

# Trends and Seasonality of osteoporotic hip fractures incidence in Portugal, from 2000 to 2004

Carla Oliveira <sup>(1)</sup>

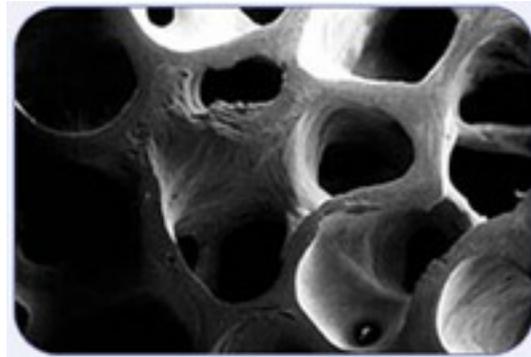
Maria de Fátima Pina <sup>(1,2)</sup>

<sup>(1)</sup> Instituto Nacional de Engenharia Biomédica, GeoEpidemiology Group

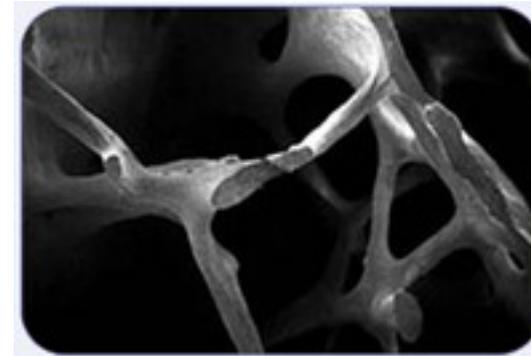
<sup>(1,2)</sup> Faculdade de Medicina da Universidade do Porto

# The Context

- Osteoporosis
  - is a disease of the skeleton characterized by loss of bone mass.
- The incidence of osteoporosis is increasing with population ageing worldwide.



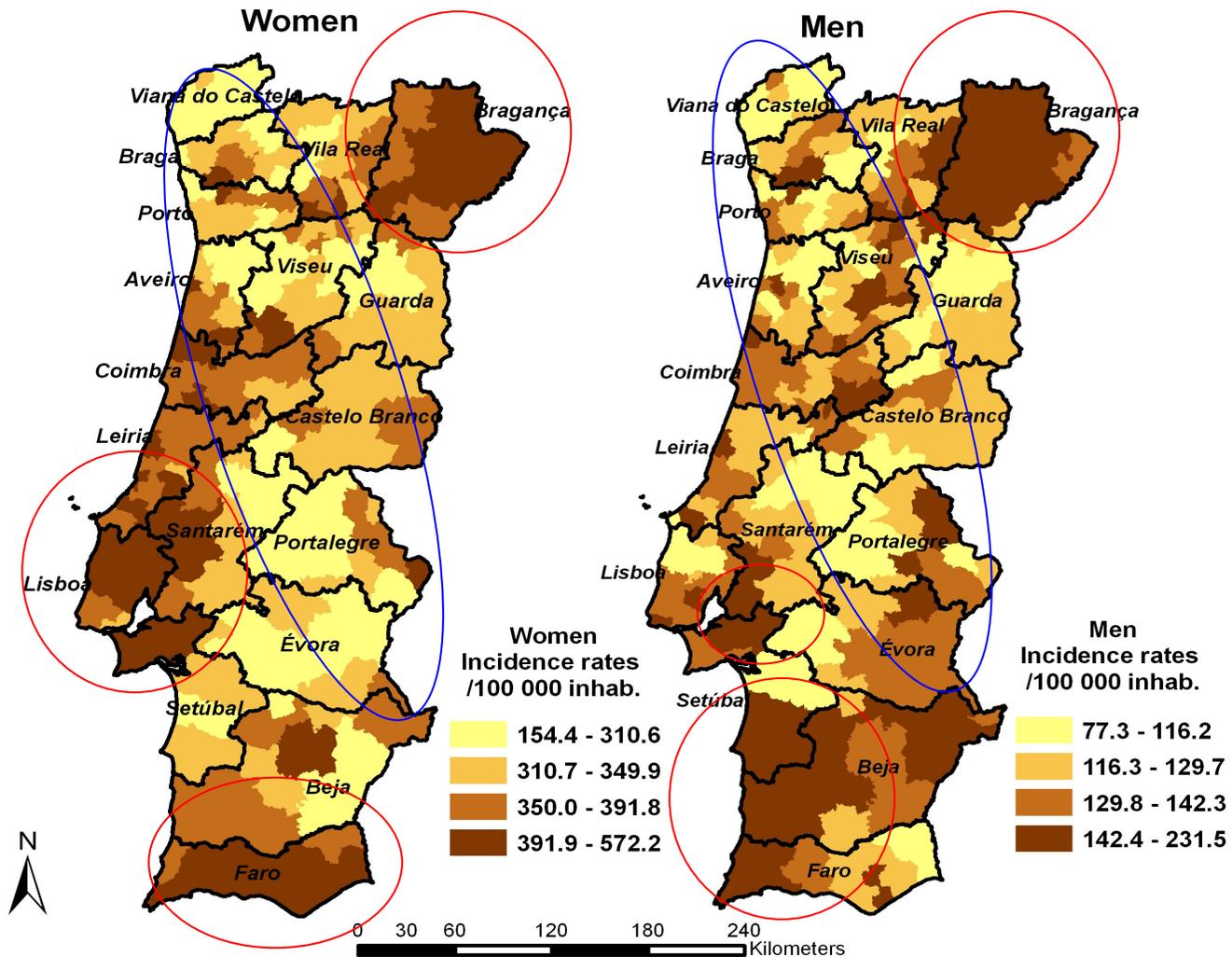
Normal bone



Bone with osteoporosis

- In epidemiology, a good indicator of osteoporosis is:
  - hip fractures caused by low impact on individuals with age over 49 years old

