AREA-BASED VARIATIONS IN CERVICAL CANCER PREVENTION: RESULTS OF A SPATIAL ANALYSIS IN COLOMBIA

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  - Primary and secondary prevention
  - Objectives
- Methodology
- Results
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INTRODUCTION

Colombia in context

- One of the most inequitable countries in Latin America[1,2,3]
  - High levels of poverty
  - Differences by regions
- Barriers to access health services among[4]:
  - Socially disadvantaged populations
  - Individuals with different health insurance programs
- Internal armed conflict
  - High economic and social impact[5]
  - Forced internal displacement of individuals to big cities[6]
    - Women and children
    - Health status of displaced populations
    - Access to health care

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2. Cardona D, et al. [Inequities in health among Latin American and Caribbean countries (2005-2010)]. Gac Sanit. 2013;27(4):292-7.
3. Cortés D, Vargas J. Inequidad regional en Colombia. Universidad del Rosario; 2012.
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5. Franco S, et al. The effects of the armed conflict on the life and health in Colombia. Ciência & Saúde Coletiva. 2006;11:349-61.
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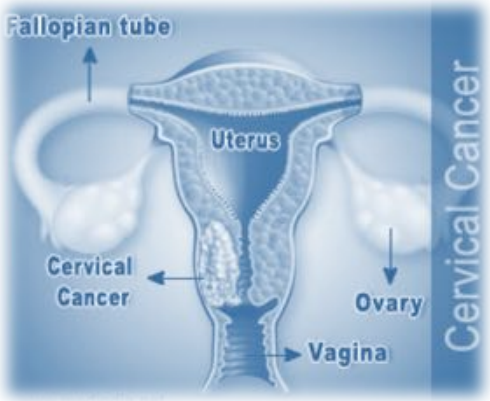
Colombia in context

- Cervical cancer (CC)
  - Second cause of cancer mortality among women in the country[1]
  - Estimated burden of pre-cervical cancers[2]:
    - 8 million international dollars (2005)
  - Included as a national priority[3]
- No studies describing the spatial variations of limited access to primary and secondary CC prevention programs have been conducted



1. Piñeros, M., et al. Patterns and trends in cancer mortality in Colombia 1984-2008. Cancer Epidemiology. 2013; 37, 233-239.
2. de la Hoz-Restrepo F et al. [Evaluating the burden of disease caused by human papillomavirus in Bogota]. Rev Salud Publica (Bogota). 2009;11(3):454-67
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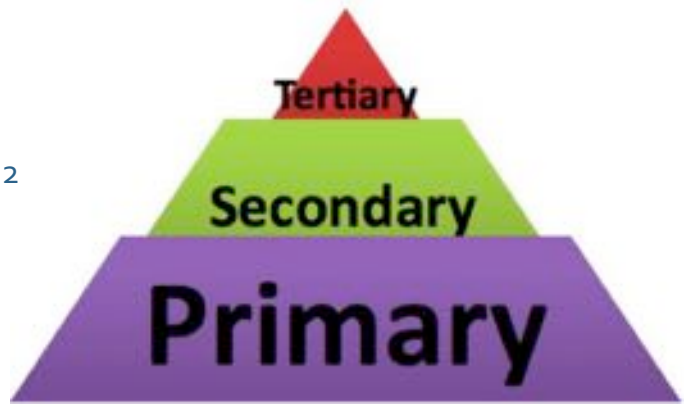
Primary and secondary prevention

- Primary prevention[1]
  - Prevent disease occurrence among susceptible individuals
    - Disease education, vaccination, health promotion, etc.
- Secondary prevention[1]
  - Reduce the burden of disease by identifying asymptomatic individuals with the disease in an early stage
    - Screening
- Both strategies are important to prevent CC[2]



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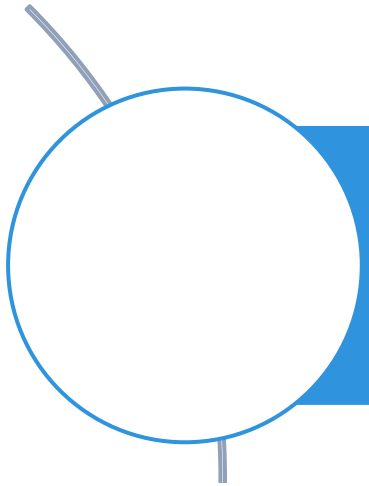
Objectives



