2045 – 2050 at the latest.

The revised financing model recommends a fourfold increase in base funding to meet UMIC standards, an eightfold increase to reach HIC standards, a twelvefold increase (pessimistically) to achieve Rwanda's health care self-reliance, and a sixteenfold increase (pessimistically) to attain health-care sovereignty.

3.4.4. Strategic framework for securing additional funding sources to support the effective implementation of HRV 2050 (2024/2025 – 2040/2041)

This section outlines the framework for securing additional funding sources essential for the successful implementation of Rwanda's HRV 2050. The framework emphasizes the need for innovative financing strategies to address the identified funding gap, as the current health expenditure trajectory falls short of the required levels to meet the UMIC and HIC targets by 2035 and 2050, respectively. Key mechanisms for mobilizing additional funds include leveraging domestic resources, strengthening the CBHI system, and exploring new funding models that align with

Rwanda's broader economic goals. These approaches will be critical in ensuring Rwanda's health system evolves sustainably while advancing its UHC objectives and achieving its HRV 2050 targets.

To proceed cautiously, this study divided the total RWF 174.44 billion by three, yielding adjusted annual figures: RWF 58.69 billion (2024/2025), RWF 122.66 billion (2025/2026), RWF 192.39 billion (2026/2027), RWF 230.31 billion (2027/2028), and RWF 298.26 billion (2030/2031). Additional mobilized funds through 2040/2041 are detailed in Table S9.

3.4.5. Financial preparedness for the execution of the HRV 2050 in Scenario III

Figure 3 and Table S9 illustrate that the CBHI recorded a net income of RWF 2.18 billion in 2021/2022, projected to rise to RWF 849.41 billion by 2040/2041, driven by the “minimum 1% specific tax for UHC and HRV 2050.” The cumulative net income is expected to reach RWF 6,985.66 billion, including RWF 516.94 billion from previous periods, resulting in a net cumulative saving of RWF 6,468.72 billion (92.6%). Notably, these figures exclude the revenues from the Comfortable Package membership, IGA_HS, and medical tourism in the faith-based health sector.

The combined 13 funding sources are projected to exceed the financial threshold of RWF 290.04 billion for UMIC health-care standards by 2027/2028, reaching RWF 313.55 billion. The threshold for HICs of RWF 580.08 billion is expected to be surpassed by 2035/2036, with RWF 621.91 billion, 15 years ahead of the 2050 target. Rwanda's health care self-reliance target of RWF 870.12 billion (12 times the baseline) is projected to be met by 2039/2040, with a recorded amount of RWF 897.77 billion. By FY 2040/2041, CBHI income is expected to reach RWF 984.57 billion, 13.58 times the initial threshold of RWF 72.51 billion. The UHC sovereignty threshold of RWF 1,160.16 billion (16 times the baseline) is forecasted to be surpassed in 2042/2043, with total CBHI income reaching RWF 1,183.98 billion.

3.4.6. Effective implementation of health-related measures under Scenario IV (2021/2022 – 2040/2041)

Figure 4 illustrates that the CBHI system recorded a net income of RWF 2.18 billion in 2021/2022, projected to rise to RWF 418.88 billion by 2040/2041. Furthermore, Figure 4 and Table S10 illustrate Scenario IV, showing net accumulated revenue (reserves) of RWF 3,470.34 billion (Figure S10) allocated to all specialist-care costs and other unmet needs related to social health protection. Of the total RWF 6,985.66 billion in accumulated reserves illustrated in Scenario III, RWF 3,515.66 billion (50.33%) is allocated to improving universal access to primary, hospital, and