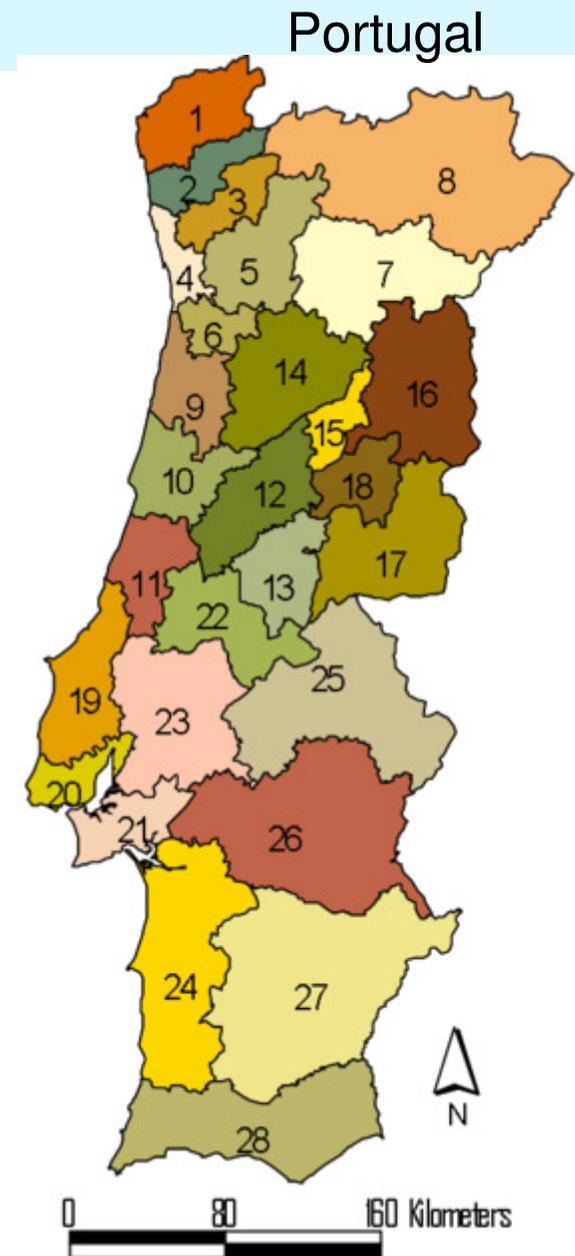
# Hip Fractures in Portugal



PINA MF, Alves S, Barbosa M, Barros H, 2008, Hip fractures cluster in space: an epidemiological analysis in Portugal. *Osteoporosis Int.* in press. Online first: <http://dx.doi.org/10.1007/s00198-008-0623-1>

# Objective of this work

- Analyze time series of hip fractures to:
  - Identify if there is **trend** and **seasonality** of hip fractures
    - by gender?
    - by geographic units?
    - by gender and geographic units?
  - **forecast** the hip fractures cases in the coming years?



# Materials

- Softwares:
  - The statistical program **R<sup>TM</sup>**.
  - To map: **ArcGIS<sup>TM</sup>**.
  - To manipulate the databases: **ACCESS<sup>TM</sup>** , **SPSS<sup>TM</sup>** and **EXCEL<sup>TM</sup>**.
- Database
  - National Hospital Discharge Register
    - **demographic information**: age, sex, place of residence,...
    - **clinical information**: cause of admission, diagnosis and clinical procedures, encoded by ICD-9-CM.



# Materials

Patients registers were included for individuals:

- > 49 years old
- Diagnosis:
  - hip fractures (ICD9-CM 820.x)
- Cause:
  - fractures caused by low impact (codes\* E849.0, E849.7, E880,...).
- Place of residence:
  - Continental Portugal (Azores and Madeira archipelagos excluded)
- Excluded: all cases with bone cancer, and all re-incident cases (when they were possible to identify)