To use global and local tests for clustering to describe spatial patterns in the frequency of not having heard of HPV vaccination and not having had a Pap test

METHODOLOGY

Methodology

- Population of study
  - Colombian girls and women (13-49 years) who have not heard of HPV vaccination
  - Colombian women (18-49 years) who have never had a Pap testing
- Data
  - 2010 Colombian National and Demographic Health Survey
  - 2010 estimations of population by the Colombian National Department of Statistics
- Dependent variables

Having not heard of HPV vaccination)	Having not had a Pap test
Frequency of women who have not heard of HPV vaccination at the department level	Frequency of women who have not had Pap testing at the department level

Methodology

- Statistical analysis
  - Global and local cluster identification
    - Moran's I test *(R software)*
    - Kulldorff's spatial scan statistic *(SaTScan software)*
  - Bayesian Poisson models with random effects
    - Account for spatially structured and unstructured variability *(WinBugs)*
  - Models

MODEL 1 DV: having not heard of HPV vaccination	**MODEL 2** DV: having not had a Pap test
• Departmental frequency of women with no formal education, subisidsed health insurance, and living in rural areas • 2010 population density	

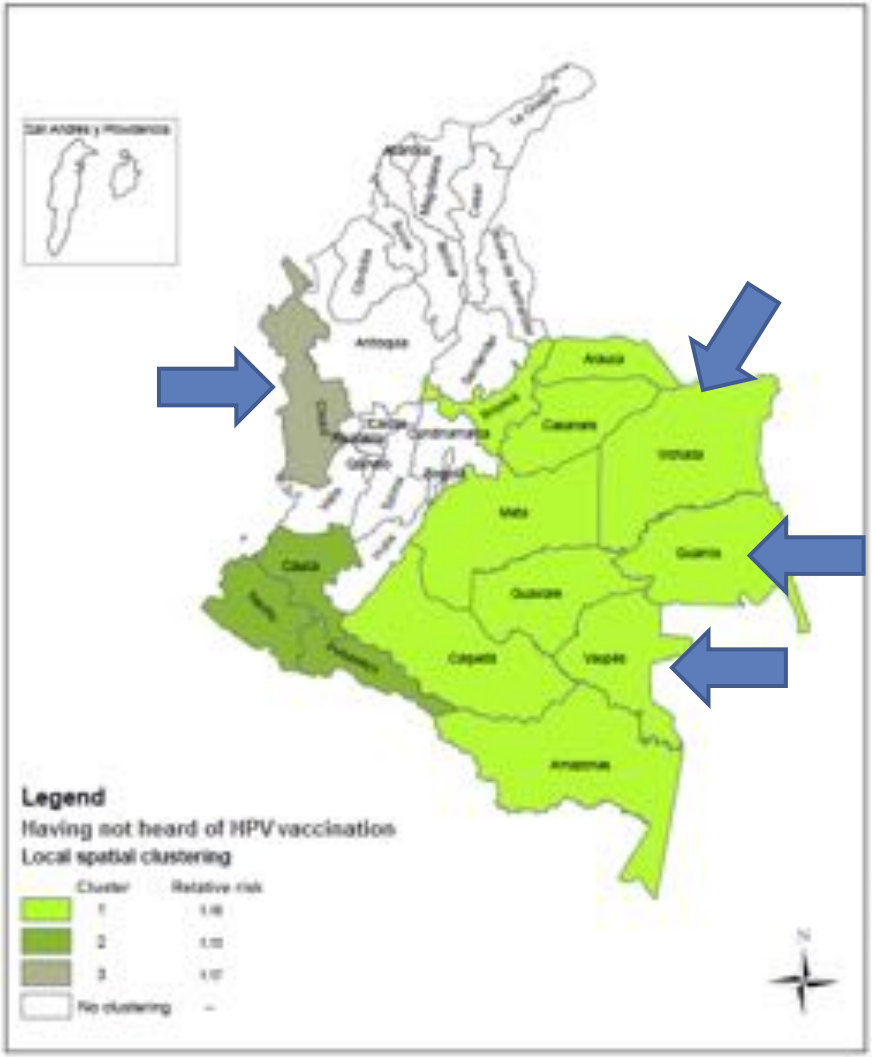
  - Results were mapped in *ArcGIS*

