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Beyond Reimbursement Rates: A Liquidity-Sensitive Household Capacity-to-Pay Framework for Reimbursement-Based Health Insurance in Morocco

Abdelghni el amoumri

abdelghnielamoumri@gmail.com

Sidi Mohamed Ben Abdellah University

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Abstract

Formal health-insurance coverage may fail to translate into effective access when patients must pay providers before reimbursement. This paper develops a liquidity-sensitive household capacity-to-pay framework that complements conventional ex-post financial-protection measures with an ex-ante measure of the resources required at the point of care. The framework distinguishes residual capacity to pay (RCTP), liquidity burden, final out-of-pocket burden, effective reimbursement, and the immediate financing gap. Because linked Moroccan household, health-need, provider-price, and claims data are not publicly available, the framework is illustrated through a calibrated synthetic simulation rather than used to estimate population prevalence. Sixteen household profiles combine four net-income levels with four household compositions, while sensitivity analyses vary essential expenditure, housing costs, debt service, transfers, and financing arrangements. Under baseline assumptions, a MAD 18,000 hospital bill represents 4.39 months of RCTP for a single adult earning MAD 8,000 per month and 18 months for a two-adult household with one child at the same income. Final burden after reimbursement is substantially lower, showing that ex-post protection and ex-ante affordability can diverge. Direct payment reduces the financing gap even when the final reimbursement rate is unchanged. The framework is intended as a transparent stress-testing and empirical-design tool, not as an estimate of unmet need in Morocco. It identifies testable implications for future linked household-and-claims research and for the evaluation of reimbursement versus third-party-payment arrangements.

1 Introduction

Universal health coverage is commonly evaluated through service coverage and financial protection, but formal entitlement is not equivalent to effective access (World Health Organization and World Bank 2023). In reimbursement-based insurance, an insured patient may be legally entitled to a substantial benefit while still being required to finance the provider bill before the insurer pays. This timing requirement creates an economic problem that is distinct from the final out-of-pocket (OOP) burden: the household must first mobilize cash, savings, credit, transfers, or an authorized direct-payment mechanism at the treatment date.

The distinction matters because household resources are committed before a health shock occurs. Taxes and compulsory contributions reduce disposable income, while housing, food, transport, education, debt service, and the needs of dependants limit the amount that can be redirected to an unexpected medical bill. A single adult and a household with children can therefore face very different financing constraints at the same income. This is consistent with the broader access literature, which treats affordability and enabling resources as necessary conditions for realized use (Andersen 1995; Penchansky and Thomas 1981; Levesque et al. 2013), and with the capability perspective, which distinguishes formal resources from what people are effectively able to achieve with them (Sen 1999).

Health-economics research has developed rigorous measures of catastrophic expenditure, impoverishment, and capacity to pay (Xu et al. 2003; Wagstaff and van Doorslaer 2003; World Health

Organization 2005). These measures are indispensable for assessing the welfare consequences of payments that occur. They do not, however, fully describe a reimbursement system in which the household may need to advance an amount substantially larger than the final retained payment. Claims data can also condition analysis on people who successfully reached care and completed the payment-and-claim pathway. Coping strategies such as borrowing, asset sales, or family transfers may enable utilization while shifting the burden across time or households (Flores et al. 2008).

This paper therefore develops a liquidity-sensitive household capacity-to-pay framework for reimbursement-based health insurance. The contribution is not to replace established catastrophic-expenditure measures or to claim a uniquely 'true' measure of household resources. Instead, it adds a pre-utilization layer to financial-protection analysis by separating: (i) the household's residual capacity after essential commitments; (ii) the amount that must be mobilized before reimbursement; (iii) the final OOP burden after reimbursement; (iv) the reimbursement actually obtained relative to the provider price; and (v) the financing gap remaining at the treatment date. Table 1 summarizes how these measures differ from one another and from need-adjusted utilization analysis.