INEB - Instituto de Engenharia Biomédica

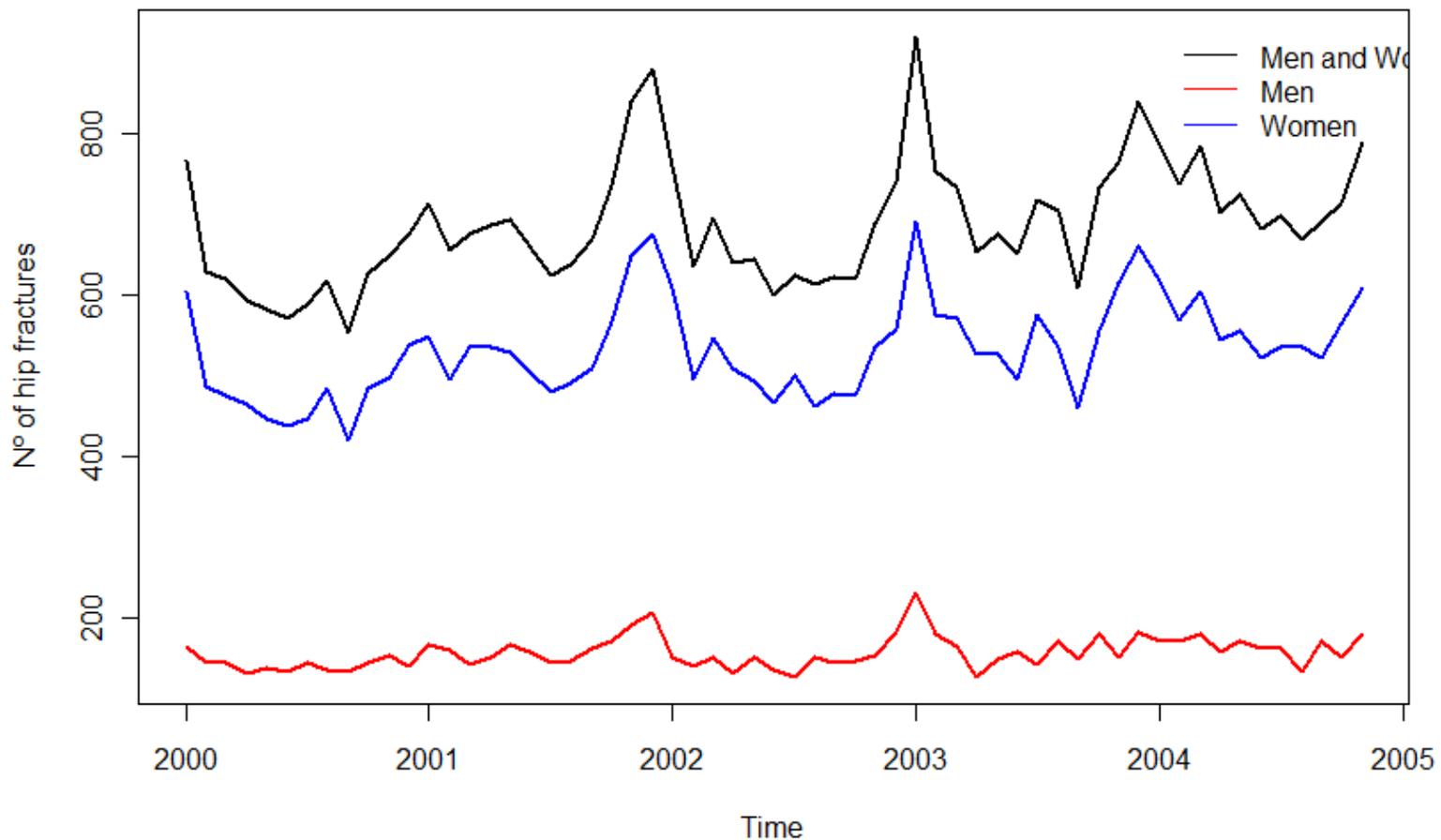


# Methods

- (1<sup>st</sup>): Classical Decomposition Method
  - decomposing the time series into seasonal, trend and random components.
- (2<sup>nd</sup>): Holt-Winters forecasting model
  - uses a exponential smoothing with trend and seasonality components included in the model.
- (3<sup>rd</sup>): Box-Jenkins forecasting model
  - ARIMA – which fits a mixed autoregressive integrated moving average to a given set of data.
  - SARIMA - a variation of ARIMA which included seasonality in the model.

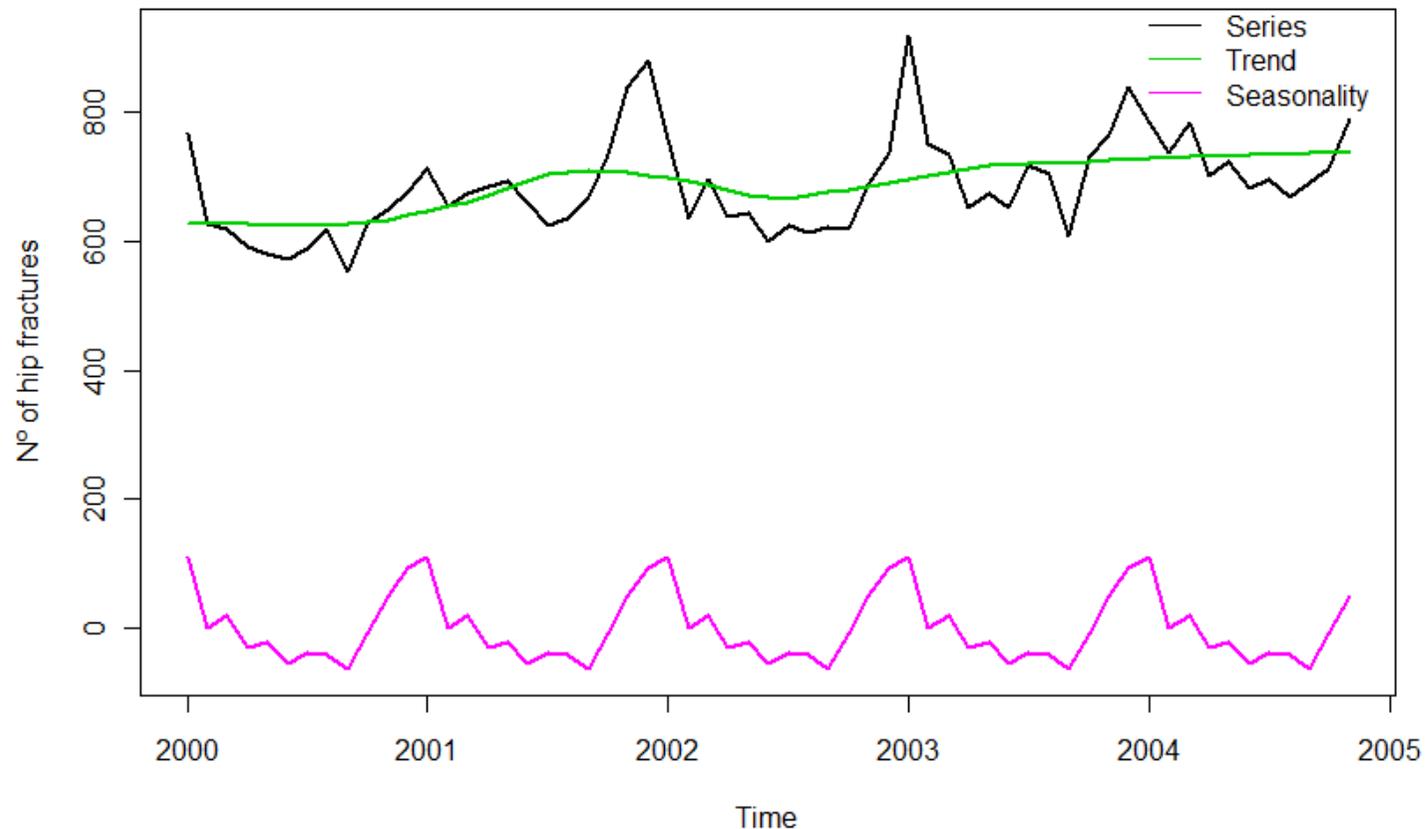
# Preliminary Descriptive Results

- Number of **Hip Fractures**, from 2000 to 2004, in Portugal, (**total** and by **gender**)



