Risk Adjustment Mechanisms in Colombia

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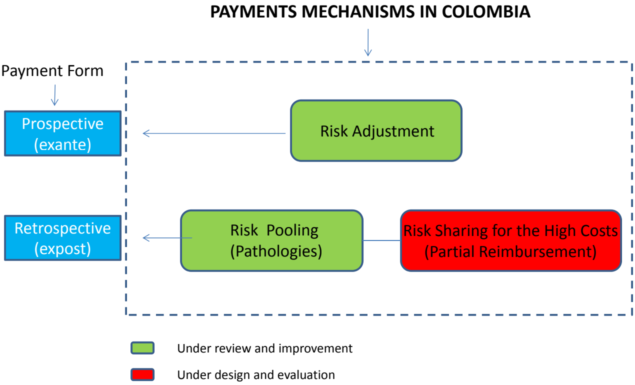
Plan of Presentation

Main objectives

- This ongoing reseach project has focused on:
  1. Redisigning the whole risk adjustment mechanism in Colombia (broad objective).
  2. Adjusting current main components: Exante risk adjustment and expost risk pooling by pathologies (specific objective).

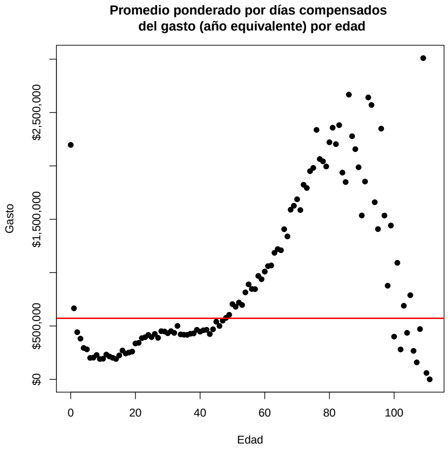
Broad design

- Broad design we are proposing:



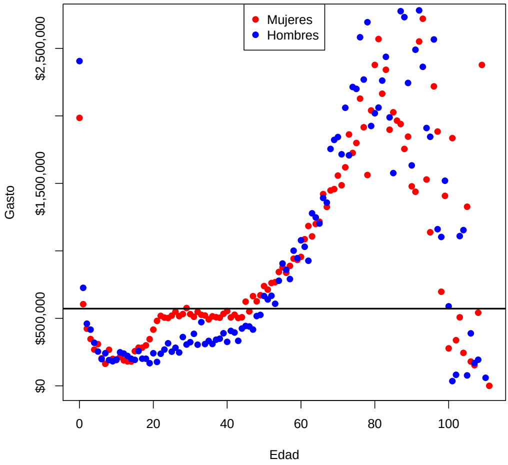
Plan of Presentation

Risk Factors Current System: Age, sex, locality



Risk Factors Current System: Age, sex, locality

Promedio ponderado por días compensados
del gasto (año equivalente) por edad y género



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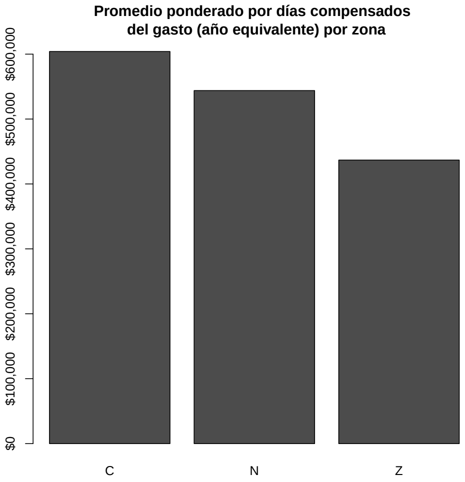

Exploring new factors

- Current model (linear regression) cannot explain more than 2% of the proportion of variaton of annualized health expenditures.
- We have been studying:
  1. Disability.
  2. Chronic diseases: 29 groups.
  3. IR-DRG adapted to Colombia (24 groups).
  4. HCC adapted to Colombia.