Morocco is used as a calibration setting because mandatory health coverage has expanded while reimbursement rules, national reference tariffs, provider prices, and heterogeneous household budgets can interact in ways that make timing economically relevant (Royaume du Maroc 2002; Agence Nationale de l’Assurance Maladie n.d.-a, n.d.-b). Public sources provide contextual information on household income and expenditure, but no public linked micro-dataset was identified that jointly observes household resources, health need, deferred care, provider prices, advance payment, and claims. The empirical application is therefore deliberately synthetic. It is a stress test of the framework under disclosed assumptions, not an estimate of the prevalence of financial exclusion or an evaluation of a specific Moroccan insurer.

The analysis addresses three questions. First, how far can the point-of-care liquidity burden diverge from the final annual burden after reimbursement? Second, how sensitive is this divergence to household composition and pre-committed resources such as housing and debt? Third, how do alternative financing arrangements, especially third-party payment, change the immediate financing gap independently of the final reimbursement rate? The paper proceeds from the conceptual framework to the Moroccan calibration, simulation design, results, interpretation, and an empirical validation agenda.

2 Conceptual framework

2.1 From entitlement to realized use

Health-service utilization is generated through a sequence of conditions rather than a single entitlement decision. A health need must arise and be recognized; a suitable provider must be available and reachable; the proposed care must be acceptable; and the household must be able to meet the monetary and non-monetary requirements of treatment. The Andersen model distinguishes need from enabling

resources (Andersen 1995), while Penchansky and Thomas (1981) and Levesque et al. (2013) explicitly identify affordability as a dimension of access. The present framework is located at this enabling stage: it measures the financial capacity to move from need to treatment under a reimbursement design.

This positioning is important for interpretation. A higher amount of claims among higher-income households would not by itself establish inequity because health need, age, chronic disease, provider choice, severity, and treatment intensity may differ. The relevant empirical test is whether financial capacity predicts utilization, delay, treatment intensity, or coping responses among insured people with comparable health need and access conditions. The synthetic analysis below does not answer that causal question; it formalizes a mechanism and derives measurable quantities that can later be tested with linked data.

2.2 Ex-post protection versus ex-ante liquidity

Catastrophic-health-expenditure methods relate OOP payments to household resources after allowing for subsistence or basic needs (Xu et al. 2003; World Health Organization 2005). Wagstaff and van Doorslaer (2003) further show how health payments can be studied through both catastrophic and impoverishing effects. These approaches establish the central principle that the welfare meaning of a medical payment depends on the resources available to the household.

A reimbursement contract adds a timing problem. Consider a hospital bill of MAD 18,000 for which the basic insurer ultimately reimburses MAD 9,600 and a complementary arrangement contributes MAD 2,000. The final retained payment is MAD 6,400, but the initial payment requirement may still be MAD 18,000 if reimbursement occurs only after the household pays and submits the claim. The first amount is an ex-ante liquidity requirement; the second is an ex-post retained burden. Conflating them can make a benefit appear accessible because it is generous after treatment even when the household cannot finance entry into treatment.

Coping responses do not eliminate this distinction. Savings convert accumulated assets into current liquidity; family assistance shifts part of the cost to another household; and borrowing converts an immediate gap into future debt service. Flores et al. (2008) show why financing responses can materially affect the measurement of catastrophic expenditure and poverty. Accordingly, the framework treats these responses as sources of financing at the treatment date rather than as ordinary recurring income.

2.3 Relationship to conventional indicators

Table 1 positions the proposed indicators alongside conventional measures. The framework is deliberately complementary: final burden remains necessary for evaluating financial protection, while the liquidity burden and financing gap capture the pre-reimbursement requirement. Need-adjusted utilization remains the empirical test of whether the proposed mechanism affects realized access.

Table 1
Relationship between the proposed framework and conventional indicators

Measure	Numerator	Resource base	Primary question
Nominal reimbursement rate	Contractual percentage	Reference tariff	What percentage does the rule state?
Effective reimbursement rate	Actual reimbursement	Provider price paid	What share of the actual bill is reimbursed?
Final burden ratio	Annual OOP payment	Annual residual capacity to pay	How heavy is the retained cost after reimbursement?
Liquidity burden	Bill due at point of care	Monthly residual capacity to pay	How many months of residual capacity are required upfront?
Financing gap	Immediate bill minus liquid/authorized resources	Cash, savings, approved direct payment or emergency support	What amount remains unfunded at the treatment date?
Need-adjusted utilization	Use among persons with comparable need	Observed need and enabling covariates	Does financial capacity predict use after need is controlled?

