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Universal Health Insurance (UHI) in Côte d'Ivoire: Determinants of enrolment and impact on inequalities in access to care

N'DRI Kouamé Jean-Marc
Lecturer-Researcher, Péléforo Gon Coulibaly University, Department of Economics, Korhogo, Ivory Coast
Email: jeanmarcndri2010@gmai.com
orcid.org/0009-0006-6749-5708

KOFFI Adjoua Binette Raïchata Laurène
Researcher at the Laboratory for Economic Policy Analysis and Modelling (LAMPE), Alassane Ouattara University, Bouaké, Ivory Coast
Email: laurenekoffi45@gmail.com

IRIE Bi Gnanin Marius Willy
Researcher at the Laboratory for Economic Policy Analysis and Modelling (LAMPE), Alassane Ouattara University, Bouaké, Ivory Coast
Email: bishopirie89@gmail.com

N'GOUANDI Chris Roland Ghislain
Master's degree holder in Economics and Development Strategy, Institute Universities d'Abidjan, Ivory Coast
Email: chrisngouandi@gmail.com

***Abstract*---**This article analyses the determinants of enrolment in Universal Health Coverage (UHC) and its impact on inequalities in access to healthcare in Côte d'Ivoire, using data from the 2021 Harmonised Household Living Conditions Survey (EHCVM, n = 40,475 individuals). The study relies on a two-level multilevel logit model (individuals, regions), an Erreygers-corrected concentration index, and Propensity Score Matching (PSM). The results show that age, education, marital status, income and media access positively and significantly influence UHC enrolment, whereas gender, household size, area of residence and distance to a health facility show no robust effect. The concentration index (CI = -0.1348; Erreygers index = -0.1243) reveals that access to care is concentrated among the poorest individuals. Finally, the PSM estimation shows that UHC enrolment

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Corresponding author: *XXXX, Email: xxxx@gmail.com*
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increases the probability of using a health service by about 9 percentage points (ATT = 0.0904; $p < 0.01$). These results suggest that UHC improves healthcare utilisation, but that its effect on reducing inequalities remains limited without a parallel improvement in the supply of care.

***Keywords*---**Universal Health Coverage, healthcare access inequalities, multilevel logistic regression, concentration index, Propensity Score Matching, Ivory Coast.

1. GENERAL INTRODUCTION

Health is a vital element of population well-being and plays a decisive role in economic and social development. Good health increases individuals' efficiency, helps build human capital and supports economic growth over the long term (Sidibe and Audibert, 2022). Conversely, restricted access to medical services harms household well-being and aggravates precarity. As Sen (1999) points out, having access to health services is not enough to guarantee their use; it is also essential that people have the economic and social resources that enable them to actually use them. Following this reasoning, Marmot (2013) highlights that health disparities stem from the social conditions in which people are born, grow, live and work.

These inequalities are brought to light at the global level by clear differences between countries. In 2022, life expectancy at birth was approximately 82 years in France, whereas it was around 59 years in Côte d'Ivoire (World Bank, 2022). According to the WHO in 2023, household out-of-pocket payments remain one of the main obstacles to the use of health services in low- and middle-income countries. In this context, Universal Health Coverage (UHC) has gradually become a key tool for reducing disparities in access to care, by striving to ensure that all members of society benefit from essential health services without encountering financial barriers.

In Côte d'Ivoire, Universal Health Insurance (Couverture Maladie Universelle, CMU), established by Law No. 2014-131 of 24 March 2014 and effectively implemented from October 2019, is one of the major social protection reforms in the health sector initiated by the authorities. According to the National Health Insurance Fund (Caisse Nationale d'Assurance Maladie), in 2025 more than 23 million individuals were enrolled in the CMU, representing 68.1% of the population (CNAM, 2025). At the same time, the supply of care has improved: the country now has 3,286 primary-care health facilities, compared with 2,311 in 2020, in addition to 102 general hospitals, 21 regional hospital centres, 5 university hospital centres and 5 specialised institutes (RASS, 2024). The national density of health professionals stands at 12.15 per 10,000 residents, a figure that nonetheless remains below the recommended international standard of 23 per 10,000 residents. Although progress has been made, inequalities in access to care persist, showing differences according to income level, place of residence, region of residence, level of education and distance to health facilities. In 2024, the

national indicator for referral hospitals was only 0.64 per 150,000 inhabitants, compared with a standard of 1 per 150,000 (RASS, 2024).

However, the real impact of the CMU on reducing these disparities is a matter of debate in the field of economics. On the one hand, numerous studies highlight the beneficial effects of health insurance systems on access to care: Blanchet et al. (2012) show that Ghana's national health insurance scheme considerably strengthened the use of care among disadvantaged households, while Thuong (2020) emphasises that insurance schemes reinforce financial security and encourage the use of health services in low- and middle-income countries. On the other hand, more refined research demonstrates that expanding health coverage does not necessarily amount to a reduction in disparities when the supply of care is inadequate or poorly distributed (Wagstaff & Lindelow, 2008), and that the poorest groups may remain prevented from truly benefiting from coverage because of indirect costs and insufficient information (Ekman, 2007a).