Results

Table : Individual-level predictive performance indicators (annualized expenditure)

2*Model	Estimation sample			Validation sample		
	R^2(%)	*MAPE*	*CPM*(%)	R^2(%)	*MAPE*	*CPM*(%)
Until 2009	1.27	1.31	4.29	1.02	1.31	3.52
(1): Current	1.45	1.30	4.86	1.15	1.31	4.13
AgeGroup*Gender*Zone	1.47	1.30	4.93	1.16	1.30	4.19
Age*Gender*Zone+Age2+Age3	0.98	1.34	2.12	0.82	1.34	1.35
AgeGroup*Gender*Zone*City	1.47	1.30	4.93	1.16	1.30	4.19
AgeDummies*Gender*Zone	1.56	1.30	4.95	1.12	1.31	4.15
(1) + Disability (D)	1.65	1.30	5.06	1.38	1.30	4.39
(1) x Disability (D)	1.71	1.30	5.07	1.38	1.30	4.36
(1) + Hospitalization (H)	5.71	1.21	11.54	4.83	1.21	11.02
(1) x Hospitalization (H)	7.73	1.13	17.32	6.36	1.13	16.82
(1) + Specialist (S)	3.53	1.22	10.79	2.92	1.23	9.98
(1) x Specialist (S)	3.98	1.17	14.62	3.27	1.17	13.75
(1) + Morbidity (M)	1.46	1.30	4.88	1.16	1.31	4.13
(1) + Chronic	10.85	1.16	14.92	9.04	1.17	13.99
(1) + DRG	12.57	1.08	21.14	6.12	1.17	14.12
(1) + HCC	4.71	1.24	9.53	4.10	1.24	8.85
(1) + D + H + S	6.72	1.24	8.94	5.73	1.25	8.23
(1) x D x H x S	9.58	1.05	23.46	7.54	1.05	22.78

Results

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AgeGroup*Gender*Zone*City	1.47	1.30	4.93	1.16	1.30	4.19
AgeDummies*Gender*Zone	1.56	1.30	4.95	1.12	1.31	4.15
(2): (1) + D + H + S + M	6.76	1.25	8.21	5.77	1.26	7.51
(3): (1) x D x H x S + M	9.61	1.05	22.93	7.57	1.06	22.25
(2) + Chronic	13.52	1.17	14.43	11.38	1.18	13.52
(2) + DRG	13.07	1.13	17.59	6.61	1.21	11.38
(2) + HCC	8.55	1.23	10.24	7.39	1.23	9.54
(3) + Chronic	15.41	1.04	23.74	12.49	1.05	22.86
(3) + DRG	14.90	1.00	26.72	7.98	1.10	18.94
(3) + HCC	11.07	1.04	23.61	8.94	1.05	22.97

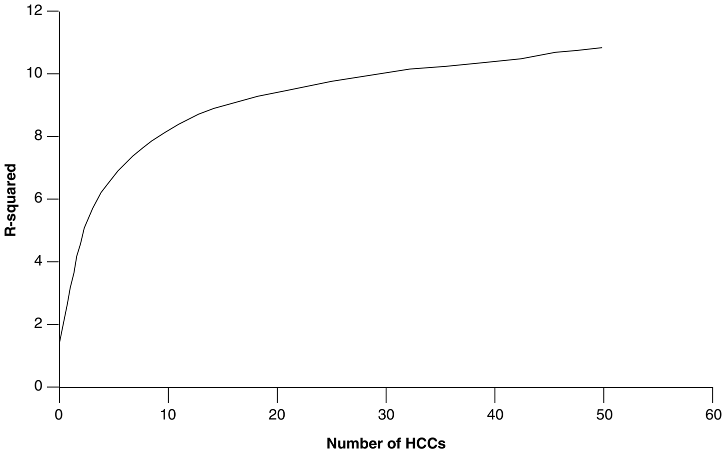
Comparing with other studies

- Risk adjustment of Medicare capitation payments using the CMS-HCC Model (Pope, Kautter, Ellis, Ash, etc. (2004))

Comparing with other studies

Figure 4

Model Explanatory Power as a Function of Number of Hierarchical Condition Categories (HCC)



NOTES: All models, including the one with zero HCCs, include 24 age/sex cells, and Medicaid and originally disabled status. Results based on stepwise regression analysis.

