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Determinants of Health Insurance Coverage in Rwanda: A Nationally Representative, Survey-Weighted Analysis of the 2023/2024 Seventh Integrated Household Living Conditions Survey (EICV7)

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Abstract

Background

Rwanda has expanded health insurance enrolment to among the highest levels in sub-Saharan Africa, primarily through the Community-Based Health Insurance scheme (Mutuelle de Santé). Whether this near-universal coverage is distributed equitably across demographic and socioeconomic groups, and which individual- and household-level factors continue to drive non-enrolment, remains insufficiently characterized using the most recent national survey round. This study assessed the distribution of health insurance coverage across individual profile characteristics and identified the determinants of insurance coverage countrywide.

Methods

A cross-sectional analysis was used for individual-level microdata on 62,058 respondents from the 2023/2024 Seventh Integrated Household Living Conditions Survey (EICV7). A survey-weighted logistic regression model (quasibinomial family, logit link) accounting for primary sampling units, strata, and household sampling weights was fitted to estimate adjusted odds ratios (aOR) for insurance coverage across sex, age, marital status, residence area, education, economic activity, income, welfare (Ubudehe) category, consumption quintile, internet use, recent illness, and recent health consultation.

Results

A weighted health insurance coverage of 85.3% was observed among the sampled respondents, whereby tertiary education (aOR 7.58), the highest consumption quintile (aOR 4.45), and internet use (aOR 2.62) were the strongest independent predictors of coverage. Crucially, once socioeconomic factors were controlled, residence area (urban vs. rural) was no longer a significant predictor, suggesting that earlier urban–rural gaps were driven by underlying wealth and education differences rather than geography per se.

Conclusions

Health insurance coverage in Rwanda remains high but follows a clear socioeconomic and educational gradient. Strengthening enrolment among the least-educated, poorest, and least digitally connected populations, and reinforcing linkages between routine health contacts and enrolment, are priorities for sustaining progress toward universal health coverage.

Background

Achieving Universal Health Coverage (UHC) remains a central policy objective across low- and middle-income countries (LMICs). UHC is defined as ensuring that all people and communities receive the quality health services they need, including safe and effective medicines and vaccines, without suffering financial hardship [1]. This financial-protection dimension is tracked globally through Sustainable Development Goal (SDG) indicator 3.8.2, which as of a 2025 revision measures the proportion of the population whose out-of-pocket health expenditure exceeds 40% of household discretionary budget, a threshold intended to better capture hardship among the poorest households[2, 3]. Across sub-Saharan Africa (SSA), however, out-of-pocket payments persist even for services nominally covered by insurance, reflecting a broader policy implementation gap between the design of health-financing schemes and their experience at the point of care [4].

While many LMICs have expanded public health insurance over the past two decades, progress has often been uneven, with persistently low coverage, adverse selection under voluntary enrolment, and incomplete financial protection in several settings [5]. Because enrolment under voluntary health insurance (VHI) is self-selected, such schemes are prone to market failures arising from adverse or risk selection, which can trigger a cycle of rising premiums and further selection, threatening the affordability and stability of the scheme over time. Where VHI is layered onto fragmented health systems, it can deepen fragmentation and produce unbalanced risk pools skewed toward sicker enrollees, eroding the redistributive capacity that would otherwise favor the poor [6]. Reviews of community-based health insurance (CBHI) programs across LMICs note that household-level mandatory enrolment has been used to curb adverse selection, though some programs fail to achieve full household enrolment in practice, with compulsory participation paired with subsidies for the poor offered as an alternative mitigation strategy [7].

Rwanda is a notable exception to this pattern of uneven progress. The country has expanded health insurance enrolment to among the highest levels recorded in a resource-constrained setting, anchored by the Community-Based Health Insurance scheme (Mutuelle de Santé), alongside formal-sector social insurance administered through the Rwanda Social Security Board (RAMA) and private commercial schemes [8]. Mutuelle de Santé traces its origins to a pilot program launched in three districts between 1999 and 2004, before being scaled nationally as Rwanda's principal vehicle for universal access to healthcare [9]. A defining reform came in 2011, when the scheme was restructured around a system of tiered premiums intended to make the program more financially progressive and sustainable, drawing on the country's Ubudehe community-based wealth-categorization system [10]. Ubudehe classifies every Rwandan household into a small number of socioeconomic tiers originally four numbered categories and, since a 2020/2021 revision, five categories labelled A through E — through a participatory village-level process that weighs income, assets, and capacity for economic self-sufficiency rather than income alone[11]. This tiering underpins full premium subsidies for members of the two poorest Ubudehe sub-categories, a design feature directly relevant to the welfare-gradient analysis this study undertakes [12]. Implementation has also been reinforced administratively: local leaders and community health workers have had district-level CBHI coverage built into their performance-based financing incentives, contributing to enrolment levels that exceeded 90% by 2010 and have been broadly sustained since [13,