Note: *The first five measures can be calculated in the synthetic simulation. Need-adjusted utilization requires empirical data.*

3 Moroccan calibration setting

3.1 Household resources and expenditure

The Moroccan National Survey on Household Living Standards 2022–2023 reports average annual household expenditure of MAD 83,713 and average annual household income of MAD 89,170. It also reports that 71.8% of households have income below the national mean, while food and housing-energy account for substantial shares of consumption (Haut-Commissariat au Plan 2025). These national statistics are not used as population weights and do not identify the budget of an insured household. They are used only as contextual anchors for the plausibility of substantial essential commitments. Table 2 reports the published values and their role in the simulation.

Table 2
Published Moroccan calibration anchors

Published indicator	Value	Source	Use in this paper
Average annual household expenditure	MAD 83,713	HCP 2025	Contextual calibration only
Approximate monthly equivalent	MAD 6,976	Calculated from HCP 2025	Plausibility check; not an assigned household budget
Average annual household income	MAD 89,170	HCP 2025	Contextual calibration only
Households below mean income	71.8%	HCP 2025	Shows heterogeneity around the mean
Food share of expenditure	38.2%	HCP 2025	Supports an essential-consumption deduction
Housing and energy share	25.4%	HCP 2025	Supports housing-cost sensitivity
Health share of expenditure	5.9%	HCP 2025	Descriptive context; not a health-need estimate

Note: *MAD denotes Moroccan dirhams. Values are national averages and are not assigned to the synthetic households as observed data.*

The simulation uses net monthly household income because taxes and compulsory contributions are unavailable for discretionary spending once they have already been deducted. Regular debt service and a normative essential-expenditure budget are then deducted to obtain residual capacity. The purpose is not to define a poverty line or an official minimum-consumption basket, but to make the household-resource assumption explicit and test its sensitivity.

3.2 Reimbursement architecture

Morocco's basic medical-coverage framework is established by Law No. 65 – 00 and implementing regulations (Royaume du Maroc 2002). The National Health Insurance Agency publishes national reference tariffs and guidance concerning long-term and costly conditions (Agence Nationale de l'Assurance Maladie n.d.-a, n.d.-b). In a tariff-based reimbursement architecture, reimbursement can depend on the recognized reference tariff rather than the price charged by the provider. Consequently, a high nominal coverage percentage can translate into a lower effective reimbursement rate when the provider price exceeds the tariff base.

The care prices, coverage rates, and complementary amounts used below are synthetic parameters. They do not reproduce a named insurance or mutual-fund contract. The institutional sources justify the structure of the calculation—provider price, reference tariff, coverage rate, and reimbursement—but not the selected scenario amounts. This separation is maintained throughout the paper to avoid interpreting the simulation as an audit of a particular insurer.

4 Methods

4.1 Design and inferential scope

The study is a calibrated synthetic simulation. It combines hypothetical household profiles with illustrative care and reimbursement scenarios. This design is appropriate for examining accounting identities, thresholds, and sensitivity to assumptions when linked household-and-claims data are unavailable. It is not used to estimate prevalence, causal effects, behavioral elasticities, or the distribution of unmet need. All numerical results are conditional on the inputs shown in Tables 3 and 4.

The household is the unit of affordability analysis because dependants share resources and essential expenditure. Four net-income levels—MAD 5,000, 8,000, 12,000, and 18,000—are crossed with four household structures: one adult; two adults without children; two adults with one child; and two adults with two children. This yields 16 profiles. No probability weights are assigned to the profiles, so the simulation does not represent the Moroccan household distribution.

During manuscript preparation, an AI-assisted tool was used for English-language editing and document formatting. The author reviewed all analytical statements, calculations, references, and interpretations and accepts responsibility for the final text.

