Are we getting there?

The pursuit of health equity in Portugal

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Outline

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   - ⇨ Portugal
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Introduction

- Two basic principles – National Health Service
  - → the tendency to be a free system at the point of consumption
  - → the universality and general access to the system

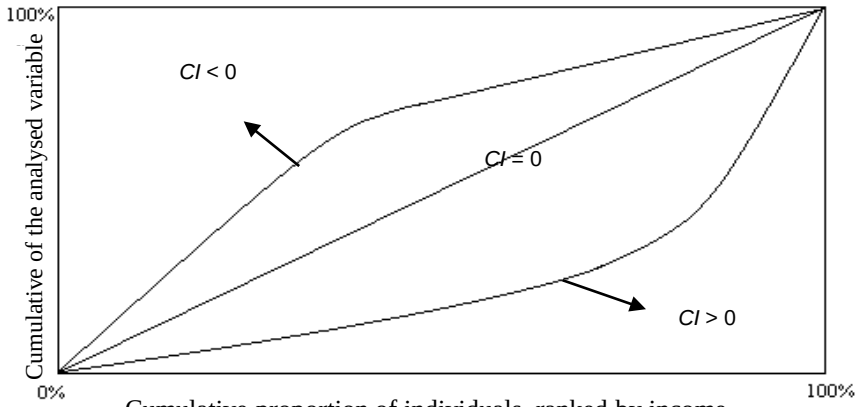
- Different levels of health care utilization:
  - → not able to access the system (utilization is zero)
  - → not able to consume more medical services (utilization is 0,1,2,3,…)

- Horizontal (in)equality concept (HI)

  Equal treatment of equals

- 4ºINS 2005/2006 - fourth survey of national health

Methodology



$$CI = \frac{2 \times \mathrm{cov}(y_i, R_i)}{\bar{y}}$$

y_i - analyzed variable

$\bar{y}$ - the average of y_i

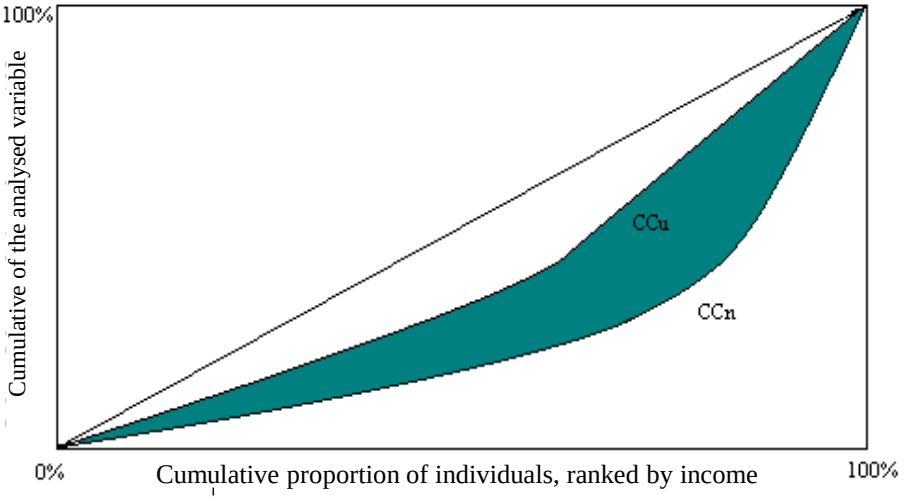
R_i - rank

$\mathrm{cov}(.)$ - covariance

Inequality in health care

utilization necessity

$$HI = CI_u - CI_n$$



Methodology

- Actual utilization: number of consultations
- Needed-utilization:
  - need variables (health status, age)
  - non-need variables (education, income, region, occupation)

⇒ the omitted variables bias problem

→ apply a fixed value to all non-need variables (normalized to their mean)

$$\hat{y}_i^N = G\left(\sum_N \hat{\beta}_N x_i^N + \sum_{NN} \hat{\beta}_{NN} \overline{x}_i^{NN} \right)$$

- G(.) – zero inflated negative binomial model (zinb model)
  - → discrete data
  - → excess zeros = barrier to access the system

Methodology

$$HI = CI_u - CI_n$$

- CI of actual utilization

  considers the characteristics of each individual (and their differences)

- CI of needed-utilization

  reflects the necessity that the population has if individuals had the same level of non-need factors (region, education,...)