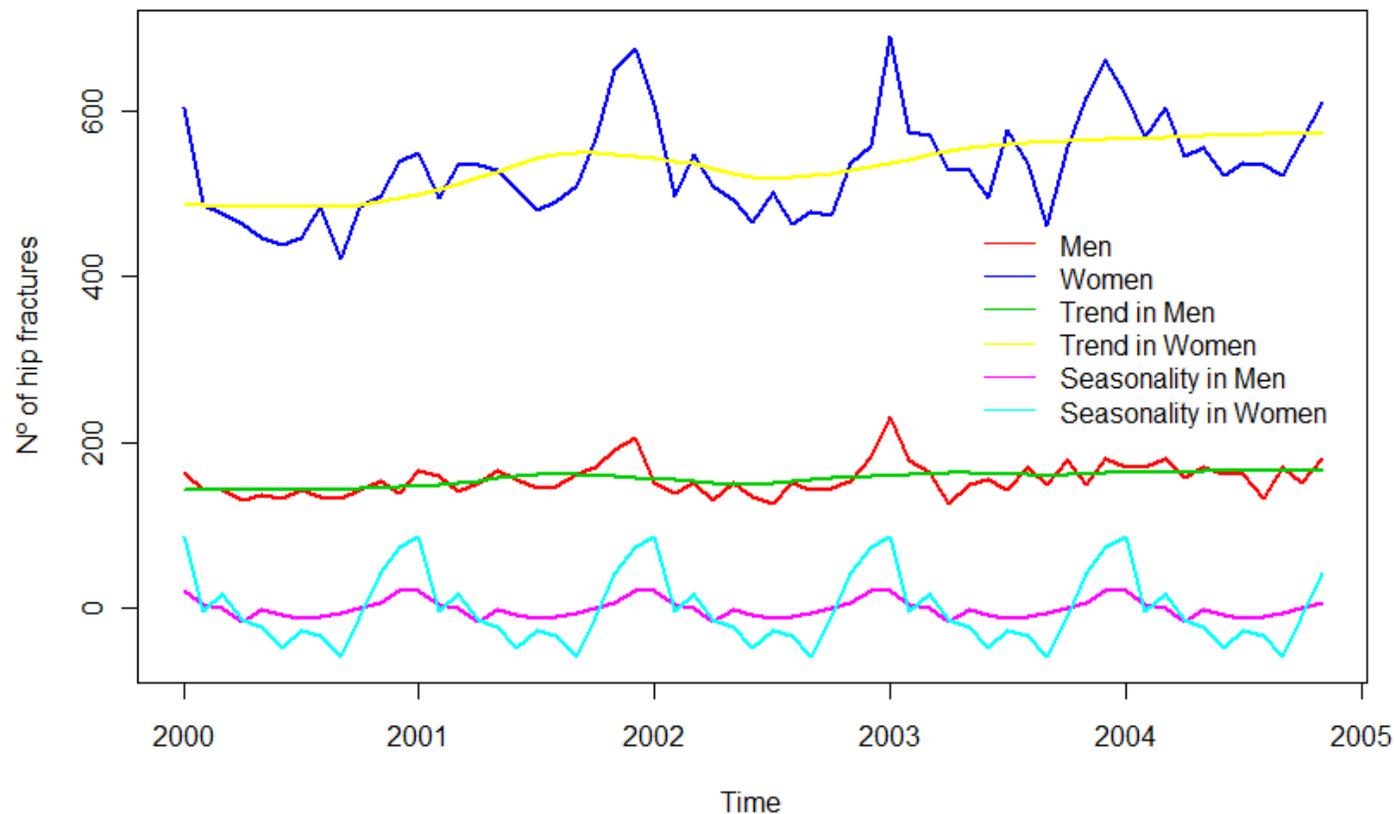
# Preliminary Results: 1st Method

- Estimation of the **Trend** and **Seasonality** in Hip Fractures, from 2000 to 2004, in Portugal