4.2 Residual capacity to pay

Let Yd denote disposable monthly household resources before essential expenditure. When gross income is observed, Yd = Yg + Tr − Tax − SC − DS, where Yg is gross household income, Tr is stable regular transfers, Tax is direct tax, SC is compulsory social contributions, and DS is regular debt service. When net income is used, Tax and SC are not deducted again. Residual monthly capacity to pay is defined as:

RCTPm = max(Yd − B, 0)

where B is the normative essential-expenditure budget. Annual residual capacity is RCTPa = 12 × RCTPm. A zero value does not mean that the household ceases consumption; it means that, under the selected budget assumption, no stable positive residual can be assigned to an additional medical shock without reducing essentials, drawing on assets, receiving transfers, accumulating arrears, or borrowing. The term 'residual' is used deliberately to avoid implying that the measure is a uniquely true or directly observed capacity-to-pay concept.

4.3 Essential-expenditure assumptions

Table 3 reports the baseline normative budgets. They increase with household size and include housing and energy, food, essential transport, basic education, communications, hygiene, clothing, and routine household needs. Because these values are assumptions rather than observed household budgets, the robustness analysis varies the total budget by ± 15% and separately changes housing, debt, and transfers.

Table 3
Baseline monthly essential-expenditure budgets used in the simulation

Household	Housing and energy	Food	Transport	Education and other essentials	Total
One adult	1,800	1,200	450	450	3,900
Two adults, no children	2,200	2,000	650	750	5,600
Two adults, one child	2,500	2,600	750	1,150	7,000
Two adults, two children	2,700	3,100	850	1,650	8,300

Note: *All amounts are monthly MAD and are synthetic calibration parameters, not official poverty lines or observed household budgets.*

4.4 Care and reimbursement scenarios

For provider price P, reference tariff T, and basic coverage rate r, basic reimbursement is R = min(P, T) × r. Basic OOP is P − R. An illustrative complementary amount C yields final OOP = max(P − R − C, 0). Table 4 reports four care scenarios. The complementary package C1 is an experimental parameter and does not represent a named product.

Table 4
Synthetic care, tariff, and reimbursement parameters

Care scenario	Provider bill P	Reference tariff T	Rate r	Basic reimbursement R	Basic OOP	OOP after C1
Routine outpatient care	900	600	70%	420	480	280
Intermediate diagnostics/dental care	3,500	2,200	70%	1,540	1,960	1,260
High-cost hospitalization	18,000	12,000	80%	9,600	8,400	6,400
Monthly chronic-care episode	1,500	1,200	90%	1,080	420	300

Note: *C1 contributes MAD 200, 700, 2,000, and 120 respectively. All values are illustrative and are not attributable to a specific insurer.*

4.5 Outcome measures

The five analytical outcomes are defined in Table 5. Ratios that use RCTP are reported only when residual capacity is positive. The 40% catastrophic threshold is retained only as a conventional analytical reference from the financial-protection literature, not as a legal rule or universal welfare boundary (Xu et

al. 2003; World Health Organization 2005). Continuous ratios are emphasized because households close to zero residual capacity are especially sensitive to denominator assumptions.

Table 5
Indicator definitions and interpretation

Indicator	Formula	Unit	Interpretation
Liquidity burden (LB)	P / RCTPm	Months	Months of residual capacity needed to advance the provider bill
Final annual burden (FB)	Annual OOP / RCTPa	Percent	Share of annual residual capacity retained after reimbursement
Effective reimbursement rate (ERR)	(R + C) / P	Percent	Actual reimbursed share of the provider price
Immediate financing gap (FG)	max(P − L, 0)	MAD	Bill not covered by liquid resources or authorized direct payment L
Residual capacity to pay (RCTP)	max(Yd − B, 0)	MAD/month	Recurring resources remaining after debt service and the essential budget

Note: *RCTP is a model-based residual measure. It should be recalibrated with observed data before empirical policy use.*

4.6 Experimental design and sensitivity analysis

The analysis proceeds in five steps. First, income is held constant while household composition changes. Second, the high-cost hospitalization scenario is applied to selected positive-RCTP profiles to compare ex-ante liquidity burden with ex-post final burden. Third, the essential budget for a two-adult, two-child household is varied by − 15%, baseline, and + 15%. Fourth, housing costs, debt service, and regular transfers are varied at a fixed income. Fifth, the immediate financing gap is recalculated under savings, family support, borrowing, and third-party-payment arrangements. This sequence isolates which conclusions arise from the reimbursement rule and which depend on household-resource assumptions.

