Free Access to and Utilization of Health Services in Senegal

Effects on Vulnerable Populations

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Access to healthcare in Senegal

Challenging $\rightarrow$ Out of pocket (OOP) expenditures on user fees

Solution to the OOP costs:

- Promote subsidized health insurance premiums
- Offer user fee subsidies

However, **supply-side** problems:

- Poor coverage ($\approx$ 20% according to Transform Health)
- Poor targeting of subsidies for insurance premium
- Reduced insurance packages

And, **demand-side** problems:

- Low take-ups of insurance schemes
- Competing traditional services (healers, street vendors) + self medication
- Aversion to administrative complications + cultural bias

Subsidized insurance usage $\rightarrow$ mixed to disappointing results. Vulnerable population remains underserved

Research Question

What is the impact of the UHC on healthcare outcomes?

1. Estimating the effect of the UHC on health outcomes like utilization ofhealthcare services and the OOP expenditures for the eligible population?
2. Investigating the externality effects of the presence of eligible members in the household on the propensity to report illness, utilization of healthcare services and OOP expenditures of the ineligible members

Preview

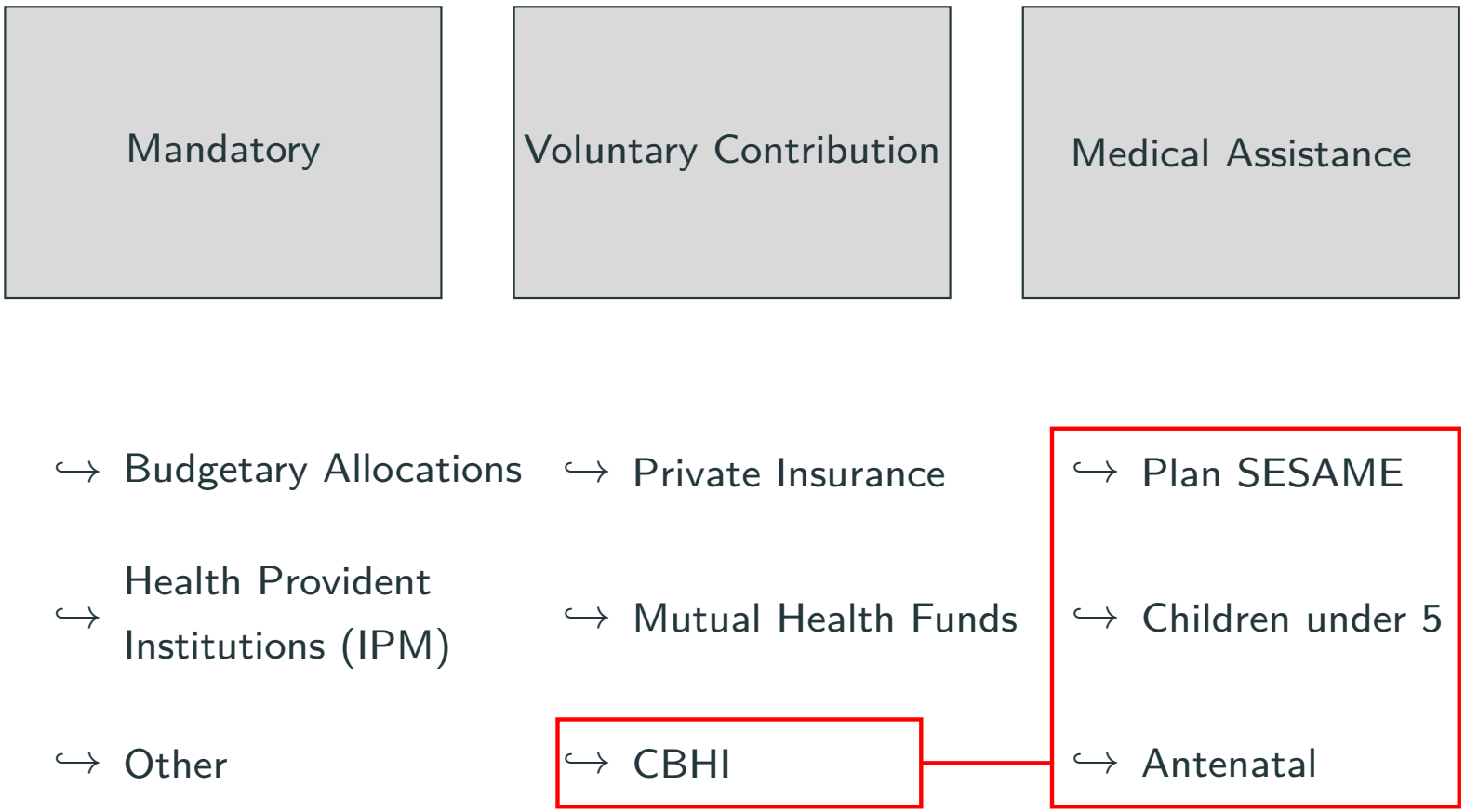
In this project:

