Medical Faculty Heidelberg

Análise espacial de desigualdades intra-urbanas da saúde no Rio de Janeiro - Introdução de um índice de desigualdade

Martin Bortz
Medical School University of Heidelberg
Doctoral Candidate, Institute of Public Health

One of the most striking examples [of health inequalities] is the systematic differences in health between different socioeconomic groups. This social pattern of disease is pervasive. No law of nature decrees that the children of poor families should die at a higher rate than that of children born into rich families.

UrbanHEART

Background: Inequality vs. Inequity

a difference in health that is systematic, socially produced (and, therefore, modifiable) and unfair is an inequity in health[1]

[1]Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. Geneva, World Health Organization, 2008

Background: ‚Geographical Space' as Social Determinant of Health

– city is place of enormous concentration of disparity

- urban spatial structuring is determined by political, ideological, social and market-oriented patters
- allocation of population and population health within cities follows rules of functional internal organization

*see David Harvey "Right to the City"

Intra-urban approach

- small scale geographical unit
- definition of key (local) urban health topics
- selection of socially sensitive indicators

*as disaggregated as possible (avoid clustering of ICD codes or spatial units)

Excurse: UrbanHEART Indicator

#	HEALTH CARE OUTCOME	CORE INDICATOR
1.	Summary indicator	Infant mortality
2.	Disease-specific indicator	Diabetes
3.	Disease-specific indicator	Tuberculosis
4.	Disease-specific indicator	Road traffic injuries

#	INDICATOR	
SUMMARY INDICATORS		
1.	Under-five mortality rate	Th
2.	Maternal mortality ratio	Th
3.	Life expectancy at birth	prev of
DISEASE-SPECIFIC INDICA		
4.	A. All cancer B. Cardiovascular disease C. Respiratory diseases D. HIV and AIDS E. Homicide rate F. Mental illness	Age pe exa

Index of Urban Health Disparity[1]

- one single metric to represent inequalities
- objective marker for setting goals, evaluating interventions and planning
- significance exclusivly for local level
- constructed for small areas within an administrative jurisdiction

[1] Development of an Urban Health Index (unpublished), Institute of Public Health, Georgia State University

Excurse: HDI Methodology

- constructed from
  - life expectancy at birth
  - measures of schooling
  - gross national income per capita
- The resulting value is a proportion between 0.0 and 1.0

$$I^S = \frac{I - \min^*(I)}{\max(I) - \min^*(I)},$$

- **Step 1** – Standardization of single indicator
- transformation of actual values into dimensionless proportion between 0 and 1

I^S is the standardized indicator

I is the observation in the small area

max is the maximum value

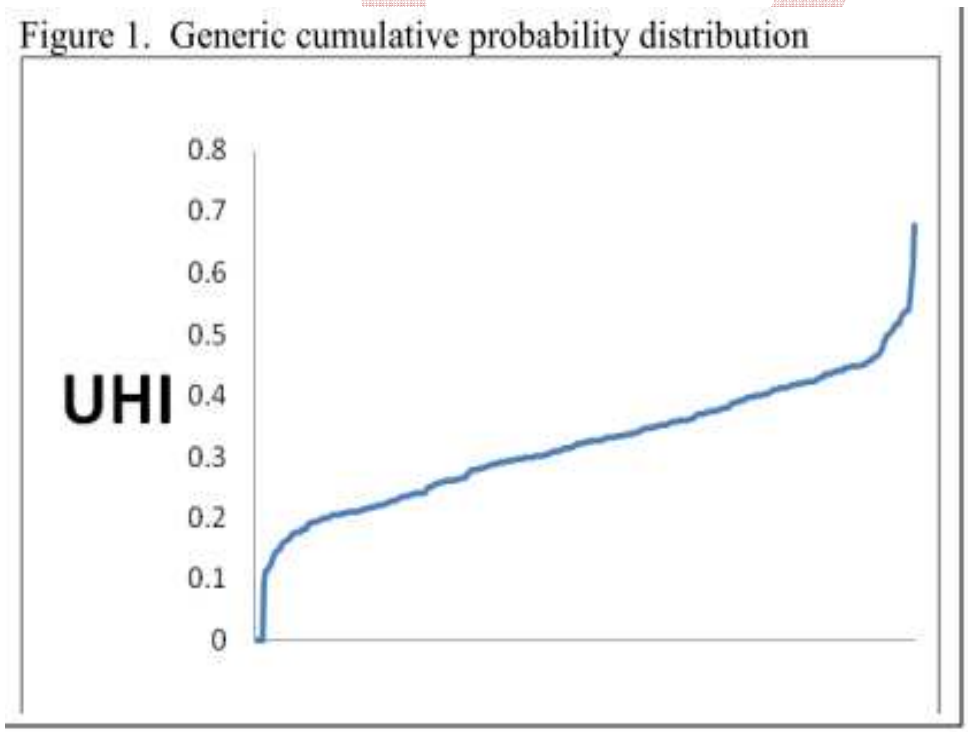
min is the minimum value

- **Step 2** - combination of indicators through calculation of geometric mean
- result is overall urban health index
- based on work by Atkinson

$$\text{Geometric mean} \quad G = \left(\prod_{i=1}^{n} I_i^S \right)^{\frac{1}{n}}$$

- **Step 3** – create rank order of the index value and design a graph

	Indicator
1	0.1483
2	0.1576
3	0.1589
4	0.1624
5	0.1683
6	0.1693
7	0.1750
8	0.1765
9	0.1851
10	0.1892
11	0.1928
12	0.1943
13	0.1949



1. The RATIO of the extremes

- The ratio of the mean of the upper 10% to the mean of the lower 10% of the distribution as marker of overall disparity

2. The slope of the midsection

- steep slope suggests heterogenous group; flat slope suggests relative uniformity in the central segment of the data
- Using OLS linear regression; calculating the slope through the points defining the middle 80% of the distribution

Results Urban Health Index
-
Rio de Janeiro 2002-2010

Unit of analysis

- Individual geo-coded data vs. **artificial administrative boundaries**
- Census tract < **bairro** < districto administrativo < area de planejamento

Data source

- IBGE Census data
- National Datasus and Municipal Tabnet
- (**SIM**, SINAN, **SINASC**, SIH/ SIA, SIAB)