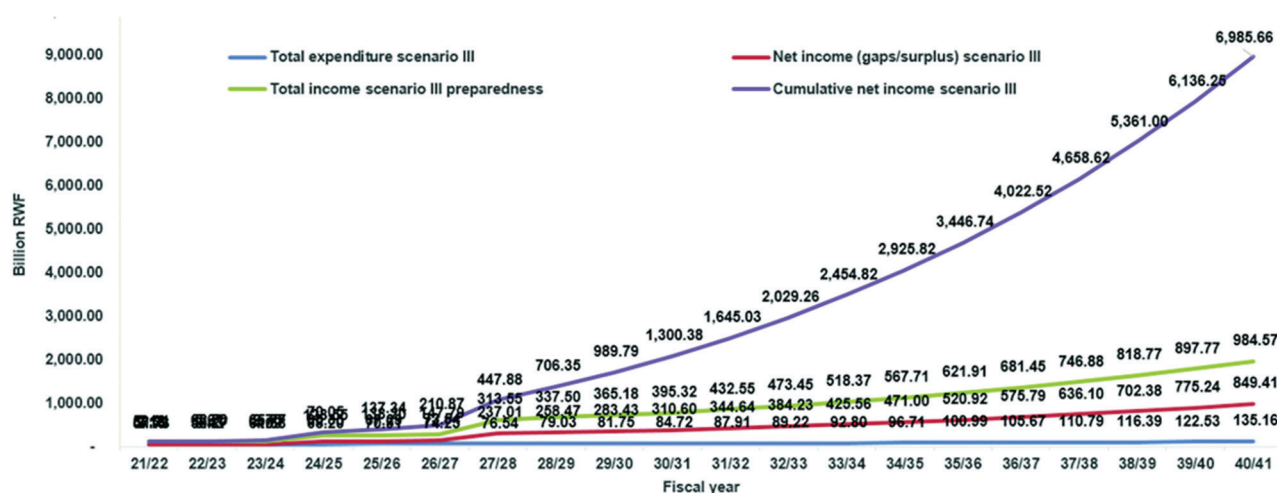


Figure 3. Forecast of the Community-Based Health Insurance system's financial preparedness for the implementation of the health-related Vision 2050, Scenario III (2024/2025 – 2040/2041), based on data extracted from Table S5. Image created by the authors using microsoft excel 2016.

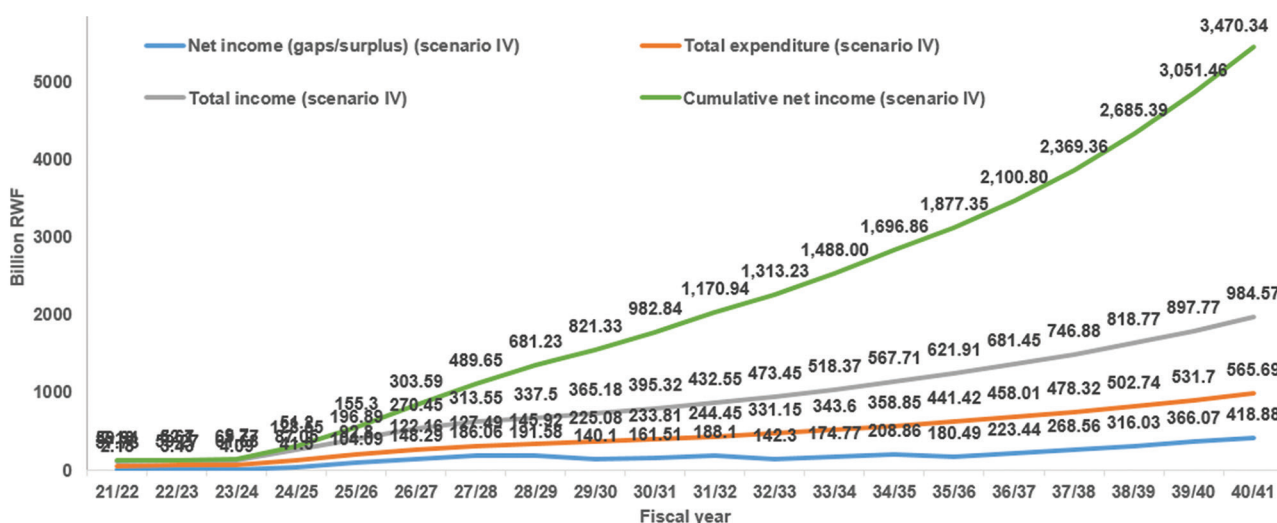


Figure 4. Forecast of the Community-Based Health Insurance system's effective implementation of the HRV 2050, Scenario IV, based on data extracted from Table S10. Image created by the authors using Microsoft Excel 2016.

specialized care nationwide. Of this amount, the study allocates RWF 1,100 billion (15.75%) to KFH, whereas the remaining RWF 2,415.66 billion (34.58%) is designated to the modernization of the P/A health-care system at all levels. This includes the addition of essential medicines required by the new epidemiological profile, such as those for non-communicable diseases, traffic injuries, and mental health issues. It also covers the integration of disability-related drugs and advanced antiretroviral drugs into the national list of essential drugs to meet the 95-95-95 targets in HIV care. In addition, the allocation addresses the per capita expenditure for special inclusion (vertical health equity) of people living with disabilities and people living with AIDS under the CBHI program. Finally, it supports

copied with the costs induced by the upgraded benefit package for CBHI members, transitioning from primary care and hospital care to universal access to specialized and super-specialized care starting from 2030/2031 and further extending from 2035/2036. The specific allocation and related portion from the RWF 2,415.66 billion (34.58%) for each area will be refined at the appropriate time when sufficient funds are raised, starting from 2027/2028 and/or by 2030/2031 at the latest.