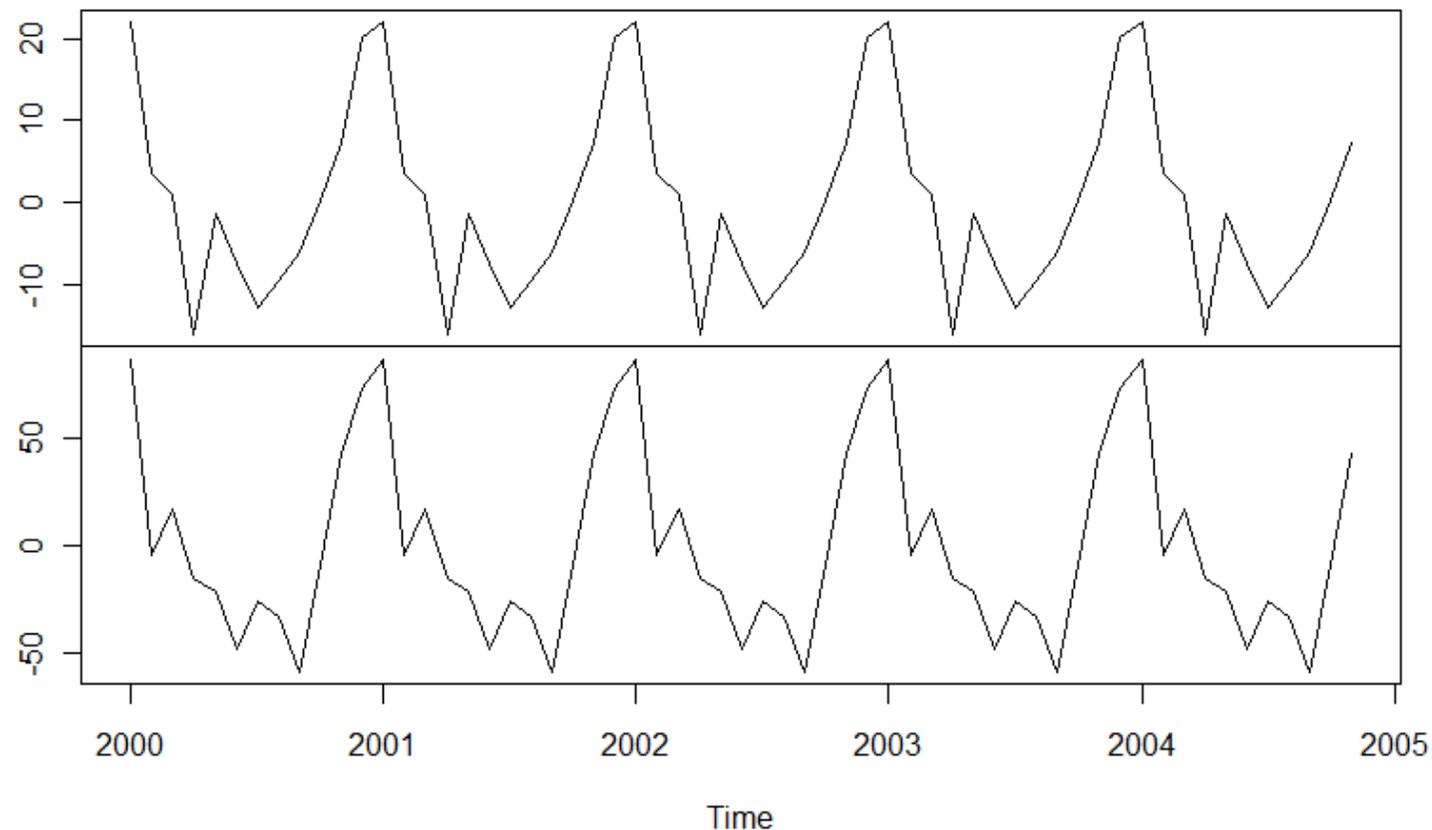
# Preliminary Results: 1st Method

- Estimation of the Trend and Seasonality in Hip Fractures, from 2000 to 2004, in Portugal, by **Men** and **Women**



# Preliminary Results: 1st Method

- Estimation of the Seasonality in Hip Fractures, from 2000 to 2004, in Portugal, by **Men** and **Women**