Key urban health topics & main indicators

a) infectious disease: Tuberculosis
HIV

b) NCD: Ischaemic Heart Disease,
Diabetes
Breast and Cervix Cancer

c) external health: Homicide
Traffic accidents

d) Infant health: Infant Mortality

Generation of Mortality Rates

Mortality rate in study population: 5-years weight

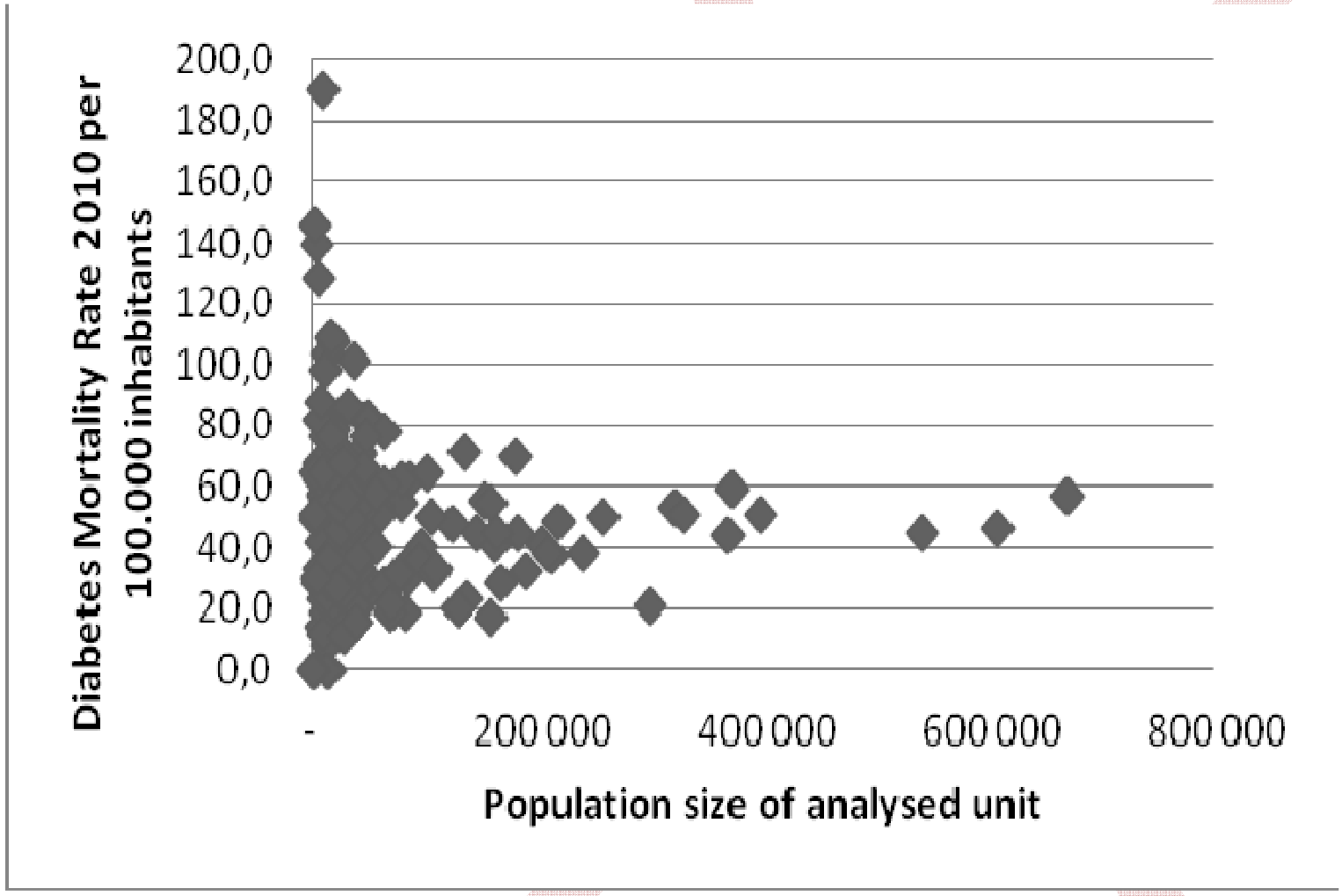
Years 2000-2012

ICD-Code I20-I25 Ischaemic Heart

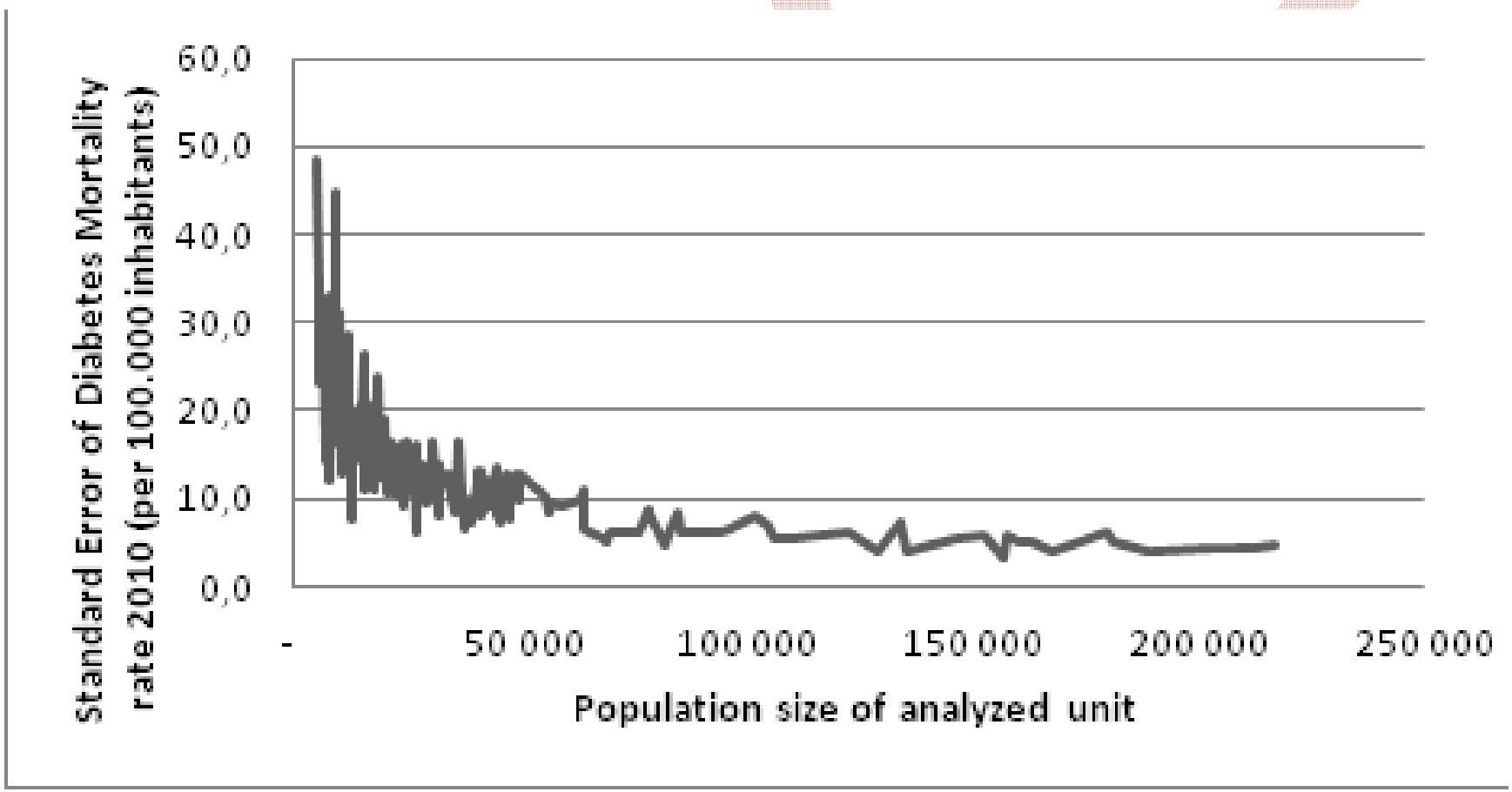
	Neighborhoods	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
3304557001	Centro	158,94	158,25	144,42	136,14	140,72	143,00	143,00	148,99	153,66	141,18	133,93	116,71	99,65
3304557002	Gamboa	130,96	96,20	78,88	71,90	79,58	81,31	81,31	72,47	79,50	75,29	68,11	55,64	47,29
3304557003	Santo Cristo	126,85	131,46	139,76	128,46	107,45	98,41	98,41	83,36	75,50	68,00	88,40	97,21	90,12
3304557004	Caju	49,78	59,86	67,99	69,12	81,92	82,29	82,29	72,82	64,77	58,42	52,74	48,18	55,14
3304557005	Catumbi	122,35	133,95	140,94	149,14	126,85	109,15	109,15	108,19	108,49	117,54	97,16	75,88	72,09
3304557006	Rio Comprido	105,65	112,66	120,16	110,63	107,28	94,66	94,66	92,01	98,15	88,64	84,77	83,41	89,57
3304557007	Cidade Nova	7,57	28,30	65,80	86,19	93,36	78,15	78,15	85,02	75,52	66,08	62,20	68,38	87,23
3304557008	Estácio	74,64	70,24	90,26	102,05	106,47	97,30	97,30	95,49	101,24	92,40	90,76	78,66	73,94
3304557009	Flamengo	147,18	146,85	149,74	151,24	156,99	151,97	151,97	147,81	139,09	131,64	121,50	113,64	98,79
3304557010	Glória	219,85	216,33	210,78	175,58	169,30	148,79	148,79	156,25	173,36	154,56	138,70	103,98	81,47
3304557011	Laranjeiras	132,81	125,81	121,60	114,24	113,35	102,03	102,03	97,81	96,90	85,02	79,91	75,32	77,11
3304557012	Catete	137,18	143,46	142,85	133,79	134,17	123,20	123,20	101,04	85,63	78,91	79,39	79,25	78,29
	...													