3.4.7. Effective utilization of RWF 6,985.66 billion in accumulated reserves from 2024/2025 to 2040/2041

The researchers propose allocating the remaining reserve of RWF 3,470.34 billion to modernizing health-care

infrastructure, including digital diagnostic technology, advanced medical equipment, automation of financial management and billing systems, and other uncovered capital cost areas, as shown in Figure 5. Of this amount, RWF 1,764.68 billion (25.26%) will be directed toward modernizing health infrastructure, acquiring advanced medical equipment, digital diagnostic technologies, and laboratory tests, as well as automating financial management and claims payment (Table S11). The remaining RWF 1,705.66 billion (see the lower row of Table S11) will be allocated as follows: (i) RWF 1,007.09 billion (14.42%) for clinical capacity development, (ii) RWF 307.37 billion (4.4%) for special medical inclusion with advanced assistive devices for people living with disabilities, (iii) RWF 307.37 billion (4.4%) for elderly socioeconomic empowerment to complement the current Vision 2020 Umurenge Program's monthly direct support, aiming to enable this vulnerable subgroup to withstand shocks, as well as combat extreme poverty and malnutrition. In the first time, the complement will match the current monthly allocation through 2027/2028 and will be adjusted periodically based on available reserves or the country's economic growth; and (iv) RWF 83.83 billion (1.2%) for technical assistance and advisory services (Figure 5).

3.4.8. The roadmap of the long-term HRV 2050's sustainable development strategy

This section outlines the roadmap of the long-term HRV 2050's sustainable development strategy.

a. First year of implementation to 2029/2030

This phase includes:

- (i) Rwanda's UHC (CBHI and P/A health-care system) aims to meet UMIC health-care system standards, providing near-free access to specialized care, with reimbursement via CBHI/CHFP through a third-party payment system
- (ii) The pilot phase from the first year of FASP PPM until 2027/2028 will follow "input-based planning and budgeting" or selective planning. From 2028/2029 to 2030/2031, planning will be semi-selective, combining existing resources with additional funding from 13 new resources (Table 3)
- (iii) The CHFP will assume new responsibilities, implementing reforms, innovations, and cost-control measures. Clinical skills will be strengthened through coaching by specialists, doctors, and other health professionals in hospitals
- (iv) At the primary health-care level, community health workers will provide home-based psycho-social-medical support, and health centers will be introduced with a

- (v) "new generation" approach. Supportive supervision and on-the-job training will be organized regularly. Specialists, doctors, and health professionals will undergo a 3-month training to become future trainers. The MOH, the Ministry of Finance and Economic Planning, and stakeholders will develop a hospital investment plan, focusing on essential specialties. Geographic access to quality specialty care will be equitably programmed at both central and decentralized levels.

b. From 2031/2032 to 2035/2036

This phase will implement "target-based planning and budgeting (TBPB) health interventions," focusing on specialized universal access for the first time by combining previous resources with 13 new funding sources (Table 3).

Alongside input-based planning and budgeting, the systems will integrate all resources, including the new funding sources, to provide specialized care to CBHI beneficiaries. From 2031/2032 to 2035/2036, this approach will enable Rwanda to fully cover all CHFP costs as a third-party payer for health interventions in Scenarios II and IV, thereby reflecting a TBPB implementation model.

c. From 2036/2037 to 2040/2041

Between 2036 and 2041, the CHFP will address any delayed programs, health interventions, or unmet health-service needs related to Rwanda's UHC model, aligned with the WHO's UHC CUBE. During this period, planning, budgeting, and execution will incorporate systemically all preventive, promotional, rehabilitative, and palliative care, primarily utilizing internal resources from an autonomy/self-reliance (*agaciro*) perspective.

d. From 2040/2041 to 2045

This period will involve systemic planning and budgeting for all activities related to CBHI and the health-care delivery system, primarily using internal resources (manpower, money, materials, and methods).

In addition, the TBPB system will integrate and manage, alongside the CHFP and other health care-related interventions, the salaries of support staff.

e. From 2046 to 2050

This phase will reflect the sovereignty standard of Rwanda's UHC model, as demonstrated through the TBPB system alongside the CHFP and health care-related interventions. It will also include the integration of salaries for all health workforce, in addition to the support staff already integrated within the CHFP financial management framework.

f. Post-2050 era

The post-2050 TBPB system should integrate water and sanitation in accordance with Rwanda's effective sovereignty model, primarily utilizing internal resources, i.e., manpower, money, materials, and methods. The first three are tangible resources, whereas the fourth, the methods, is an intangible resource focused on integrating research and innovation.

3.5. Highlighted benefits, outcomes, and impact (Specific Objective 5)

3.5.1. Macroeconomic gains

Currently, the amount of macroeconomic gain per capita is USD 76.7, calculated by subtracting from USD 4.47 from USD 81.17. When multiplied four times (UMIC level), it totals USD 213.12 – derived from USD 231 minus USD 17.88. At eight times (HIC level), it reaches USD 615.24 – calculated from USD 651 minus USD 35.76. At 12 times (Rwanda's UHC system self-reliance level), the amount is