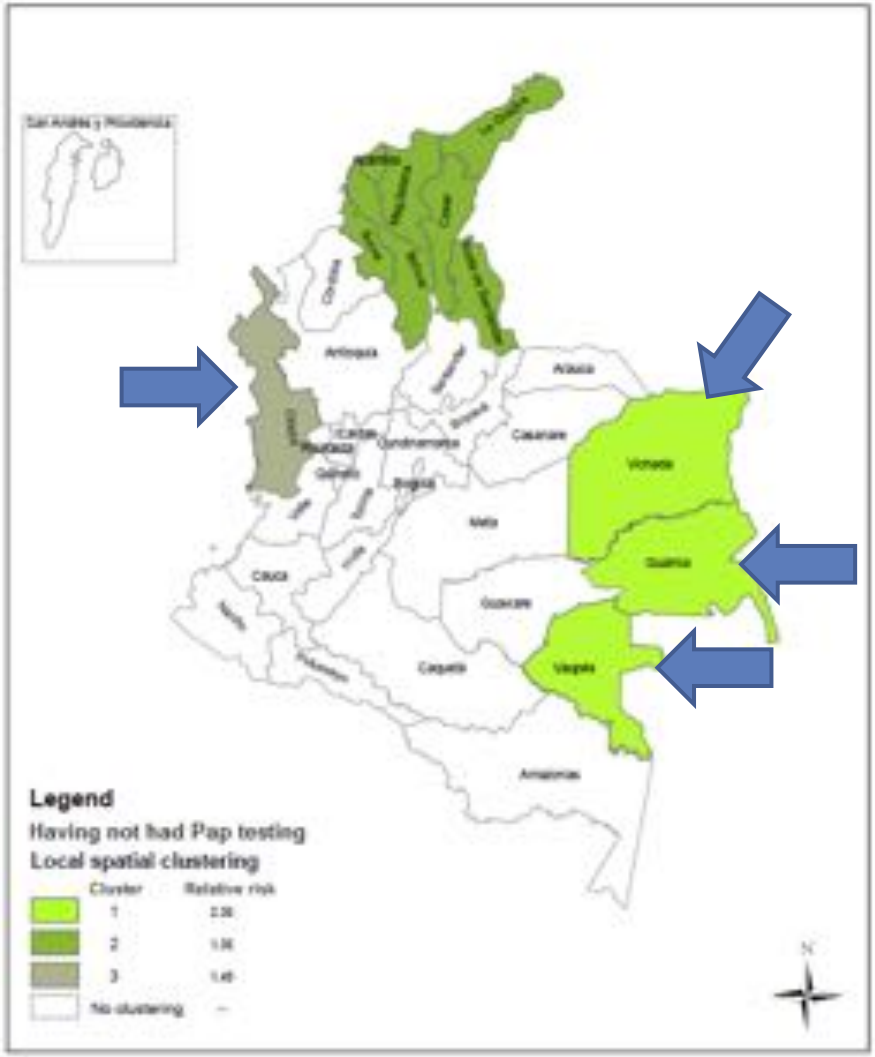
RESULTS

Results

- Women who have not heard of HPV vaccination
  - In total, 39,158 (73.2%)
- Women who have not had Pap testing
  - In total, 5,128 (12.7%)
- Significant spatial autocorrelation in both variables of study
  - Moran's I HPV vaccination=0.49, p-value=0.0003
  - Moran's I Pap testing=0.34, p-value=0.0004
- Three statistically significant local clusters of cases were found for each of the dependent variables

Results


Legend
Having not heard of HPV vaccination
Local spatial clustering
Cluster
Relative risk
No clustering


Legend
Having not had Pap testing
Local spatial clustering
Cluster
Relative risk
No clustering

Results

- Model 1

$$\ln(y) = \ln(e_i) + \text{alpha} + \beta_1 X_{\text{NoEdu\_propCAT}} + \beta_2 X_{\text{rural}} + \beta_3 X_{\text{Subs\_ins}} + \beta_4 X_{\text{NoEdu\_propCAT}} X_{\text{rural}} + v_i + \mu_i$$

where:

$X_{\text{NoEdu\_propCAT}}$ represents the categorised proportion of no education in each department;
X_{rural} represents the proportion of women living in rural areas in each department;
$X_{\text{Subs\_ins}}$ is the proportion of women with subsidised health insurance by departments,
$X_{\text{NoEdu\_propCAT}} X_{\text{rural}}$ represents the interaction term between the categorised proportion of no education and the proportion of rurality in each department.