→ Small number problem

Sample size I



Sample size II



How to control for Small Number Problem?

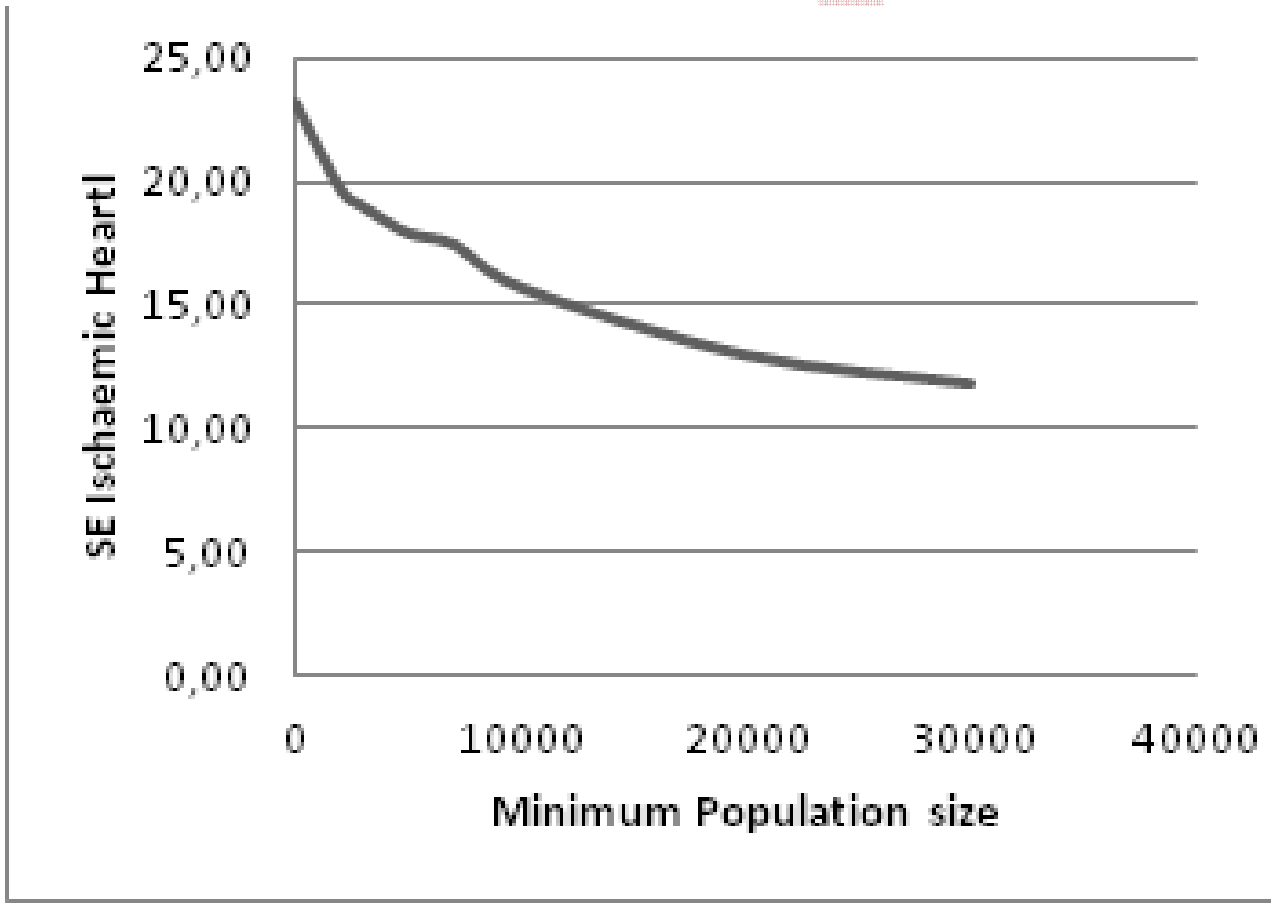
a) exclusion of neighborhoods
   - due to population size (Standard Error)
   - due to 0-health event count (reliablity)