This debate is particularly relevant in the context of Côte d'Ivoire: although the figures indicate a rapid increase in the number of CMU beneficiaries, they cannot confirm that this policy has truly reduced disparities in access to care, given that membership of an insurance scheme guarantees neither increased consumption of health services nor a narrowing of differences between social classes. This research addresses the following question: what are the determinants of enrolment in Universal Health Insurance, and what is the impact of this policy on reducing inequalities in access to care in Côte d'Ivoire?
The main aim of this article is to examine the factors influencing enrolment in Universal Health Insurance and to assess its impact on inequalities in access to care in Côte d'Ivoire.

The literature on health insurance in developing countries has generally developed along two largely disjointed lines: the determinants of household enrolment in health insurance schemes, on the one hand, and the causal evaluation of their impacts on the use of care, on the other. However, few studies combine, within a single analytical framework, the determinants of enrolment and the causal evaluation of the impact of health insurance on inequalities in access to care in the Ivorian context, which justifies the interest of this article. By combining these two aspects, it makes it possible to correct the selection bias to which any impact evaluation that ignored the determinants of enrolment is liable to be exposed, and thus to offer more credible results to inform the public policies for implementing the Universal Health Insurance (CMU) currently in place in Côte d'Ivoire.

The article is structured as follows. The second part provides an overview of the theoretical and empirical literature. The third part details the methodology adopted. The fourth part describes the estimation results. The fifth part analyses and discusses these results in light of the current literature. Finally, the sixth part is devoted to the conclusion, followed by the bibliography.

2. THEORETICAL AND EMPIRICAL LITERATURE REVIEW

2.1. Theoretical foundations

The theoretical analysis of Universal Health Insurance sheds light on the processes through which health social protection schemes affect disparities in access to care. Two major arrangements govern social protection systems: the Bismarckian system (1881), based on contributions from employees and employers, whose access is linked to participation in the labour market (Or et al., 2010; Shufani, 2023), and the Beveridge model (1942), which is tax-financed and aims at universal coverage detached from occupational status, like the British National Health Service (Bennett et al., 2010). Although the second model is generally better placed to guarantee equity of access, both encounter in practice conflicts between equity, efficiency and financial sustainability (Van Der Zee & Kroneman, 2007).

From a microeconomic standpoint, Arrow's (1963) theory of insurance and uncertainty justifies the use of health insurance by the intrinsic uncertainty surrounding the occurrence of illness and the associated costs: mechanisms such as the CMU reduce this uncertainty by eliminating, or reducing, out-of-pocket payments for vulnerable groups. However, this protection has limits, in particular moral hazard (Pauly, 1968), which refers to the tendency of people with better coverage to use more care; this phenomenon has been empirically validated by the Oregon health insurance experiment (Finkelstein et al., 2012) and broken down by Einav and Finkelstein (2018) into an income effect and a substitution effect. The theory of information asymmetry (Akerlof, 1970; Spence, 1973; Stiglitz, 1987) also underlines the information imbalance between patients and health professionals, which may give rise to supplier-induced demand (McGuire, 2000); by facilitating access to care and understanding of insured persons' rights, the CMU can help reduce this asymmetry (Einav et al., 2010).

According to Grossman's (1972) model, health is viewed as a capital stock that individuals maintain through various investments (prevention, care, nutrition), and the demand for care results from the need to preserve this capital. By reducing the direct cost of care, the CMU could increase this demand, especially among low-income households. However, the ability to invest in health varies with income and level of education (D. Cutler & Lleras-Muney, 2010). Andersen's behavioural model (1968, 1995), which is still widely used, serves to explain the use of health services. This model distinguishes between predisposing factors (such as age, gender and level of education), enabling factors (such as income, health insurance and availability of services) and health needs. In this context, the CMU plays an enabling role; however, actual access to care is influenced by non-financial obstacles such as geographical distance, the quality of facilities and social norms, which may persist even when coverage is in place (Peters et al., 2008; Giedion et al., 2013; Babitsch et al., 2012).

In conclusion, the theory of social disparities in health (Marmot & Wilkinson, 2005; Adler & Newman, 2002; Braveman & Gottlieb, 2014; Solar & Irwin, 2010) highlights that health status and the use of medical services are linked not only to access to insurance, but also to living conditions (income, level of education, employment, social environment). This approach suggests that, whatever the

ambition of a health coverage policy, it is not sufficient to eradicate disparities in access to care if the relevant social determinants are not addressed at the same time. These combined theoretical frameworks underpin the examination of the individual and contextual factors that influence enrolment in the CMU and the assessment of its causal impact on the use of health services, while stressing the need to remain vigilant about its sole effectiveness in reducing socioeconomic disparities in access to care.

2.2. Empirical review

In the empirical literature, a distinction is generally made between two types of determinants of health insurance enrolment: individual factors and contextual factors. Regarding individual factors, age generally has a positive effect. According to Amu et al. (2022), using a multilevel logistic model based on DHS data covering 23 sub-Saharan African countries, coverage is observed to increase with age. This finding is also confirmed by Njoumemi et al. (2023) in Cameroon. However, this relationship is not universal, with some studies indicating a reduced likelihood among very young adults depending on the institutional structures examined. Education is also a robust determinant. Amu et al. (2021), who analysed DHS data from various sub-Saharan African countries, and Handebo et al. (2023), focusing on Ethiopia, demonstrated that a secondary or higher level of education considerably increases the probability of being insured. Indeed, education facilitates understanding of insurance systems and promotes access to information.