SOURCE: (Pope et al., 2001.)

Incentives for cream-skimming

Table : Predictive ratios for non-annualized expenditure quintiles

2*Model	Estimation sample		Validation sample	
	Q1	Q5	Q1	Q5
Until 2009	15.48	0.26	15.53	0.27
(1): Current	15.22	0.27	15.26	0.28
AgeGroup*Gender*Zone	15.20	0.27	15.24	0.28
Age*Gender*Zone+Age2+Age3	16.16	0.25	16.22	0.25
AgeGroup*Gender*Zone*City	15.20	0.27	15.24	0.28
AgeDummies*Gender*Zone	15.15	0.27	15.18	0.28
(1) + Disability (D)	15.15	0.28	15.19	0.28
(1) x Disability (D)	15.13	0.28	15.19	0.28
(1) + Hospitalization (H)	8.41	0.52	8.52	0.53
(1) x Hospitalization (H)	8.78	0.55	8.88	0.56
(1) + Specialist (S)	9.27	0.45	9.38	0.45
(1) x Specialist (S)	9.36	0.47	9.46	0.48
(1) + Morbidity (M)	15.21	0.27	15.24	0.28
(1) + Chronic	8.94	0.53	8.97	0.53
(1) + DRG	3.52	0.76	0.76	0.76
(1) + HCC	11.47	0.41	11.47	0.41
(1) + D + H + S	5.26	0.61	5.42	0.62
(1) x D x H x S	5.99	0.65	6.08	0.66

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AgeGroup*Gender*Zone*City	15.20	0.27	15.24	0.28
AgeDummies*Gender*Zone	15.15	0.27	15.18	0.28
(2): (1) + D + H + S + M	5.08	0.61	5.24	0.62
(3): (1) x D x H x S + M	5.83	0.65	5.92	0.66
(2) + Chronic	3.63	0.71	3.76	0.72
(2) + DRG	1.99	0.78	1.92	0.84
(2) + HCC	4.07	0.66	4.19	0.67
(3) + Chronic	4.37	0.73	4.44	0.74
(3) + DRG	3.06	0.81	1.15	0.84
(3) + HCC	4.91	0.69	4.96	0.70

Plan of Presentation

Aim and scope

- Expost risk pooling by pathologies (Cuenta de Alto Costo - CAC), currently works for renal chronic disease.
- Soon four more patologies will be introduced.
- CAC is regulated by the government but managed by health insurers (EPSs).
- It is meant to be a pool for risk sharing of high cost pathologies (currently only chronic renal disease).
- Five new patologies will follow: AIDS, Cancer, Artritis, Epilepsy.

The working mechanism

- The actual mechanism.
  1. Using the prevalence of renal chronic disease per health insurer within each age group, estimate a normal distribution (uses almost 70 data points per age group).
  2. Estimate upper and lower bounds for prevalence per age group.
  3. Compare each health insurer prevalence to the upper and lower bounds.
  4. If an insurer has prevalence below the lower bound it contributes to the fund. If above it receives from the fund.
  5. All tranfers are fixed in advance and the same for every age group (15.000 USD).