Inequity that arises exactly because individuals are not equally treated even after the different levels of need have been accounted for

Results: Barriers

"Excess zeros" : those who would be expected to have health assistance do not actually receive it

	Coef.	Std. Dev.	P-value
inflate			
income	-0,00311	0,001	0
age	-0,08311	0,011	0
education	0,07337	0,025	0
public_subsystem	-0,30922	0,465	0,51
private_subsystem	0,62201	0,644	0,33
insurance_no	12,25788	417,863	0,98
_cons	-11,95733	417,863	0,98

1. As the income raises the chance to have zero consultations decreases
2. As older one gets the barriers to accede the system decrease
3. As the number of school years increases the chance of not having consultations also increases

Results: Portugal

The Portuguese health system appears with relatively high inequity

Bago d'Uva et al (2006)		
Country	HI for general practitioner visits	HI for specialist visits
Belgium	-5,30.	3,40.
Greece	-1,60.	7,30.
Italy	-2,70.	9,60.
Netherlands	-2,80.	2,60.
Portugal	**1,80.**	**19,90.**
Spain	-3,90.	8,30.

Estimating the zinb model:

	CI u	CI n	HI(%)
Portugal	0,0106	-0,0268	**3,74.**

- The health system favours the better-off
- Poorer individuals consumed less medical services but the ones who need more those services

Results: Regions

But… are there differences across the Portuguese regions?

	Cl u	Cl n	HI(%)
Norte	0,0302	-0,0278	**5,80.**
Centro	-0,0184	-0,0499	**3,15.**
Lisboa_ValeTejo	0,003	-0,0433	4,63.
Alentejo	-0,0146	-0,0369	**2,23.**
Algarve	-0,0349	-0,0279	-0,70.
Açores	0,0548	-0,0112	6,60.
Madeira	0,0559	0,007	**4,89.**

Evaluation and Analysis

Time series analysis	• Only 4 INS were computed till now
Regional cross-section analysis	• Only seven regions
International analysis	• Few comparable international studies

Simulation process	• Create enough representative sub-populations of the global sample • Create *"small Portugals"* by randomly and repeatedly extracting information from the global sample

Evaluation and Analysis

- National analysis ➔ simple linear regression

Dependent variable: HI

Independent variables:

- Mean income
- Percentage of unemployed individuals
- Percentage of individuals with more than three chronic diseases
- Percentage of individuals with no private insurance
- Percentage of individuals that are part of a public subsystem
- Percentage of individuals that are part of a private subsystem
- Percentage of individuals with more than 65 years
- Mean income of the 5% / 10% / 25% poorest individuals

Evaluation and Analysis

- National analysis

Restricted model		
Variables	Coef.	P-value
meanincome	0,0002	0,04
more_3_chronic diseases	-0,6297	0,06
_cons	-0,0886	0,37

1. A generalized increase in income does not by itself reduce inequity
2. A structure that supports individuals with several chronic diseases promotes equity
3. The ageing of the population by itself does not determine inequities
4. Increasing the average number of schooling will not diminishing health inequity
5. Public and private subsystems do not influence health inequity

Conclusion

1. Barriers to access - income
2. Pro-rich system at a national level

   → the richest individuals consumed more but have less need
3. Policies should not worried with the inevitable ageing of population,
4. Economic growth does not seem, at least by itself, to solve the problem of inequity
5. Disparities across the Portuguese regions

6. Keep with the regional analysis in further investigations
7. Use the decomposition process in further analysis

Thank you

Evaluation and Analysis

- Regional analysis ➔ fixed effects model: $HI = \alpha_i + \sum \beta_j \chi_j$

Variables	Coef.	P-value
meanincome	0,000	0,324
more_3_chronic diseases	-0,1734	0,598
unemployed_mean	-0,3398	0,432
income5perc	-0,0003	0,327
income10perc	0,000	0,734
income25perc	0,000	0,729
more_than_65	0,2207	0,443
education_mean	0,0203	0,396
private_sub.	**-1,0753**	**0,052**
public_sub.	0,0410	0,861
insurance.	-0,2238	0,523
_cons	0,1826	0,645

1. The higher the percentage of individuals part of a private subsystem the lower the average HI
2. Differences in the regional average income does not motivate regional health disparities
3. Differences in the regional ageing of the population by itself does not determine regional inequities

Variables

Need indicators

- health status
- ever smoked
- sick for less/more than 3 months
- disable temporary / permanently
- gender
- age ; age^2
- male*age ; male*age^2

