Socioeconomic deprivation and congenital anomalies: spatial patterns in Portugal, 2010–2021

Carlos Aniceto[1], Paula Braz[1], Luis Roxo[1], Ausenda Machado[1], Carlos Matias-Dias[1]

[1] Department of Epidemiology, National Institute of Health Doctor Ricardo Jorge, Lisbon, Portugal

Background/Objectives

- **Congenital anomalies (CA)** include **structural/functional malformations, chromosomal anomalies, and other genetic diseases** arising during intrauterine life.

- Although a **link between socioeconomic inequalities and CA** is suggested **evidence in Portugal remains scarce**.

- Analyze the **geographic distribution of CA prevalence** (PCA) and the **European Deprivation Index** (EDI), and their **spatial association** in mainland Portugal, using national CA registry data from **2010-2021.**

  - Calculate the CA prevalence by municipality;

  - Indicator of spatial concentration of CA prevalence and EDI.

Methods

- Observational ecological study.
- Study period: **2010-2021** (2010-2015 and 2016-2021).
- Study population: cases reported to the national CA registry in **mainland Portugal**.
- Sample: **13971 CA cases**.
- Variables: **CA cases** in mainland Portugal, all births in mainland Portugal, disaggregated by the mother's municipality of residence, EDI Portuguese version, based on the 2011 census (Ribeiro et al. 2017).
- **Statistical and spatial analysis methods:**
  - **(i) Spatial Empirical Bayes method:** to estimate the prevalence of CA
  - **(ii) Spatial cluster analysis:**
    - Indicator of spatial concentration of CA prevalence and EDI, using the **bivariate Local Moran's I**.