14, 15]. Financing has drawn on a mixed-revenue model, with roughly two-thirds of Mutuelles funding coming from member premiums, alongside government, donor, and co-funding contributions, though recurring deficits have periodically required government intervention to preserve scheme solvency. Reforms continue: as of early 2026, Rwanda's lowest income bracket pays no premium at all under a revised, more progressively tiered contribution structure, underscoring the state's ongoing commitment to protecting the poorest from financial exclusion.

This expansion has coincided with measurable gains in healthcare utilization. According to EICV7 (2023/2024), the proportion of individuals reporting a medical consultation following a recent health issue has continued to rise compared with earlier survey rounds, consistent with broader improvements in financial access to care [16]. A recent EICV7-based analysis of insurance and utilization patterns corroborates this trend, finding that 71% of individuals with a reported health issue in the four weeks preceding the survey obtained a medical consultation, up from 57% in EICV5 (2016/17) [11].

Nonetheless, national surveys and program evaluations have repeatedly documented socioeconomic, educational, and gender-based gradients in insurance enrolment, with premium affordability, awareness, and proximity to enrolment points cited as recurring barriers among poorer and rural households [12, 13]. Analysis of the preceding EICV5 round found that household heads in the highest wealth quintile had substantially higher odds of being insured than those in the lowest quintile (adjusted OR 3.82, 95% CI 3.37–4.33, $p < 0.001$), a wealth gradient this study's EICV7-based welfare-category findings appear to reaffirm nearly a decade later [12]. Broader multi-country evidence from the region situates this pattern within a wider structural challenge: across several SSA health-financing schemes, education, age, and household size significantly shape enrolment, underscoring the roles awareness and affordability play, while high premiums and limited scheme understanding remain major participation barriers [17, 18]. Gender is a further recurring axis of inequity: pooled analyses of Demographic and Health Survey data from more than two dozen SSA countries have found overall insurance coverage of roughly one-fifth of the population, with women's decision-making autonomy independently associated with their own likelihood of enrolment [19, 20], and separate multi-country analyses reporting that both men and women with higher education have more than seven-fold higher odds of coverage than those with no education, with exposure to radio, television, and print media also independently associated with enrolment[21, 22]. Notably, several of these regional analyses report lower insurance coverage among women than men [15, 17].

Cross-country comparisons within sub-Saharan Africa further show that, while Rwanda performs strongly on overall enrolment relative to a regional pooled average nearer 21% [14], residual socioeconomic gradients in coverage persist in common with other high-performing systems in the region [11]. A recent equity-focused analysis of EICV7 data from Rwanda's Vision Umurenge Program sectors notes that comparative evidence from SSA indicates substantial heterogeneity, with Rwanda performing relatively well on enrolment yet still contending with socioeconomic gradients in service use, reflecting a poverty–health feedback loop [11]. This reinforces a broader point in the equity literature on

CBHI: expanding enrolment does not automatically resolve inequities in utilization or effective access, and the two require separate evaluation [23, 24].

These questions sit within an active national policy window. Rwanda's Health Sector Strategic Plan V (HSSP V, 2024/25–2028/29) explicitly commits the sector to advancing universal health coverage by 2030 through five strategic pillars spanning workforce, infrastructure, quality, health security, and sustainable health financing, including strategic purchasing and strengthened health insurance mechanisms [25]. An updated, individual-level analysis of the most recent EICV7 round, with appropriate accounting for the complex survey design (clustering, stratification, and sampling weights), is needed to inform current targeting of enrolment and retention interventions under this strategic plan and the broader UHC agenda, since most existing analyses of insurance determinants in Rwanda draw on earlier EICV rounds or aggregate district-level indicators that can obscure within-district heterogeneity and individual-level effects[26].

This study addresses this gap by (i) describing the distribution of health insurance coverage across demographic, socioeconomic, and geographic subgroups, and (ii) identifying the independent individual- and household-level determinants of coverage using a survey-weighted multivariable logistic regression model.