Non-Need indicators

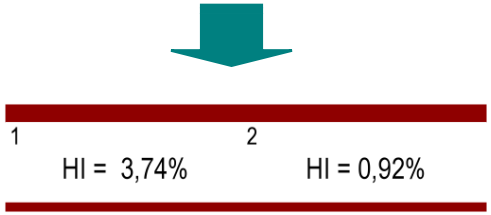
- schooling years
- marital status
- occupational status
- nationality
- equivalent income

$$I_{ik} = \frac{\bar{I}_{ik}}{s_k^{\varepsilon}}$$

- region
- private insurance
- subsystem

Database: 4ºINS

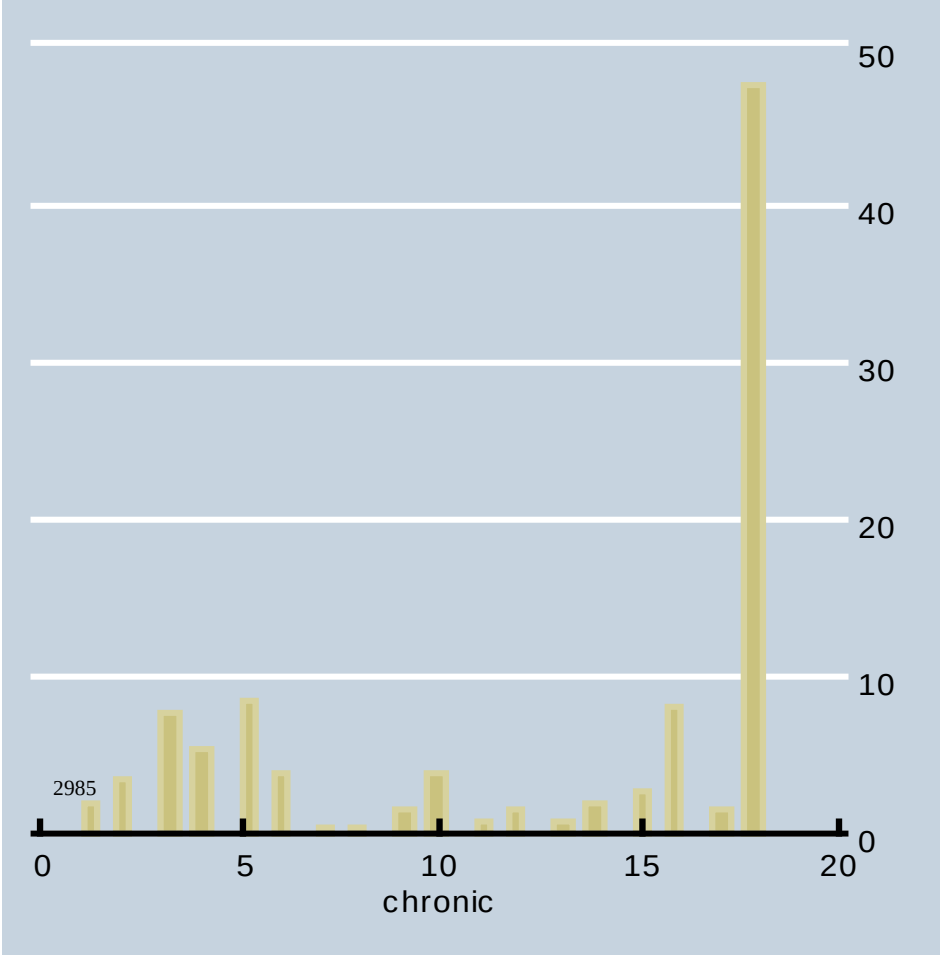
	Real distribution of the pop	%	2nd version NHS distribution	%
Norte	3745236	35%	6100	15%
Centro	2385911	22%	5950	14%
Lisboa_ValeTejo	2808414	26%	6008	15%
Alentejo	760933	7%	5777	14%
Algarve	426386	4%	6175	15%
Açores	244006	2%	5961	14%
Madeira	246689	2%	5332	13%
Total	10617575	100%	41303	100%