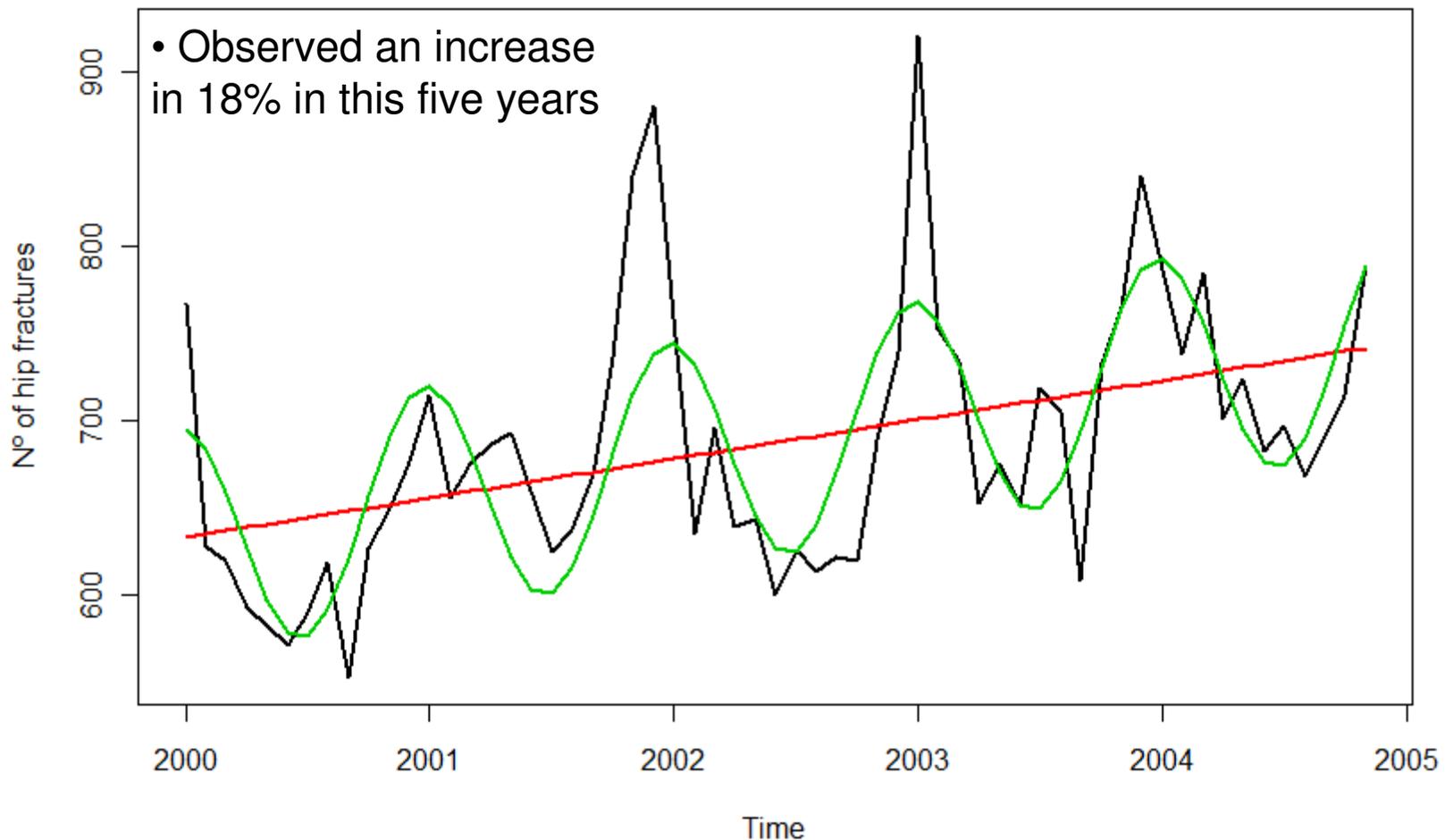


M  
e  
n

W  
o  
m  
e  
n

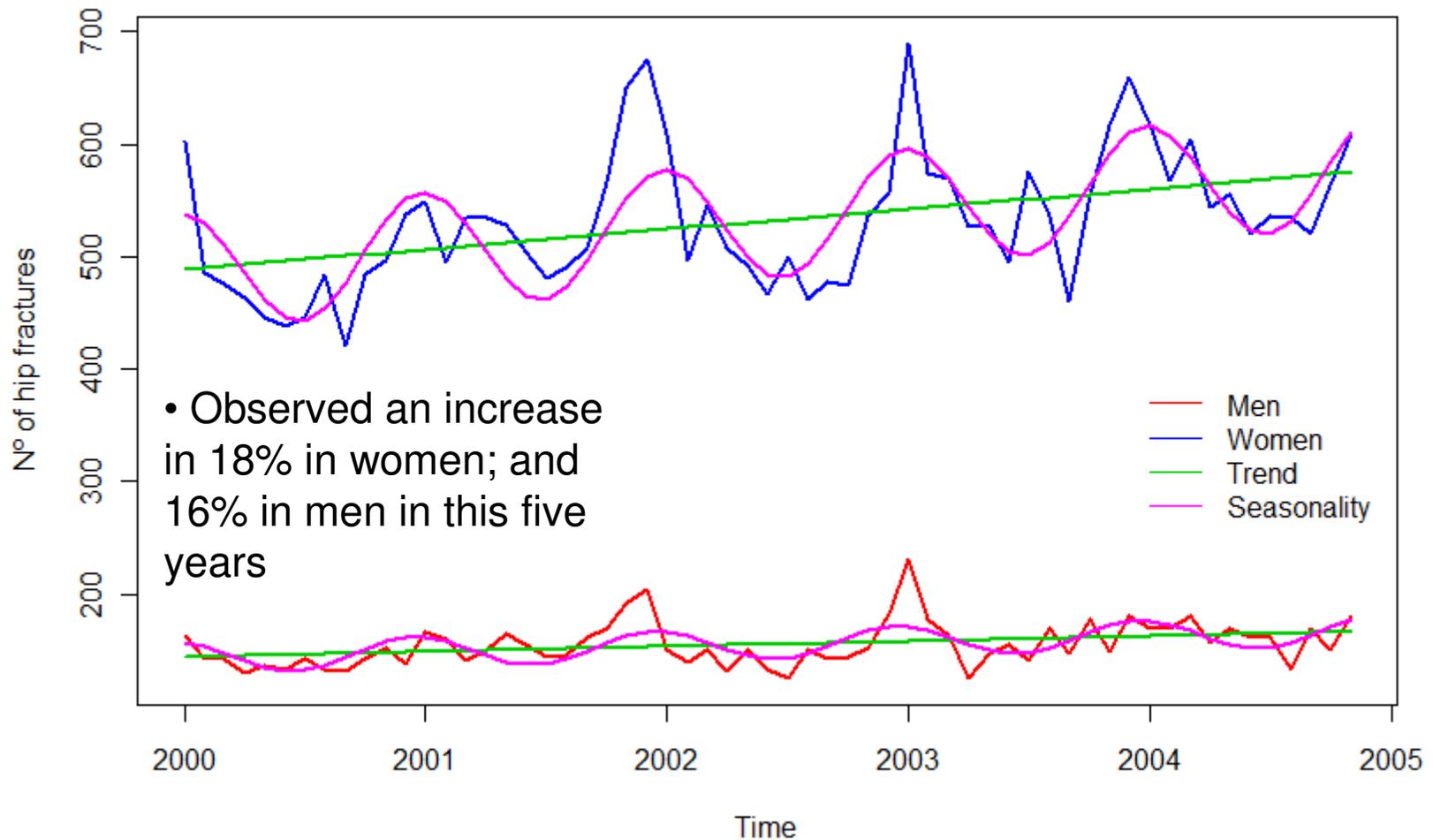
# Preliminary Descriptive Results

- Hip Fractures, from 2000 to 2004, in Portugal
  - Others methods: Linear and sigmoid Function