- Observe a healthcare policy that provides user-fee exemptions to vulnerable groups of the population (Universal Healthcare Coverage)
- Estimate causal effects of the policy adoption on healthcare outcomes, identified using age discontinuities in the eligibility criterion
- In two steps
  - Estimate parameters on eligible individuals using RDD
  - Estimate parameters on ineligible family members (externality) through LPMs.
- Outcomes
  - Utilization (consulting visit)
  - Healthcare Expenditures (in $)
  - Propensity to report illness

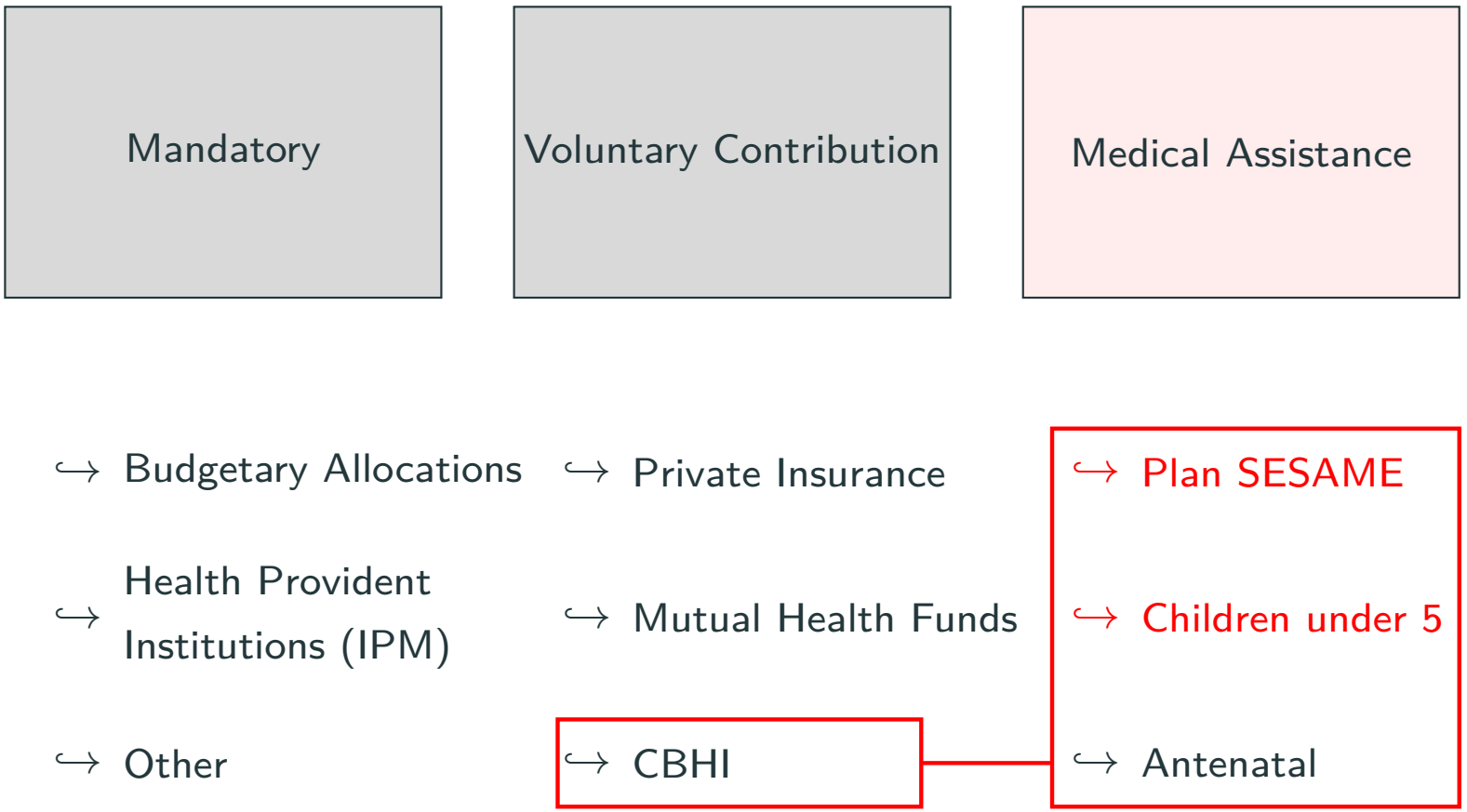
The fragmented Senegalese Healthcare System