1. Equivalent income + no weights
2. Aggregate income + weighted according to the real distribution of the population

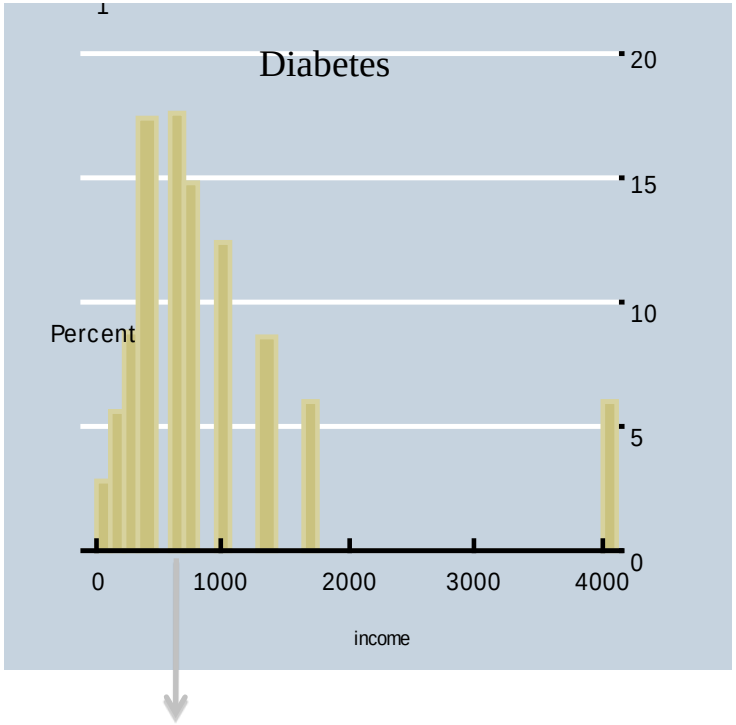
Chronic diseases

1. Diabetes
2. **Asthma**
3. Blood_pressure
4. Chronic_pain
5. **Rheumatism**
6. Osteoporosis
7. Glaucoma
8. Retinopathy
9. Cancer
10. Kidney_stones
11. Renal_failure
12. Chronic_anxiety_disorder
13. Chronic_wound
14. Emphysema
15. Cerebral_hemorrhage_ICH
16. **Obesity**
17. Depression
18. Myocardial_infarction
19. Other



Chronic diseases

Equivalent income: $I_{ik} = \frac{\bar{I}_{ik}}{s_k^{\varepsilon}}$



$$I_{ik} = \frac{4000}{1^{0,6}} = 4000$$

$$I_{ik} = \frac{1750}{1^{0,6}} = 1750$$

595,43

$$I_{ik} = \frac{1750}{2^{0,6}} = 1154,57$$

249,33

$$I_{ik} = \frac{1750}{3^{0,6}} = 905,24$$

143,51

$$I_{ik} = \frac{1750}{4^{0,6}} = 761,73$$

587,6216 - point of the rank income which has 50% of the population on the left and 50% on the right

Equivalent income

Aggregate income (month)		
	income class	Mid-point
A	] 0 , €150]	75
B	] €150 , €250]	200
C	] €250 , €350]	300
D	] €350 , €500]	425
E	] €500 , €700]	600
F	] €700 , €900]	800
G	] €900 , €1200]	1050
H	] €1200 , €1500]	1350
I	] €1500 , €2000]	1750
J	more than €2000	4000

Individual equivalent income: $$I_{ik} = \frac{\bar{I}_{ik}}{s_k^{\varepsilon}}$$

I_{ik} Equivalent income

$\bar{I}_{ik}$ Mid-point of each class

s_k Family size

ε Elasticity of income-family size

$$I_{ik} = \frac{4000}{1^{0,6}} = 4000 \qquad I_{ik} = \frac{1750}{1^{0,6}} = 1750 \qquad I_{ik} = \frac{1750}{2^{0,6}} = 1154,57$$

Evaluation: HI (std dev)

	Restricted model			Unrestricted model		
Variables	Coef.	Std. Dev.	P-value	Coef.	Std. Dev.	P-value
meanincome	0,0002	0	0,04	0,0001	0,00	0,63
more_3_chronic diseases	-0,6297	0,34	0,06	-0,6798	0,37	0,07
unemployed_mean	-	-	-	-0,3665	0,49	0,45
income5perc	-	-	-	-0,0006	0,00	0,18
income10perc	-	-	-	-0,0001	0,00	0,81
income25perc	-	-	-	-0,0002	0,00	0,70
std. dev.	-	-	-	**0,0001**	**0,00**	**0,69**
more_than_65	-	-	-	0,2729	0,33	0,40
education_mean	-	-	-	0,0214	0,03	0,46
private_sub.	-	-	-	0,0942	0,53	0,86
public_sub.	-	-	-	-0,0035	0,26	0,99
insurance.	-	-	-	-0,0260	0,36	0,94
_cons	-0,0886	0,09	0,37	-0,0256	0,43	0,95

