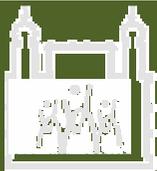




# Pesticide Sales and adult male cancer mortality in Brazil

Juliana de Rezende Chrisman





ELSEVIER

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)



Int. J. Hyg. Environ. Health ■ (■■■■) ■■■–■■■

**International Journal  
of Hygiene and  
Environmental Health**

[www.elsevier.de/ijheh](http://www.elsevier.de/ijheh)

## Pesticide sales and adult male cancer mortality in Brazil

Juliana de Rezende Chrisman<sup>a</sup>, Sérgio Koifman<sup>b</sup>, Paula de Novaes Sarcinelli<sup>a</sup>, Josino Costa Moreira<sup>a</sup>, Rosalina Jorge Koifman<sup>b</sup>, Armando Meyer<sup>c,\*</sup>

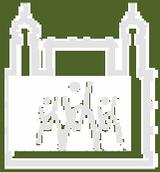
<sup>a</sup>*Centro de Estudos da Saúde do Trabalhador e Ecologia Humana, Escola Nacional de Saúde Pública, Fundação Oswaldo Cruz. Rio de Janeiro, Brazil*

<sup>b</sup>*Departamento de Epidemiologia e Métodos Quantitativos em Saúde, Escola Nacional de Saúde Pública, Fundação Oswaldo Cruz. Rio de Janeiro, Brazil*

<sup>c</sup>*Instituto de Estudos de Saúde Coletiva, Universidade Federal do Rio de Janeiro, Avenida Um. Praça Jorge Machado Moreira, 100. Cidade Universitária, 21941-598 Rio de Janeiro, Brazil*

Received 8 April 2008; received in revised form 30 July 2008; accepted 30 July 2008

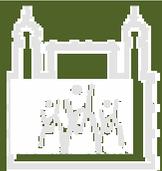




# Introduction

- Increasing use of pesticide and adverse effects to human health and environment.
- By the end of 1980s estimates of 25 million poisoning among agricultural workers in developing countries.
- Pesticides are also suspected to be etiologically linked to a number of chronic diseases.
- Farmers have a lower overall mortality than general population.
- For specific cancer they have a higher risk:
  - Brain
  - Stomach
  - Leukemia
  - Prostate
  - Non-Hodgkin's lymphoma
  - Liver

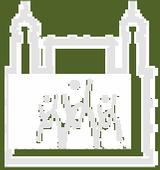




# Introduction

- Brazil is the world's third largest consumer of pesticides.
- Studies that evaluate public health impact of pesticide use in Brazil are relatively scarce and usually focus on acute effects.
  - Study with agricultural workers in Rio de Janeiro
  - Correlation with breast and ovarian cancer in the 11 states.

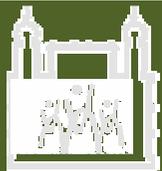




# Objective

We extended the correlation analysis of pesticide consumption in the same 11 Brazilian states in 1985 to several specific-site cancer mortality rates in general male population from the same states between 1996 and 1998.