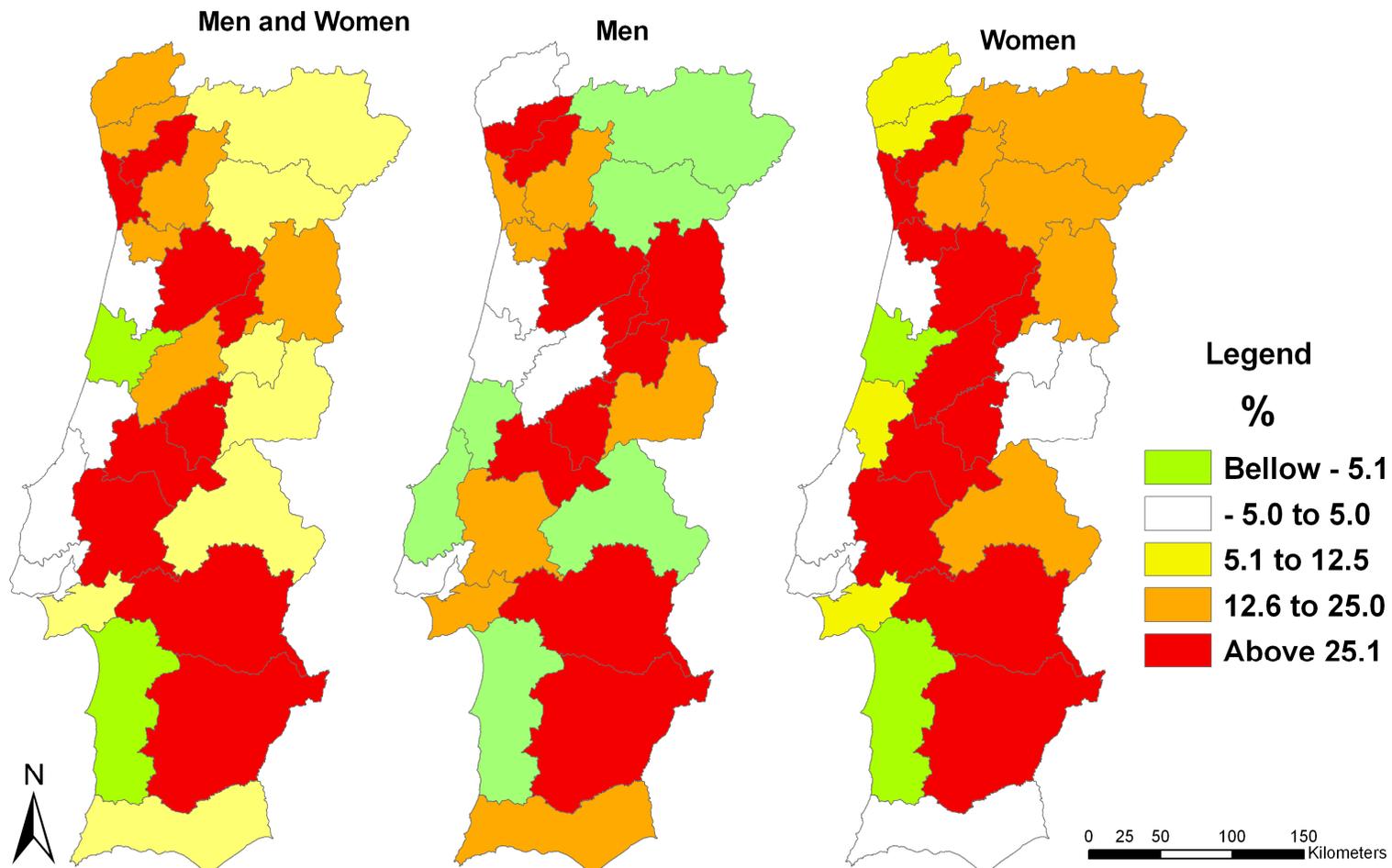
# Preliminary Descriptive Results

- Hip Fractures, from 2000 to 2004, in Portugal
  - Others methods: Linear and sigmoid Function