- The redistribution of income does not seem to influence health inequities
- A generalized increase in income does not solve health inequities
- The system is able to detect and support those with higher need

Barriers to access

Inflate	Coef.	Std. Dev.	P-value
age	-0,08629	0,01	0,00
education	0,04620	0,03	0,08
public_subsystem	-13,32199	428,49	0,98
private_subsystem	-15,99033	1913,82	0,99
insurance_no	14,55290	697,40	0,98
_cons	-15,28230	697,40	0,98

- Even when income is not consider as a potential barriers to access the heath system…

… as age increases the barriers to access decrease

… as education increases the barriers to access increase

… private subsystem, public subsystem and having no private insurance do not represent a barrier to access

CIu and CIn

Variables that influence CIu and CIn			
National case	CIu	-	mean income of the 5% poorest individuals
		+	average education
	Cin		none
Regional case	CIu	-	percentage of individuals that are part of a private subsystem
	Cin	+	mean income
		-	percentage of individuals older than 65 years
		+	percentage of individuals with no private insurance

Literature Review

Kakwani et al. (1997)	
Title	Socioeconomic inequalities in health: measurement, computation and statistical inference
Question	The best way to measure inequality
How to calculate inequity	Concentration index - $CI = \frac{2 \times \mathrm{cov}(y_i, R_i)}{\bar{y}}$ Concentration curve - L(s)
Variables	Pre-tax household income per equivalent adult Self-assessed health and presence of chronic illness Age and gender (for standardizatiion)
Results	Even after taking into account the demographic structure of the sample, inequalities in health favour the better-off Inequality is more pronounced if health is measured by sah than if it is measured by chronic illness

Literature Review

Bago d'Uva (2006)	
Title	Measurement of horizontal inequity in health care utilization using European panel data
Question	Is utilization of health care distributed according to need, irrespective to income?
How to calculate inequity	Short-run $HI_t = CI_{ut} - CI\left(\hat{y}_{it}^{N}\right)$ Long-run $HI_T = CI_{uT} - CI\left(\hat{y}_{iT}^{N}\right)$ (average predicted number of visits across periods)
Variables	Utilization - GP consultations and specialists consultations Need indicators - self assessed health - any chronic physical or mental health problem, illness or disability - age; age2; gender; age*gender; age2*gender Non-need indicators - education; marital status; activity status - time dummies
Results	Pro-poor inequity in GP visits in most countries Pro-rich inequity in specialist visits in all countries Portugal as the highest pro-rich inequity in specialist visits and one of the highest in GP visits The pro-poor inequity in GP visits in most countries and the pro-rich inequity in specialist visits in all countries does not change with the long-run analysis

Literature Review

Simões, Paquete and Araújo (2008)	
Title	Equidade horizontal no acesso a consultas de clínica geral, cardiologia e medicina dentária em Portugal
Question	Inequity in the public, the private and public-private health care systems
How to calculate inequity	$HI = CI_u - CI_n$
Variables	Utilization - number of consultations (private, public and mixed systems) Necessity - public: self-assessed health; disabled temporarily; diabetes;... - private: pain or emergencies; remove a teeth;... - mixed: physical activity; smoking; obesity;...
Results	The private, the public and the mixed systems appear as pro-rich systems

Literature Review

Pereira (1992)	
Title	Horizontal equity in the delivery of health care in Portugal
Question	Is inequity in health care being achieved?
How to calculate inequity	$HI = CI_{use\ (\text{exp enditure})} - CI_{ill\ (morbidity)}$
Variables	Utilization - WTP: multiply the number of consultations, on an individual basis, by their respective prices Need - sah - incapacity or restricted activity due to an illness which had been present for over than three months - incapacity to perform "normal" tasks or roles
Results	Even though the poor are favoured in terms of health care utilization, the system favours the wealthier individuals

Literature Review

Pereira et al. (1985)	
Title	Equidade geográfica no sistema de saúde Português
Question	Regional disparities concerning health care inequity
How to calculate inequity	Correlation techniques - correlation between two groups of indicators in a region - correlation between several groups of indicators - variation between discticts - coeficient of variation (national std. dev./national mean) and relation of the extreme values
Variables	Health indicators: infant mortality rate (perinatal, neonatal, post-neonatal Health care indicators: - supply of health care resources (beds, number of doctors) - utilization (consultations, exames,...) - heath care expenditure Socio-economic indicators (education, urbanization,...) Demographic indicators (% > 65 years, % <4 years, fecundation rate,...)
Results	Districts with more medical resources benefit from higher public expenditure Districts with lower levels of health had fewer medical resources, lower supply of medical resources and lower public expenditure Urban, industrialied and wealthier disctricts use more health care services Inequities are stonger in the access of primary care services