Results

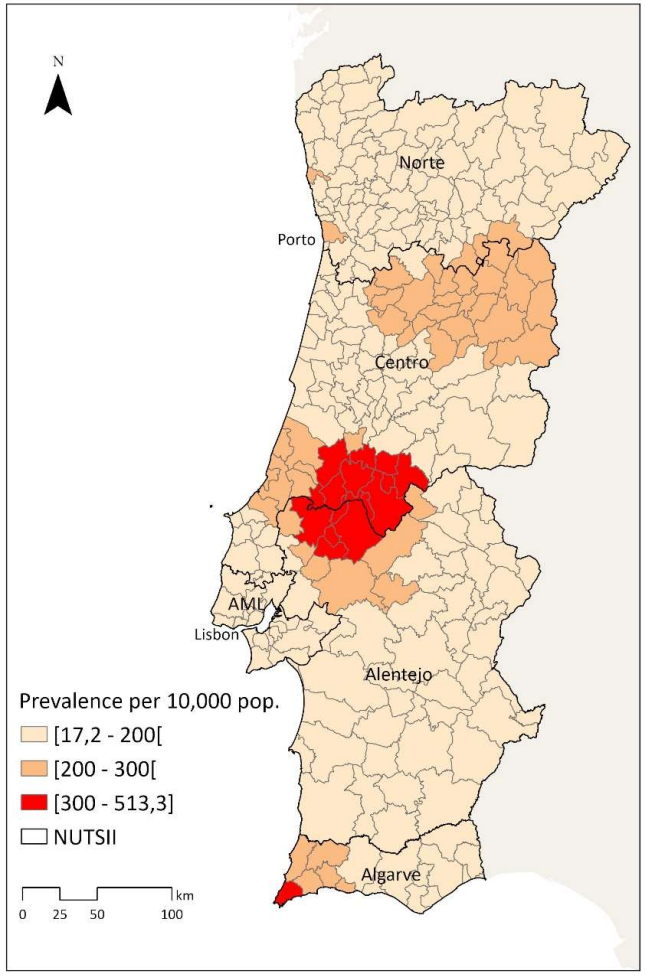

Fig.1. CA prevalence by municipality, 2010-2015

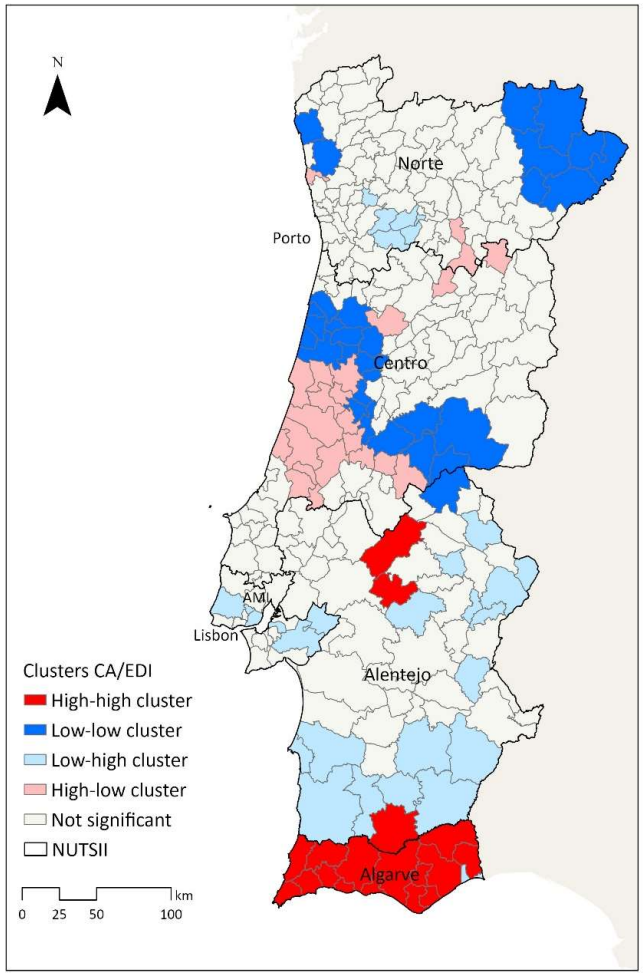

Fig. 2. Spatial concentration indicator of CA prevalence and EDI, 2010–2015

2010–2015

- **Higher CA prevalence** in municipalities of the **Center, Alentejo and Algarve regions** (PCA >300 cases/10^4 all births).
- **Lower prevalence** in municipalities of the **North region** (PCA <200 cases/10^4 all births).
- **Cluster of high PCA and EDI values** (p≤0.05): in municipalities of the **Algarve and Alentejo** region.
- **Clusters of low PCA and EDI values** (p≤ 0.05): **North and Center regions**.