The effect of gender varies across institutional and cultural contexts. Agyemang-Duah et al. (2024) in Ghana find a greater propensity to enrol among women caregivers, whereas Singh et al. (2025), in their comparative study of six Southeast Asian countries, reveal uneven disparities from one country to another. Ziegler et al. (2024), for their part, found no notable difference in India. Marital status and income level are among the most consistent factors in the literature. Zegeye et al. (2023) for 29 sub-Saharan African countries, and Misnaniarti et al. (2025) in Indonesia, show that married individuals are more likely to enrol than single people. Meanwhile, Wodessa et al. (2025) in Ethiopia and Muremyi et al. (2025) in Rwanda reveal a significant wealth gap, with the poorest households being markedly less likely to be covered. As regards contextual factors, place of residence (Adeniran et al., 2024; Tsega et al., 2024), distance to health facilities (Tuolong et al., 2024) and media exposure (Barman et al., 2025; Dowou et al., 2024) appear to be key elements influencing enrolment. Nevertheless, the effect of the media is not systematically uniform depending on the means of communication used (Olatunji et al., 2021).

Regarding the impact of health insurance on inequalities in access to medical care, various studies employing the propensity score technique reach a favourable conclusion on the use of health services following coverage. According to Nshakira-Rukundo et al. (2021), who worked in rural Uganda, community-based health insurance promotes increased use of preventive care. For their part, Anindya et al. (2020) demonstrated in Indonesia that the national JKN programme stimulates the use of maternal health services, particularly among women living in the most precarious households. Continuing in this vein, Zhang et al. (2023), from China, and Carré et al. (2026), from France, use difference-in-

differences methodologies and conclude that the expansion or merger of insurance systems reduces disparities in access to care. However, these results are qualified by other studies. Frimpong (2023) in Ghana showed, using Wagstaff's concentration index, that health insurance accounts for only part of the pro-rich disparities observed in the use of care, while Sekyi and colleagues (2024), using the instrumental variables method, observed varied effects across social classes. These discrepancies corroborate the conclusions of Wagstaff and Lindelow (2008) as well as Ekman (2007a). They establish that financial accessibility is a necessary but not sufficient condition for durably reducing disparities in access to care when the supply of health services remains deficient or poorly distributed.

Overall, the theoretical and empirical literature converges in emphasising that enrolment in health insurance depends jointly on individual characteristics (age, education, income, marital status) and contextual ones (residence, access to information, proximity of infrastructure), and that the impact of health insurance on inequalities in access to care remains conditioned by the state of health service provision.

3. METHODOLOGY

3.1-Analysis of variables

This section presents the main variables selected for the analysis as well as the data source used in this study.

3.1.1 Data sources of the study

For this study, we use data from the Harmonised Survey on Household Living Conditions (EHCVM) conducted by the National Statistics Agency (Anstat, 2021) across the whole Ivorian territory. The survey was carried out in two waves among 12,965 households comprising a total of 64,491 individuals, in order to comprehensively capture the living conditions of Ivorian households. The sample is divided so as to provide data well suited to comparing urban and rural areas and to analysing the main poverty indicators. Our analysis focuses specifically on the impact of the CMU on inequalities in access to care in Côte d'Ivoire.

3.1.2 Presentation of the study variables

As in any econometric study, two main groups of variables are used for the research: the explained variable and the explanatory variables.

3.1.3 Dependent variables

For the multilevel Logit model, the dependent variable is access to Universal Health Insurance (CMU). It provides information on individuals' enrolment status in a health coverage scheme and makes it possible to identify the factors that influence the probability of enrolling. This variable is qualitative and dichotomous and is coded as follows: 1 if the individual benefits from health coverage (CMU) and 0 otherwise.

For the Propensity Score Matching (PSM) method, the outcome variable is the consultation of a health service or a traditional healer in the thirty days preceding

the survey following a health problem. This dichotomous variable is coded 1 if the individual used a health service and 0 otherwise.

Finally, the analysis of socioeconomic inequalities in access to care relies on the Erreygers-corrected concentration index. Constructing this index requires first ranking individuals according to their socioeconomic position. To this end, income is used as the ranking variable. It makes it possible to order individuals from the poorest to the richest in order to examine how access to care is distributed across the different socioeconomic groups.