Methods

Study setting

This study was conducted using data collected across the Republic of Rwanda, organized into five provinces (Kigali City, Northern, Southern, Eastern, and Western) and 30 districts, further subdivided into sectors, cells, and villages. Rwanda operates a decentralized, three-tiered health system comprising health posts and health centers at the community and sector level, district hospitals, and referral/teaching hospitals at the national level. Health financing is anchored by the Community-Based Health Insurance scheme (Mutuelle de Santé), which covers the majority of the population outside the formal sector, alongside the Rwanda Social Security Board's medical insurance (RAMA) for public- and formal-sector employees, and private commercial insurance schemes. The analysis draws on nationally representative household survey data collected across all five provinces and 30 districts, capturing both urban and rural populations.

Study design

This was a cross-sectional analytical study based on secondary analysis of individual-level microdata from the Seventh Integrated Household Living Conditions Survey (EICV7, 2023/2024), a nationally representative household survey implemented by the National Institute of Statistics of Rwanda (NISR). The EICV7 is the seventh round in a series of household living conditions surveys conducted periodically by NISR since 2000/01 to monitor poverty, welfare, and socioeconomic indicators. For the purposes of

this study, individual-level records containing health insurance status and the covariates of interest were extracted from the EICV7 dataset for cross-sectional analysis; no follow-up or repeated measurement of respondents was involved.

Sampling strategy

EICV7 employed a multi-stage stratified cluster sampling design, drawing samples from each of Rwanda's 30 districts, which served as the sampling strata. NISR developed a Master Sample of primary sampling units (PSUs) based on data from the 2022 Rwanda Census of Population and Housing, designed to support various national household surveys during the intercensal period, including the EICV. Within each stratum, Master Sample PSUs (enumeration areas) were selected using probability proportional to size (PPS) sampling, with the number of households enumerated in the census serving as the measure of size for each enumeration area. NISR determined the EICV7 sample size by examining EICV5 data to compute sampling errors and 95% confidence intervals for district-level poverty rate estimates, yielding a nationally and district-representative sample of 15,066 households. Households were selected at the second stage within sampled enumeration areas, and all consenting individual household members were eligible for interview, producing the individual-level analytic file. Sample weights, primary sampling unit identifiers, and stratum (district) identifiers were retained in the released microdata to support design-based (survey-weighted) estimation, which was applied throughout this analysis.

Data collection

EICV7 data collection spanned a 12-month period, from October 16, 2023 to October 15, 2024, and was divided into nine nationally representative cycles to capture seasonal variation in income and consumption. Data collection, including the listing, sampling, and assignment of households, was conducted electronically using tablets via the EICV7 Computer-Assisted Personal Interviewing (CAPI) application, with the questionnaire programmed in CSPro by NISR's data processing team. Trained enumerators administered structured household and individual-level questionnaire modules covering demographic characteristics, education, economic activity and income, welfare (Ubudehe) classification, consumption expenditure, health status and health-seeking behavior, health insurance enrolment, and access to information and communication technologies (including internet use). Field activities were coordinated by national coordinators overseeing EICV7 fieldwork across districts, with routine supervision and electronic data transmission to NISR central servers to support ongoing quality control. For the present study, the health insurance and covariate modules relevant to the individual-level analytic file were extracted from the final, cleaned EICV7 dataset released by NISR.

Data analysis

Data extraction, cleaning, and all statistical analyses were conducted in R (R Core Team), using the survey package to account for the complex sampling design. Descriptive analyses were first used to characterize the distribution of health insurance coverage and covariates across the sample, followed by design-based bivariate tests of association, and finally a multivariable survey-weighted logistic regression model to identify independent determinants of coverage, as detailed below.

This study conducted a cross-sectional analysis of individual-level microdata from EICV7 (2023–2024), implemented by NISR using a multi-stage stratified cluster sampling design spanning all five provinces and 30 districts of Rwanda. The analytic sample comprised 62,058 individual records with complete information on health insurance status and the covariates of interest.

Inclusion/exclusion

The analysis included all individual records with non-missing health insurance status and complete information on the core covariates (demographic, socioeconomic, and health-seeking variables) and survey design variables (weights, strata, primary sampling units). Records with item non-response on the outcome or core covariates were excluded listwise; categorical variables retaining a non-trivial “not applicable” category (e.g., marital status, internet use) were preserved as a distinct level where relevant to minimize unnecessary data loss.

Insurance. The outcome variable was self-reported health insurance status at interview (insured vs. not insured), encompassing Community-Based Health Insurance (Mutuelle de Santé), social insurance, and private/NGO-based schemes.