b) 5-years weight

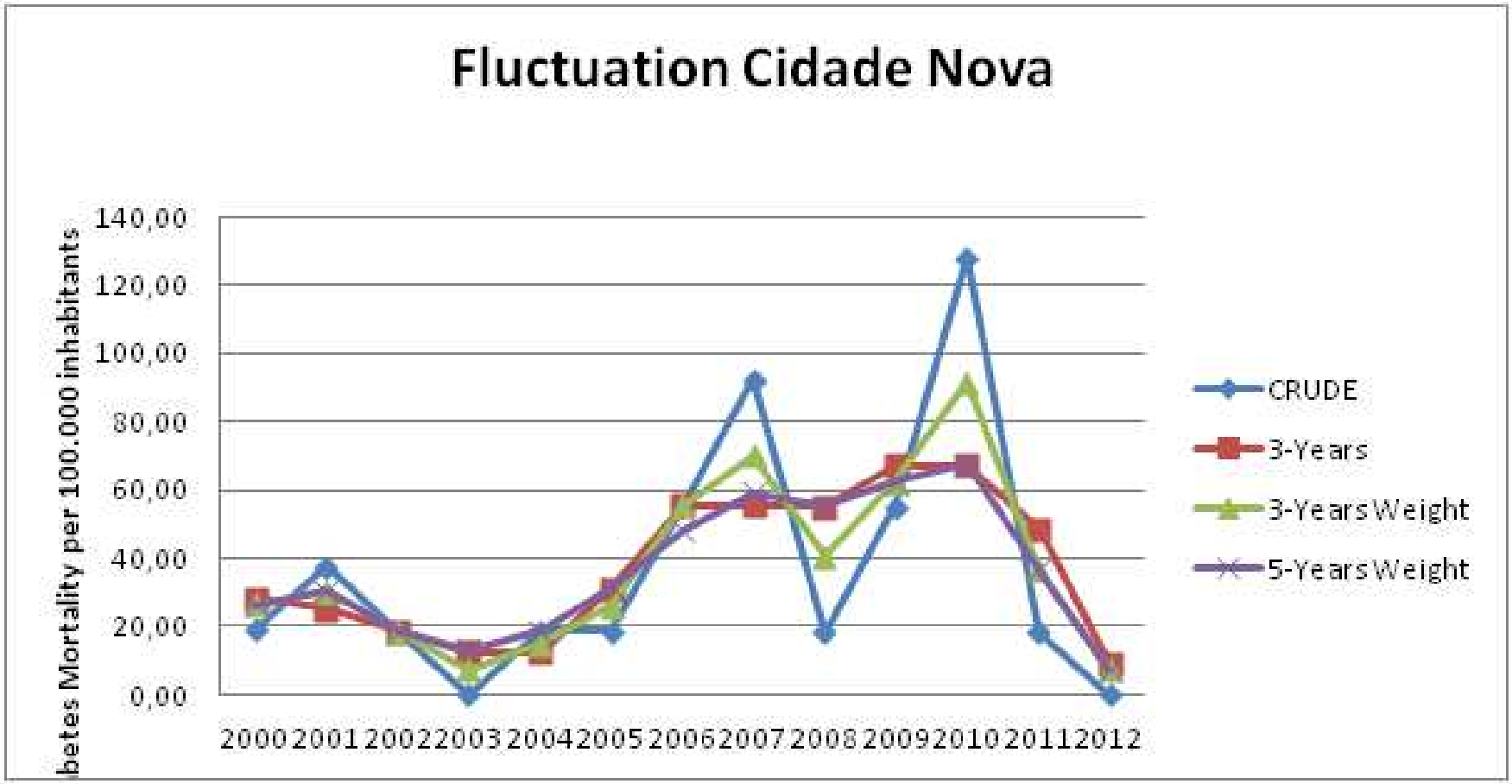
*instablity remains challenging

*alternative: Bayesian approach?

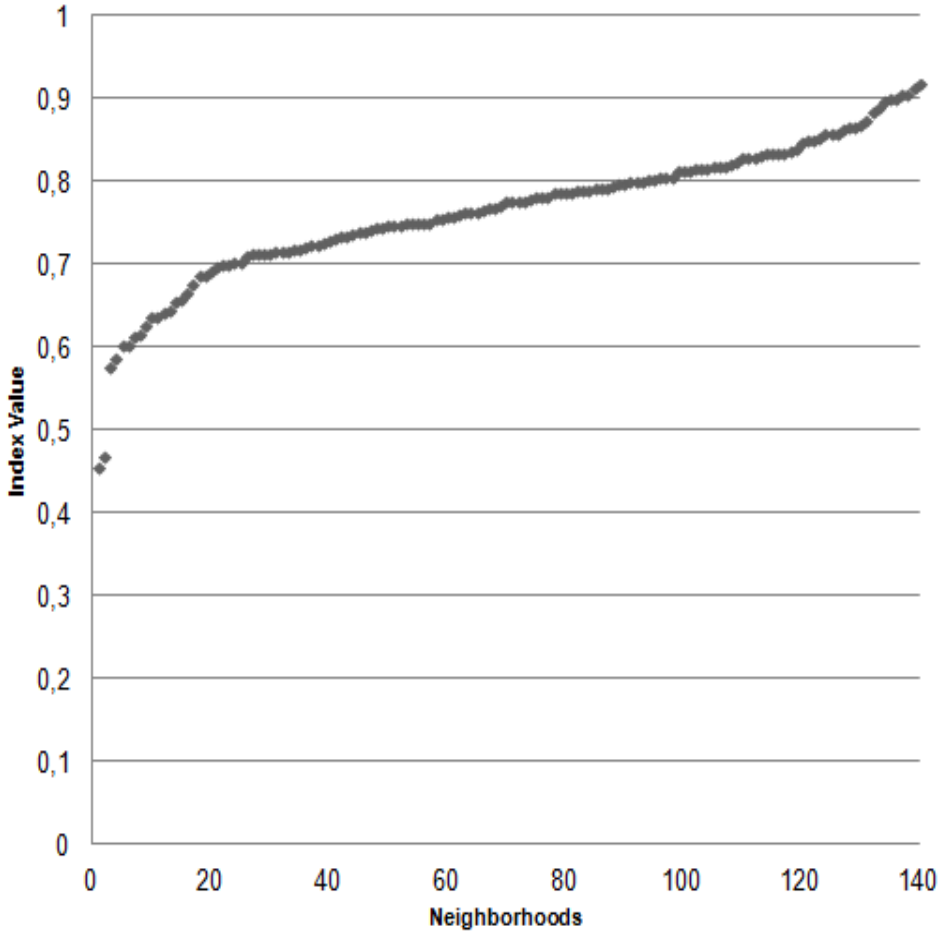
Definition cut-off minimum population size



5-years weight to control for fluctuation (0.1*0.2*0.4*0.2*0.1)