3.1.4 Independent variables

The variables used in this study differ according to the objective pursued by each method of analysis. All the variables used in this study are presented in the tables below, distinguishing individual variables, contextual variables and the ranking variable used for the analysis of inequalities in access to care

Table 1: Individual variables used in the multilevel Logit and PSM models

VARIABLES	JUSTIFICATION
AGE	Age influences the perception of health risk and the demand for protection against health expenditure. Older individuals, who generally have greater medical needs, are more likely to seek health coverage (Niangaly et al., 2025). The categories are 0 = Under 25 years; 1 = 25 to 35 years; 2 = 36 to 45 years; 3 = 46 years and over
Gender	Gender may explain differences in enrolment in health coverage schemes and in the use of health services owing to differences in health needs, social constraints and care-seeking behaviour (Antabe et al., 2025). The categories are 0 = Female; 1 = Male
niv_educ	Education promotes access to information, understanding of health insurance mechanisms and enrolment procedures. Empirical studies show that a high level of education increases the probability of being enrolled in health insurance (Zegeye et al., 2023). The categories are 1 = Primary or less; 2 = Secondary; 3 = Post-secondary / Higher
taille_mena	Household size influences financial capacity and health coverage needs. It is a factor associated with enrolment in health insurance schemes (Adebayo et al., 2015). The categories are 1 = Fewer than 5 people; 2 = 5 to 10 people; 3 = 11 people or more
Sit_Matrimoniale	Marital status may influence access to information, the sharing of financial resources and decisions relating to the household's health protection (Misnaniarti et al., 2025). The categories are 0 = Single; 1 = Married; 2 = Widowed
Rev	The economic level is a major determinant of enrolment in social protection mechanisms. Households with greater resources have a higher contributory capacity and are

	generally more likely to be enrolled in health insurance (Moyehodie et al., 2022). The categories are 1 = Low income; 2 = Intermediate income; 3 = High income

Source: Authors, based on EHCVM 2021

Table 2: Contextual variables used in the multilevel Logit and PSM models

VARIABLES	SPECIFICATION
Mil_resi	Place of residence influences enrolment in health insurance through differences in access to health facilities, information and administrative services. Rural populations often face greater constraints in accessing health coverage (Tsega et al., 2024). The categories are 0 = Rural; 1 = Urban
acces_med	Access to digital technologies improves the dissemination of information on health programmes and may facilitate knowledge of enrolment procedures for health coverage schemes (Dowou et al., 2024). The categories are 0 = No; 1 = Yes
Dist_domi_sante	Distance to health facilities is a geographical barrier that may limit the use of care and reduce the incentive to enrol in health insurance mechanisms (Tuolong et al., 2024). The categories are 0 = Less than 2 km; 1 = 2 to 5 km; 2 = 5 km and over

Source: Authors, based on EHCVM 2021

Table 3: Variable used to calculate the concentration index

VARIABLES	**SPECIFICATION**
Income	Variable used as the economic indicator to calculate the concentration index in order to capture inequalities (Wagstaff & Van Doorslaer, 2000)

Source: Authors, based on EHCVM 2021

3.2. Methodological approach of the article

This section presents the methodological approach adopted to meet the study's objectives and test the hypotheses formulated.

3.2.1 Presentation of the article's first model

The multilevel model is an extension of classical regression models that makes it possible to analyse data with a hierarchical structure. The classical linear multilevel model cannot be applied directly when the dependent variable is binary. A multilevel Logit model must then be used, which makes it possible to estimate the probability that an event occurs as a function of a set of individual and contextual explanatory variables. In a classical regression model, the relationship between a dependent variable and the explanatory variables can be represented in the following general form:

$$Y_i = \beta_0 + \beta_{01} x_i + \beta_{01} Z_i + e_i \quad \textbf{(1)}$$

And $e_i \rightarrow N(0, \delta_e^2)$

Where Y_i : Dependent variable of individual (i), β_0: Mean parity within the group, β_i : Estimator of the individual-level variable (i), x_i : Individual-level explanatory variable (i) , β_{01} : Estimator of the contextual variable, Z_i : Contextual explanatory variable (i), e_i: Residuals, i.e. the gap between the actual score of individual (i) and the predicted value.

When a single region is examined, the variation is due exclusively to individuals and can be represented by a variance assumed to be normal. One equation is estimated per region, including various regions considered as subsets of a larger group. This leads to the multilevel variance components model (Snijders & Bosker, 2012).

$$Y_{ij} = (\beta_0 + U_0) + \beta_1 x_{ij} + \beta_{01} z_j + e_{ij} \quad \textbf{(2)}$$

Where

$u_{01} \rightarrow N(0, \delta^2_{u0})$ And $e_{ij} \rightarrow N(0, \delta^2_e)$

u_{01} : Level-2 residual (contextual, or region (j)), e_{ij} : Residual of individual i within region j (level 1, individual), Y_{ij} : Dependent variable for an individual (i) belonging to region (j), x_{ij} : Parity of the explanatory variable of individual (i) belonging to region (j), z_j : Parity of the explanatory variable of the region (j).

- **The empty model**

The multilevel approach relies on progressive modelling, the first step of which is to estimate an empty model that makes it possible to assess the share of variance attributable to the different levels of analysis through random effects. Thus, each category of the dependent variable (0 or 1) is associated with a probability of occurrence. According to Snijders and Bosker (2012), the general form of the multilevel Logit model for a binary dependent variable is expressed as follows:

$$\Omega = \frac{\delta^2_{u0}}{\delta^2_{e0} + \delta^2_{u0}} \quad \textbf{(3)}$$

- **The model with individual factors**

Adding individual variables makes it possible to explain part of the variation observed in the decision to take up health insurance. The model thus takes the following form:

$$Y_{ij} = \left(\beta_0 + U_{0j}\right) + \beta_1 x_{ij} \quad \textbf{(4)}$$

Where

$U_{0j} \rightarrow N(0, \delta^2_{u0})$

This model highlights the influence of individuals' socioeconomic and sociodemographic characteristics, without incorporating contextual effects.