Demographic and socioeconomic covariates. Covariates included sex, age (years), marital status (informal/consensual union, legally married, single, widowed/separated/divorced), residence area (rural/urban), highest educational attainment (no education, primary, secondary, tertiary), economic activity (apprentice/volunteer, informal/family work, self-employed, unemployed, wage employed), household income, welfare (Ubudehe) category (severely poor, moderately poor, non-poor), and consumption quintile (Q1–Q5, poorest to richest).

Health-seeking and access covariates. Internet use, recent illness in the last four weeks, and recent health consultation in the last four weeks were included to capture digital access and recent contact with the health system.

Survey design and estimation

The survey followed a multi-stage, stratified design. A design object was declared in R using the survey package, specifying primary sampling units (clusters), strata, and household sampling weights, with nesting of clusters within strata. Unless otherwise noted, point estimates and standard errors are design-based via linearization.

Statistical analysis

Descriptive statistics (weighted proportions and means) were generated for the outcome and all covariates, with bivariate associations between insurance status and each covariate tested using Pearson's chi-squared test (categorical variables) and the Wilcoxon rank-sum test (continuous variables). A multivariable survey-weighted logistic regression model (quasibinomial family, logit link) was fitted including the full covariate set described above, of the general form $\text{logit}[\Pr(\text{Insured} = 1)] = \beta_0 + \beta_1\text{Sex} + \beta_2\text{Age} + \ldots + \beta_k X_k$. Adjusted odds ratios (aOR) with 95% confidence intervals (CI) were obtained by exponentiating model coefficients. Statistical significance was set at $p < 0.05$. All analyses were conducted in R.

Ethics and consent

This study is a secondary analysis of de-identified, publicly catalogued EICV7 microdata accessed through the NISR Microdata Catalog under a formal data use agreement. The original EICV7 survey was implemented in accordance with national statistical and ethical standards governing human subjects research, with informed consent obtained from all participants by NISR prior to data collection. Because this study involved secondary analysis of anonymized data with no possibility of identifying individual participants, no additional ethical approval or informed consent was required for the present analysis.

Results

Determinants of health insurance coverage

The survey-weighted multivariable logistic regression results show that the strongest independent predictors of coverage were tertiary education (aOR 7.58, 95% CI 5.44–10.55, relative to no education), the highest consumption quintile (aOR 4.45, 95% CI 3.75–5.27, relative to Q1), secondary education (aOR 3.40, 95% CI 3.06–3.78), the fourth consumption quintile (aOR 2.70, 95% CI 2.33–3.13), internet use (aOR 2.62, 95% CI 2.29–3.00), legal marriage (aOR 2.35, 95% CI 2.07–2.66), and non-poor welfare status (aOR 2.20, 95% CI 1.98–2.45). Recent health consultation (aOR 1.87, 95% CI 1.72–2.03) and primary education (aOR 1.61, 95% CI 1.51–1.71) were also positively associated with coverage. Male sex was independently associated with modestly lower odds of coverage (aOR 0.94, 95% CI 0.90–0.98, p = 0.003), as was severely poor welfare status (aOR 0.69, 95% CI 0.57–0.84) relative to moderately poor status. Residence area, economic activity category, and income showed weak or imprecisely estimated associations with coverage once other socioeconomic factors were accounted for(Table 2).

Table 1
Baseline characteristics of the study population by health insurance status, EICV7 2023/2024 (n = 62,058), survey-weighted.

Variable	Overall N = 62,058	Uninsured (0) N = 8,909	Insured (1) N = 53,149	p-value
Sex				**0.009**
Female	32,421 (52%)	4,540 (51%)	27,881 (52%)	
Male	29,637 (48%)	4,369 (49%)	25,268 (48%)	
Age, years (mean, SD)	25.12 (19.54)	22.22 (19.08)	25.60 (19.58)	< 0.001
Marital status				**< 0.001**
Informal/consensual union	6,986 (16%)	1,206 (21%)	5,780 (15%)	
Legally married	13,214 (30%)	1,053 (19%)	12,161 (32%)	
Single	19,201 (44%)	2,666 (47%)	16,535 (44%)	
Widow/Separated/Divorced	4,092 (9.4%)	695 (12%)	3,397 (9.0%)	
Residence area				**0.4**
Rural	46,113 (74%)	6,590 (74%)	39,523 (74%)	
Urban	15,945 (26%)	2,319 (26%)	13,626 (26%)	
Highest education				**< 0.001**
No Education	9,699 (16%)	2,131 (24%)	7,568 (14%)	
Primary Level	39,044 (63%)	5,812 (65%)	33,232 (63%)	
Secondary Level	11,377 (18%)	895 (10%)	10,482 (20%)	
Tertiary Level	1,938 (3.1%)	71 (0.8%)	1,867 (3.5%)	
Economic activity				**< 0.001**
Apprentice/Volunteer	106 (0.2%)	10 (0.1%)	96 (0.2%)	
Informal/Family Work	5,112 (8.2%)	466 (5.2%)	4,646 (8.7%)	
Self-Employed	14,078 (23%)	1,402 (16%)	12,676 (24%)	
Unemployed	30,793 (50%)	4,935 (55%)	25,858 (49%)	
Wage Employed	11,969 (19%)	2,096 (24%)	9,873 (19%)	