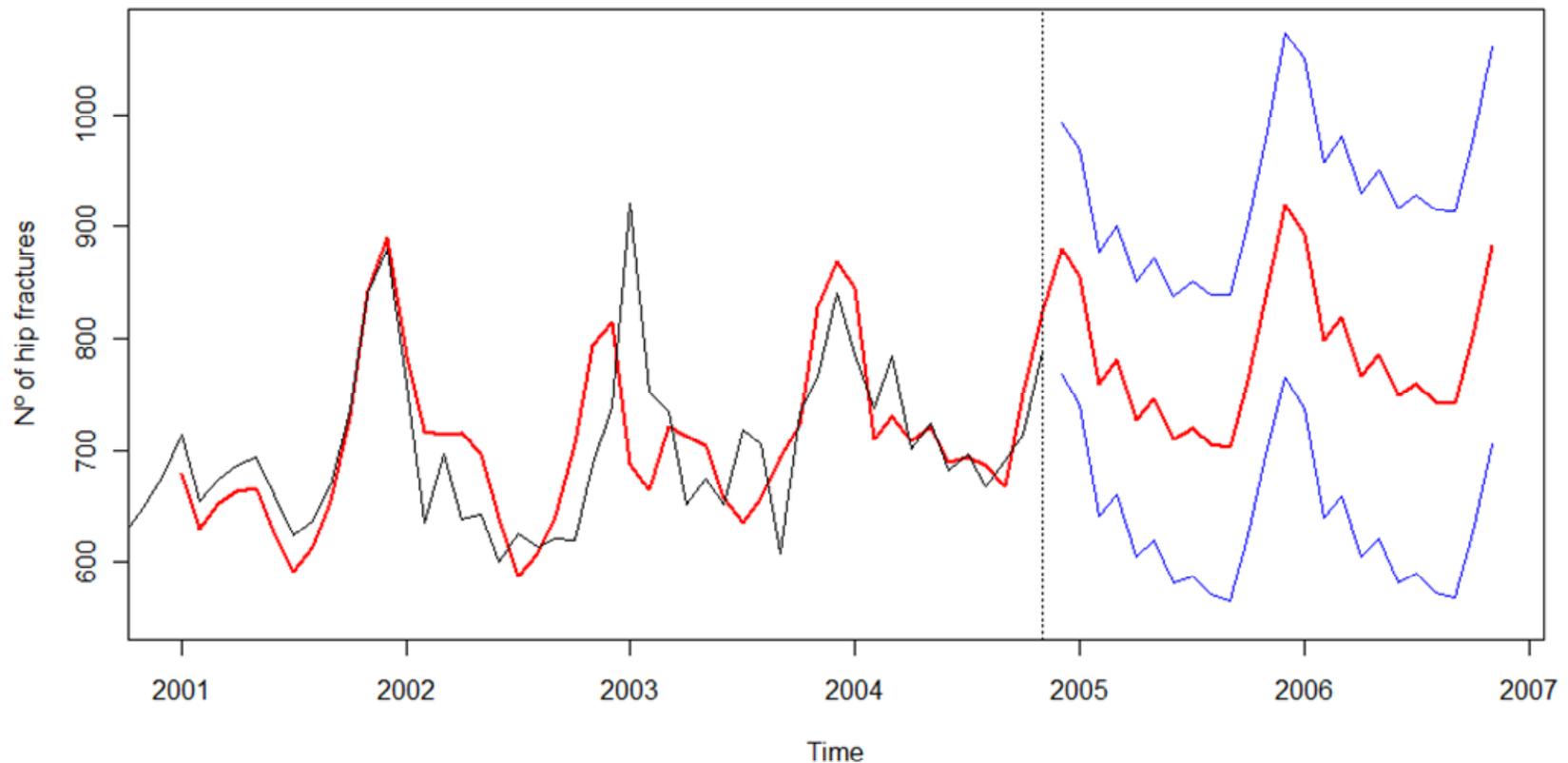
# Preliminary Descriptive Results

- Trend for Hip Fractures, from 2000 to 2004, in Portugal by different regions



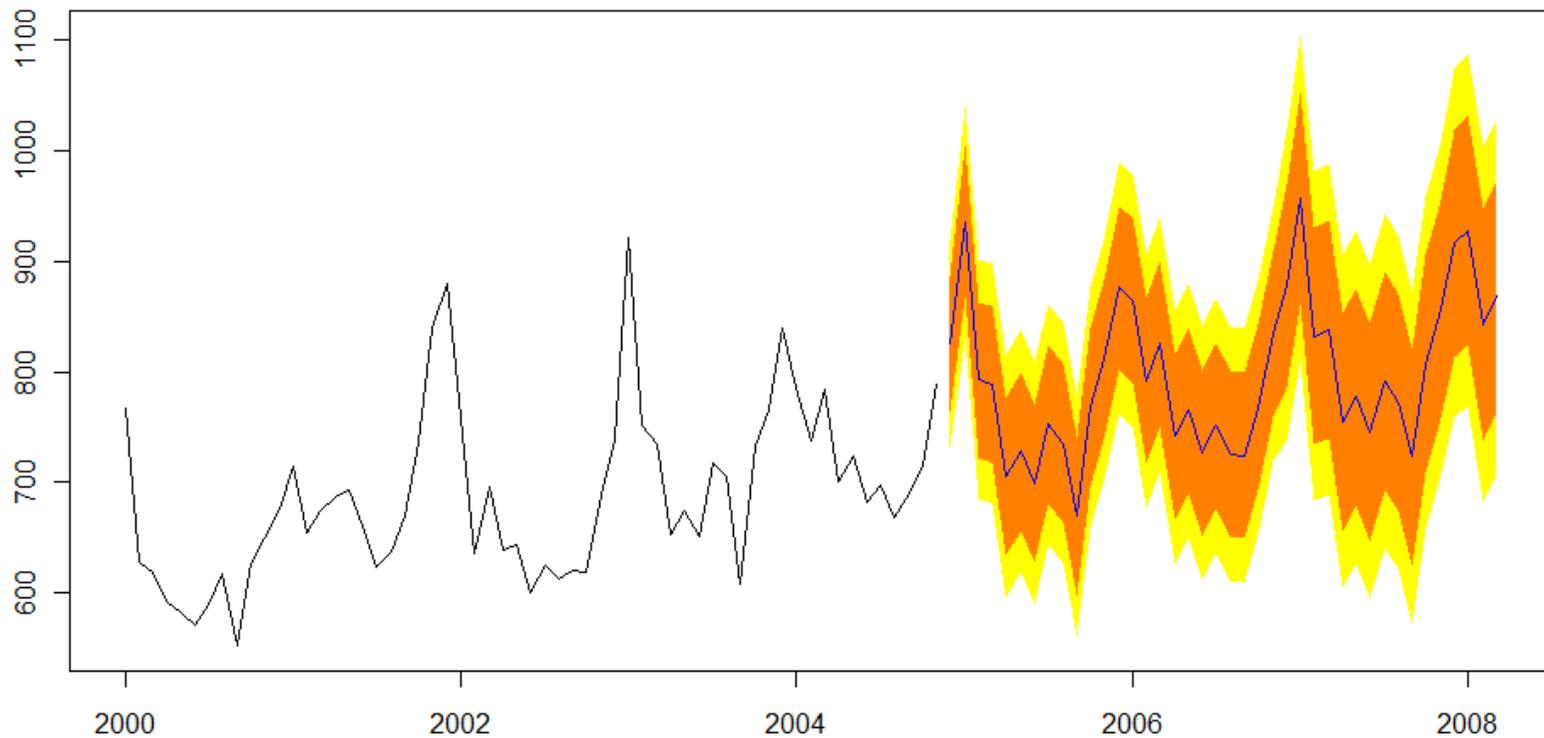
# Preliminary Results: 2nd Method

- Forecast, using the **Holt-Winters** method, of **Hip Fractures**, from 2005 to 2007, in **Portugal**



# Preliminary Results: 3rd Method

- **Forecast**, using the **SARIMA(1,1,1)(1,1,0)12** method, of Hip Fractures, from 2005 to 2008, in Portugal



# Discussion

- There is **seasonality** in hip fractures.
- There is a small **tendency** of increase of hip fractures between 2000 and 2004.
- For men the lower incidence is in the beginning of summer while in women is in the end of summer.
- The highest incidences, both for men and women, are in **Winter**.
- The model predicts that the increase will continue in the coming years.



INEB - Instituto de Engenharia e Biomédica



# Discussion

- It seems to have two different moments in the epidemic of hip fractures in Portugal:
  - The regions with highest incidence rates are with a tendency of decrease in the number of cases of hip fractures, similar to what is being report for other European countries.
  - The regions with lower incidence rates are with a tendency of strong increase in the number of cases of hip fractures.

# Acknowledgments

- FCT  Fundação para a Ciência e a Tecnologia  
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR
- INEB – Instituto Nacional de Engenharia Biomédica  

- Serviço de Epidemiologia da Faculdade de Medicina da Universidade do Porto



INEB - Instituto de Engenharia Biomédica