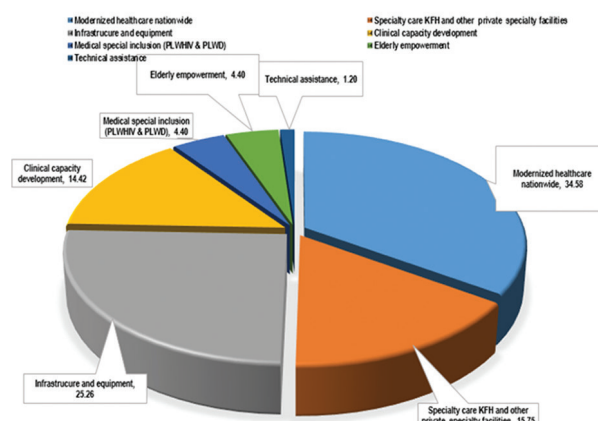


Figure 5. Projected effective utilization of RWF 6985.66 billion in accumulated reserves from 2024/2025 to 2040/2041. Image created by the authors based on data extracted from the respective relativized utilization (%) as a share of the total cumulative reserve of RWF 6,985.66 billion mentioned above

Table 3. Extrapolation of additional funding sources for the Community-based Health Insurance system

Funding sources	2021/2022	2022/2023	2023/2024	2024/2025	2025/2026	2026/2027	2027/2028	2028/2029	2029/2030	2030/2031
1% national general budget	47.65	46.66	50.03	53.03	56.21	59.59	63.16	66.95	70.97	75.23
1% alcohol, sugary, sweet drinks, and narcotics	2.74	2.95	3.19	3.38	3.58	3.80	4.03	4.27	4.53	4.80
1% other insurers and other RSSB schemes	4.10	4.31	4.52	4.79	5.08	5.39	5.71	6.05	6.42	6.80
1% mining and quarries	5.67	6.13	6.62	7.02	7.44	7.88	8.36	8.86	9.39	9.95
1% cement industry	3.42	3.69	3.99	4.23	4.48	4.75	5.03	5.34	5.66	6.00
1% tourism sector	5.28	5.70	6.16	6.53	6.92	7.33	7.77	8.24	8.73	9.26
0.5% complementary employees	7.07	7.63	8.24	8.74	9.26	9.82	10.41	11.03	11.69	12.39
1% employers	14.13	14.84	15.58	16.52	17.51	18.56	19.67	20.85	22.10	23.43
Public places (markets, playgrounds, stadiums, exhibition expos; RWF 200 per entry)	4.80	5.33	5.91	6.27	6.65	7.04	7.47	7.91	8.39	8.89
5% external funds in the health sector out of the general budget	6.78	7.12	7.48	7.92	8.40	8.90	9.44	10.00	10.60	11.24
1% external funds in other sectors	13.56	14.24	14.95	15.85	16.80	17.81	18.88	20.01	21.21	22.48
1% export	10.20	11.02	11.90	12.61	13.37	14.17	15.02	15.92	16.88	17.89
1% import	19.22	20.76	22.42	23.76	25.19	26.70	28.30	30.00	31.80	33.71
Total identified additional financing	141.37	150.37	163.16	58.69	122.66	192.39	230.31	251.0	273.64	298.26

Notes: Data are presented in billion (RWF) at constant 2023 prices, exchange rate is USD 1 to RWF 1,170.6 as of July 21, 2023.

USD 922.86 – derived from USD 976.50 minus USD 53.64. At 16 times (Rwanda's UHC system sovereignty level), it sums to USD 1,230.48 – calculated from USD 1,302 minus USD 71.52.

3.5.2. Strengthening of the CBHI system and health care delivery systems in line with the HRV 2050

The 1st year of the implementation of FASP PPM-related reform increased the AGR of community health workers from –5% to 206%, the AGR of provincial hospitals from 10% to 40%, and the AGR of contracted private specialty health establishments from 10% to 20% (see Scenario II). It also clinically strengthened all P/A health-care facilities by upgrading tariffs from the 2024/2025 base level to fourfold by 2030/2031 (UMIC level), eightfold by 2035/2036 (HIC level), and, in a pessimistic scenario, twelvefold (self-reliance level) by 2040/2041, at the latest. The accumulated reserve is projected to reach RWF 6,985.66 billion, to be efficiently allocated to CBHI, modernization of the P/A health-care delivery system, and other unmet social-health programs and services (Figure 5).

3.5.3. Contribution to national priorities

This study aligns with the priorities of the national health sector, including the completed National Strategy for Transformation 1 (NST1, 2017 – 2024), particularly Pillar 18 in the Social Transformation section, and its successor, NST2 (2025 – 2029).

Although it does not directly address poverty (national priority no.1), malnutrition (national priority no.2), or health sector priority no.1, this study aims to assist all Rwandans to withstand financial hardship due to illness, support vulnerable groups in coping with health-related shocks, and contribute to poverty reduction through socioeconomic empowerment and targeted support for combating malnutrition among elderly vulnerable sub-groups.

This study indirectly supports the three key cross-cutting areas of the NST1 – capacity development, HIV/AIDS and non-communicable diseases, and disability and social inclusion – by allocating a portion of the accumulated reserve (RWF 6,985.66 billion) to these programs. It also reinforces the 9th Resolution of the 16th National Leadership Retreat (March 2019), which emphasized the financial sustainability of CBHI. Furthermore, it addresses the concerns raised in the HSSP IV midterm review (2020/2021) regarding insufficient financing for the second term (2021 – 2024), which could impede the success of HSSP V. In addition, the study indirectly contributes to the development, outputs, outcomes, and impact of the 4×4 Health Reform while also supporting health sector priorities, such as SDG Target 3.8 (UHC Index).