Variable	Overall N = 62,058	Uninsured (0) N = 8,909	Insured (1) N = 53,149	p-value
Sex				**0.009**
Income (mean, SD)	70,137.40 (352,227.57)	23,456.59 (187,064.48)	79,095.52 (375,049.98)	< 0.001
Welfare (Ubudehe) category				**< 0.001**
Moderately poor	13,822 (22%)	2,921 (33%)	10,901 (21%)	
Non-Poor	44,854 (72%)	5,021 (56%)	39,833 (75%)	
Severely Poor	3,382 (5.4%)	967 (11%)	2,415 (4.5%)	
Consumption quintile				**< 0.001**
Q1 (poorest)	12,561 (20%)	2,924 (33%)	9,637 (18%)	
Q2	12,691 (20%)	2,251 (25%)	10,440 (20%)	
Q3	12,681 (20%)	1,695 (19%)	10,986 (21%)	
Q4	12,354 (20%)	1,242 (14%)	11,112 (21%)	
Q5 (richest)	11,771 (19%)	797 (8.9%)	10,974 (21%)	
Internet use (Yes)	8,375 (20%)	527 (9.9%)	7,848 (21%)	< 0.001
Illness, last 4 weeks (Yes)	16,792 (27%)	2,214 (25%)	14,578 (27%)	< 0.001
Health consultation, last 4 weeks (Yes)	13,762 (22%)	1,236 (14%)	12,526 (24%)	< 0.001

Persistent socioeconomic gradient in coverage

Health insurance coverage varied markedly by household economic status, following a consistent and monotonic gradient rather than a simple binary divide. Coverage rose steadily from 76.7% among individuals in the poorest consumption quintile (Q1) to 93.2% among those in the wealthiest quintile (Q5), a gap of 16.5 percentage points across the wealth distribution(Table 1). A parallel pattern was observed using the welfare category classification, with coverage lowest among the severely poor (71.4%), intermediate among the moderately poor (78.9%), and highest among the non-poor (88.8%).

Educational attainment as an independent pathway to coverage

A comparably steep gradient was observed by educational attainment. Coverage increased from 78.0% among individuals with no formal education to 85.1% among those with primary education, 92.1%

among those with secondary education, and 96.3% among those with tertiary education.

Modest geographic variation and near-parity by residence and sex

Provincial variation in coverage was more modest than the socioeconomic and educational gradients described above, though still policy-relevant. Coverage ranged from 83.4% in Western Province to 91.9% in Northern Province, with City of Kigali, Southern, and Eastern provinces clustering in a narrower 83–85% band. By contrast, coverage did not differ meaningfully by sex (85.3% among males versus 86.0% among females) or by residence area (85.7% in rural areas versus 85.5% in urban areas).

An unexpected deficit in coverage among the formally employed

A counterintuitive pattern emerged with respect to economic activity. Individuals in wage employment reported the lowest coverage of any economic activity category (82.5%), together with the unemployed (84.0%), while self-employed individuals (90.0%) and those engaged in informal or family work (90.9%) reported markedly higher coverage.

Table 2
Adjusted odds ratios (aOR) for health insurance coverage from the multivariable survey-weighted logistic regression model.