Literature Review

Or et al. (2008)

Title	Impact of health care system on socioeconomic inequalities in doctor use
Question	Regional disparities concerning health care inequity
How to calculate inequity	$\begin{cases} C_{ij} = 1 \;\; if \; at \; least \; one \; visit \\ C_{ij} = 0 \;\; if \; zero \; visits \end{cases} \Rightarrow \begin{cases} C_{ij} = 1 \;\; if \;\; C_{ij}^{*} > 0 \\ C_{ij} = 0 \;\; if \;\; C_{ij}^{*} < 0 \end{cases}$ Multilevel logistic regression Probability of care consumption by i in country j the size and the direction of the social inequity in health care utilization $C_{ij}^{*} = \alpha_{oj} + x_{ij}\alpha_{1j} + z_{ij}\gamma_{j} + u_{ij}$ The impact of social status differs across countries the proportion of the variation in health care utilization that can be explained by social status, controlling for other determinants of demand and unobserved factors $C_{ij}^{*} = (\beta_{o} + \mu_{oj}) + x_{ij}(\beta_{1} + \mu_{1j}) + z_{ij}\pi + e_{ij}$ Introducng health system characteristics the explanaition of observed social inequities by introducing a number of health systems characteristics $C_{ij}^{*} = (\beta_{o} + \mu_{oj}) + x_{ij}(\beta_{1} + w_{j}\tau_{k}\omega_{1j}) + z_{ij}\pi + e_{ij}$
Variables	Health care utilization: GP visits and specialist visit Social status: education Health needs: self reported health and body mass index Individual variables: age, gender, urbanization Health system characteristics: doctor availability, the methods of physician
Results	Higher education increases the consumption of specialist consultations The probability of visiting a doctor increases after 50 years of age The BMI does not influence utilization of specialist consultations Portugal - well-educated tend to use more GP and specialist consultations

Literature Review

Machenbach et al. (2008)	
Title	Socioeconomic inequalities in health in 22 European countries
Question	Identify opportunities for the reduction of inequalities
How to calculate inequity	Relative inequality index ratio between the estimated mortality/morbidity/risk factor among persons at rank 1 (the lowest education, occupation or income level) and rank 0 (the highest level) Slope index of inequality $slope = \frac{2 * mortality\ rate * (RII - 1)}{RII + 1}$
Variables	Mortality - age, gender, causes of death, indicators of SES Morbidity - self-assessed health Risk factors of disease - smoking and obesity
Results	In general, mortality was higher for those countries with lower education, which have smoking and/or alcoholic habits Lower ranked individuals (socioeconomical terms) assessed their health in lower levels

Decomposition process

The concentration index is given by $CI = \frac{2 \times \text{cov}(y_i, R_i)}{\bar{y}}$

The decomposition process is based on the covariance formula

$$\text{cov}(y_i, R_i) = E\left[(R_i - \bar{R})(y_i - \bar{y})\right]$$

If our analysis is based on a linear model

$$\text{cov}(y_i, R_i) = E\left[(R_i - \bar{R})(\alpha_0 + \alpha_1 x_i + e_i - \alpha_0 - \alpha_1 \bar{x})\right]$$

$$\text{cov}(y_i, R_i) = \alpha_{1k} E\left[(R_i - \bar{R})(x_{ik} - \bar{x}_k)\right]$$

$$\text{cov}(y_i, R_i) = \frac{\hat{\alpha}_{1k}}{N} \sum_{i=1}^{n} \left[(R_i - \bar{R})(x_{ik} - \bar{x}_k)\right]$$

$$\text{cov}(y_i, R_i) = \frac{\hat{\alpha}_{1k}}{N} \text{cov}_k(x_{ik}, R_i)$$

y_i - analyzed variable

$\bar{y}$ - the national average of y_i

R_i - rank

$\bar{R}$ - the national average rank

$\text{cov}(.)$ - covariance

The zinb model

$$y_i \sim \begin{cases} 0 & with \quad probability \quad \varphi_i \\ g(y_i|x_i) & with \quad probability \quad 1-\varphi_i \end{cases}$$