The working mechanism: Problems

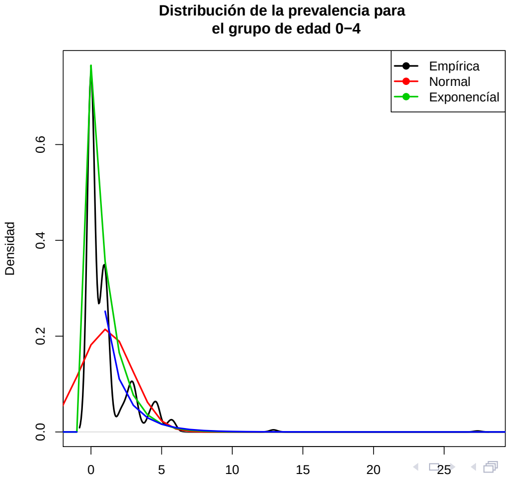
1. Prevalence is not normal even within age group.
2. It is unbalanced almost by definition (in 2011 the government had to finance it with almos 20 million USD, the same value of the fund).
3. Provides incentives for risk selection.

Non normality

Table : Normality testing.

	Test				
Rango Edad	Shapiro-Wilk	Anderson-Darling	Cramer-von Mises	Lilliefors	Shapiro-Francia
0-4	2.8E-07	1.4E-10	3.3E-08	1.0E-07	2.4E-06
5-9	4.2E-06	1.5E-04	1.6E-03	2.6E-02	1.3E-05
10-14	6.2E-05	2.4E-03	9.9E-03	6.0E-02	9.4E-05
15-19	5.5E-03	7.4E-02	1.7E-01	1.4E-01	5.4E-03
20-24	3.1E-06	5.9E-06	3.9E-05	8.6E-04	7.3E-06
25-29	2.4E-07	3.6E-05	2.3E-04	5.5E-04	7.6E-07
30-34	1.7E-14	4.5E-31	7.4E-10	3.8E-20	1.7E-12
35-39	1.9E-12	2.8E-25	7.4E-10	7.6E-18	9.0E-11
40-44	7.9E-11	5.7E-14	1.6E-09	6.3E-11	1.3E-09
45-49	1.8E-12	6.6E-28	7.4E-10	5.8E-22	9.2E-11
50-54	1.6E-10	4.8E-16	7.4E-10	4.3E-12	2.9E-09
55-59	3.3E-06	6.3E-08	2.8E-06	4.4E-05	1.6E-05
60-64	1.0E-03	6.4E-04	1.6E-03	3.4E-03	2.7E-03
65-69	3.7E-02	4.7E-02	8.8E-02	9.1E-02	8.7E-02
70-74	1.7E-02	2.0E-02	2.8E-02	8.2E-02	3.6E-02
75-79	2.1E-02	3.6E-02	5.7E-02	1.5E-01	6.2E-02
80 +	7.2E-04	2.3E-03	5.2E-03	9.4E-03	7.5E-04
Total	5.7E-13	3.5E-28	7.4E-10	7.7E-24	3.2E-11

Other distributions



Other distributions

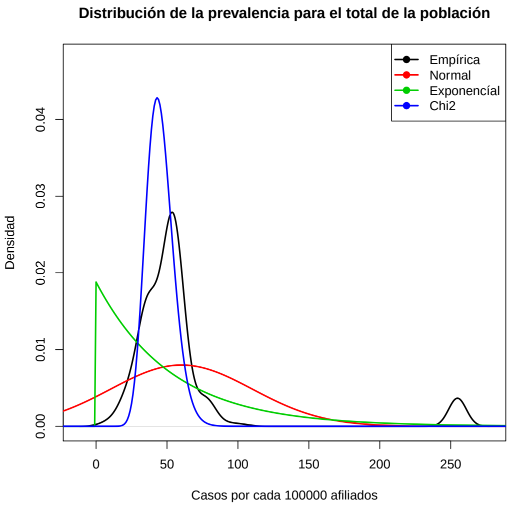
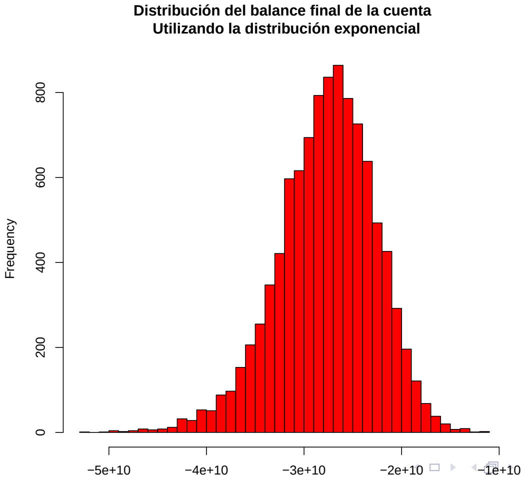