Variable	aOR	95% CI	p-value
Sex			
Female	Ref		
Male	0.94	0.90–0.98	0.003
Age, years	1.01	1.01–1.01	< 0.001
Marital status			
Informal/consensual union	Ref		
Legally married	2.35	2.07–2.66	< 0.001
Single	1.27	1.15–1.40	< 0.001
Widow/Separated/Divorced	0.99	0.88–1.13	0.92
Residence area			
Rural	Ref		
Urban	0.97	0.85–1.11	0.69
Highest education			
No education	Ref		
Primary	1.61	1.51–1.71	< 0.001
Secondary	3.40	3.06–3.78	< 0.001
Tertiary	7.58	5.44–10.55	< 0.001
Economic activity			
Apprentice/Volunteer	Ref		
Informal/Family Work	1.17	0.59–2.32	0.66
Self-Employed	1.08	0.55–2.11	0.83
Unemployed	0.62	0.32–1.22	0.17
Wage Employed	0.57	0.29–1.12	0.10
Income	1.0000040	1.0000005–1.0000075	0.026
Welfare (Ubudehe) category			
Moderately poor	Ref		

Variable	aOR	95% CI	p-value
Sex			
Non-Poor	2.20	1.98–2.45	< 0.001
Severely Poor	0.69	0.57–0.84	< 0.001
Consumption quintile			
Q1 (poorest)	Ref		
Q2	1.40	1.22–1.60	< 0.001
Q3	1.94	1.68–2.25	< 0.001
Q4	2.70	2.33–3.13	< 0.001
Q5 (richest)	4.45	3.75–5.27	< 0.001
Internet use			
No	Ref		
Yes	2.62	2.29–3.00	< 0.001
Recent illness (last 4 weeks): Yes	1.12	1.05–1.20	< 0.001
Recent consultation (last 4 weeks): Yes	1.87	1.72–2.03	< 0.001

Discussion

This study examined the sociodemographic, economic, and behavioral determinants of health insurance coverage in Rwanda using nationally representative EICV7 (2023/2024) data. Several consistent patterns emerged, spanning individual characteristics, socioeconomic position, and healthcare-related behaviors, several of which both confirm and complicate the picture emerging from the broader regional literature on health insurance in sub-Saharan Africa (SSA).

Sex and marital status

Sex was weakly but significantly associated with coverage, with men showing marginally lower odds than women (aOR 0.94, 95% CI 0.90–0.98, p = 0.003). This finding is notable in a regional context: pooled multi-country DHS analyses across SSA have generally reported the opposite pattern, with male coverage exceeding female coverage in urban settings and women facing systematically lower odds tied to weaker household decision-making autonomy [19, 22]. The reversal observed in Rwanda is consistent with a health-financing architecture that enrolls insurance at the household level through Mutuelle de Santé rather than relying on individually-brokered, employment-linked schemes, and may also reflect targeted attention to women's health needs (e.g., maternal and reproductive health services) within Rwanda's CBHI benefit package. Age was positively associated with coverage (aOR 1.01 per year, p <

0.001), consistent with greater health system engagement and more established household registration among older individuals.

Marital status showed a more pronounced effect: legally married respondents had over twice the odds of coverage relative to those in informal or consensual unions (aOR 2.35, $p < 0.001$), and single individuals also demonstrated significantly higher odds (aOR 1.27, $p < 0.001$), whereas the widowed, separated, or divorced group did not differ from the reference category (aOR 0.99, $p = 0.92$). This pattern suggests that legal marital recognition, rather than partnership status broadly, facilitates access to coverage, plausibly through formal household-based enrolment mechanisms characteristic of Rwanda's community-based health insurance system, in which household registration, identity documentation, and Ubudehe categorization are often anchored to a legally recognized household head [7, 8]. In contrast, residence area showed no meaningful association (aOR 0.97, 95% CI 0.85–1.11, $p = 0.69$), indicating that urban–rural disparities in coverage may have narrowed in Rwanda even as such disparities persist elsewhere in the region, where urban residence has been independently associated with higher odds of coverage after adjustment for other socioeconomic factors [17]. This narrowing plausibly reflects Rwanda's community-based, geographically decentralized model of enrolment, which does not depend on urban formal-sector employment for access in the way that many other SSA insurance schemes do.

Education

Education emerged as one of the strongest predictors of coverage, with a clear dose-response gradient across attainment levels: primary (aOR 1.61), secondary (aOR 3.40), and tertiary (aOR 7.58) education were each associated with progressively higher odds of coverage relative to no education (all $p < 0.001$). This gradient likely reflects the cumulative influence of health literacy, awareness of insurance schemes, and greater capacity to navigate enrolment procedures among more educated individuals, and it closely mirrors findings from multi-country SSA analyses in which individuals with higher education have been found to have more than seven-fold higher odds of coverage relative to those with no education [22]. The consistency of this gradient across very different national health-financing architectures suggests that education operates as a robust, largely context-independent lever for insurance uptake, and reinforces the case for embedding insurance literacy content within Rwanda's existing adult literacy and community health worker outreach programs.