3.5.4. Ultimate impact

The ultimate impacts include:

- (i) Improved health and welfare: Better health outcomes, enhanced welfare, and increased life expectancy
- (ii) Increased productivity: A healthier population will boost productivity, leading to higher GDP and economic growth, aligned with Rwanda's HRV 2050
- (iii) Sustainable stakeholder engagement: All stakeholders in the UHC and HRV 2050 model can confidently ensure long-term institutional and financial sustainability
- (iv) Health sector vision: Rwanda envisioned for 2050 will be realized by 2040/2041 at the latest

4. Discussion

The discussion will focus on: (i) CBHI's persistent financial deficit during the assessed period, (ii) the simulated financial sustainability of CBHI from 2021/2022 to 2040/2041, (iii) key factors contributing to Rwanda's UHC success, (iv) experiences from Ghana (low-middle-income country), Indonesia (formerly middle-income country, now UMIC), and Thailand (UMIC), which implemented bundled payment methods as cost-containment measures in their UHC systems, and (v) the rationale for abolishing the 10% co-payment.

4.1. Financial viability of the CBHI system during the assessed longitudinal period and prospective period

This section outlines the CBHI's financial viability during the assessed period.

4.1.1. Financial viability of the CBHI system during the assessed longitudinal period

Financial deficits persist in the CBHI scheme despite regular financial interventions from the GOR to settle debts owed to public and faith-based health facilities. The latest top-up of RWF 22.63 billion, disbursed through the prime minister's order in FY 2020/2021, aimed to address CBHI's financial gaps and prevent system collapse. However, the deficit increased from RWF 19.21 billion in 2019/2020 to RWF 19.67 billion in 2020/2021. This worsening deficit occurred despite no significant changes in CBHI, health-care utilization, or national and global health trends before the COVID-19 pandemic. The ongoing financial distress highlights the need for coordinated national action and cost-control measures, including introducing a cost-control culture in CBHI's financial management.

This research emphasizes the importance of strategic purchasing and the PPM as cost-control tools. These mechanisms can prevent overbilling, support CBHI's

financial sustainability, and contribute to Rwanda's goal of achieving UHC in line with WHO's SDG Target 3.8 (UHC index). However, the health sector continues to face challenges, including modernizing infrastructure and equipment, addressing competing priorities, such as workforce expansion, and navigating the decline in external funding. Adopting effective cost-control measures, such as an active PPM, is crucial in this context.

4.1.2. Financial viability of the CBHI system during the prospective period

This section outlines the CBHI's financial viability during the prospective period.

- a. Scenario I: Financial viability of the CBHI system under the continuation of the fee-for-service PPM

The simulation results show a significant worsening of the persistent deficits, putting the CBHI at risk of bankruptcy and threatening the collapse of the public health-care system. Consequently, the GOR is forced to regularly settle arrears owed to health facilities since 2015. This situation disrupts the functioning of public health-care facilities and strains relationships between CBHI and contracted facilities. As a government-sponsored insurance scheme, CBHI relies on the Ministry of Finance and Economic Planning to settle arrears directly from the national general budget.

- b. Scenario II: Projected financial viability of the CBHI system under the fully active-strategic purchasing PPM

Scenario II simulates the reform's implementation, demonstrating CBHI's financial sustainability from 2021/2022 to 2040/2041. The reforms and innovations are projected to lead CBHI to achieve the study's target of long-term financial sustainability.

Regarding the P/A health-care system, it is assumed that timely reimbursement of claims upon invoice submission and verification will incentivize public/agreed health-care providers contracted with CBHI to gradually enhance their self-sufficiency. In addition, the government could utilize the accumulated reserves of RWF 1,429.97 billion to improve health-care quality, invest in health sector priorities, and address unmet needs, such as covering the 10% co-payment for P/A health-care facilities, maintaining the average annual prepayment fee of RWF 3,000, and expanding universal access to specialized care nationwide.

- c. Scenario III: Projected financial sustainability of the CBHI system under the fully active-strategic purchasing PPM with revenues from 1% specific tax

The simulation excludes revenue from the 1% specific tax and focuses on Rwanda's financial readiness to mobilize, collect, and allocate funds for HRV 2050-related

quality health care and innovations. A closer look at Table S9 and the "subtotal income from 2nd GOR top-up" in Scenario III reveals that, with current funding sources, the 1% specific tax alone is projected to generate RWF 773.62 billion (Table S9) by 2040/2041 – 133% of the RWF 580.08 billion required to meet HIC's health-care standards. These additional funding sources alone could enable Rwanda to achieve the HRV 2050 targets. This highlights Rwanda's potential to leverage its social and human capital to overcome health-care challenges and achieve financially sustainable development, including HRV 2050.