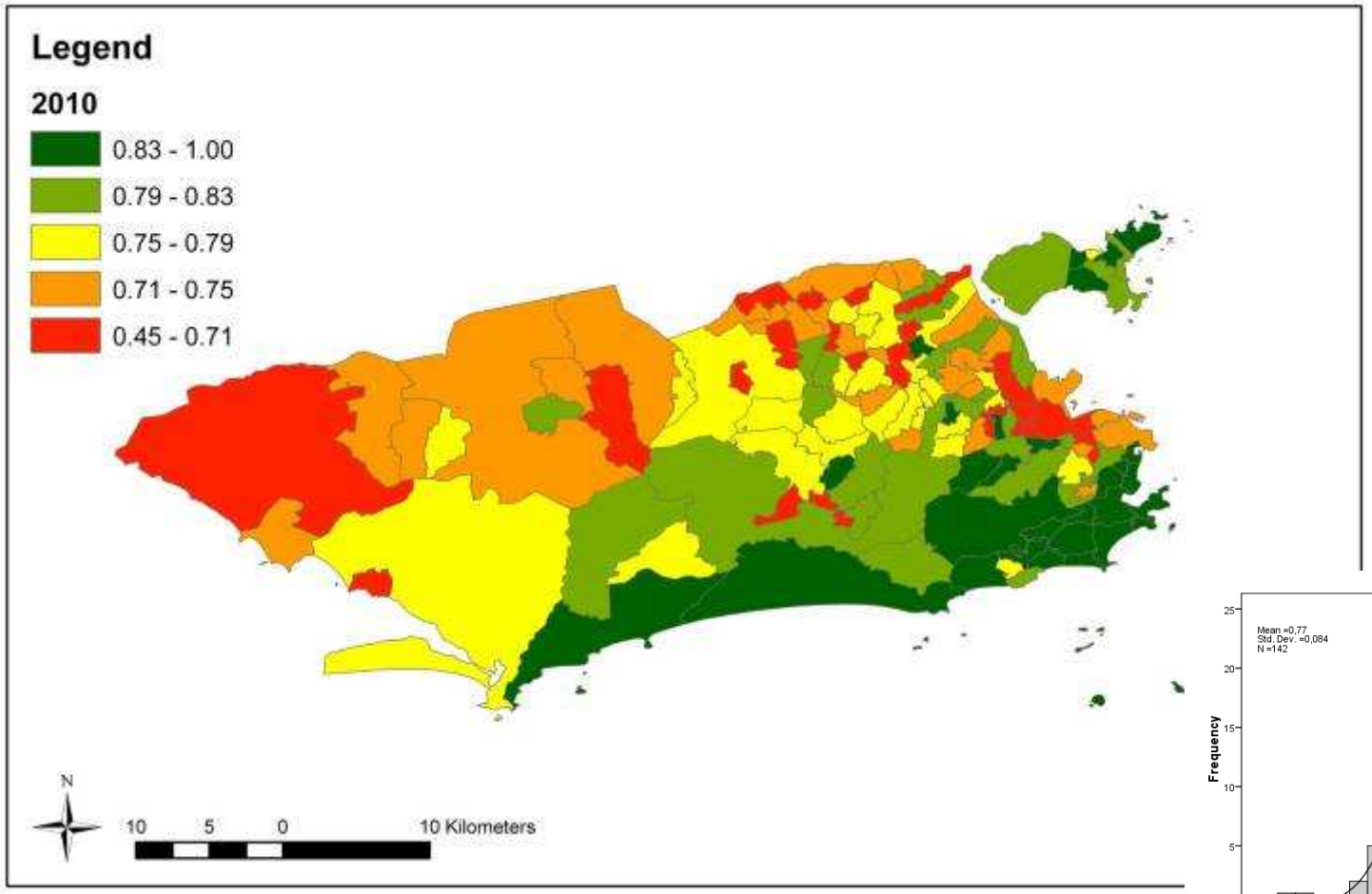
Ranked distribution of Index Values in 142 neighborhoods of Rio de Janeiro Municipality, 2010

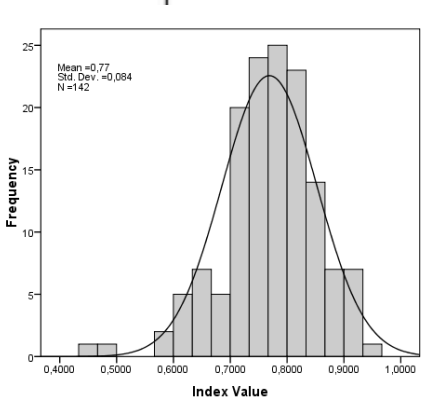


Index	
Disparity Ratio	1,51
Disparity Slope	0,21
SE (MR)	7,94

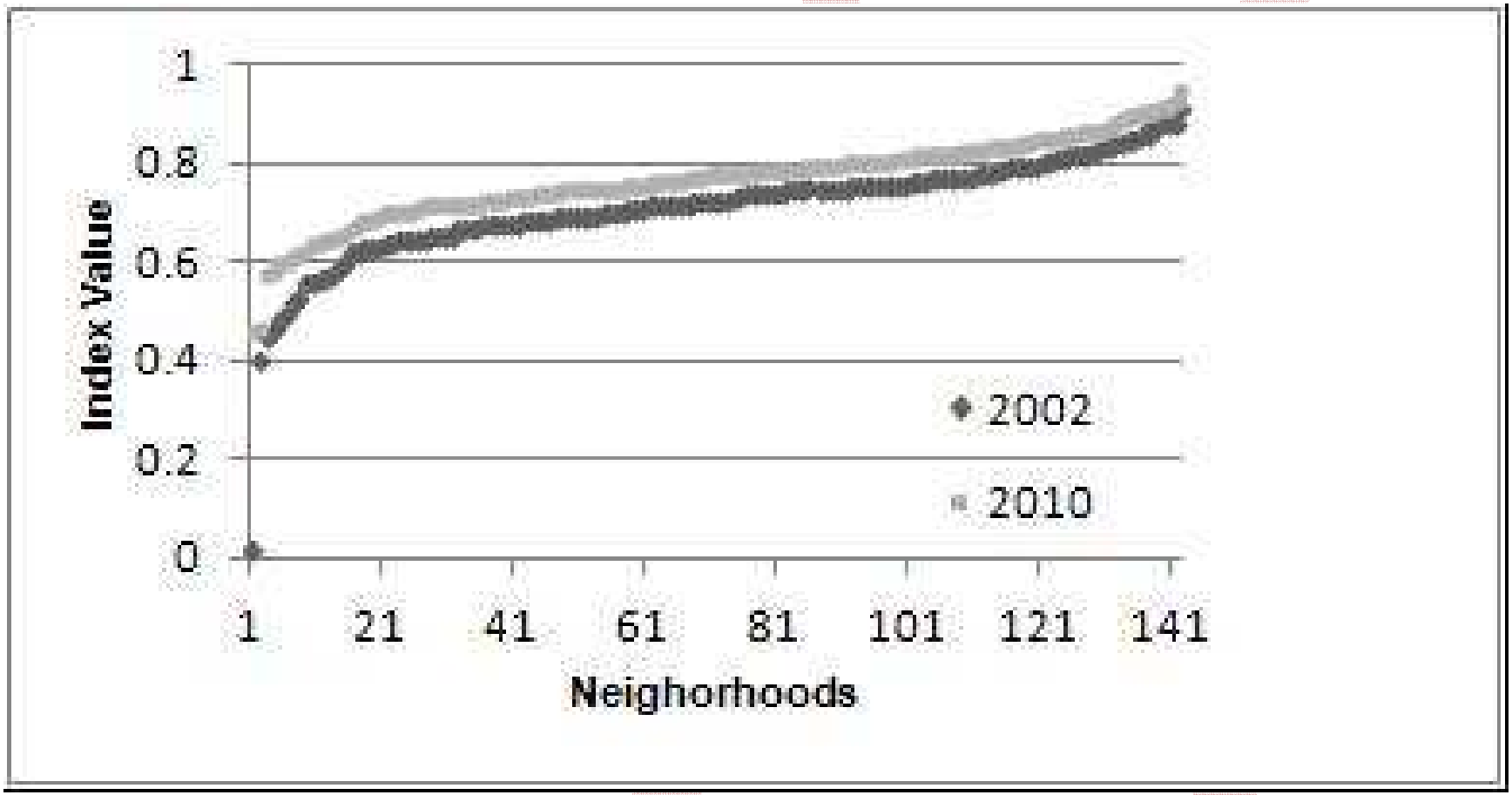
Index Values	
Mean	0,77
Std Dev	0,08
Min	0,46
Max	0,95
Range	0,49
Median	0,78
10th Pctl	0,66
90th Pctl	0,87

Map displaying Urban Health Index in 142 neighborhoods of Rio de Janeiro Municipality, 2010