Economic activity and income

By contrast, type of economic activity showed no statistically significant association with coverage; informal/family work (aOR 1.17, $p = 0.66$), self-employment (aOR 1.08, $p = 0.83$), unemployment (aOR 0.62, $p = 0.17$), and wage employment (aOR 0.57, $p = 0.10$) were all statistically indistinguishable from the reference category (apprentice/volunteer) in the adjusted model, even though the unadjusted results showed markedly lower raw coverage among the wage-employed (82.5%) than among the self-employed (90.0%) or informally employed (90.9%). This apparent paradox — formal wage employment associated with the lowest raw coverage of any activity category — warrants particular attention, since it runs counter to the common assumption that formal employment, with its association to RSSB/RAMA

registration, should mechanically raise insurance coverage. A plausible explanation is that wage-employed individuals who are enrolled in RAMA or private employer-based schemes may under-report or inconsistently classify this coverage relative to Mutuelle de Santé membership in survey response, or that a subset of wage earners in transitional or informal wage arrangements fall into a coverage gap analogous to the “missing middle” documented among informal-sector workers elsewhere in the region, who often earn too much to qualify for premium subsidies but too little to comfortably prioritize premium payment [13]. Income itself demonstrated a statistically significant but practically negligible effect (aOR 1.0000040, p = 0.026), most plausibly attributable to the large sample size rather than any substantive relationship, underscoring the general caution that statistical significance in very large surveys does not equate to practical importance.

Welfare category and consumption quintile

Welfare category and consumption quintile provided clearer evidence of a socioeconomic gradient: non-poor individuals had roughly double the odds of coverage relative to the moderately poor (aOR 2.20, $p < 0.001$), while the severely poor showed significantly reduced odds (aOR 0.69, $p < 0.001$) despite formally qualifying for full premium subsidies under Rwanda's Ubudehe-tiered financing model [27, 28, 29]. This gradient was mirrored, and further reinforced, by consumption quintile, where odds rose steadily from Q2 (aOR 1.40) through Q3 (aOR 1.94) and Q4 (aOR 2.70) to Q5, the richest group (aOR 4.45; all $p < 0.001$), a gradient of similar direction to, and broadly consistent in magnitude with, the wealth-quintile gradient documented in the preceding EICV5 round (adjusted OR 3.82 for richest versus poorest quintile) [12]. That the severely poor — nominally the most heavily subsidized group — continue to show the lowest odds of coverage is a finding with direct policy salience: it suggests that residual barriers to enrolment among the poorest are not purely financial, but may include awareness gaps, distance to enrolment points, documentation requirements, or the opportunity cost of the enrolment process itself, echoing barriers to uptake documented in earlier EICV rounds [12] and across other SSA health-financing schemes more broadly [13]. Taken together, these findings indicate that broader economic position — captured through welfare status and household consumption — is a more robust determinant of insurance coverage than employment type per se.

Internet use and information access

Internet use was independently associated with substantially higher odds of coverage (aOR 2.62, 95% CI 2.29–3.00, $p < 0.001$), even in the context of education- and income-related variables already in the model. This association may reflect enhanced access to information about insurance benefits and enrolment platforms, or may serve as a proxy for broader socioeconomic advantage not fully captured by the other covariates examined. This finding is consistent with regional evidence that exposure to media — including radio, television, and print — is independently associated with higher odds of insurance coverage across SSA populations, a relationship attributed to greater awareness of scheme benefits and enrolment procedures [16]. As Rwanda's digital infrastructure and e-government services (including digital ID and mobile payment platforms increasingly used for Mutuelle de Santé premium

payment) continue to expand, internet access may become an increasingly important, and modifiable, lever for closing residual coverage gaps, particularly if digital enrolment channels can be extended to populations who currently lack internet access.