Mandatory	Voluntary Contribution	Medical Assistance
↪ Budgetary Allocations	↪ Private Insurance	↪ Plan SESAME
↪ Health Provident Institutions (IPM)	↪ Mutual Health Funds	↪ Children under 5
↪ Other	↪ CBHI	↪ Antenatal

The fragmented Senegalese Healthcare System



The fragmented Senegalese Healthcare System



UHC: Promoting health access in Senegal, 2013-17

Focus of the project: Second component of the UHC: Free access to services for children (aged below 5) and the elderly (aged 60+)

→ Build on Plan SESAME for the elderly since 2006

→ Eliminate direct user fee (OOP costs) with no administrative burden

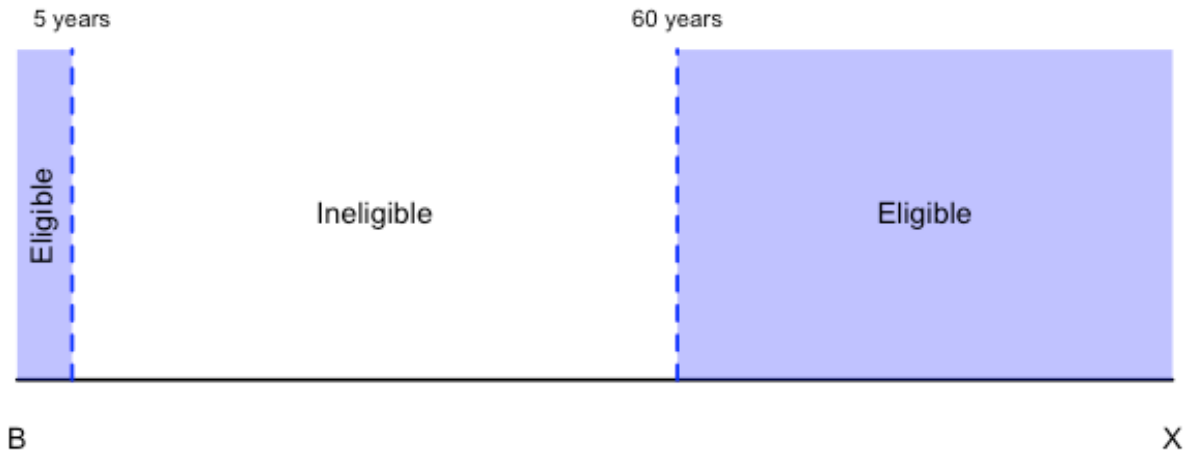


Figure 1: Eligibility Cutoffs (Age at B: 0 y; at X = 104 y)

Literature Review

1. Health insurance capacities: Bernal et al. (2017), Bagnoli (2019), Donato & Mosqueira (2019), Rashad et al. (2019), Agbanyo (2020, Taverne et al. (2021), Bousmah et al. (2022), Darkwah (2022), Ly et al. (2022), Wood (2022)

2. UHC and free access: Atchessi et al. (2016), Manthalu et al. (2016), Lépine et al. (2017), Manthalu (2018), Omari & Karasneh (2020), Paul et al. (2020), Renard (2022), Taverne et al., (2023),

Data

Living Standard measurements / Enquête Harminisée sur les conditions de vie des ménages (LSMS-EHCVM)

- is a multi-topic living standard measurement survey
- records over 120,000 individuals living in more than 14,000 households in 598 communities across two waves (2018-19, 2021-22)
- contains HH- and individual-level information on employment, health, consumption and other living standard topics
- is merged with community-level geocoded data from Agence National de la Statistique et de la Démographie (ANSD)