- **The model with contextual factors**

Contextual variables are introduced to explain variations between groups or regions using level-2 factors likely to influence enrolment in the CMU. The model is presented as follows:

$$Y_{ij} = \left(\beta_{00} + u_{0j}\right) + \left(\beta_{10} + u_{1j}\right) x_{ij} + \beta_{01} . z_j + \beta_{11} . z_j . x_{ij} \quad \textbf{(5)}$$

$U_{0j} \rightarrow N(0, \delta^2_{u0})$, $u_{1j} \rightarrow N(0, \delta^2_{u1})$ And $COV\left(u_{0j}, u_{1j}\right) = \delta_{u01}$

Adding contextual variables makes it possible to reduce variation between groups and to identify its sources. This model thus provides a better understanding of the determinants of health insurance enrolment.

3.2.2 Model specification

The study draws on that of N'guessan et al. (2025), who examined the determinants of enrolment in the CMU. On the basis of the previous study, the variables retained are age, income, level of education, sex, marital status and place of residence.

The model adopted in this study takes the following functional form:

$$Y = f(\ Genre\ , AGE\ , niv_educ\ , taille_mena, Sit_Matrimoniale, Rev, Mil_resi\ , acces_med\ , Dist_domi_sante) \quad \textbf{(6)}$$

In econometric form, the regression model is presented as follows:

$$acces_CMU_i = \beta_0 + \beta_{1i}.Genre_i + \beta_{2i}.\ AGE_i + \beta_{3i}.niv_educ_i + \beta_{4i}.taille_mena_i + \beta_{5i}.Sit_Matrimoniale_i + \beta_{6i}.Rev_i + \beta_{7i}.Mil_resi_i + \beta_{8i}.acces_med_i + \beta_{9i}.Dist_domi_sante_i + \varepsilon_i \quad \textbf{(7)}$$

For i = {1, 2, …, n}

Where acces_CMU: the status of enrolment in Universal Health Insurance of individual (i) belonging to region(j).

3.2.3 Presentation of the concentration index

The concentration index is an indicator used to quantify socioeconomic inequalities in a health variable. It is based on the relationship between the variable studied and individuals' socioeconomic rank. It is associated with the concentration curve, which graphically represents the cumulative share of the health variable as a function of the ranking of individuals according to their level of wealth (O'Donnell et al., 2007). The concentration index is calculated using the following formula:

$$\boldsymbol{IC} = \frac{2}{\bar{y}}\ COV_w(y_i, R_i) \quad \textbf{(8)}$$

$\bar{y}$: represents the mean of the variable studied, y_i: denotes the access-to-care variable of individual(i),

R_i: Corresponds to the relative rank of individual i in the socioeconomic distribution, COV_w: Representation of the covariance by the sampling weights.

Thus, a concentration index significantly below zero (CI < 0) indicates that access to care is more concentrated among the most socioeconomically disadvantaged individuals (pro-poor inequality). Conversely, an index significantly above zero (CI > 0) reflects a concentration of access to care among the most advantaged individuals (pro-rich inequality). Finally, an index value close to zero (CI = 0) reveals a relatively equitable distribution of access to care across the different socioeconomic categories of the population, thus reflecting an absence or a low presence of socioeconomic inequalities (Kakwani et al., 1997).

3.2.4 Correction of the concentration index using Erreygers' approach

Since the access-to-care variable used in this study is binary, the classical concentration index may be influenced by the mean of the variable studied. To

overcome this limitation, Erreygers (2009) proposes a correction that yields a normalised index suited to variables bounded between 0 and 1.
The Erreygers-corrected index is defined as follows:

$$E(h) = 4\bar{y}\, C(h) \quad \textbf{(9)}$$

Where
$E(h)$: R represents the Erreygers-corrected concentration index,$\bar{y}$: denotes the mean of the health variable studied, $C(h)$: represents the classical concentration index.

3.3 Presentation of the second study model (PSM)

The propensity score (Propensity Score Matching, PSM) is based on estimating the conditional probability that an individual receives the treatment given his or her observable characteristics. Introduced by Rosenbaum and Rubin (1983), it is defined as follows:

$$e(X_i) = P(T_i = \frac{1}{X_i}) \quad \textbf{(10)}$$

Where T_i represents the treatment variable and takes the value 1 when the individual is enrolled in Universal Health Insurance (CMU), and 0 otherwise. The vector X_i denotes the set of observable characteristics likely to influence enrolment in the CMU.
According to Rosenbaum and Rubin (1983), the propensity score has a balancing property which implies that, conditional on $e(X)$ the distribution of observable covariates becomes similar between the treated and control groups: $T \perp \frac{X}{e(X)n}$

3.3.1 Specification of the second study model (PSM)

The approach adopted in this study draws on work using the Propensity Score method to evaluate the impact of health insurance schemes on access to care, notably the study by Anindya et al. (2020). This method makes it possible to estimate the impact of enrolment in the Universal Health Insurance (CMU) by comparing individuals enrolled in the CMU with non-enrolled individuals with similar observable characteristics.