Figure : Empirical, normal, exponencial and Ξ^2.

Simulation study: unbalanceness



Simulation study: unbalanceness

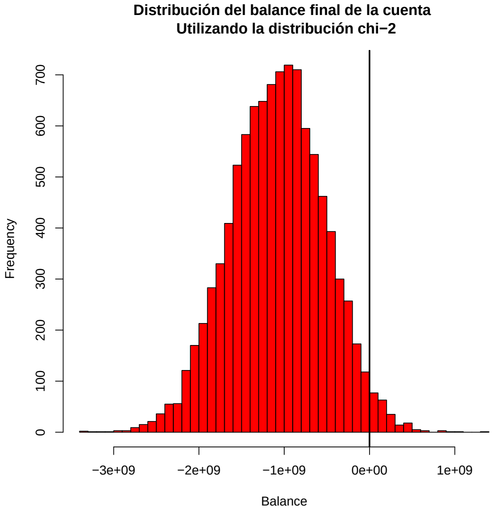


Figure : Distribución del balance final de la cuenta de alto costo asumiendo una distribución χ^2.

Plan of Presentation

Balanceness and efficiency selection tradeoff

- We explore two main ideas:
  1. Optimal linear payment rules in a structural model (Barros, Pedro (2003). Cream-skimming, incentives for efficiency and payment system. Journal of Health Economics.
  2. A model of exante and expost risk adjustment.

Optimal linear payment rules

- Considere the general linear payment rule in a three agent (insurer, insured, regulator) rational interacting agents.
  $S_i(p, X(e_i)) = \alpha_0 + \alpha_1 \overline{p}_i X(e_i) + \alpha_2 \overline{p} X(e_i)$
  were $\overline{p}_i$ is the prevalence of one disease in insurer i and $X(e_i))$ is the cost of the disease as a function of insurer effort e.
- This payment rule include:
  1. Pure risk premium: $\alpha_1 = \alpha_2 = 0$
  2. Risk adjustment (expost) or full reimburesement: $\alpha_0 = \alpha_2 = 0, \alpha_1 = 1$
  3. Population based risk adjustment (exante): $\alpha_0 = 0$, $\alpha_1 = 0$, $\alpha_2 = 1$.

Optimal linear payment rules

- In this model the optimal payment rule is: $\alpha_1 = 1, \alpha_2 = -1$, es decir:

$$S_i = \alpha_0 + X(e_i)(\overline{p}_i - \overline{p}) \quad (1)$$

- This mechanism provides `indirect` incentives for efficiency by paying a discounted value of th efull value of the pathology ($X(e_i)$ would be this optimal value).