4.7 Reproducible implementation

The calculation can be implemented in a spreadsheet, statistical package, or claims platform. The sequence is: obtain net recurring household resources and stable transfers; deduct regular debt service; assign or estimate the essential budget; calculate RCTPm and RCTPa; enter provider price, reference tariff, coverage rate, and complementary benefit; calculate reimbursement, OOP, ERR, LB, and FB; enter liquid resources or authorized direct payment to calculate FG; and repeat the calculation under alternative assumptions. Appendix A provides platform-neutral pseudocode so that synthetic inputs can later be replaced by observed variables without changing the indicator definitions.

5 Results

5.1 Household composition and residual capacity

Table 6 reports monthly RCTP for all 16 baseline profiles. At a net monthly income of MAD 8,000, residual capacity falls from MAD 4,100 for one adult to MAD 2,400 for two adults and MAD 1,000 for two adults with one child; it is zero for the two-adult, two-child profile under the baseline budget. The result should not be read as a claim that all Moroccan two-child households at this income have no discretionary resources. It is the mechanical implication of the disclosed budget assumptions and illustrates why income alone is an incomplete denominator for a household affordability stress test.

Table 6
Monthly residual capacity to pay by net income and household composition

Net monthly income	One adult	Two adults	Two adults + 1 child	Two adults + 2 children
5,000	1,100	0	0	0
8,000	4,100	2,400	1,000	0
12,000	8,100	6,400	5,000	3,700
18,000	14,100	12,400	11,000	9,700

Note: *RCTP is set to zero when net income does not exceed the baseline essential budget. Amounts are MAD per month.*

5.2 Liquidity burden versus final burden

The hospitalization scenario provides the clearest test of the distinction between timing and final burden. Table 7 shows that at MAD 8,000 net income, the MAD 18,000 bill represents 4.39 months of RCTP for one adult but 18 months for two adults with one child. Their basic final annual burdens are 17.1% and 70.0%, respectively. C1 reduces the final burden to 13.0% and 53.3%, but it does not reduce the initial MAD 18,000 requirement unless the benefit is delivered through direct payment.

At MAD 12,000, the liquidity burden ranges from 2.22 months for one adult to 4.86 months for two adults with two children, while the corresponding basic final burdens are 8.6% and 18.9%. At MAD 18,000 with two children, the final burden is 7.2%, yet the household would still need the equivalent of 1.86 months of residual capacity to advance the full bill. Thus, an episode can fall below a conventional annual catastrophic-burden threshold while remaining difficult to finance at the treatment date.

Table 7
Hospitalization liquidity and final-burden results for selected profiles

Income	Household	Monthly RCTP	Liquidity burden	Basic final burden	Final burden after C1
8,000	One adult	4,100	4.39 months	17.1%	13.0%
8,000	Two adults + 1 child	1,000	18.00 months	70.0%	53.3%
12,000	One adult	8,100	2.22 months	8.6%	6.6%
12,000	Two adults + 2 children	3,700	4.86 months	18.9%	14.4%
18,000	One adult	14,100	1.28 months	5.0%	3.8%
18,000	Two adults + 2 children	9,700	1.86 months	7.2%	5.5%

Note: *Provider bill = MAD 18,000; basic OOP = MAD 8,400; OOP after C1 = MAD 6,400.*

5.3 Sensitivity to the essential budget

Because RCTP depends on the essential-budget assumption, Table 8 varies the baseline budget for a two-adult, two-child household by ± 15%. The income gradient remains, but burden magnitudes change substantially. At MAD 12,000 income, the basic final burden ranges from 14.2% under the lower budget to 28.5% under the higher budget. At MAD 8,000, the baseline and + 15% assumptions yield zero residual capacity, so a ratio is not calculated. These results demonstrate that local calibration is not a cosmetic refinement: the denominator can materially change the classification of financial burden.