- d. Scenario IV: Effective implementation of the "minimum 1% specific tax for UHC and HRV 2050"

The implementation of Scenario IV is expected to yield significant economic, health, and social protection benefits, potentially surpassing initial expectations. With the implementation of the "minimum 1% specific tax for UHC and HRV 2050", all anticipated benefits, outcomes, and impacts outlined in the related sections become more feasible, as our assumptions and results do not account for:

- (i) This study took a cautious approach by dividing the 2024/2025 mobilized amount by three and spreading it over the next 3 financial years
- (ii) Additional financing sources will be introduced beyond the initial 13 listed above
- (iii) A 6 – 9% AGR for 2024/2025 to 2030/2031 and a 10% AGR for 2040/2041 were used instead of Rwanda's actual AGR of 9.7% and 9.8% for the first and second terms of 2024
- (iv) Revenues from the Comfortable Package membership were excluded. Income-generating activities related to health services (IGA_HS) and revenues generated by the medical tourism strategy were also not considered in the simulations.

4.2. Key factors contributing to the success of Rwanda's UHC

The key factors include:

- (i) Rwanda's HRV 2050: Achievability and potential as revealed by the current study findings and conclusions.
- (ii) Rwanda's HRV 2050 is ambitious but attainable, grounded in its demonstrated and projected capacities.
- (iii) Government-Sponsored Health Sector Performance. Rwanda continues to advance its healthcare system, particularly in investment and equity, aligning with HRV 2050, despite national and global fluctuations.
- (iv) Rwanda has sustained gains in its health system, especially in equity and public investment, consistent with HRV 2050's strategic vision.

- (v) Quality health-care system performance: Rwanda ranked 70th globally for best health-care systems in 2023, with a health-care system score of 58.2. This marks a significant improvement from its 172nd position among 190 WHO member states in the 2000 ranking (World Health Organization, 2000).

4.3. Factors conducive to the success of UHC in Rwanda

In addition to the structural achievements, Rwanda's UHC success can be attributed to several hidden enabling factors:

- (i) Good governance and stewardship: Political leadership and strong governance align resources with population health needs, contributing to national and global health goals
- (ii) Integration of faith-based health-care system: Faith-based organizations manage approximately 40% of health facilities, integrated with the public health system while maintaining autonomy
- (iii) Decentralization: Rwanda's decentralized health system improves both access to care and UHC delivery by incorporating local governance
- (iv) Adaptation of global health goals: Rwanda tailors global health targets, such as the Millennium Development Goals, to its context, facilitating remarkable health outcomes
- (v) Homegrown innovations: Programs such as CBHI, performance-based financing, and community health workers are pivotal in expanding UHC
- (vi) Community health workers: Community health workers provide essential health services, particularly in rural areas, addressing 80% of local health needs
- (vii) Inter-sectoral collaboration: Rwanda's health system thrives on cross-sector cooperation through frameworks, including the Sector Wide Approach and Joint Action Development Forum
- (viii) Aid coordination and mutual accountability: Transparent aid management has fostered trust and efficiency, ensuring mutual accountability in resource allocation.

4.4. Capability to address current and emerging challenges in the UHC scheme amid a changing global landscape

Rwanda is well-positioned to tackle both existing and emerging health challenges through strategic financing and policy implementation:

- (i) Health financing: Key approaches include social mobilization via CBHI, revenue generation through various funding sources, and pooling funds to improve financial protection
- (ii) Public spending on health control and/or

monitoring: The government's health budget ensures quick responses to health emergencies and efficient resource use. Regular monitoring through quarterly business plans and biannual meetings will strengthen routine public financial management, accountability, and transparency in Rwanda's UHC Model

- (iii) Health taxes: Taxes on harmful products, such as tobacco, alcohol, and sugary drinks, will promote public health and generate revenue. A proposed generalized tax levy, the "minimum 1% specific tax for UHC and HRV 2050," will further support these goals
- (iv) Innovative and strategic funding: Scenarios propose a 1% tax to fund Rwanda's UHC and HRV 2050 goals. Private sector involvement will be critical in reducing the government's financial burden and will be the main funding source of the P/A health-care system
- (v) Sustainable health progress: Rwanda's UHC model focuses on resilience and financial sustainability, ensuring long-term access to quality health care
- (vi) Nobody behind, vertical equity, and special inclusion: Efforts will focus on protecting vulnerable groups from financial hardship, expanding subsidized/affordable quality health-care services, and tackling social costs, including those of feeding and dietetics services
- (vii) Coordination and solidarity: Effective collaboration between ministries, the National Bank of Rwanda, the RSSB, and the private sector will ensure long-term UHC and HRV 2050 success
- (viii) Tackling health inequality: Rwanda has strongly emphasized equity, ensuring that marginalized and rural populations benefit from health-care services.
- (ix) Tackling health workforce shortages: Through training and retention programs, such as the 4×4 Health Reform, Rwanda is ensuring an adequate and skilled health workforce.
- (x) Tackling non-communicable diseases: Rwanda is responding to the growing burden of non-communicable diseases by promoting prevention programs and integrating care for these diseases into the national health strategy. Rwanda's experience in handling health crises, such as COVID-19 and Ebola, has demonstrated its readiness to tackle emerging health concerns through rapid response systems, effective containment measures, and international collaboration.