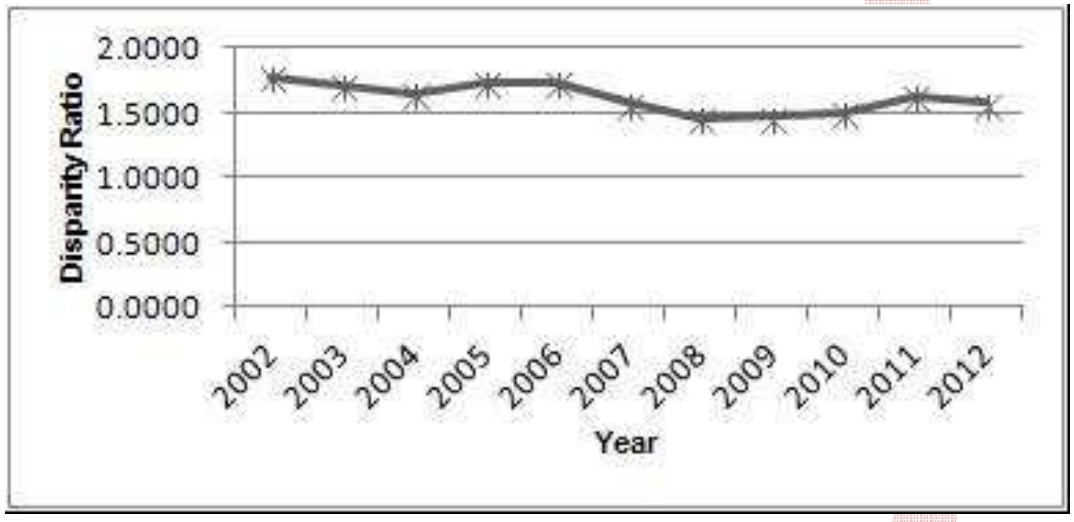


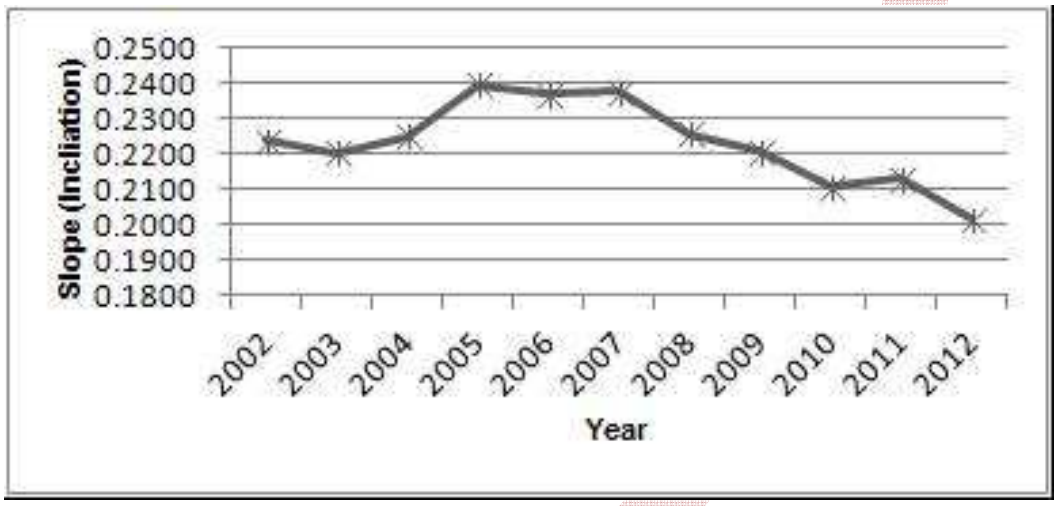


Ranked distribution of Index Values in Rio de Janeiro Municipality, 2002 and 2010

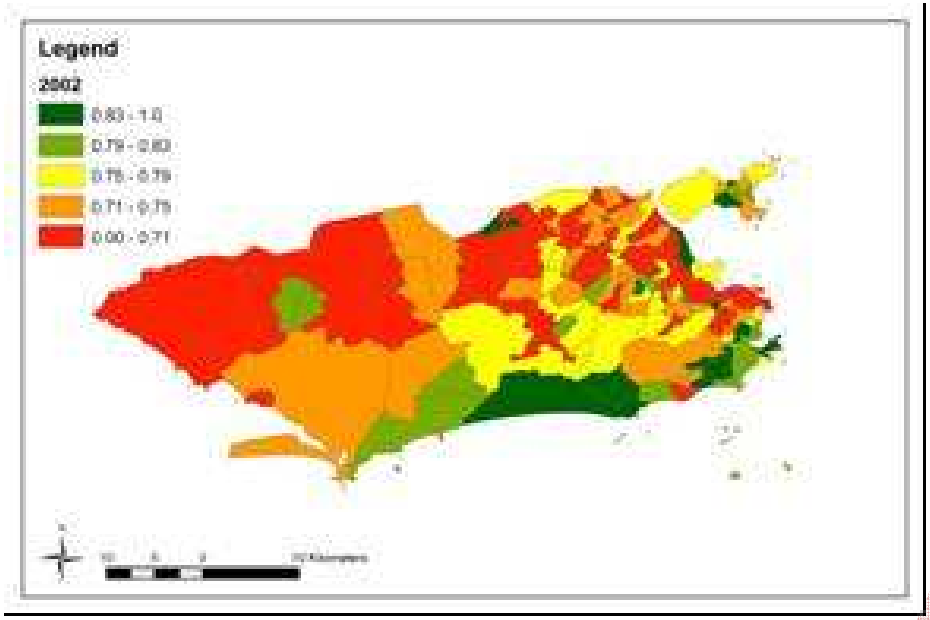


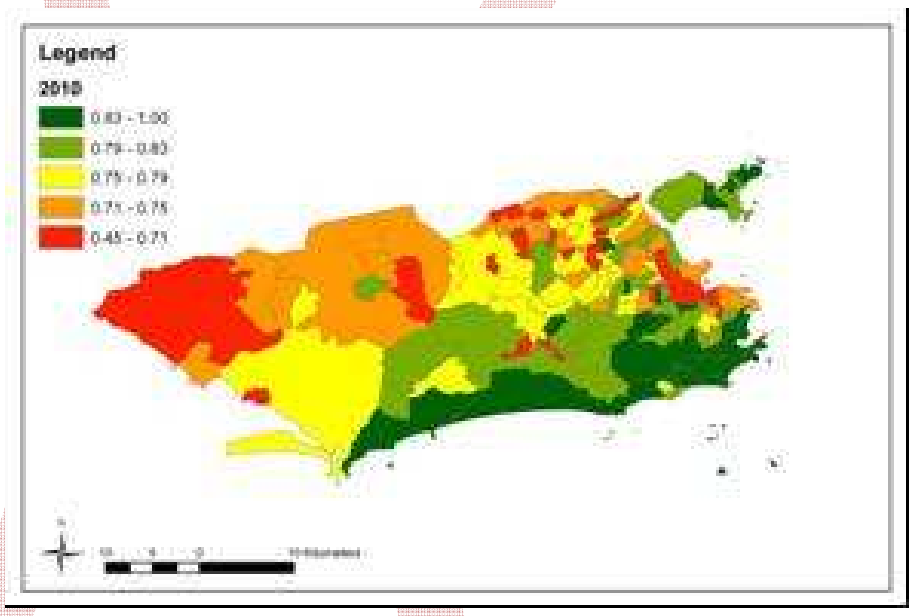
Disparity Slope and Ratio UHI in Rio de Janeiro Municipality, 2002-2012