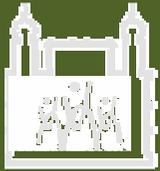


# Methods

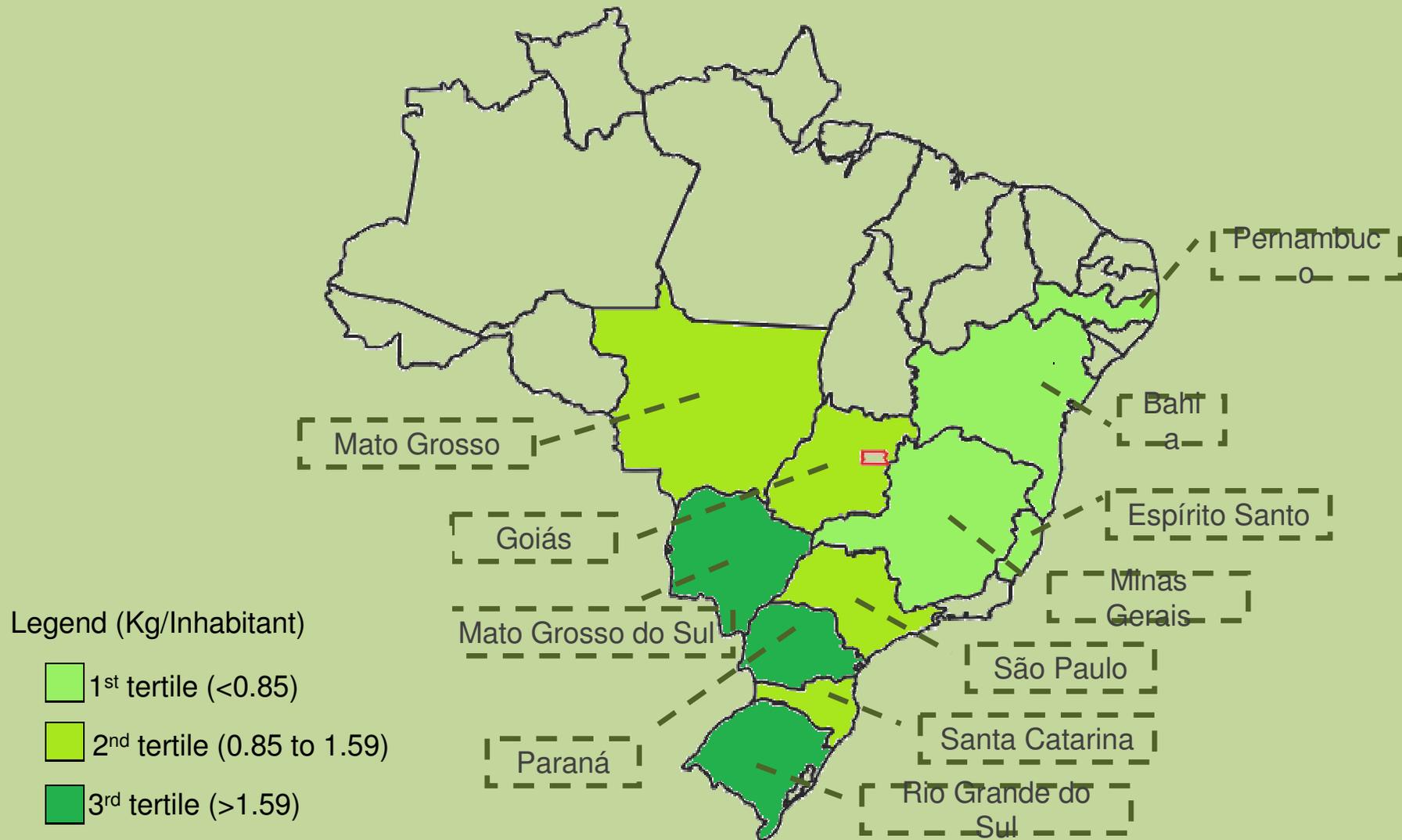
- Pesticide per capita consumption in 1985.
- Cancer mortality during 1996 to 1998 was classified according to ICD-10<sup>th</sup> Edition:

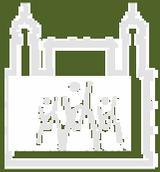
- Leukemia
- Non-Hodgkin lymphoma
- Multiple Myeloma
- Prostate
- Soft tissue
- Larynx
- Lip
- Esophagus
- Lung
- Pancreas
- Bladder
- Liver
- Testis
- Stomach
- Brain





# Methods





# Methods

## ● Pattern analysis

- Relationships between pesticide use, cancer mortality rates and confounding variables.
- Factor analysis - principal component analysis and varimax.
- Cancer types suspected to be etiologically linked to pesticide exposure versus those not commonly associated.

## ● Multiple linear regression analysis

- Relationship between per capita sales and specific-sites cancer mortality rates, controlling from other covariates.
- PCA and colinearity analysis were used to select confound variables.

## ● Cancer Mortality Rate Ratios

- States are categorized as low, medium and high pesticides consumption.
- First tertile as reference.



# Results- Pattern analysis

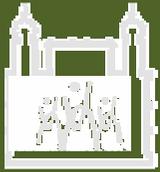
69,52%

Rotated component matrix

VARIABLES	FAC1	FAC2
per capita expenditure with pesticides	0.625	0.090
access to treated water	0.622	0.196
domestic wastewater treatment	0.943	0.091
per capita consumption of refrigerators	0.933	0.254
per capita consumption of leguminous vegetables	-0.811	0.018
per capita consumption of fruits	0.207	0.944
per capita consumption avian meat	0.329	0.828
per capita consumption egg	0.311	0.807
per capita consumption chick	0.107	0.609
per capita consumption milk grade	0.718	0.252
Human development Index	0.889	0.278
Per capita consumption of tobacco	0.905	0.289
mortality rates for prostate cancer	0.461	0.793
mortality rates for colon cancer	0.885	0.336
mortality rates for stomach cancer	0.813	0.374
mortality rates for NHL	0.840	0.280
mortality rates for multiple myeloma	0.637	0.665
mortality rates for leukemia	0.706	0.360
mortality rates for brain cancer	0.776	0.546

VARIABLES	FAC1	FAC2
per capita expenditure with pesticides	0.103	0.741
domestic wastewater treatment	0.383	0.813
per capita consumption of leguminous	-0.187	-
per capita consumption of vegetables	0.936	0.032
per capita consumption of fruits	0.927	0.006
meat	0.853	0.123
per capita consumption milk	0.385	0.751
Human development Index	0.519	0.818
per capita consumption of tobacco	0.851	0.31
mortality rates for penis cancer	0.629	0.232
cancer	-0.625	0.402
mortality rates for male breast cancer	-0.137	0.876

