

# ABILITY OF ESTIMATORS TO MEASURE HEALTH' INEQUALITIES

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**Ability of Ratio, Risk Excess, Attributable Fraction and Relative Difference to estimate inequalities in health. High Income OECD Countries, 1998-2002.**

# Introduction

- Inequalities in the world have increased, in last two decades (2-4)
- Some authors have mentioned the increase in socio-economic inequalities between populations and specially in the topic of health of populations

2. Navarro V. Neoliberalism, "Globalization", unemployment, inequalities, and the welfare state. In: Navarro V, ed. The political economy of social inequalities. Consequences for health and quality of life. New York: Baywood Publishing Company, Inc., 2002:530 págs.
3. Black D, Morris J, Smith C, Townsend P. Inequalities in health. The Black report. Harmondsworth, Middlesex: The Chaucer Press Ltd., 1982:239.
4. Bambas A, Casas J. Assesing equity in health: conceptual criteria. Equity and Health, Ocassional Publication #8. Washington: PAHO, Pan American Health Organization, 2001.

# Introduction

- Whitehead has defined inequity as the unequal conditions that are unnecessary and avoidable but, in addition, are also considered unfair and unjust (7)

7. Whitehead M. The concepts and principles of equity and health. WHO Regional Office for Europe, Discussion Paper. 2000.

# Introduction

- Inequity has been measured with indicators like Gini Coefficient, Concentration Index and Lorenz Curve.

# Three questions

- How much is the inequity and inequity-in-health-level?
- How much does the strategy can improve it?
- How to measure inequity and inequity in health?

# Introduction

- Epidemiology has used estimators for knowing differences between two or more groups under study as ratio (R), risk difference (RD), attributable fraction (AF) and relative difference (RD)
- Equity or inequity in health should be measured

# Objective

- To examine the ability of ratio (R), risk difference (RD), attributable fraction (AF) and relative difference (RD) to rate inequalities-in-health in univariate and composite ways

# Methodology

- Ecological study.
- Seven indicators were used: maternal mortality ratio, child mortality rate, infant mortality ratio, low birth weight (%), life expectancy (years at birth), measles immunisation (%), DTP immunisation (%).

# Methodology

- 24 High Income OECD Countries (Countries of the Organisation for Economical Cooperation and Development), classified in that way by the World Bank, were selected. Data were obtained from de OECD Health Data, 2004, 3rd edition. Data about child mortality and Gross Domestic Product (GDP) were obtained from the World Development Indicators 2005, on CD-ROM. The study period was between 1998 and 2002.

# Methodology

- **Risk Ratio**, is defined as the probability of developing a disease in exposed people compared with the probability of the non exposed people. It was estimated with equation (1)

$$RR = \frac{\text{Country rate}}{\text{lowest Country rate}} \quad (1) \text{ Negative Outcomes}$$

$$RR = \frac{\text{Best Country rate}}{\text{Country rate}} \quad (1) \text{ Positive Outcomes}$$

# Methodology

- **Risk Excess:** It is an absolute measure of risk, and it's called too, risk difference. It was estimated through the equation (2) in case of negative outcomes like maternal mortality, infant mortality and low birth weight. In case of positive outcomes like life expectancy or immunisation covertures, equation (3) was used.

RE1= Country rate-lowest Country rate (2)

RE2= Highest Country rate-Country rate (3)

# Methodology

- **Attributable fraction (AF) or attributable risk** is defined as the amount or proportion of disease incidence that can be attributed to a specific exposure. In this case, the exposure is to live in each one of the countries studied. It is a relative measure of risk (24-25)

24. Gordis L. Epidemiology. Philadelphia: Elsevier Saunders, 2004:335.

25. Rothman K. Measuring disease occurrence and causal effects. In: Rothman K, ed. Epidemiology. An introduction. New York: Oxford University Press, 2002:223.