Table 8
Sensitivity of hospitalization burden to the essential-expenditure budget

Net income	Budget assumption	Essential budget	Monthly RCTP	Basic final burden
8,000	−15%	7,055	945	74.1%
8,000	Baseline	8,300	0	Not calculated
8,000	+ 15%	9,545	0	Not calculated
12,000	−15%	7,055	4,945	14.2%
12,000	Baseline	8,300	3,700	18.9%
12,000	+ 15%	9,545	2,455	28.5%
18,000	−15%	7,055	10,945	6.4%
18,000	Baseline	8,300	9,700	7.2%
18,000	+ 15%	9,545	8,455	8.3%
Note: *Household: two adults and two children. Final burden uses the basic OOP of MAD 8,400.*				

5.4 Housing, debt, and transfers

Table 9 holds net income at MAD 12,000 for a two-adult, two-child household and varies pre-committed resources. Ownership without housing debt raises RCTP to MAD 5,200 and lowers the basic final burden to 13.5%. A high-cost-city assumption or MAD 1,500 of monthly debt service each lowers RCTP to MAD 2,200 and raises final burden to 31.8%. When high city costs and debt are combined, residual capacity falls to MAD 700 and the MAD 8,400 retained payment equals one full year of RCTP. A stable MAD 1,000 transfer improves the ratio, but such a transfer should enter recurring resources only if it is sufficiently regular and reliable.

Table 9
Housing, debt, and transfer sensitivity at MAD 12,000 net income

Scenario	Essential budget	Debt service	Regular transfer	Monthly RCTP	Basic final burden
Baseline renter / medium-cost area	8,300	0	0	3,700	18.9%
Owner without housing debt	6,800	0	0	5,200	13.5%
High-cost city	9,800	0	0	2,200	31.8%
Baseline plus debt	8,300	1,500	0	2,200	31.8%
Baseline plus stable transfer	8,300	0	1,000	4,700	14.9%
High-cost city plus debt	9,800	1,500	0	700	100.0%

Note: *RCTP = net income + regular transfer − debt service − essential budget.*

5.5 Financing responses and third-party payment

Table 10 separates reimbursement generosity from financing at the treatment date. With no liquid support, the financing gap for the MAD 18,000 hospital bill is the full amount. Savings, exceptional family support, and borrowing reduce the immediate gap but respectively deplete assets, shift cost to another household, or create future debt service. Basic third-party payment reduces the point-of-care household requirement to the basic OOP of MAD 8,400. If the complementary benefit is also settled directly, the immediate household requirement falls to MAD 6,400. The final reimbursement amounts are unchanged; what changes is the timing and allocation of financing.

Table 10
Immediate financing gap under alternative responses to a MAD 18,000 hospital bill

Financing response	Immediate resource or authorized payment	Remaining gap	Economic interpretation
No liquid support	0	18,000	Full advance-payment barrier
Liquid savings	5,000	13,000	Access improves by depleting an asset
Exceptional family support	3,000	15,000	Part of the cost is shifted to the support network
New loan	10,000	8,000	Immediate access improves; future RCTP may fall
Basic third-party payment	9,600 paid by insurer	8,400	Household pays only basic OOP at point of care
Third-party payment including C1	11,600 paid by insurers	6,400	Household pays final OOP at point of care

Note: *The table does not include provider discounts, installment agreements, or public-sector alternatives.*

6 Discussion

6.1 Main economic interpretation

The simulation demonstrates why reimbursement generosity and effective affordability should be treated as separate dimensions. The key result is not that larger households are necessarily financially excluded in Morocco; the synthetic design cannot establish that claim. Rather, the calculations show that a reimbursement contract can produce a large wedge between the amount a household must mobilize before treatment and the amount it ultimately retains after reimbursement. This wedge is economically meaningful whenever liquidity is constrained.