4.5. Fee-for-service mechanism versus fully active-strategic purchasing mechanism

This study compares FFS and FASP payment mechanisms in Ghana, Indonesia, and Thailand. When social health insurance uses DRGs, high-cost providers may refrain from

contracting unless they can reduce their costs (Hsiao *et al.*, 2007; Nyandekwe *et al.*, 2020). Although most providers oppose capitation, the study argues that bundled payments can effectively control costs and should be implemented, as they can reduce deficits and mismanagement. Data from Rwanda's CBHI (2011/2012 – 2020/2021) supports the assertion that cost escalation occurred under the FFS PPM practice.

4.5.1. Ghana

Ghana, a low-middle-income country in West Africa, had a GDP per capita of USD 2,409 in 2020 (up from USD 1,779.89 in 2017) and per capita health spending of USD 84.98. In 2005, Ghana launched the National Health Insurance Scheme (NHIS) to promote UHC. While NHIS expanded health-care access, financial sustainability has been a concern, with the deficit rising from 4.8% in 2009 to 23.7% in 2010 before dropping to 1.87% in 2012 after adopting the DRG payment policies. The NHIS attributed rising deficits to “moral hazards” and mismanagement, prompting cost-containment measures, including the capitation paid claims scheme. Health-care professionals have criticized the fairness of this payment method. During the pilot phase of the “*Mutuelles de santé*” in Rwanda, many health-care providers opposed the capitation PPM, which was ultimately rejected due to failing to cover the actual costs of health services (Schneider and Diop, 2000).

4.5.2. Indonesia

Indonesia, a middle-income country in Southeast Asia, had a GDP per capita of USD 4,333 in 2020, with health expenditures at USD 132.96 per capita. In 2014, Indonesia launched the Jaminan Kesehatan Nasional (JKN) program, covering 145 million people, with 86.4 million eligible for financial assistance. Despite promoting equity, actuarial studies show that JKN's per capita subsidy is insufficient to cover its costs. While the government adopted a provider contracting system to address this, the financial gap remains, requiring higher contribution rates and cost-containment strategies.

4.5.3. Thailand

Thailand, a UMIC, had a GDP per capita of USD 7,067 in 2020, with a per capita health expenditure of USD 305.09. Thailand achieved UHC through its Social Health Insurance program (1988 – 1997), funded by taxes, with no premiums for beneficiaries. The government also provides benefits to civil servants through the Civil Servants Medical Benefit Scheme. Despite cost-control efforts such as capitation and DRG systems, disparities remain between civil servants and other program participants, similar to issues seen in Rwanda's other private social health insurance institutions and CBHI.

4.6. Rationale for abolishing the co-payment scheme

The prepayment system reflects CBHI members' ownership and aligns with Rwanda's constitution, which mandates the state to promote health and involve the population in health activities. Despite high membership coverage, Nyandekwe *et al.* (2014) reported that only 2.17% of the 94% CBHI target population can afford the 10% co-payment for specialized treatments, such as kidney transplants, costing RWF 2 – 2.5 million. Without abolishing the co-payment scheme, 91.83% of CBHI members would be excluded, raising concerns over government accountability.

To address this, we propose abolishing co-payments at public/agreed health-care facilities, with CBHI reimbursing costs via a third-party mechanism. This would ensure equal access to specialized care for all members. The CBHI annual premium of RWF 3,000 (USD 2.56) accounts for 3.2% reducing to 3% of the projected per capita health expenditure of USD 81.17 for 2024/2025. Abolishing co-payments would raise subsidized CBHI coverage to 97%, enabling Rwanda's health-care system – from community health workers home-based care to tertiary hospital levels – to deliver nearly free care across all levels, ensuring universal access and protecting members from financial hardship.

Abolishing co-payments would increase CBHI member's coverage to 96.8% (100% minus 3.2%) rounding to 97% and enable Rwanda's health-care system – from community health workers to tertiary hospitals – to provide nearly free primary, hospital, specialty, and super specialty care, ensuring universal access and shielding members from financial hardship.

Abolishing co-payments at primary health-care levels would reduce health-care costs for CBHI members, encourage timely visits, and prevent complications that could result in costly hospital treatments. At hospitals, it would improve access to expensive care for the 91.83% of members who cannot afford the 10% fee. In addition, maintaining a fixed CBHI premium rate until 2040/2041 would protect members from catastrophic health expenses and increase resilience against health-care shocks.