# Methodology

## Negative outcomes

$$AF1 = \frac{\text{Country rate} - \text{lowest rate}}{\text{Country rate}} * 100$$

## Positive outcomes

$$AF2 = \frac{\text{Highest Country rate} - \text{Country rate}}{\text{Highest Country rate}} * 100$$

# Methodology

- **Relative difference of total difference.** It is a relative measure of risk, in which the proportion is established using the absolute difference between the best and worst country to compare. Equation (6) was used in case of negative outcomes and equation (7) in case of positive outcomes.

# Methodology

Negative outcomes

Country rate – lowest Country rate

$$RD\ 1 = \frac{\text{Country rate} - \text{lowest Country rate}}{\text{Highest Country rate} - \text{lowest Country rate}} * 100$$

Positive outcomes

Highest Country rate – Country rate

$$RD2 = \frac{\text{Highest Country rate} - \text{Country rate}}{\text{Highest Country rate} - \text{lowest Country rate}} * 100$$

# Methodology

- All of the epidemiologic measures were adjusted by the population size (weighted), and a summary estimation of each one of them was made (SWE, summarized and weighted estimator), using the equation:

$$\text{SWE} = \sum(\text{crude estimations per country}) * (n/N)$$

# Methodology

- Concordance test (kappa) was used to evaluate agreement between **positions of inequity in the variables selected**, estimated through estimators (SWE) and Gini coefficients.
- Gini coefficients were estimated based in Schneider et al (15)

15. Schneider MC, Castillo-Salgado C, Bacallao J, et al. [Methods for measuring inequalities in health]. Rev Panam Salud Publica 2002; 12:398-414.

# Methodology

- For the composite: Principal component analysis was made to determine which of the SWE had the highest variance represented at the first factor (CV1) and at the cut-point (CV).

# Methodology

- Kaiser's eigenvalue rule and Cattell's screen test were used to define the cut point. In cases where they disagree the cut-off point was selected using the nearest factor to one.

# Methodology

- The data base and estimation of Gini coefficients and Lorenz curves (27) were made in Excel®. Kappa coefficient was used. Statistical analysis was made with STATA version 8.1.

# Results

- Countries included had, in constant dollars (of 2000), between 78% and 79% of the Gross Domestic Product (GDP) of the world, and between 57% and 54% when this was based on Parity of Purchasing power (PPP) adjusted GDP.

## Exploratory analysis of variables selected. High Income OECD countries. 1998-2002.

	1998	1999	2000	2001	2002
	Me	Me	Me	Me	Me
Maternal mortality ratio per 100000 live births	6,9	5,6	6	6,5	6,2
Infant mortality ratio, per 1000 live births	5	4,8	5	5	4,8
Child mortality rate per 1000 under 5 years old children	6,2	6,2	6	6	6
Life expectancy at birth (years)	77,9	78	78,1	78,5	78,5
Low birth weight (%)	6,1	6,4	6,3	6,4	6,5
Dpt covertures (%)	95	95	95	95	94
Measles immunization (%)	90,5	90,6	90,8	90,6	91,2

# Weighted epidemiologic estimators. High Income OECD Countries, 1998-2002

	1998	1999	2000	2001	2002
<b>Maternal mortality ratio, per 100000 live births</b>					
<b>Ratio</b>	7,25 (1)	7,35(1)	7,42 (1)	7,46 (1)	7,48 (1)
<b>RExcess</b>	0,01 (7)	0,01 (7)	0,01 (7)	0,01 (7)	0,01 (7)
<b>AFraction</b>	83,0 (1)	81,6 (1)	83,4 (1)	83,65 (1)	82,99 (1)
<b>RDifference</b>	32,91(6)	36,1 (6)	36,4 (6)	36,6 (6)	36,8 (6)
<b>Gini Coeff.</b>	0.21 (1)	0,25 (1)	0,21 (1)	0,20 (1)	0,21 (1)