The indicators answer different questions. ERR measures how much of the actual provider price is ultimately reimbursed. FB measures retained payment relative to annual residual resources. LB measures the size of the initial bill relative to monthly residual capacity. FG measures the amount that remains unfunded after liquid resources and authorized direct payment are recognized. Because these outcomes are not algebraically interchangeable, a policy can improve one while leaving another unchanged. A complementary benefit paid after the claim lowers final burden but not the initial liquidity requirement; a third-party-payment mechanism lowers the financing gap even if the ultimate reimbursement amount is identical.

This distinction is consistent with the economic purpose of risk pooling. Insurance is intended to separate access to needed care from the realization of a large idiosyncratic expenditure shock, while

purchasing arrangements determine how pooled resources are translated into services (Arrow 1963; Kutzin 2013). A reimbursement system that requires households to act as short-term financiers may preserve risk sharing ex post while weakening it at the moment of use. Whether this mechanism materially reduces utilization is an empirical question, not a conclusion of the present simulation.

6.2 Claims selection as a testable hypothesis

Administrative claims begin after a sequence of selection events: a patient perceives need, reaches a provider, accepts the proposed care, obtains or mobilizes payment, and submits a claim. People who delay, downgrade, or forgo care because of price or liquidity may therefore be absent from the claims file. The paper refers to this possibility as a claims-selection hypothesis rather than an established fact. It would be supported if, among insured people with comparable need and geographic access, lower RCTP or a larger financing gap predicted lower use, greater delay, lower treatment intensity, medication non-adherence, borrowing, or asset depletion.

Testing the hypothesis requires an independent measure of health need. Concentration curves and concentration indices can describe socioeconomic gradients in realized benefits, but interpretation must account for legitimate differences in need and for the properties of bounded outcomes (Kakwani et al. 1997; O'Donnell et al. 2008). A claims-only comparison by income would therefore be insufficient.

6.3 Sensitivity and measurement implications

The sensitivity results are central to the interpretation of the framework. Table 8 shows that a ± 15% change in the essential budget materially changes burden ratios, and Table 9 shows that housing and debt can generate differences comparable to those produced by income. RCTP should therefore not be treated as a fixed national constant. An empirical implementation should estimate or assign essential budgets using transparent regional, tenure, and household-composition rules and should report sensitivity to alternative specifications.

The same caution applies to liquid assets and informal support. A household with low recurring residual capacity but substantial liquid savings may finance a one-off episode, while a household with positive monthly residual capacity may still be unable to mobilize a large bill immediately. For this reason, the financing-gap indicator should be reported alongside RCTP rather than inferred from it. The framework separates stocks of immediately available resources from recurring flows precisely to avoid treating them as equivalent.

6.4 Policy interpretation

The framework does not imply that third-party payment is costless or universally preferable. Moving payment from households to insurers shifts administrative tasks and financial risk. Insurers may incur costs for eligibility verification, prior authorization, coding review, provider contracting, fraud control, dispute resolution, and information systems; providers may face payment delays or rejected claims. The relevant policy comparison is therefore between these administrative costs and the household costs of advance payment, delayed treatment, borrowing, asset depletion, and incomplete risk pooling.

A policy evaluation should consequently measure both sides. Outcomes should include point-of-care payments, unmet need, utilization conditional on need, claim-processing time, provider payment delay, denial and appeal rates, insurer administrative cost per claim, borrowing, asset depletion, and final OOP. A phased introduction of direct payment could support quasi-experimental evaluation when implementation timing varies across services, providers, or regions. The present model can be used to define the financial outcomes for such an evaluation, but it cannot determine the welfare effect without observed data.

7 Empirical validation agenda

The next empirical stage should link household survey information with anonymized claims or provider records. The household component should measure net recurring income, dependants, housing tenure and cost, debt service, regular transfers, essential expenditure, liquid savings, emergency support, borrowing, and asset depletion. Health need should be measured independently through diagnosed chronic conditions, symptoms, disability, pregnancy, injuries, clinician recommendations, and other clinically relevant indicators. Outcomes should include any use, visits, treatment intensity, provider sector, price charged, reimbursement received, claim-processing time, deferred care, medication non-adherence, and financial coping.