$g(y_i|x_i)$ represents a negative binomial distribution:

$$\Pr[y_i|x_i] = \frac{\Gamma(y_i+\eta_i)}{\Gamma(y_i+1)\Gamma(\eta_i)}\left(\frac{\eta_i}{\lambda_i+\eta_i}\right)^{\eta_i}\left(\frac{\lambda_i}{\lambda_i+\eta_i}\right)^{y_i} \qquad y_i = 0,1,2,\ldots$$

$\Gamma(.)$ Gama distribution

$y_i = \exp(x_i\beta)$

$\eta_i = \left(\frac{1}{\alpha}\right)\lambda_i^k$

α Degree of over dispersion

Concentration index

According to Kakwani et al.: $CI = 1 - 2\int_0^1 L(s)ds$ $\qquad CI = \frac{2}{N\mu}\sum_{i=1}^{N} w_i y_i R_i - 1$

Where

$$\mu = \frac{1}{N}\sum_{i=1}^{N} w_i y_i$$

$$R_i = \frac{1}{N}\sum_{j=1}^{i-1} w_j + \frac{1}{2} w_i$$

- μ Weighted mean utilization of the sample
- N Sample size
- w_i Sampling weight of each individual
- R_i Weighted relative fractional rank of each individual
  or the weighted cumulative proportion of the population up to the mid-point of each individual weight

CI can be computed conveniently using μ and R_i :

$$CI = \frac{2}{N\mu}\sum_{i=1}^{N} w_i (y_i - \mu)(R_i - \frac{1}{2}) \quad \Rightarrow \quad CI = \frac{2}{\mu}\mathrm{cov}_w(y_i, R_i)$$

Variables

Name	Definition
diabetes	takes value 1 if the individual has diabetes; 0 otherwise
asthma	takes value 1 if the individual has asthma; 0 otherwise
blood_pressuree	takes value 1 if the individual has blood pressure; 0 otherwise
chronic_pain	takes value 1 if the individual has a chronic pain; 0 otherwise
rheumatism	takes value 1 if the individual has rheumatism; 0 otherwise
osteoporosis	takes value 1 if the individual has osteoporosis; 0 otherwise
glaucoma	takes value 1 if the individual has glaucoma; 0 otherwise
retinopathy	takes value 1 if the individual has retinopathy; 0 otherwise
cancer	takes value 1 if the individual has cancer; 0 otherwise
kidney_stones	takes value 1 if the individual has kidney stones; 0 otherwise
renal_failure	takes value 1 if the individual has a renal failure; 0 otherwise
chronic_anxiety_disorder	takes value 1 if the individual has a chronic anxiety disorder; 0 otherwise
chronic_wound	takes value 1 if the individual has a chronic wound; 0 otherwise
emphysema	takes value 1 if the individual has emphysema; 0 otherwise
cerebral_hemorrhage_ICH	takes value 1 if the individual has a cerebral hemorrhage (ICH); 0 otherwise
obesity	takes value 1 if the individual has obesity; 0 otherwise
depression	takes value 1 if the individual has a depression; 0 otherwise
myocardial_infarction	takes value 1 if the individual has a myocardial infarction; 0 otherwise
others	takes value 1 if the individual has other chronic disease; 0 otherwise
ever_smoked	takes value 1 if the individual has ever smoked; 0 otherwise
disable_permanently	takes value 1 if the individual has being disable permanently; 0 otherwise
disable_temporarily	takes value 1 if the individual has being disable temporarily; 0 otherwise