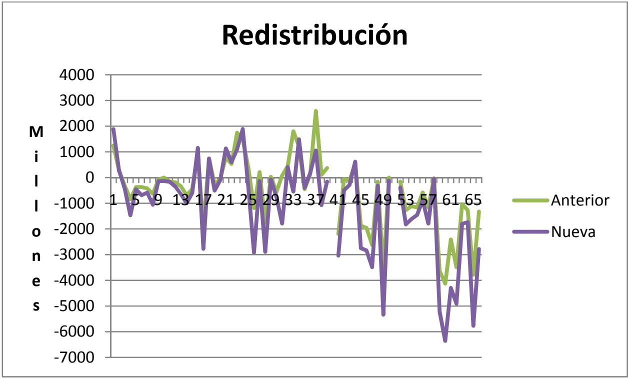
Optimal linear payment rules

- In the case of the expost mechanism in Colombia, α_0 is already risk adjusted by three factors.
- Age is highly correlated with renal disease therefore we modify the previous payment rule by setting the expost payment to:

$$C_i^{expost} = X(e_i) \sum_{g \in G} (p_i^g - p^g) \tag{2}$$

were G are the group of age categories used to risk adjust the capitation payment.

Results



Redistribución
4000
3000
2000
1000
0
-1000
-2000
-3000
-4000
-5000
-6000
-7000
Millones
1 5 9 13 17 21 25 29 33 37 41 45 49 53 57 61 65
Anterior
Nueva