μ is the structured variability
v is the unstructured variability

- Model 2

$$\ln(y) = \ln(e_i) + \text{alpha} + \beta_1 X_{\text{Subs\_ins}} + \beta_2 X_{\text{Density\_CAT}} + v_i + \mu_i$$

where:

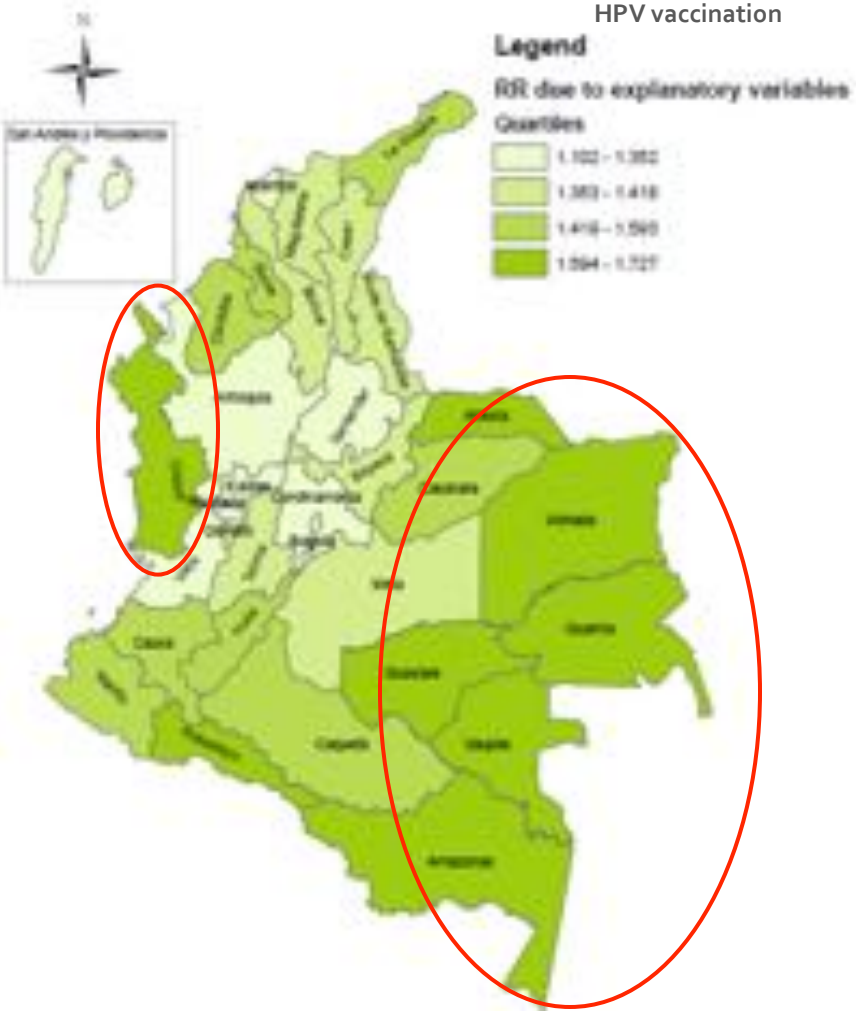
$X_{\text{Subs\_ins}}$ is the proportion of women with subsidised health insurance by departments, and
$X_{\text{Density\_CAT}}$ represents the categorised proportion of population density in each department.