Sample Consturction

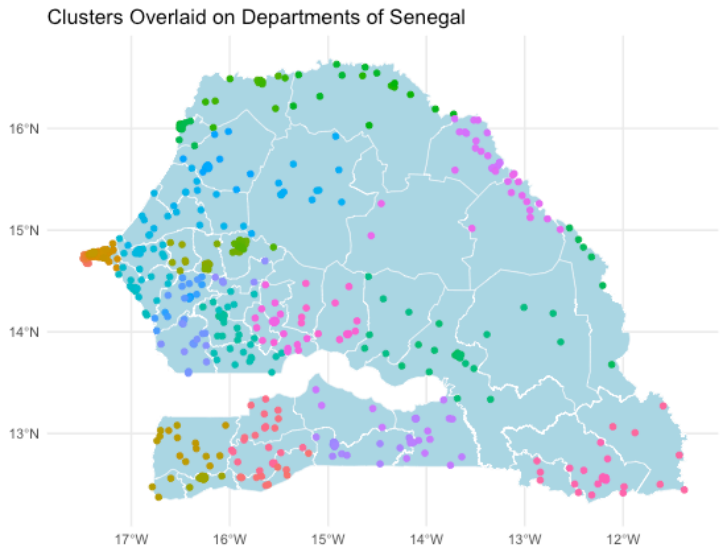


Figure 2: 598 Population Adjusted Community Centroids

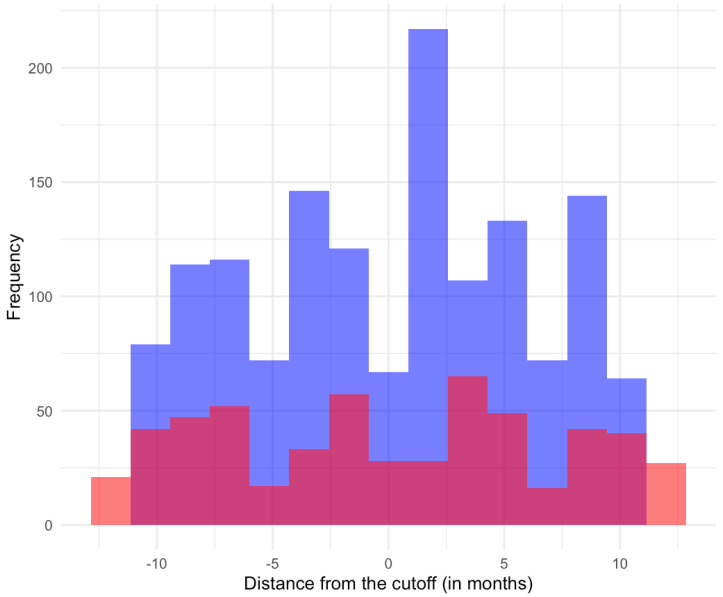


Figure 3: Sample Histogram (5, 60)

Full sample	→	**Estimable sample**	→	**Around cutoffs (total)**
(All individuals)		(Sick individuals)		(Individuals within ± 10 or 12 months)
128,237 individuals		31,373 individuals		2,016 individuals
14,000+ households		11,000+ households		1,800+ households

Figure 4: Sampling Stages

Summary Statistics

Variable	Mean	Std. dev.
Household level variables		
Urban	0.540	0.498
Household Size (number)	10.694	6.423
Household Coverage Composition (number)		
Eligible Children	1.587	1.628
Eligible Elderly	0.691	0.802
Ineligible Members	8.016	4.978
Household Head Education (Percentage)		
None (or Kindergarten)	69.37	
Primary	15.17	
Secondary (General & Technical; 1 & 2)	11.16	
Post-secondary & Higher Education	4.30	
Number of households	11 000	
Individual level variables		
Female	0.408	0.492
Religion (Percentage)		
Muslim	95.92	
Other Religions	4.08	
Health Problem in Last 1 Month (Percentage)		
Fever/Malaria	24.36	
Eye, Skin and Dental	6.69	
Blood Pressure Problems (incl. Diabetes)	6.50	
Stomach Problems (incl. Digestive)	4.92	
Cough, Cold, Respiratory	10.38	
Others/Unspecified	28.44	
Headache and Sore Throat	4.71	
Pain/Fatigue	14.01	
Health Expenditures in Last 3 Months (Average, USD)		
GP Cost	1.702	8.271
Specialist Cost	1.578	8.399
Dentist Cost	0.282	2.516
Medical Exam	6.500	42.284
Observed Consultation in the last 1 month	0.577	0.494
Observed health expenditure in the last 3 months (USD)	9.916	12.129
Number of individuals	31,373	

Design

- **Sample**: Household-level
- **Method**: Local linear RD with optimal bandwidth
- **Outcomes**:
  - Healthcare Utilization (consultation visits)
  - Healthcare Expenditures
- **(Demographic) Covariates**: Urban, Gender, Household Size, Educated Household Head (bin), Formal Education (bin)

$$y_i = \beta_0 + \beta_1 D_{a \geq a^*} + f(a,\ covs) + \delta_{dep} + \omega_{wave} + \epsilon_i \tag{1}$$

-
  - y_i: outcome of a person i
    - Utilization, $Y_1 = \mathbb{I}_{\{\text{Utilization in the last 1 month}\}}$

      $$Y_1 = \begin{cases} 1 & \text{if } \textit{consulted medical professional}, \\ 0 & \text{if } \textit{did not consult or consulted traditional} \end{cases}$$

    - Healthcare expenditure is a continuous variable
  - D: binary treatment based on age
  - $f(\cdot)$: linear function – allows for different slopes on both sides
  - δ: department indicator; ω: wave indicator

Free access may:

- Target the vulnerable population
- Eliminate financial and administrative barriers

Logically, this should raise utilization and lower costs!