# Weighted epidemiologic estimators. High Income OECD Countries, 1998- 2002

	1998	1999	2000	2001	2002
<b>Infant mortality ratio, per 1000 live births</b>					
<b>Ratio</b>	2,15 (2)	2,27 (2)	1,77 (3)	1,93 (3)	2,33 (2)
<b>RExcess</b>	0,3 (5)	0,3 (5)	0,23 (6)	0,25 (5)	0,29 (5)
<b>AFraction</b>	50,7 (2)	52,8 (2)	39,1 (3)	44,02 (3)	53,23 (2)
<b>RDifference</b>	64,9 (2)	64,8 (2)	58,8 (2)	61,1 (2)	63,6 (1)
<b>Gini Coeff.</b>	0,12 (2)	0,13 (2)	0,13 (3)	0,13 (2)	0,15 (2)

## Weighted epidemiologic estimators. High Income OECD Countries, 1998- 2002

	1998	1999	2000	2001	2002
<b>Child mortality rate, per 1000 children</b>					
<b>Ratio</b>	1,61 (4)	1,75 (4)	1,66 (4)	1,61 (4)	1,6 (4)
<b>RExcess</b>	0,26 (6)	0,29 (6)	0,26 (5)	0,24 (6)	0,23 (6)
<b>AFraction</b>	34,7 (4)	40,0 (4)	35,2 (4)	35,1 (4)	34,5 (4)
<b>RDifference</b>	55,5 (3)	57,3 (3)	52,5 (4)	58,3 (3)	57,0 (4)
<b>Gini Coeff.</b>	0,118(3)	0,117(3)	0,144(3)	0,122(3)	0,116(3)

# Weighted epidemiologic estimators. High Income OECD Countries, 1998- 2002

	1998	1999	2000	2001	2002
<b>Low birth weight (%)</b>					
<b>Ratio</b>	1,94 (3)	1,92 (3)	1,83 (2)	2,14 (2)	1,83 (3)
<b>RExcess</b>	3,28 (3)	3,31 (3)	3,16 (3)	3,77 (3)	3,24 (3)
<b>AFraction</b>	46,1 (3)	45,64 (3)	43,1 (2)	51,5 (2)	43,1 (3)
<b>RDifference</b>	71,2 (1)	68,9 (1)	65,8 (1)	68,5 (1)	63,5 (2)
<b>Gini Coeff.</b>	0,09 (4)	0,09 (4)	0,09 (4)	0,08 (4)	0,09 (4)

## Weighted epidemiologic estimators. High Income OECD Countries, 1998- 2002

	1998	1999	2000	2001	2002
	<b>Life expectancy at birth (years)</b>				
<b>Ratio</b>	1,04 (7)	1,03 (7)	1,04 (7)	1,04 (7)	1,04 (7)
<b>RExcess</b>	2,78 (4)	2,55 (4)	2,96 (4)	2,94 (4)	3,13 (4)
<b>AFraction</b>	3,45 (7)	3,17 (7)	3,65 (7)	3,61 (7)	3,82 (7)
<b>RDifference</b>	44,7 (4)	51,0 (4)	52 (5)	57,7 (5)	57,9 (3)
<b>Gini Coeff.</b>	0.009 (7)	0.008 (7)	0.007 (7)	0.005 (7)	0.007 (7)

## Weighted epidemiologic estimators. High Income OECD Countries, 1998- 2002

	1998	1999	2000	2001	2002
	<b>Dpt-immunization coverture (%)</b>				
<b>Ratio</b>	1,15 (5)	1,16 (5)	1,12 (5)	1,12 (5)	1,12 (5)
<b>RExcess</b>	12,2 (1)	12,3 (1)	10,4 (1)	9,7 (1)	10,2 (1)
<b>AFraction</b>	12,2 (5)	12,3 (5)	10,5 (5)	9,88 (5)	10,3(5)
<b>RDifference</b>	40,8 (5)	41,3 (5)	57,9 (3)	57,8 (4)	45,9 (5)
<b>Gini Coeff.</b>	0,05 (5)	0,05 (5)	0,04 (5)	0,04 (5)	0,04 (5)