μ is the structured variability
v is the unstructured variability

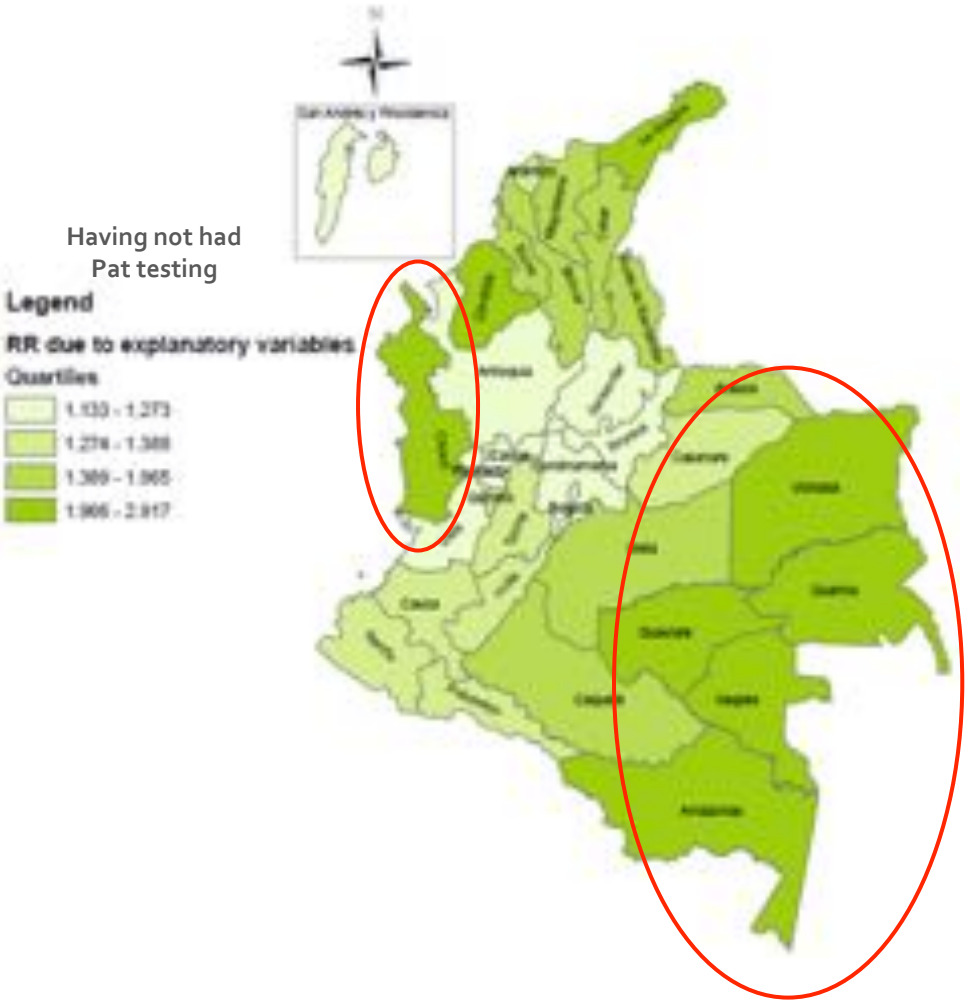
- Both models recognized that these spatial variations were associated with the departmental percentage of women with subsidized health insurance.
- These models identified that HPV vaccine awareness and Pap testing were less common in peripheral Colombian departments.

Results

Having not heard about HPV vaccination



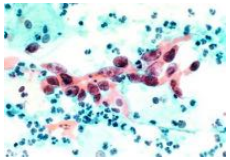
Having not had Pat testing



POPULATION HEALTH IMPLICATIONS

Population Health Implications

- This study applies a methodology useful to:
  - Demonstrate spatial variations in health outcomes to different stakeholders in Colombia
  - Target specific CC prevention programs in high-risk departments
  - Understand departmental socioeconomic factors associated with the uptake of primary and secondary CC prevention strategies
- Spatial analyses are useful to study patterns of health-related outcomes considering:
  - Behavior of the outcome in neighboring areas
  - Inclusion of explanatory variables (e.g. area-based socio-demographic factors)
- This methodology could be successfully replicated in other settings.



Population Health Implications

- There are departments in Colombia with a higher risk of not having heard of HPV vaccination and not having had Pap testing
  - Chocó
  - Vichada
  - Guanía
  - Guaviare
  - Vaupés
  - Amazonas
- Need to focus resources towards more disadvantaged and high-risk areas

Acknowledgements

- PROFAMILIA, Colombia
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- School of Public Health, University of Saskatchewan

THANK YOU!