59,93%



# Results- Linear regression analysis

	Unadjusted model				Adjusted Model				
	$\beta$	p	r	r <sup>2</sup>	$\beta$	p	r	r <sup>2</sup>	p-model
Prostate (C61)	4.73	0.019	0.69	0.48	2.91	0.037	0.97	0.94	0.019
Soft Tissue (C49)	0.37	0.015	0.71	0.56	0.20	0.031	0.98	0.96	0.010
Laryhnx (C32)	2.24	0.062	0.56	0.33	1.26	0.004	1.00	0.99	0.000
Leukemia (C91-C95)	2.10	0.021	0.68	0.46	1.43	0.010	0.98	0.97	0.006
Lip (C00)	0.09	0.010	0.73	0.54	0.08	0.074	0.89	0.79	0.199
Esophagus (C15)	5.69	0.046	0.61	0.37	3.71	0.062	0.96	0.93	0.030
Lung (C34)	11.53	0.089	0.54	0.29	8.15	0.024	0.98	0.91	0.007
Pancreas (C25)	2.26	0.040	0.63	0.39	1.35	0.037	0.98	0.96	0.011





# Results- Cancer mortality rates

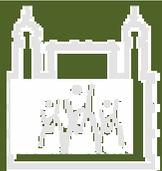
Cancer site (ICD-

Adjusted Mortality

ratio

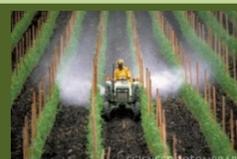
10)	Tertile	Ratio	Mortality Rate Ratio	CI 95%	p-trend
Prostate (C61)	1 <sup>st</sup>	20,55	1,00	-	0,01
	2 <sup>nd</sup>	32,85	1,60	(1,57-1,63)	
	3 <sup>rd</sup>	34,11	1,66	(1,63-1,69)	
Soft Tissue (C49)	1 <sup>st</sup>	0,81	1,00	-	0,04
	2 <sup>nd</sup>	1,39	1,72	(1,56-1,89)	
	3 <sup>rd</sup>	1,56	1,93	(1,75-2,12)	
Larynx (C32)	1 <sup>st</sup>	5,23	1,00	-	0,03
	2 <sup>nd</sup>	12,02	2,30	(2,22-2,38)	
	3 <sup>rd</sup>	11,42	2,18	(2,11-2,27)	
Leukemia (C91-C95)	1 <sup>st</sup>	6,53	1,00	-	0,04
	2 <sup>nd</sup>	10,45	1,60	(1,55-1,66)	
	3 <sup>rd</sup>	12,60	1,93	(1,87-2,00)	
Lip (C00)	1 <sup>st</sup>	0,05	1,00	-	0,05
	2 <sup>nd</sup>	0,12	2,40	(1,66-3,47)	
	3 <sup>rd</sup>	0,28	5,60	(4,00-7,84)	
Esophagus (C15)	1 <sup>st</sup>	11,47	1,00	-	0,07
	2 <sup>nd</sup>	18,57	1,62	(1,58-1,66)	
	3 <sup>rd</sup>	27,48	2,40	(2,34-2,45)	
Lung (C34)	1 <sup>st</sup>	21,84	1,00	-	0,07
	2 <sup>nd</sup>	44,67	2,05	(2,01-2,08)	
	3 <sup>rd</sup>	60,20	2,76	(2,71-2,80)	

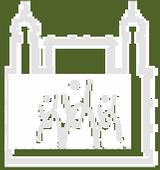




# Discussion

- Difference in time\_ latency period.
- Unviable information about sales of specific pesticide class. Unknown the most pesticides used in Brazil in 1985.
- Restriction to ascertain cause –effect.
- This studies are in accordance with several epidemiologic studies.
- Significant correlations.
- Mortality rates are significant higher in states with elevate and moderate pesticides sales per capita.





# Conclusions

Results of the present study indicate that pesticide sales per capita in 11 Brazilian states, in 1985, showed **high to moderate correlation with prostate, soft tissue, larynx, leukemia, lip, and esophagus cancer mortality rates**, in the same states, a decade further. Moreover, the states aggregated in the **2nd and 3rd tertiles of pesticide sales per capita displayed significant higher mortality for all cancer types** included in this study when compared to states placed in the 1st tertile, as evidenced by the mortality rate ratios. For most of the cancer sites, mortality rate ratios suggested the occurrence of a **dose–response pattern across tertiles.**





# Obrigada

Aos colaboradores:

Sergio Koifman- ENSP/FIOCRUZ

Paula de Novaes Sarcinelli- ENSP/FIOCRUZ

Josino Costa Moreira- ENSP/FIOCRUZ

Rosalina Jorge Koifman- ENSP/FIOCRUZ

Armando Meyer- IESC/UFRJ