Map displaying UHI inRio de Janeiro Municipality, 2002 and 2010





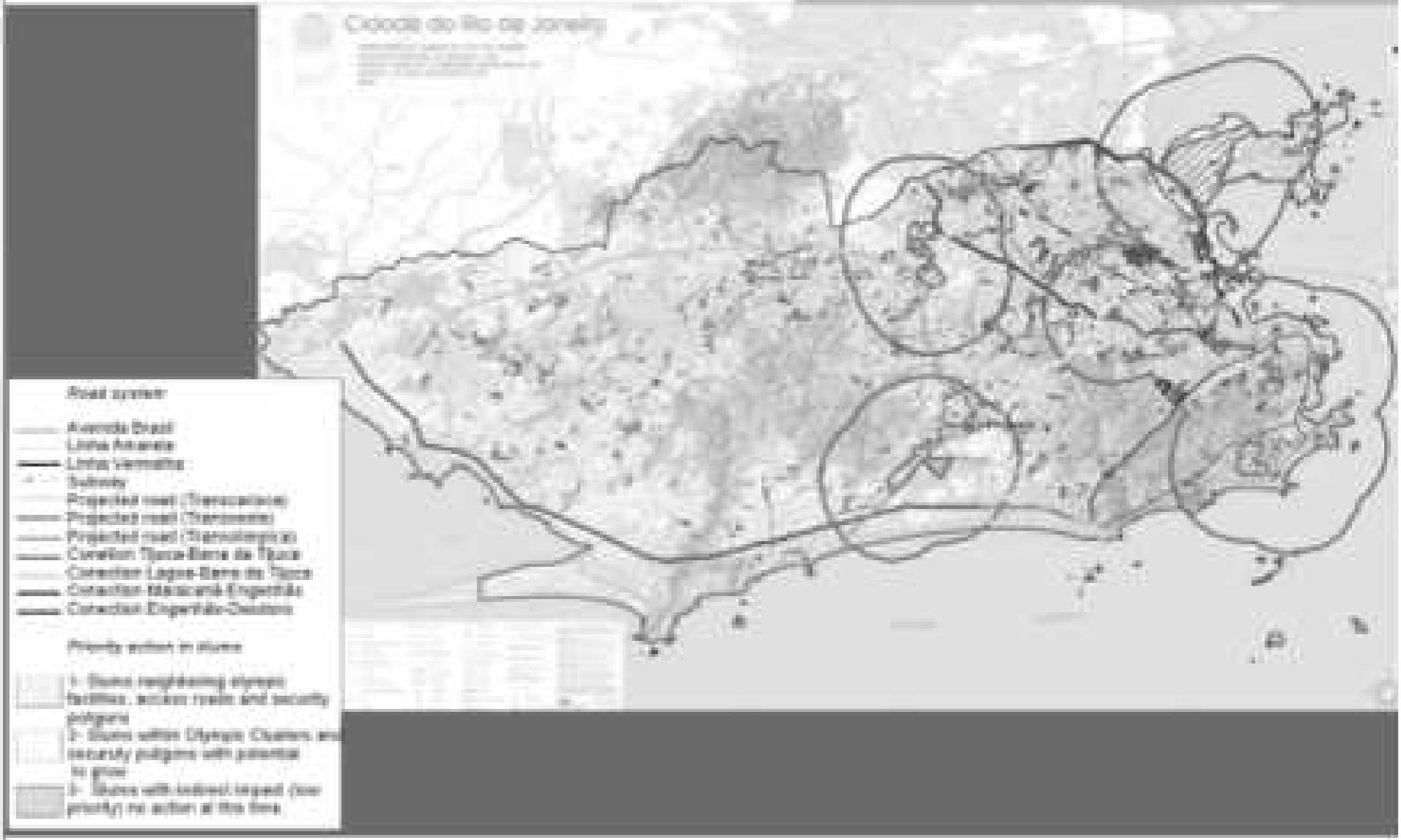
Further Application

a) Rio‘s urban transformation process (Rio2016) and its impact on health equity

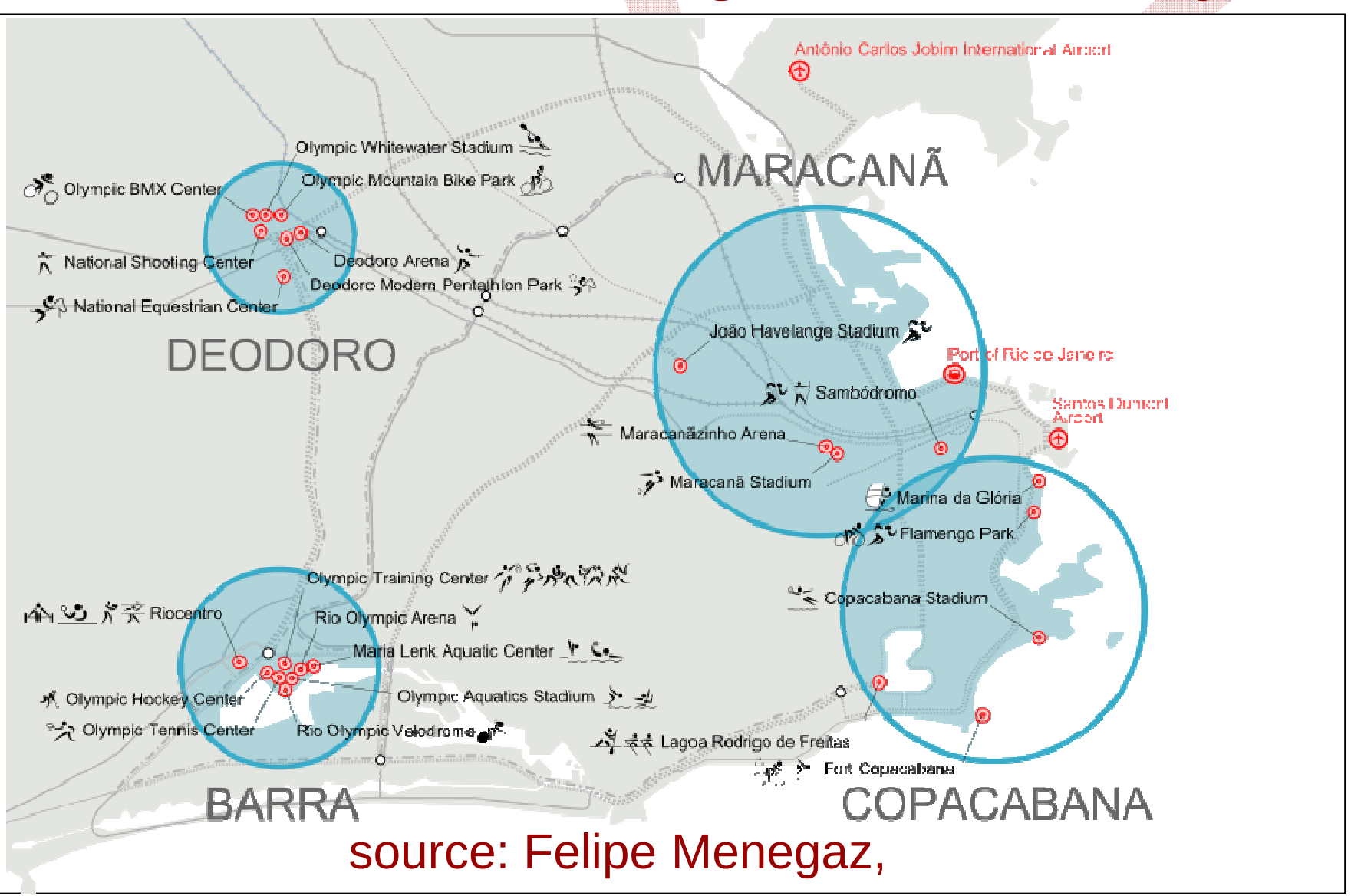
- Morar Carioca, PAC
- UPP
- extension **Programa Saúde da Família**