Main Estimates

	Children (1)	Elderly (2)	Pooled (3)		Children (1)	Elderly (2)	Pooled (3)
Utilization	0.01	0.35	0.21*	**Expenditures**	0.28	-2.55	-0.49
	(0.08)	(0.22)	(0.12)		(0.73)	(2.01)	(0.70)
Observations	971	408	1379	Observations	1109	423	1532
Bandwidth	2.83	3.80	3.12	Bandwidth	3.32	3.04	3.67
Demog.				Demog.			
Covariates	×	×	×	Covariates	×	×	×
Department FE	✓	✓	✓	Department FE	✓	✓	✓
Wave FE	✓	✓	✓	Wave FE	✓	✓	✓
Robust p-value	✓	✓	✓	Robust p-value	✓	✓	✓

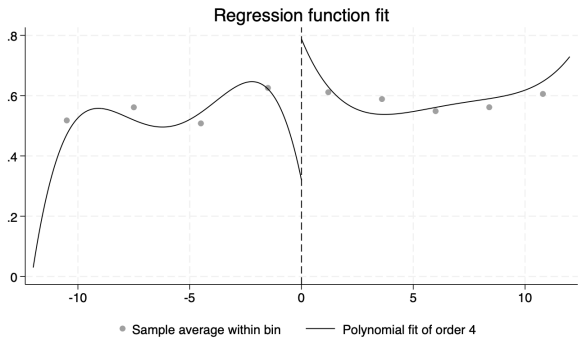


Figure 5: Utilization, Pooled

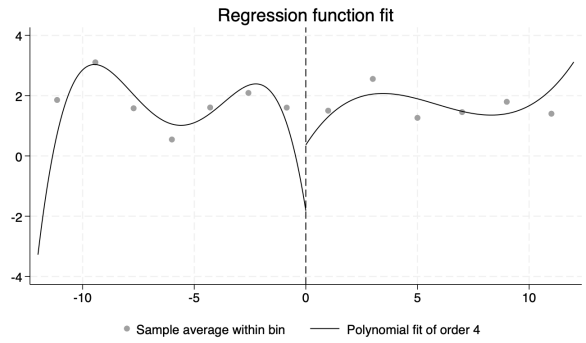


Figure 6: Expednitures, Pooled

Conditioning on Urbanity (Pooled)

	Urban (1)	Rural (2)
Utilization	0.34***	-0.05
	(0.12)	(0.44)
Observations	737	642
Bandwidth	2.84	2.95
Demog. Covariates	×	×
Department FE	✓	✓
Wave FE		
Robust p-value	✓	✓

	Urban (1)	Rural (2)
Expenditures	-0.09	-1.86***
	(1.26)	(0.64)
Observations	799	733
Bandwidth	3.20	3.56
Demog. Covariates	×	×
Department FE	✓	✓
Wave FE	✓	✓
Robust p-value	✓	✓

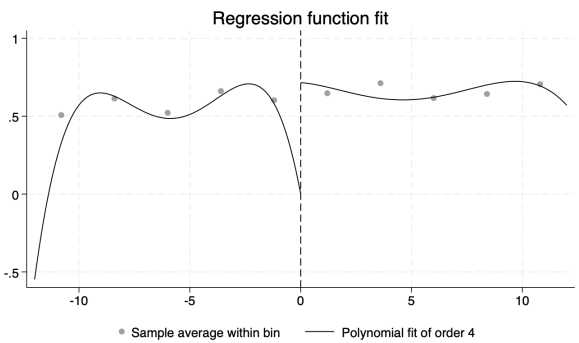


Figure 7: Utilization, Urban

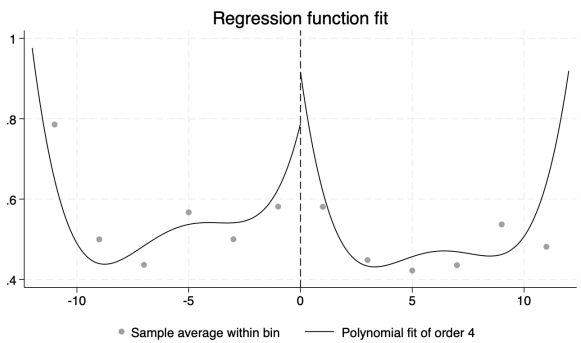


Figure 8: Utilization, Rural

Conditioning on Urbanity (Pooled)