The primary empirical test is utilization conditional on need. Binary use can be modeled with an appropriate limited-dependent-variable model, while visit or claim counts can be analyzed with count models. Health expenditure and reimbursement often combine a mass at zero with a right-skewed positive distribution, making two-part models a natural candidate, subject to specification checks (Deb and Norton 2018). The key exposure should be RCTP, the financing gap, or their ranks rather than income alone. Covariates should include age, sex, health status, chronic disease, disability, education, geographic access, provider availability, and insurance design.

A second validation should compare alternative essential-budget specifications and quantify reclassification of financial burden. A third should compare survey-reported need and deferred care with claim submission to test the claims-selection hypothesis. A fourth should evaluate reimbursement versus third-party payment using a phased policy change where available. Data linkage should occur in a secure environment with identifiers removed from the analytical file, and future primary research should undergo appropriate ethics and data-protection review.

8 Limitations

Several limitations define the scope of the contribution. First, household budgets, care prices, coverage rates, and complementary amounts are synthetic. National data provide contextual anchors but do not convert the scenarios into population estimates. The results cannot be used to estimate the proportion of Moroccan households facing unmet need or to compare actual insurers.

Second, the essential budget is normative and simplified. Actual costs vary by region, tenure, transport, schooling, disability, household preferences, and economies of scale. The sensitivity analysis demonstrates this dependence but does not resolve it. Third, health need and behavior are not estimated. Households may choose public providers, negotiate prices, use informal credit, borrow, sell assets, postpone care, or accept different treatment intensity. The model classifies some of these responses but does not estimate their frequency or welfare consequences.

Fourth, the analysis is static. It does not model reimbursement delays, repeated shocks across household members, savings depletion, debt accumulation, or recovery time. A dynamic microsimulation would be more informative but would require observed transition probabilities and behavioral rules. Fifth, the financing-gap measure depends on how liquid resources and authorized payments are defined. Empirical applications should distinguish cash and liquid savings from uncertain credit or exceptional transfers.

Finally, the claims-selection mechanism remains a hypothesis. The simulation establishes a plausible economic pathway, not evidence that liquidity constraints currently reduce insured utilization in Morocco. That question requires linked measures of need, use, deferred care, household resources, and claims.

9 Conclusion

Reimbursement-based health insurance can provide substantial ex-post financial protection while still requiring households to finance a much larger amount at the point of care. This paper develops a liquidity-sensitive framework that makes this timing distinction explicit. Residual capacity to pay, liquidity burden, final burden, effective reimbursement, and the financing gap describe different parts of the payment pathway and should not be treated as substitutes.

The calibrated Moroccan simulation shows that the same hospital bill can imply very different months of residual capacity across household profiles and that direct payment can reduce the immediate financing gap without changing the ultimate reimbursement amount. These are conditional implications of a transparent model, not estimates of unmet need. The principal empirical priority is therefore to test whether liquidity-sensitive measures predict utilization, delay, and financial coping after health need and access conditions are controlled.

The broader implication for health-economics research is methodological: evaluating financial protection in reimbursement systems requires attention not only to how much households ultimately pay, but also to when they must pay it and which resources are available at that moment. Linking ex-post burden measures to ex-ante liquidity constraints can provide a more complete account of whether formal insurance coverage is economically usable.

Declarations

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Author contributions: The sole author conceived the framework, designed the simulation, interpreted the results, and approved the final manuscript.

Ethics approval: Not applicable. The study uses only synthetic household and health-care scenarios and does not involve human participants, personal data, or biological material.

Consent to participate: Not applicable.

Consent for publication: Not applicable.

Data availability: All synthetic inputs and formulas required to reproduce the reported calculations are provided in Tables 3–5 and Appendix A. No individual-level dataset was used.

Code availability: No proprietary software or external code is required. Platform-neutral pseudocode is provided in Appendix A.

Use of generative AI: An AI-assisted tool was used for English-language editing and manuscript formatting. The author reviewed the full text, calculations, references, and interpretations and accepts responsibility for the final content.

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Supplementary Files

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- AppendixA.docx