In this study, the treatment corresponds to enrolment in the CMU. The treatment variable T_i is defined as an indicator variable taking the value 1 when individual (i) benefits from health coverage and the value 0 when he or she does not. The vector of observable characteristics X_i comprises the factors likely to influence both the probability of enrolment in the CMU and the conditions of access to care. The propensity score is then defined as the conditional probability that an individual enrols in the CMU given his or her observable characteristics:

$$e(X_i) = P(T_i = \frac{1}{X_i}) \quad \textbf{(11)}$$

The effect of the CMU on inequalities in access to care is then measured using the average effect of the treatment on those treated (Average Treatment Effect on the Treated, ATT), defined as:

$$\Delta_{ATT} = E(Y_i^1 - Y_i^0 \,/\, T_i = 1) \quad \textbf{(12)}$$

Where Y_i^1 represents the observed outcome in terms of access to care when the individual benefits from the CMU, while Y_i^0 corresponds to the outcome that would have been observed for the same individual in the absence of the CMU. The ATT measures the average difference between the access to care of individuals actually enrolled in the CMU and the access to care they would have experienced had they not benefited from this coverage.

The estimation of this effect relies on the conditional independence assumption, according to which, after controlling for observable characteristics, enrolment in the CMU is independent of potential outcomes:
$\left(Y_i(0), Y_i(1)\right) \perp \frac{T_i}{X_i}$

It also relies on the common support assumption, which assumes the existence of comparable individuals between the group of enrolled and non-enrolled individuals:
$0 < P\left(T_i = \frac{1}{X_i}\right) < 1$

In this study, the effect of the CMU will be estimated using different matching methods, notably nearest-neighbour matching and kernel matching, in order to verify the robustness of the results obtained.

4. Presentation and discussion of results

This section presents the results of the empirical analyses carried out in this study.

4.1 Multilevel Logit model

4.1.1 The empty model

The results presented in the table above show that the variance of the contextual effect (Ω) is estimated at 0.233. This value, significantly different from zero at the 1% level, indicates the presence of region-related contextual effects in explaining access to the CMU. Thus, despite the relatively small magnitude of this regional variability, differences between regions remain statistically significant. These results therefore justify the use of a multilevel logit model to take into account the influence of individual and contextual factors in the analysis of CMU enrolment.

Table 4: Results of the empty model

acces_CMU	Coefficient	Std. Err.	P>|z|
_cons	0.022	0.003	0.000
Region			
Var (_cons)	0.213	0.006	
Var (e. acces_CMU)	0.233	0.003	

Source: Authors' calculations based on EHCVM 2021

4.1.2 Model with individual factors

The model results show that individuals' personal characteristics influence their probability of enrolling in Universal Health Insurance (CMU). Variables such as

age, level of education, marital status and income have a positive influence on CMU enrolment, whereas household size has a negative influence, while sex has no significant effect on coverage.

Table 5: Results of the model with the introduction of individual factors

	Model empty	Model with individual factors	
Variables		Coefficient	dy/dx Coefficient dy/dx
Constant	0.022	0.019(0.000)	
Contextual variance	0.233	0.230	
Gender (ref: Female)			
Male		-0.003(0.299)	-0.003(0.299)
AGE (ref: Under 25 years)			
25 to 35 years		-0.002(0.652)	-0.002(0.652)
36 to 45 years			0.003(0.474) 0.003(0.474)
46 years and over			0.020***(0.000) 0.020***(0.000)
niv_educ (ref: Primary)			
Secondary			0.011***(0.000) 0.011***(0.000)
Post-secondary / Higher			0.023***(0.000) 0.023***(0.000)
taille_mena (ref: Fewer than 5 people)			
5 to 10 people		-0.007*(0.092)	-0.007*(0.092)
11 people or more		-0.007(0.530)	-0.007(0.530)
Sit_Matrimoniale (ref: Single)			
Married			0.011***(0.001) 0.011***(0.001)
Widowed			0.018**(0.041) 0.018**(0.041)
Rev (ref: Low income)			
Intermediate income			0.030***(0.000) 0.030***(0.000)
High income			0.008(0.177) 0.008(0.177)

(***) significance at 1%, (**) significance at 5%, (*) significance at 10%
LR test vs. linear model: chibar2(01) = 77.11 Prob >= chibar2 = 0.0000
Source: Authors' calculations based on EHCVM 2021

4.1.3 Model with the introduction of contextual factors

The results show that several socioeconomic characteristics significantly influence the probability of enrolment in Universal Health Insurance (CMU). Age has a positive effect. Age has a positive effect: individuals aged 46 and over have a 1.8% higher probability of enrolment than those under 25 (*dy/dx = 0.018; p < 0.01*), whereas the 25–35 and 36–45 age groups show no significant effect.

The level of education is also a favourable factor. Compared with individuals with a primary level, the probability of enrolment increases by 0.8% for those with a secondary level (dy/dx = 0.008; p < 0.01) and by 1.5% for those with a post-secondary or higher level (dy/dx = 0.015; p < 0.01).

Marital status also has a positive influence. Compared with single people, married people have a 1.1% higher probability of enrolment (*dy/dx = 0.011; p < 0.01*), whereas this probability is 1.9% higher among widows/widowers (*dy/dx = 0.019; p < 0.05*).