	Urban (1)	Rural (2)
Utilization	0.34***	-0.05
	(0.12)	(0.44)
Observations	737	642
Bandwidth	2.84	2.95
Demog. Covariates	×	×
Department FE	✓	✓
Wave FE		
Robust p-value	✓	✓

	Urban (1)	Rural (2)
Expenditures	-0.09	-1.86***
	(1.26)	(0.64)
Observations	799	733
Bandwidth	3.20	3.56
Demog. Covariates	×	×
Department FE	✓	✓
Wave FE	✓	✓
Robust p-value	✓	✓

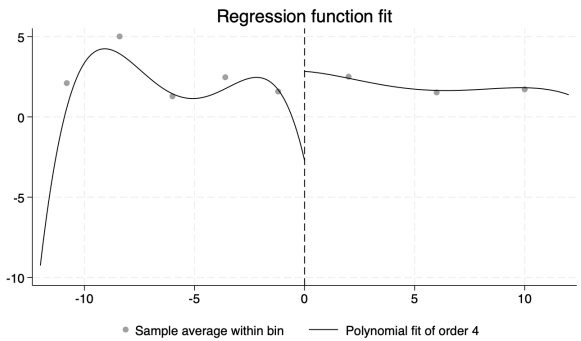


Figure 7: Expenditures, Urban

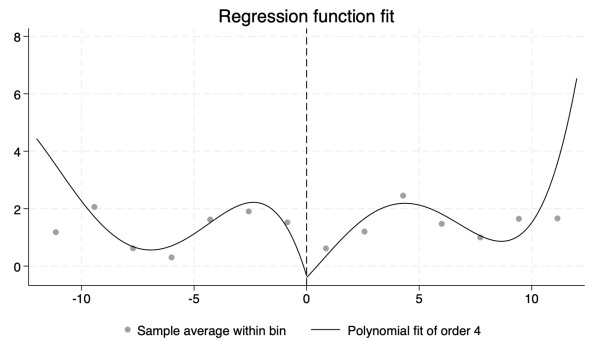


Figure 8: Expenditures, Rural

Robustness and Stability

- Density Test: Score is continuous across each cutoff ▸ Score Density Test
- Donut: dropped observations if score is 0
- Checked covariate-balance across each cutoff; unbalanced covariates are added as controls in the regressions ▸ Balance Tests
- Estimates are the same with and without covariates ▸ Comparison (by cutoff) ▸ Comparison (pooled)
- Score Placebo: Estimates are insignificant for values $\pm$ 10 months on each side for each cutoff.
- Higher Polynomial: Estimates are robust to a quadratic fit.

Externality Check

- Household-level healthcare decisions are interdependent, particularly in larger, financially constrained families.
- Targeted policies may generate spillover benefits (or costs) for ineligible household members.
- Financial relief for eligible members could either enable or constrain healthcare access for others.

$$\begin{aligned} y_i = \beta_0 + \beta_1.\textit{eligible\_child} + \beta_2.\textit{eligible\_elderly} \\ + \beta_3.(\textit{eligible\_child} \times \textit{eligible\_elderly}) \\ + \beta_4 X_i + \delta_{dep} + \omega_{wave} + \epsilon_i \end{aligned} \tag{2}$$

- y_i: outcome of a person i
  - Illness Reporting Propensity (for anyone within the HH)
  - Utilization (for the ineligible people)
  - Expenditure on self (for the ineligible people)
- X_i: Urban, Gender, Household Size, Educated Household Head (bin), Formal Education (bin), Nr. of Ineligible Members
- δ: department FEs; ω: wave FEs

Regression I: Propensity of Reporting Illness

	(1) 1-month	(2) 3-month
Has eligible child	-0.01	-0.001
	(0.1)	(0.01)
Has eligible elderly	0.01	0.001
	(0.01)	(0.01)
Has both (eligible)	-0.002	0.01
	(0.00796)	(0.01)
Number of ineligible members	-0.01***	-0.003**
	(0.001)	(0.001)
Household Size	-0.002	-0.003**
	(0.001)	(0.001)
Female	-0.05***	-0.05***
	(0.002)	(0.002)
Uneducated Head	0.001	0.01***
	(0.004)	(0.003)
Baseline	0.32***	0.27***
	(0.01)	(0.01)
Department FEs	✓	✓
Wave FEs	✓	✓
Observations	116,268	116,168