Healthcare need and utilization

Finally, healthcare need and utilization were both positively linked to coverage. Recent illness was associated with modestly higher odds of insurance coverage (aOR 1.12, 95% CI 1.05–1.20, $p < 0.001$), while recent consultation showed a stronger association (aOR 1.87, 95% CI 1.72–2.03, $p < 0.001$). The comparatively larger effect for consultation than for illness alone suggests a bidirectional relationship consistent with adverse-selection theory: individuals anticipating or experiencing healthcare needs may be more likely to seek coverage, while insured individuals may, in turn, be more likely to seek care when needed [5, 6]. This latter interpretation would suggest that insurance coverage is fulfilling its intended function of reducing barriers to healthcare utilization in the Rwandan context, consistent with the broader aim of financial risk protection embedded in the SDG 3.8 UHC target [1, 2]. At the same time, the presence of even a modest illness-coverage association is a reminder that voluntary or semi-voluntary elements within Rwanda's insurance system are not fully immune to the adverse-selection dynamics documented in VHI schemes elsewhere in the region [5, 6], reinforcing the importance of continued near-universal, rather than purely voluntary, enrolment strategies.

Policy implications

These findings carry direct relevance for Rwanda's Health Sector Strategic Plan V (2024/25–2028/29), which explicitly prioritizes sustainable health financing and strengthened insurance mechanisms as part of its pursuit of universal health coverage by 2030 [18, 19]. The persistence of a socioeconomic gradient even among the nominally subsidized severely poor category suggests that premium removal alone, as implemented in Rwanda's most recent 2026 financing reform for the lowest income bracket [7], may be necessary but not sufficient; complementary measures addressing information gaps, documentation barriers, and last-mile enrolment logistics are likely required to fully close this gap. Similarly, the unexpected coverage deficit among wage-employed individuals suggests a need for closer harmonization between RAMA/formal-sector insurance registration and national insurance coverage statistics, and possibly targeted outreach to wage earners in transitional or informal employment arrangements who may fall outside both the CBHI subsidy structure and formal-sector registration.

Strengths and limitations

This study benefits from a large, nationally representative sample with appropriate accounting for a complex multi-stage survey design, allowing for design-based inference generalizable to the Rwandan population. Nonetheless, several limitations warrant consideration. First, the cross-sectional design precludes causal inference; associations between, for example, recent consultation and insurance coverage are consistent with bidirectional causality and cannot be definitively disentangled with these data alone. Second, insurance status, illness, and consultation were self-reported, introducing the

possibility of recall or social-desirability bias, particularly for a sensitive marker of socioeconomic standing such as insurance enrolment. Third, while the Ubudehe welfare classification is a well-established and policy-relevant measure of socioeconomic status, it is assigned through a community-level participatory process that has previously been subject to public debate over consistency and perceived fairness [9], and misclassification at the household level could attenuate or bias the observed welfare-coverage gradient. Finally, as a single-country analysis, generalizability of these specific effect sizes to other SSA health-financing contexts should be made cautiously, although the directional consistency with regional evidence on education, wealth, and media-exposure gradients lends confidence to the broader patterns identified [12, 13, 15, 16].

Conclusion

Health insurance coverage in Rwanda remains high relative to regional peers but continues to follow a clear socioeconomic and educational gradient. Strengthening enrolment among the least educated, poorest, and least digitally connected populations, and reinforcing entry points linked to routine health consultations, represent priority strategies for closing residual coverage gaps and sustaining progress toward universal health coverage. Future research should extend this analytical approach to examine whether these patterns persist when linked to utilization outcomes, and how Rwanda's complementary social protection programs interact with insurance status to shape effective, equitable access to care.

Declarations

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Consent for publication

Not applicable. This study used fully anonymized secondary data with no identifiable individual information.

Data availability statement

The data that support the findings of this study are available from the National Institute of Statistics of Rwanda (NISR), subject to a formal data request and approval process. The dataset is publicly catalogued as: RWA-NISR-EICV7-2023–2024-v01: Seventh Integrated Household Living Conditions Survey (EICV7) dataset for public distribution. Access can be requested through the NISR Microdata Catalog: https://microdata.statistics.gov.rw/index.php/catalog. Restrictions apply to the availability of

these data, which were used under license for the current study and are not publicly downloadable without authorization from NISR.

Disclosure statement

I declare that there are no conflicts of interest associated with this manuscript. The research, analysis, and conclusions presented were conducted independently and reflect solely the author's views.

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Author Contribution

U.N. conceived and designed the study. U.N. and M.H.S. performed the statistical analysis. U.N. drafted the main manuscript text. F.I.M. and G.M. prepared Tables 1–3. F.S.U. and F.M. prepared Figure 1. V.N., A.M., J.B.N., and D.M. contributed to data interpretation and critically reviewed the manuscript for important intellectual content. All authors read and approved the final manuscript.

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