Compared with low-income individuals, those with an **intermediate income** have a probability of enrolment that is higher by **2.9%** (*dy/dx = 0.029; p < 0.01*), against **1.0%** for high-income individuals (*dy/dx = 0.010; p < 0.10*). Finally, access to digital media increases the probability of enrolment by 1.3% (*dy/dx = 0.013; p < 0.01*) compared with people who do not have access to it.

Table 6: Results of the model with the introduction of contextual factors

	Model empty	Model with contextual factors	
Variables	Coefficient		dy/dx Coefficient
dy/dx			
Constant	0.022	0.018(0.000)	
Contextual variance	0.233	0.230	
Gender (ref: Female)			
Male			-0.002(0.499)
-0.002(0.499)			
AGE (ref: Under 25 years)			
25 to 35 years		-0.004(0.362)	-
0.004(0.362)			
36 to 45 years			0.001(0.855)
0.001(0.855)			
46 years and over			0.018***(0.001)
0.018***(0.001)			
niv_educ (ref: Primary)			
Secondary			0.008***(0.005)
0.008***(0.005)			
Post-secondary / Higher			0.015***(0.007)
0.015***(0.007)			
taille_mena (ref: Fewer than 5 people)			

5 to 10 people	-0.006(0.124)	-0.006(0.124)
11 people or more	-0.007(0.561)	-0.007(0.561)
Sit_Matrimoniale (ref: Single)		
Married		0.011***(0.001)
0.011***(0.001)		
Widowed		0.019**(0.035)
0.019**(0.035)		
Rev (ref: Low income)		
Intermediate income		0.029***(0.000)
0.029***(0.000)		
High income		0.010*(0.099)
0.010*(0.099)		
Mil_resi (ref: Rural)		
Urban	0.005(0.105)	0.005(0.105)
Dist_domi_sante (ref: Less than 2 km)		
2–5 km	0.002(0.472)	
0.002(0.472)		
5 km and over	-0.004(0.391)	-0.004(0.391)
acces_med (ref: No)		
Yes	0.013***(0.000)	
0.013***(0.000)		

(***) significance at 1%, (**) significance at 5%, (*) significance at 10%
LR test vs. linear model: chibar2(01) = 54.80 Prob >= chibar2 = 0.0000
Source: Author's calculations based on EHCVM 2021

4.1.4 The concentration curve

Given the binary nature of the variable, the Erreygers index is -0.1243. The negative sign of this index confirms that access to care is relatively more concentrated among poor populations. The concentration curve illustrates this inequality in the distribution of access to care by income level.

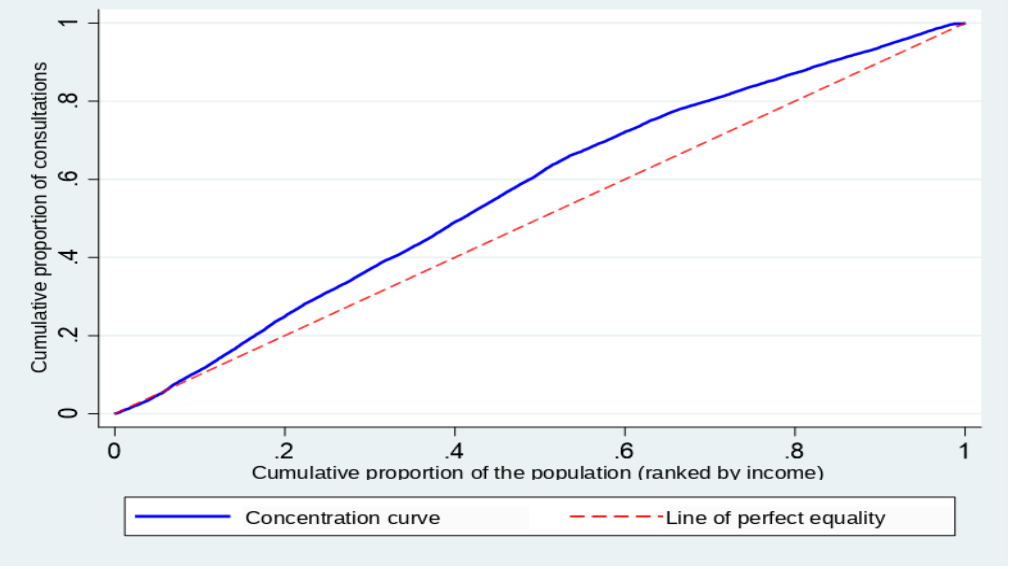


Figure 1: Inequalities in access to health care
Source: Authors' calculations based on EHCVM 2021

4.2 Propensity Score Matching, PSM

- **Verification of group balance after propensity score matching**

Table 7: Covariate balance test before and after matching

Sample	Ps R2	LR chi2	P> chi2	Mean Bias	MedBias	B	R
Unmatched	0.081	219.35	0.000	35.3	45.3	93.3	0.58
Matched	0.000	0.08	1.000	0.6	0.6	2.4	1.06

Source: Author's calculations based on EHCVM 2021

The results of the balance test show that propensity score matching considerably improved comparability between beneficiaries and non-beneficiaries of Universal Health Insurance (CMU).