Results

		Anterior	Nueva																
CAJA DE COMPENSACIÓN FAMILIAR DE ANTIOQUIA "COMFAMA"	CCF002	1.244	1.886	CAJA DE COMPENSACIÓN FAMILIAR DE CUNDINAMARCA COMFACUNDI-ARS UNICAJAS COMFACUNDI	CCF053	926	1.155	SOLIDARIA DE SALUD SOLSALUD ENTIDAD PROMOTORA DE SALUD DEL RÉGIMEN CONTRIBUTIVO Y SUBSIDIADO "SOLSALUD S.A.	EPS026	556	618	SURA EPS	EPS010	79	-1.789	EMPRESA MUTUAL PARA EL DESARROLLO INTEGRAL DE LA SALUD E.S.S. "EMDISALUD"	ESS002	-3.625	-5.210
CAJA DE COMPENSACIÓN FAMILIAR DE CARTAGENA "COMFAMILIAR CARTAGENA"	CCF007	265	269	CAJA DE COMPENSACIÓN FAMILIAR CAJACOPI ATLÁNTICO	CCF055	-1.932	-2.775	SOLIDARIA DE SALUD SOLSALUD ENTIDAD PROMOTORA DE SALUD DEL RÉGIMEN CONTRIBUTIVO Y SUBSIDIADO "SOLSALUD S.A.	EPS026 S	-1.879	-2.744	COMFENALCO VALLE E.P.S.	EPS012	450	409	COOPERATIVA DE SALUD Y DESARROLLO INTEGRAL ZONA SUR ORIENTAL DE CARTAGENA LTDA. "COOSALUD E.S.S."	ESS024	-4.128	-6.357
CAJA DE COMPENSACIÓN FAMILIAR DE BOYACÁ "COMFABOY"	CCF009	-318	-437	CAJA COLOMBIANA DE SUBSIDIO FAMILIAR-COLSUBSIDIO	CCF101	741	741	ENTIDAD PROMOTORA DE SALUD CONDOR S.A. ADMINISTRADORA DEL RÉGIMEN SUBSIDIADO	EPS030	-1.958	-2.835	SALUDCOOP EPS	EPS013	1.799	-546	ASOCIACION MUTUAL LA ESPERANZA "ASMET SALUD"	ESS062	-2.408	-4.293
CAJA DE COMPENSACIÓN FAMILIAR DE CÓRDOBA "COMFACOR	CCF015	-847	-1.470	CAJA DE COMPENSACIÓN FAMILIAR COMFAMILIAR CHOCO	CCF102	-265	-509	SELVASALUD S.A. EPS ARS	EPS031	-2.620	-3.486	HUMANA VIVIR EPS	EPS014	1.217	1.488	ASOCIACIÓN MUTUAL BARRIOS UNIDOS DE QUIBDO AMBUQ ARS	ESS076	-3.493	-4.907
CAJA DE COMPENSACIÓN FAMILIAR -CAFAM	CCF018	-370	-461	EMPRESAS PÚBLICAS DE MEDELLÍN DEPARTAMENTO MÉDICO ANTIOQUIA MEDELLIN	EAS016	-53	-97	SALUDVIDA E.P.S. S.A.	EPS033	-159	-320	HUMANA VIVIR EPS S	EPS014 S	-450	-397	ECOOPSOS EMPRES SOLIDARIA DE SALUD	ESS091	-1.032	-1.796
CAJA DE COMPENSACIÓN FAMILIAR DE LA GUAJIRA	CCF023	-370	-686	FONDO DE PASIVO SOCIAL DE FERROCARRILES NACIONALES DE COLOMBIA.	EAS027	794	1.132	SALUDVIDA E.P.S. S.A.	EPS033 S	-3.652	-5.337	SALUD COLPATRIA E.P.S.	EPS015	132	181	ASOCIACIÓN MUTUAL EMPRESA SOLIDARIA DE SALUD EMSSANAR ESS	ESS118	-1.270	-1.736
CAJA DE COMPENSACIÓN FAMILIAR DE HUILA-COMFAMILIAR HUILA	CCF024	-423	-587	COLMEDICA E.P.S.	EPS001	529	599	SALUDCOLOMBIA	EPS034	0	-121	COOMEVA E.P.S. S.A.	EPS016	2.593	1.051	ESS COMPARTA	ESS133	-3.784	-5.769
CAJA DE COMPENSACIÓN FAMILIAR DE NARIÑO	CCF027	-635	-1.059	SALUD TOTAL S.A. ENTIDAD PROMOTORA DE SALUD	EPS002	1.747	1.101	NUEVA EPS	EPS037	75.100	83.489	EPS FAMISANAR LTDA	EPS017	106	-1.071	ASOCIACION MUTUAL SER ESS EPS-S	ESS207	-1.323	-2.784
CAJA SANTANDEREANA DE SUBSIDIO FAMILIAR –CAJASAN	CCF031	-79	-141	SALUD TOTAL S.A. ENTIDAD PROMOTORA DE SALUD	EPS002 S	1.482	1.891	GOLDEN GROUP EPS	EPS039	-159	-392	SERVICIO OCCIDENTAL DE SALUD SOS EPS	EPS018	370	-159				
CAJA DE COMPENSACION FAMILIAR DE FENALCO SECCIONAL SANTANDER	CCF032	0	-136	CAFÉSALUD EPS	EPS003	370	-398	ASOCIACIÓN DE CABILDOS INDÍGENAS DEL CESAR Y GUAJIRA "DUSAKAWI A.R.S.I."	EPSI01	-1.270	-1.820	CAJA DE PREVISIÓN SOCIAL DE COMUNICACIONES "CAPRECOM"	EPS020	-8.759	-14.225				
CAJA DE COMPENSACION FAMILIAR DE SUCRE-COMFASUCRE	CCF033	-159	-164	CAFÉSALUD EPS	EPS003 S	-1.191	-2.921	ASOCIACIÓN DE CABILDOS DEL RESGUARDO INDÍGENA ZENÚ DE SAN ANDRÉS DE SOTAVENTO CÓRDOBA Y SUCRE "MANEXKA" EPS INDIGENA	EPSI02	-1.111	-1.617	CONVIDA "A.R.S. CONVIDA"	EPS022	-2.196	-3.038				
CAJA DE COMPENSACIÓN FAMILIAR DE BARRANCABERMEJA –CAFABA	CCF035	-185	-352	SANITAS S.A. E.P.S.	EPS005	212	-136	ASOCIACIÓN INDÍGENA DEL CAUCA AIC-EPS-I	EPSI03	-1.164	-1.458	CRUZ BLANCA EPS S.A.	EPS023	-53	-497				
CAJA DE COMPENSACIÓN FAMILIAR DE FENALCO DEL TOLIMA-COMFENALCO	CCF037	-344	-648	COMPENSAR E.P.S.	EPS008	-1.747	-2.893	ANAS WAYUU EPS INDIGENA	EPSI04	-582	-873	CAJA DE PREVISION SOCIAL Y SEGURIDAD DEL CASANARE - CAPRESOCA - E.P.S.	EPS025	-106	-284				
CAJA DE COMPENSACIÓN FAMILIAR DEL NORTE DE SANTANDER-COMFANORTE A.R.S.	CCF045	-688	-998	COMFENALCO ANTIOQUIA	EPS009	26	-79	ENTIDAD PROMOTORA DE SALUD MALLAMAS EPSI	EPSI05	-1.164	-1.789								
CAJA DE COMPENSACIÓN FAMILIAR DEL ORIENTE COLOMBIANO-COMFAORIENTE	CCF049	-450	-598	COMFENALCO ANTIOQUIA	EPS009 S	-556	-764	PIJAOS SALUD EPSI	EPSI06	-26	-51								