PREFEITURA
DA CIDADE DO RIO DE JANEIRO
SECRETARIA MUNICIPAL DE HABITAÇÃO

Priority Criteria

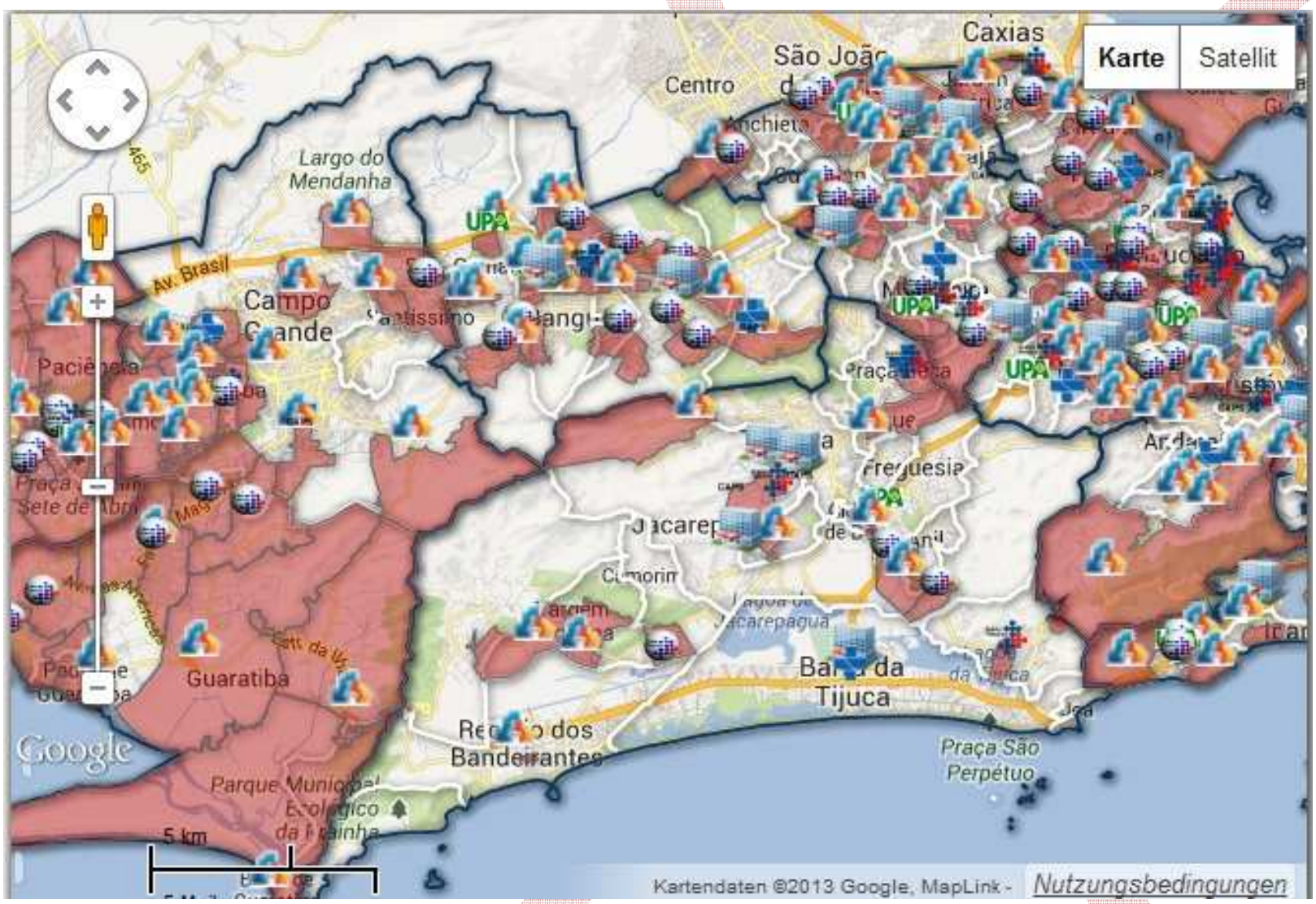


Rio2016 – becoming a Global City



source: Felipe Menegaz,

Extension Family Health Program



Further Application

a) Rio‘s urban transformation process (Rio2016) and its impact on health equity

- Morar Carioca, PAC
- UPP
- extension **Programa Saúde da Família**

b) health and market-value of urban territory

- correlation of health index with indicators like e.g. distance from centre, real estate, etc.

Intra-urban analysis - Pitfalls

- access & availability to health data
- sensibility & promptness to react towards urban transformation processes
- small number problem solved by Bayesian approach?
- age standardization necessary?
- level of analysis – how to include micro-level unit (e.g. Cantagalo within Ipanema)
- inclusion of Gran-Rio agglomeration

Obrigado

In collaboration with

WHO Kobe Center

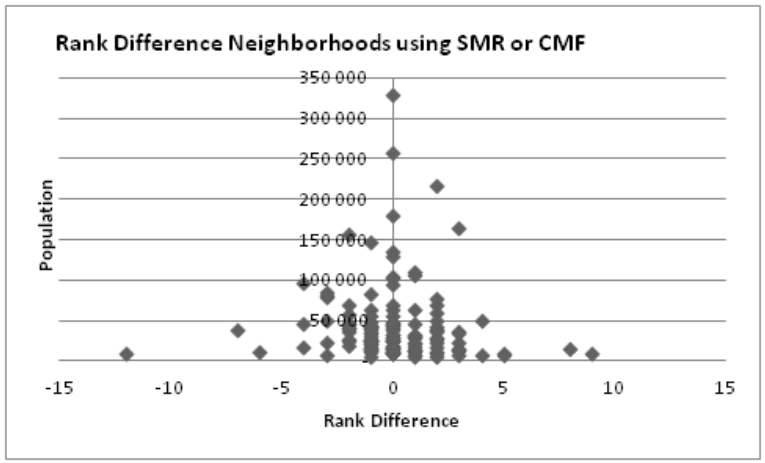
Georgia State University

Fiocruz-ICIT

Institut of Public Health Heidelberg

martin.bortz@stud.uni-heidelberg.de

Age Adjustment – SMR vs. CMF



SMR: standard but internal bias

CMF: reliable for direct comparision but high SE

Conclusion

- both, SMR as CMF, have high SE for small spatial areas
- catious use of age-adjustment technique (only if necessary)