Residual variation for not having heard of HPV vaccination

Residual variation for not having heard of HPV vaccination

v

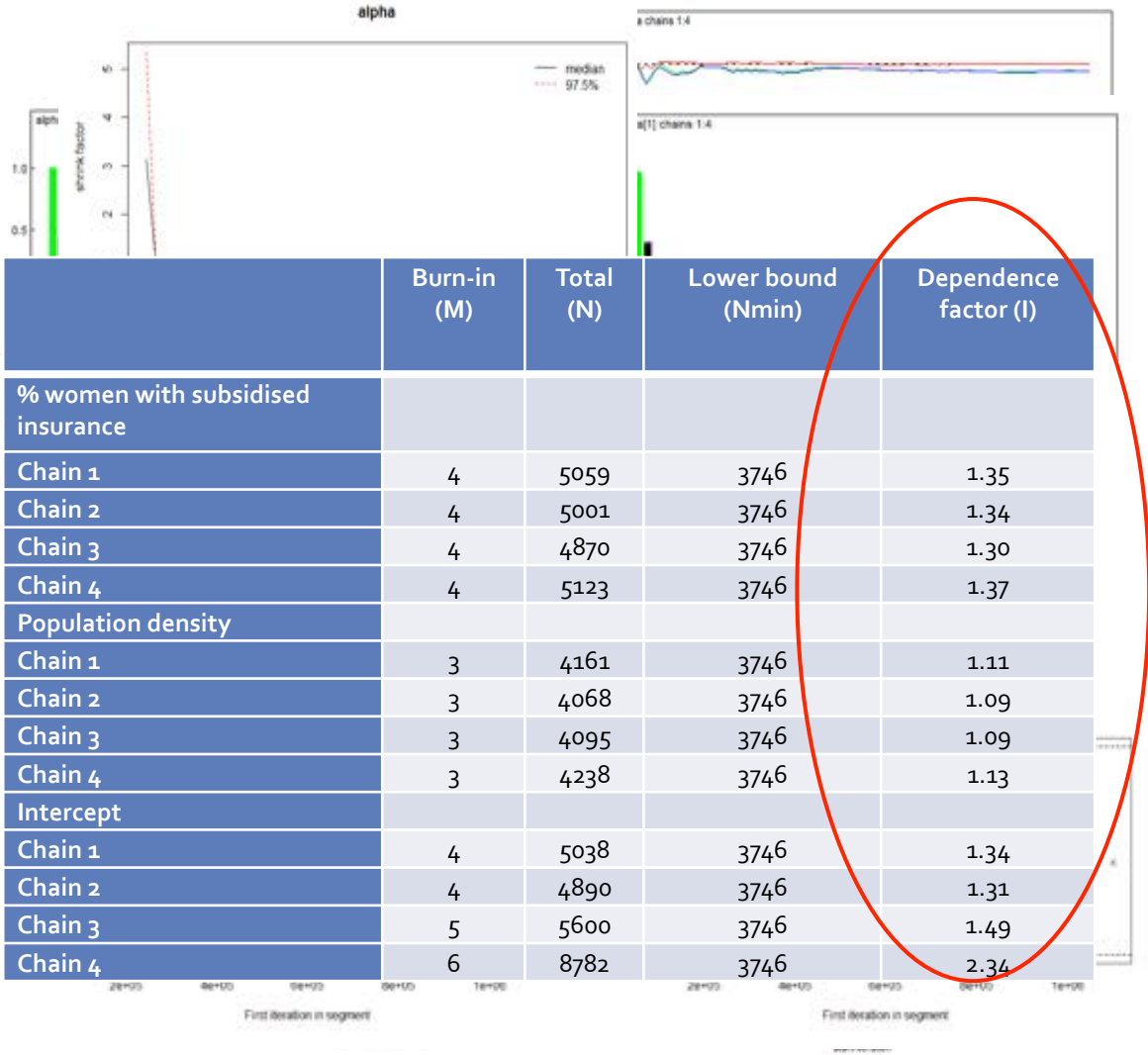
RR due to unstructured heterogeneity

μ

RR due to structured heterogeneity (clustering)

Diagnostics of Bayesian analysis

- Informally:
  - Brook-Gelman-Rubin
  - Autocorrelation plots
- Formally
  - Gelman and Rubin
  - Geweke
  - Raftery-Lewis
  - Heidelberger-Welch
    - Chains reached station values>0.05)



	Burn-in (M)	Total (N)	Lower bound (Nmin)	Dependence factor (I)
% women with subsidised insurance				
Chain 1	4	5059	3746	1.35
Chain 2	4	5001	3746	1.34
Chain 3	4	4870	3746	1.30
Chain 4	4	5123	3746	1.37
Population density				
Chain 1	3	4161	3746	1.11
Chain 2	3	4068	3746	1.09
Chain 3	3	4095	3746	1.09
Chain 4	3	4238	3746	1.13
Intercept				
Chain 1	4	5038	3746	1.34
Chain 2	4	4890	3746	1.31
Chain 3	5	5600	3746	1.49
Chain 4	6	8782	3746	2.34