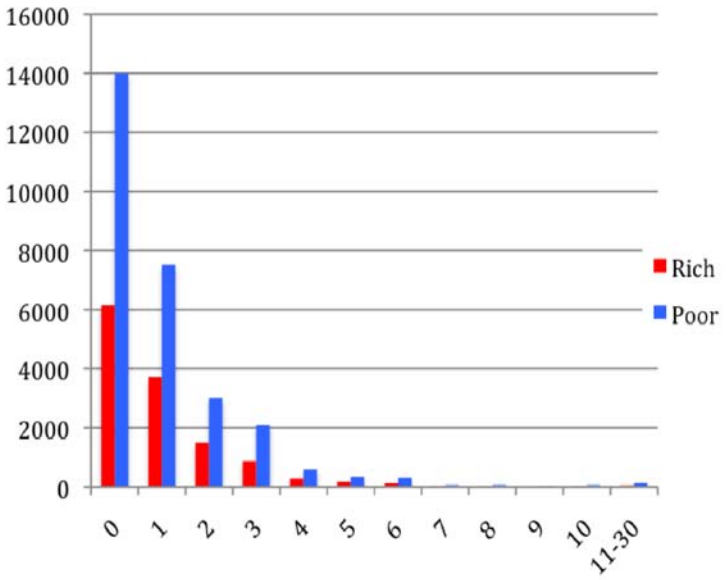
Variables

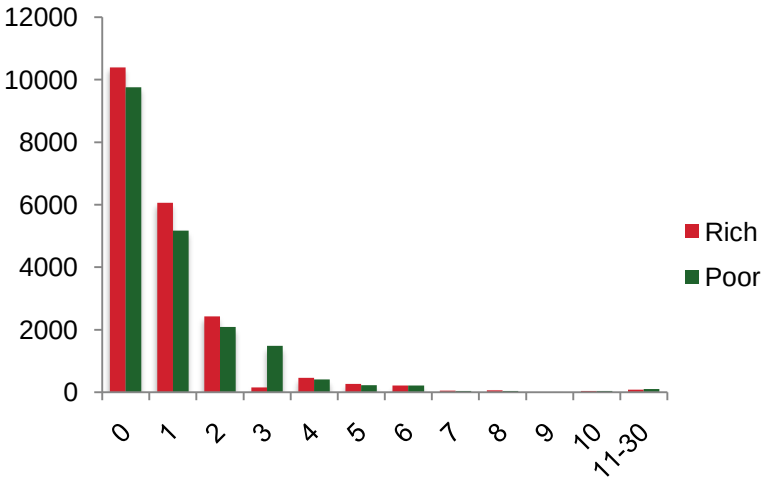
Name	Definition
sick_ST	takes value 1 if the individual has being sick for less than 3 months; 0 otherwise
sick_LT	takes value 1 if the individual has being sick for more than 3 months; 0 otherwise
age	age (years)
age2	age squared (years)
male	takes value 1 if male; 0 if female
education	years of school
married	takes value 1 if married; 0 otherwise
married_separate_property	takes value 1 if married with separate property; 0 otherwise
divorced	takes value 1 if divorced; 0 otherwise
widowed	takes value 1 if widowed; 0 otherwise
employed	takes value 1 if employed; 0 otherwise
military_service	takes value 1 if doing the military service; 0 otherwise
housekeeper	takes value 1 if the individual is a housekeeper; 0 otherwise
unemployed_less_1year	takes value 1 if unemployed for less than 1 year; 0 otherwise
unemployed_more_1year	takes value 1 if unemployed for more than 1 year; 0 otherwise
retired	takes value 1 if retired; 0 otherwise
looking_1st_job	takes value 1 if looking for the 1st job; 0 otherwise
unpaid_inernship	takes value 1 if in an unpaid internship; 0 otherwise

Variables

Name	Definition
portuguese	takes value 1 if Portuguese; 0 foreign
income	equivalent income (per month)
Norte	takes value 1 if North; 0 otherwise
Centro	takes value 1 if Centro; 0 otherwise
Lisboa_ValeTejo	takes value 1 if Lisboa and Vale do Tejo; 0 otherwise
Alentejo	takes value 1 if Alentejo; 0 otherwise
Açores	takes value 1 if Açores; 0 otherwise
Madeira	takes value 1 if Madeira; 0 otherwise
insurance_no	takes value 1 if the individual has no private health insurance; 0 otherwise
private_subsystem	takes value 1 if the individual is covered by a private subsystem; 0 otherwise
public_subsystem	takes value 1 if the individual is covered by a public subsystem; 0 otherwise
utilization	actual utilization
rankincome	rank income
mean_sah	average self-assessed health
meanincome	average income
more_3_chronic diseases	percentage of individuals with more than 3 chronic diseases
unemployed_mean	percentage of unemployed individuals
income5perc	average income of the 5% poorest individuals
income10perc	average income of the 10% poorest individuals
income25perc	average income of the 25% poorest individuals
more_than_65	percentage of individuals with more than 65 years
education_mean	average number of school years
private_sub.	percentage of individuals covered by a private subsystem
public_sub.	percentage of individuals covered by a public subsystem
insurance.	percentage of individuals that have no private health insurance

Consultations distribution





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Definitions

- Equity – differences in utilization and need that are justifiably caused
- Equality – differences in utilization independently of their nature

  → Income-related inequality in health care does not imply inequity in health care

- Barriers to access - obstacle to an individual have a first contact with the health care system