4.7. Limitations of the study

While the study did not survey Rwandan health stakeholders on the proposed FASP PPM, it is known that many health-care providers, including those in Rwanda, oppose the capitation PPM. Initially used in “*Mutuelles de Santé*,” the capitation PPM was later rejected due to its failure to cover the actual costs of health services (Schneider and Diop, 2000). While DRGs, widely used to reduce costs, remain controversial (particularly in countries such as Ghana), past resistance from health-care providers should

guide decision-making. The “minimum 1% specific tax for UHC and HRV 2050” is a reform with minimal limitations; however, limited information for decision-makers remains a challenge.

4.8. Lessons learned

The lessons learned from this study include:

- (i) A country's health-care standard is influenced more by the organization of its health-care system and political will than by its GDP per capita or health expenditure
- (ii) Rwanda's experience serves as an inspiration for other low- and middle-income countries pursuing UHC, with equity at its core
- (iii) While Rwanda's homegrown strategies, especially the multi-sectoral national solidarity funding mechanism, were effective, they may not be easily replicated elsewhere
- (iv) A transitional equitable cost-recovery system is necessary to encourage proactive prepayments to mutual health organizations or CBHI
- (v) Decision-makers should be aware that the 1% specific tax for CBHI and Ghana's 2.5% National Health Insurance contribution represent symbolic grants due to limited national resources
- (vi) Abolishing co-payments and promoting proactive visits to primary health care is a right that offers long-term financial and social benefits to CBHI members and their relatives. This approach relieves employees from the burden of costly health care and co-payments, as highlighted by Nyandekwe *et al.* (2020).

5. Conclusion

While Rwanda faces significant challenges in achieving its HRV 2050 health-care targets, with strategic investments in CBHI, utilization of internal resources, and drawing inspiration from countries such as Thailand, which offers near-free health-care services, it can meet or exceed UMIC and HIC standards. It is confident that the introduction of the “minimum 1% specific tax for UHC and HRV 2050” and other enabling factors will allow Rwanda to leverage these resources to achieve HRV 2050 by 2040/2041, surpassing expectations and overcoming emerging UHC challenges.

The revised target for 2040/2041 aligns more realistically with Rwanda's current economic growth and health system projections. This study's findings, including cost-control strategies, provide a solid foundation for addressing health sector priorities and global UHC challenges. Rwanda's model could serve as a guide for other low- and middle-income countries. In addition, the results have confirmed

the achievement of this study's objectives and have validated the initial hypotheses. They proposed strategic solutions to address the five key challenges from our previous study (Nyandekwe *et al.*, 2020), which presented the CBHI system and other unmet health programs and services.

Through innovative methods, social capital, and human capital, Rwanda's HRV 2050 for health care – once considered utopian – has been realized ahead of schedule, achieving a modernized UHC model 10 years before the 2050 milestone, despite economic constraints. This study recommends adopting Scenarios II and IV for long-term institutional and financial sustainability. Successful implementation will require strong governance, political will, and a commitment to equity at the heart of UHC. Other African nations are encouraged to draw inspiration from Rwanda's UHC model.

5.1. Recommendations

A summary of the recommendations is as follows:

- a) To the GOR and the Ministry of Finance and Economic Planning:
 - (i) Grant CBHI full administrative and financial autonomy
 - (ii) Leverage the expertise of current CBHI staff
 - (iii) Advocate for the adoption of Strategy A: a cost-neutral, efficiency-driven reform model that remains commendable even without additional financial inputs (input-based).
 - (iv) Advocate for the adoption of the 1% UHC–HRV 2050 tax as the foundation of Strategy B: A cost-conscious, target-based reform model supporting innovation and long-term HRV 2050 objectives.
- b) To the MoH:
 - (i) Implement the FASP PPM and regular tariff updates
 - (ii) Ensure data access and transparency for CBHI managers and planners
 - (iii) Strengthen clinical capacities, especially in district and provincial hospitals, and improve on-the-job training programs through proximity and outreach coaching.
- c) To the RSSB and CBHI:
 - (i) Remove the confusing budget line of “13% MOH budget” from the CBHI budget
 - (ii) Implement Scenario II and adopt DRG pricing with regular tariff updates
 - (iii) Integrate financial innovations and optimal practices from Scenario III
 - (iv) Monitor health posts and provincial hospitals to ensure quality care at the provincial hospital level and reduce fraud at the health-post level.

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Conflict of interest

The authors declare they have no competing interests.

Author contributions

Conceptualization: Médard Nyandekwe

Data curation: Médard Nyandekwe

Formal analysis: Médard Nyandekwe

Funding acquisition: Jean Baptiste Kakoma

Investigation: Médard Nyandekwe

Methodology: Médard Nyandekwe

Project administration: Médard Nyandekwe

Resources: Médard Nyandekwe

Supervision: All authors

Validation: All authors

Visualization: Médard Nyandekwe

Writing-original draft: Médard Nyandekwe

Writing-review & editing: All authors

Ethics approval and consent to participate

Scientific approval for this study, which is required as a prerequisite for ethical review was obtained from the

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Consent for publication

Authors consented to the publication of their data.

Availability of data

The survey questionnaire, the informed consent form, the datasets, and detailed data supporting the findings of the study are available and can be shared upon contact with the corresponding author.

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