- **Average effect of CMU enrolment on access to care**

Table 8: Estimation of the effect of Universal Health Insurance on access to health services

concul_serv_sant	ATT	std. err.	Z	P>|z|
acces_CMU	0.0904	0.024	3.63	0.000

Source: Authors' calculations based on EHCVM 2021

The results show that the CMU significantly improves the use of health services, at the 1% level ($p < 0.01$). The average treatment effect on the treated is 0.0904, i.e. a 9.04% increase in the probability of using care among people covered by the CMU, compared with the situation they would have experienced without coverage.

5. Discussion of results

This section first discusses the socioeconomic, demographic and institutional factors that influence populations' enrolment in Universal Health Insurance (CMU), and then analyses its impact on access to health care.

5.1 Discussion of the results on the determinants of CMU enrolment

In light of the model results, it emerges that age, level of education, income, marital status and access to media are the main determinants of enrolment in Universal Health Insurance (CMU) in our study.

- **Age**

Individuals aged 46 and over have a higher probability of enrolling in the CMU than those under 25. This situation is explained by the increase in health needs with age, notably owing to greater exposure to chronic diseases and medical expenses.

This result is in line with the work of Acharya et al. (2013) and Spaan et al. (2012), who emphasise the influence of age on participation in health insurance schemes.

- **Level of education**

People who have attained a secondary level or higher are more likely to enrol in the CMU than those with a primary level. Indeed, a higher level of education fosters better knowledge of the benefits of health insurance as well as greater ease in completing the steps required for enrolment. This finding is consistent with the work of Dixon et al. (2011) and Osei Afriyie et al. (2022), who highlight the individual characteristics, notably level of education, that influence participation in health insurance schemes.

- **Income**

Individuals in the intermediate- and high-income categories have a higher probability of enrolling in the CMU than those with low income. Economic resources make it easier to bear the costs of enrolment and to access information. This result is in line with that of Kiplagat et al. (2013), who show that the level of wealth positively influences enrolment in health insurance.

- **Marital status**

Married individuals as well as widowers/widows have a higher probability of enrolling in the CMU than single people. Indeed, marital status influences protection needs and the perception of health-related risks. These results are consistent with those of Kusi et al. (2015), who show, in the Ghanaian context, that demographic and family characteristics influence participation in health insurance schemes.

- **Access to media**

Individuals with access to media are more likely to enrol in the CMU. The media foster the dissemination of information on the benefits of health coverage and on enrolment procedures. This result is in line with the findings of Kansanga et al. (2018), according to which exposure to radio and television increases the probability of enrolling in a health insurance scheme.

5.2 Discussion of the results on the impact of the CMU on access to care

The results obtained show that Universal Health Insurance (CMU) has a positive and statistically significant effect on the use of health services. Enrolment in the CMU helps reduce the expenses directly borne by households and, consequently, the financial constraints that may limit the use of care. These results are in line with those of Finkelstein et al. (2012), who show that the introduction of health insurance in Vietnam led to a significant increase in the use of health services thanks to the reduction of households' direct expenditure. Similarly, Ekman (2007) concludes, on the basis of a review of studies conducted in several developing countries, that health insurance significantly improves the use of care by reducing the financial constraints faced by households.

6. GENERAL CONCLUSION

The aim of this article was to analyse the determinants of enrolment in Universal Health Insurance (CMU) and to assess its impact on inequalities in access to care in Côte d'Ivoire, using data from the Harmonised Survey on Household Living Conditions (EHCVM 2021) and three complementary approaches: the multilevel logit model, the Erreygers-corrected concentration index and the propensity score matching method.

The results show that CMU enrolment is significantly influenced by age, level of education, marital status, income and access to media, whereas gender, household size, area of residence and distance to the health centre show no robust effect in the final model; a residual regional effect, albeit modest, nevertheless remains after controlling for these factors. The concentration index analysis also reveals a concentration of care use among the poorest individuals, while the PSM estimation confirms that the CMU has a positive and significant effect on the use of health services, increasing by about 9 percentage points the probability of consultation among beneficiaries compared with uncovered but comparable individuals.

These results confirm that the CMU is an effective instrument for improving the use of health services in Côte d'Ivoire, by reducing the financial barriers weighing on households. However, its effect on reducing inequalities in access to care remains limited, insofar as financial coverage alone is not enough to correct disparities related to the supply of care, to information and to the socioeconomic conditions of the population. It therefore appears necessary to strengthen CMU awareness-raising efforts, particularly among the most vulnerable and least informed populations, to improve the territorial distribution of health infrastructure and personnel, and to continue efforts to increase the quality of the services offered, so that the extension of health coverage translates into an effective reduction of inequalities in access to care.

This article has certain limitations that call for caution in interpreting the results. Since the EHCVM 2021 data are cross-sectional, they do not make it possible to observe how individuals evolve before and after enrolling in the CMU, nor to completely rule out the influence of unobserved factors on coverage and care-seeking choices. The low enrolment rate observed in the sample, reflecting a still early phase of the scheme's scale-up at the time of data collection, also calls for this analysis to be updated as more recent data become available. Future research could usefully draw on panel data, examine health indicators broader than care use alone, and deepen, through qualitative approaches, the non-financial barriers that continue to limit effective access to health care in Côte d'Ivoire.

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