Table 1: Externality on reported sickness

▸ Without demog. controls

Regression II: Utilization & Expenditure of the Ineligible

	(1) Utilization	(2) Expenditure
Has eligible child	0.01	0.02
	(0.01)	(0.13)
Has eligible elderly	-0.001	-0.12
	(0.01)	(0.16)
Has both (eligible)	0.03	0.24
	(0.02)	(0.18)
Number of Ineligible members	0.01*	0.04
	(0.004)	(0.04)
Household Size	-0.01**	-0.04
	(0.003)	(.03)
Female	-0.03***	-0.65***
	(0.01)	(0.07)
Had Formal Education	0.01**	-0.04**
	(0.01)	(0.08)
Baseline	0.58***	2.83***
	(0.01)	(0.12)
Department FE	✓	✓
Wave FE	✓	✓
Observations	23,977	21,808

Table 2: Externality on utilization and expenditures by ineligible members

▸ Without demog. controls

Conclusions

- The free access **only marginally raised utilizations** of individuals with free access.
- Expenditures made to GPs, specialists, dentists and for medical exams **do not show significant results**.
- Positive utilization effects are driven by **urban households**. Expenditure cuts are pronounced for **rural households**.
- **No spillovers** within the household are observed in terms of reporting illnesses due to the presence of eligible members.
- **No observed spillovers** for utilization and healthcare expenditures for the ineligible, due to the presence of the eligible members.

Roadmap

Current situation:

- Investigating related measures (logs, sq. residuals, etc.) of expenditures to check for consistency
- Investigating retirement correlates (for people aged close to 60)
- Computing “past exposure” to treatment of the individuals currently just above cutoff 1

Up next:

- Bandwidth variation as another measure of robustness
- Find informative measures employment and education
- Compute a ”poverty” measure to check heterogeneities across wealth endowment
- Calculate distance to the closest health centres and hospitals to check for geographical access inequalities
- Theoretical justification for the underlying mechanisms of estimates

Thanks!

Questions?

Density Test

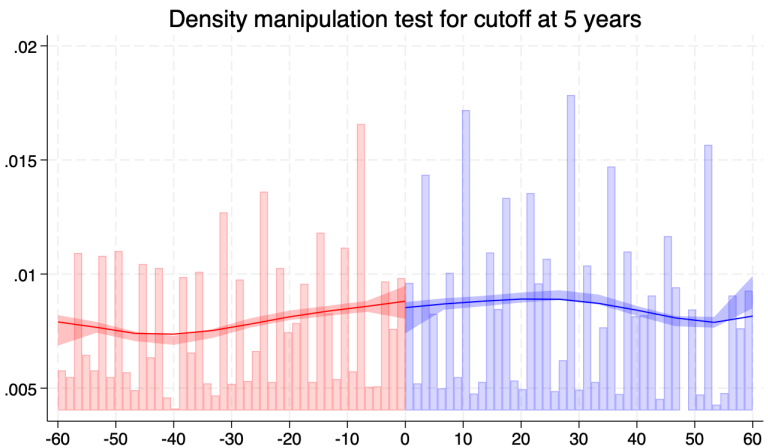


Figure 9: Continuous for Cutoff 1

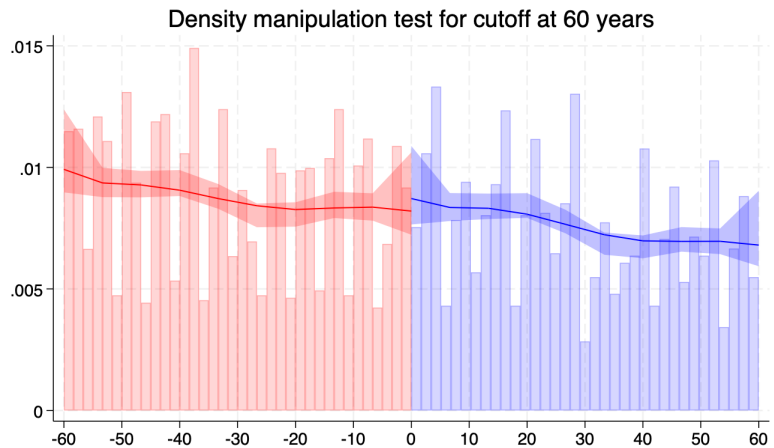


Figure 10: Continuous for Cutoff 2

▸ Back

Balance Tests (WIP)