A model of exante and expost risk adjustment

- Consider the following to step approach to risk adjustment.
- Let C be the averiage cost of health services of the population.
- Assume you have G risk groups that do not differentiate between one particular pathology (for example: age/sex groups and renal chronic disease).
- Let the adjusted, per risk groups primiums be of health insurer i be:

$$C_i^{exante} = C + \sum_{g \in G} UPC^g (p_i^g - p^g) \tag{3}$$

  p^g is the population prevalence of risk group g. p_i^g is i-th insurer prevalence of risk group g.
- This formula doesn't redistribute well the risks associated with the undifferentiated pathology.

A model of exante and expost risk adjustment

- Now assume you wished to redistribute by all risk factors (risk groups plus one pathology).
- Then the adjusted, per risk groups primiums + pathology for health insurer i would be:

$$C_i^{optimal} = C + \sum_{g \in G} C^{g,1}(p_i^{g,1} - p^{g,1}) + C^{g,0}(p_i^{g,0} - p^{g,0}) \tag{4}$$

  were $C^{g,1}$ is the average health cost within group g that have the particular pathology. Denote this new risk group by $(g, 1)$. $C^{g,0}$,$p^{g,1}$, $p^{g,1}$ have analogous interpretation.
- The proposed mechanism is:
  1. Pay exante: C_i^{exante}.
  2. Pay expost: $C_i^{expost} = C_i^{optimal} - C_i^{exante}$

Plan of Presentation

Paying for Risk Management

- Previous mechanism incentivates efficiency in an indirect way (not paying fully for renal chronic disease).
- A key question that remains is how to explicitly incentivate efficiency and good health management practices in the expost payment rule.
- For renal chronic disease it has been suggested to look:
  1. High enrollment compared to expected of diabetes and hypertense. Incidence of renal chronic disease. Mortality due to renal chronic disease.
  2. If each on of these indicatos satisfy predefined thresholds, then we say the insurer has done a good health management of the disease.

Paying for Risk Management

- It has been suggested that good health management insurer need not tranfer funds to the pool when called to do so, and is entitled to receive when it is entitled to do so.
- This will make the mechanism unbalanced.
- What is the right way of doing it?

Plan of Presentation

Conclusions

1. Prospective risk adjustment should be improved based on some of the discussed risk adjusters.
2. The expost mechanism should be balanced.
3. The proposed mechanism is simple, incentivates indirectly efficiency, and is single targeted.

Open questions

- There are two (merging) systems based on two population sin Colombia (*común* and *subsidiado*). In the meantime, should we have two pools? One with differentiated payments?
- How to pay for risk management?
- Why not try the exante expost risk adjustment mechanism?

Research agenda

- Normative vs positive risk adjusters.
- Testing the exante expost risk adjustment mechanism.
- Introducing risk management incentives.
- Introducing competition in health insurers.