## Weighted epidemiologic estimators. High Income OECD Countries, 1998- 2002

	1998	1999	2000	2001	2002
	<b>Measles immunization coverage (%)</b>				
<b>Ratio</b>	1,14 (6)	1,12 (6)	1,1 (6)	1,11 (6)	1,1 (6)
<b>RExcess</b>	10,7 (2)	9,9 (2)	8,9 (2)	9,3 (2)	8,83 (2)
<b>AFraction</b>	10,8 (6)	9,95 (6)	8,99 (6)	9,3 (6)	8,83 (6)
<b>RDifference</b>	24,4 (7)	33,2 (7)	35,7 (7)	34,4 (7)	32,7 (7)
<b>Gini Coeff.</b>	0,03 (6)	0,03 (6)	0,03 (6)	0,03 (6)	0,02 (6)

# Results

- There was concordance in the ranking of inequities among **Ratio, Attributable Fraction and Gini coefficients** from 1998 to 2002 and for **Relative Difference and Gini for 1998 and 1999** ( $p < 0.05$ ) in the position of disparities ranked among the different health outcomes studied.

**Assuming that they are  
going to be used in a  
composite**

## Epidemiologic estimators cumulated variance at the first factor and at the cut point. High Income OECD Countries, 1998-2002

	1998		1999		2000		2001		2002	
Epidemiologic estimators	CV1	CV	CV1	CV	CV1	CV	CV1	CV	CV1	CV
Ratio	0,37	0,79	0,37	0,75	0,38	0,79	0,4	0,78	0,4	0,79
Risk excess	0,36	0,81	0,36	0,77	0,38	0,81	0,41	0,79	0,41	0,78
AFraction	0,41	0,8	0,41	0,78	0,41	0,82	0,46	0,8	0,45	0,79
RDifference	0,36	0,81	0,36	0,77	0,38	0,81	0,41	0,79	0,41	0,78
Ratio-(weighted)	0,96		0,97		0,98		0,98		0,98	
AFraction (weighted)	0,86		0,89		0,92		0,92		0,93	
RDifference (weighted)	0,82		0,88		0,91		0,91		0,92	
RExcess (weighted)	0,82		0,88		0,91		0,91		0,92	

# Discussion

- This seven health indicators were included because inequalities or disparities seen between countries with them, easily could be explained as inequities.

# Discussion

- Using the behaviour of the median and confidence intervals in the measured indicators was not possible to determine, based in them, if the health conditions were better or worse between OECD countries, during the study period.

# Discussion

- Summary and weighted estimators (SWE) are by themselves, a reflex of the inequity-in- health, in each one of the used indicators. With them, one can appreciate different level of inequities in the High Income OECD Countries.

# Discussion

- This study showed a better behaviour of relative estimators (ratio and attributable fraction) in the quantity of variance that they could explain when all summary measures are joined

# Discussion

- In this study is strongly recommended, as it is usually suggested in epidemiology, to weight summary measures.
- Keppel et al suggest the use of weighted or non weighted measures, assuming that non-weighted values imply that what is important is the group itself, regardless of its share of the population, and weighting offers a population-based perspective on disparity (39).

# Discussion

- We use variance at first factor, under the assumption that the estimator who can explain the major variance (CV1 and CV) could be used as the construct to build an inequity-in-health index, because, in that conditions it can explain better the global variance of inequality than the others.

# Discussion

- Houweling (2003) used this methodology to compare the behaviour of four scales in the measurement of inequalities in health, using the variance in the first factor too, to select the best index of socioeconomic status (38)

Houweling TA, Kunst AE, Mackenbach JP. Measuring health inequality among children in developing countries: does the choice of the indicator of economic status matter? Int J Equity Health 2003; 2:8.

# Conclusions

- We recommend to use relative measures of disparities, specifically, ratios and attributable fractions

**Gracias!!**  
**Thank you!!**