	Urban	Female	Household Size	Uneducated Household Head
	(1)	(2)	(3)	(4)
Pooled	-0.13	-0.25	1.66	0.31**
	(0.15)	(0.16)	(3.18)	(0.13)
Observations	1603	1603	1603	1603
Bandwidth	3.33	2.50	3.11	2.94
Cutoff 1	0.25***	0.16***	4.76***	-0.26
	(0.03)	(0.06)	(1.26)	(0.17)
Observations	1135	1135	1135	1135
Bandwidth	3.86	3.09	3.04	2.85
Cutoff 2	-0.94	-0.41*	16.07***	0.38
	(0.63)	(0.22)	(5.12)	(0.34)
Observations	468	468	468	468
Bandwidth	2.89	2.90	2.61	2.32
Demog. Covariates	×	×	×	×
Department FE	✓	✓	✓	✓
Wave FE	✓	✓	✓	✓
Robust p-value	✓	✓	✓	✓

Back

Comparison (by cutoff)

	Without Covariates Cutoff 1 (1)	With Covariates Cutoff 1 (2)	Without Covariates Cutoff 2 (3)	With Covariates Cutoff 2 (4)
Utilization	0.01	0.01	0.35	0.40*
	(0.08)	(0.08)	(0.22)	(0.22)
Observations	971	971	408	408
Bandwidth	2.83	2.93	3.80	3.58
Expenditures	0.28	-0.08	-2.55	-2.97
	(0.73)	(0.68)	(2.01)	(2.02)
Observations	1109	1109	423	423
Bandwidth	3.32	3.29	3.04	3.03
Demog. Covariates	×	✓ Urban, Female, Household Size	×	✓ Female, Household Size,
Department FE	✓	✓	✓	✓
Wave FE	✓	✓	✓	✓
Robust p-value	✓	✓	✓	✓

Table 3: Cutoffs 1 & 2, Utilization + Expenditures

▸ Back

Comparison (pooled)

	Without Covariates **Utilization** (1)	With Covariates **Utilization** (2)	Without Covariates **Expenditures** (3)	With Covariates **Expenditures** (4)
	0.21*	0.23*	-0.49	-0.46
	(0.12)	(0.12)	(0.70)	(0.69)
Observations	1,379	1,379	1,532	1,532
Bandwidth	3.12	3.11	3.67	3.74
Demog. Covariates	×	✓ Uneducated Household Head	×	✓ Uneducated Household Head
Department FE	✓	✓	✓	✓
Wave FE	✓	✓	✓	✓
Robust p-value	✓	✓	✓	✓

Table 4: Pooled, Utilization + Expenditures

Back

Comparison (pooled, Urban-Rural)

	Without Covariates Urban (Pooled) (1)	With Covariates Urban (Pooled) (2)	Without Covariates Rural (Pooled) (3)	With Covariates Rural (Pooled) (4)
Utilization	0.34***	0.37***	-0.05	-0.04
	(0.12)	(0.12)	(0.44)	(0.36)
Observations	737	737	642	642
Bandwidth	2.84	2.81	2.95	3.28
Expenditures	-0.09	0.11	-1.86***	-1.88***
	(1.26)	(1.25)	(0.64)	(0.63)
Observations	799	799	733	733
Bandwidth	3.20	3.23	3.56	3.60
Demog. Covariates	×	✓ Uneducated Household Head	×	✓ Uneducated Household Head
Department FE	✓	✓	✓	✓
Wave FE	✓	✓	✓	✓
Robust p-value	✓	✓	✓	✓

Table 5: Pooled, Urban and Rural

Back

Regression IA: Propensity of Reporting illness (without demog. covariates)

	(1) 1-month	(2) 3-month
Has eligible child	-0.02***	-0.02***
	(0.01)	(0.01)
Has eligible elderly	0.004	-0.004
	(0.01)	(0.01)
Has both (eligible)	-0.02**	-0.01
	(0.01)	(0.01)
Baseline	0.25***	0.20***
	(.01)	(.004)
Demog. Covariates	×	×
Department FEs	✓	✓
Wave FEs	✓	✓
Observations	116,268	116,168

Table 6: Externality on reported sickness

▸ Back

Regression IIA: Utilization & Expenditure of the Ineligible (without demog. covariates)

	(1) Utilization	(2) Expenditure
Has eligible child	0.01	-0.05
	(0.01)	(0.12)
Has eligible elderly	-0.01	-0.12
	(0.01)	(0.15)
Has both (eligible)	0.017	0.20
	(0.02)	(0.18)
Baseline	0.57***	2.54***
	(0.01)	(0.09)
Demog. Covariates	×	×
Department FEs	✓	✓
Wave FEs	✓	✓
Observations	26,368	21,812

Table 7: Externality on utilization + expenditures

Back

Moments of obs w/ imputed age

▸ Back to Robustness and Stability