Results

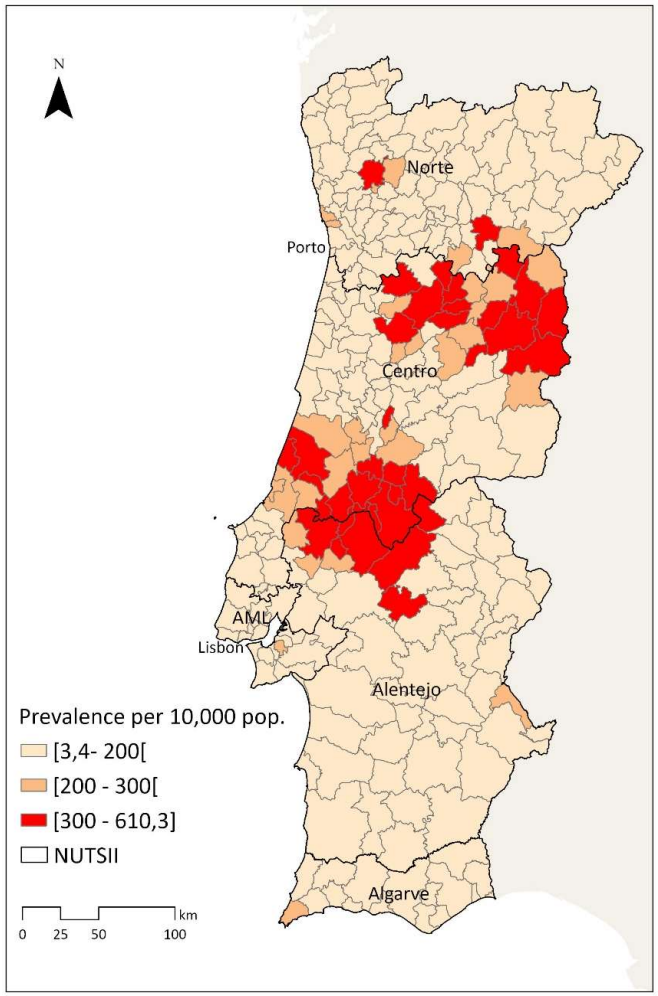

Fig.3. CA prevalence by municipality, 2016-2021

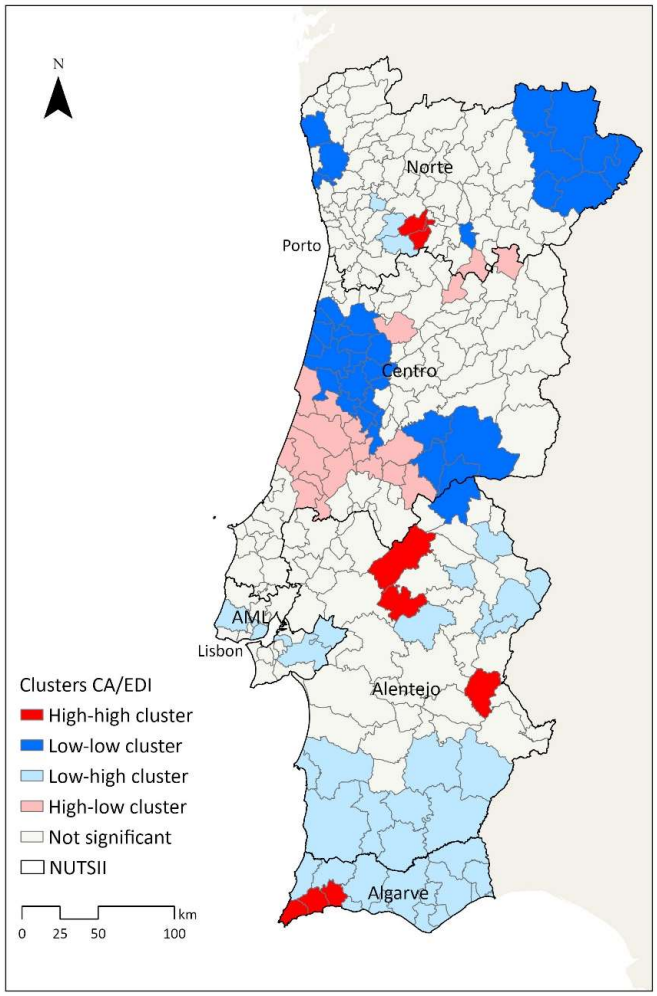

Fig.4. Spatial concentration indicator of CA prevalence and EDI, 2016–2021

2016-2021

- **Higher CA prevalence** in municipalities of the **Centre and Alentejo regions** (PCA >300 cases/10^4 all births).
- **Lower prevalence** in municipalities of the **Northern region** (PCA <200 cases/10^4 all births).
- **Cluster of high PCA and EDI values** (p≤0.05): in municipalities of the **Algarve, Alentejo and North** region.
- **Clusters of low PCA and EDI values** (p ≤ 0.05): **North and Center regions**.

Discussion/Conclusions

- A consistent **concentration of high CA prevalence associated with greater socioeconomic deprivation** was found in the **Algarve region** across both periods.
- The **bivariate Local Moran's I indicator** is a method that identifies spatial clusters and outliers, assessing the association between the prevalence values of PC and the EDI.
- **Ecological study** with an analytical component; it does **not allow inferences at the individual level**.
- The application of spatial autocorrelation and association methods proved effective for **identifying and comparing the geographic patterns of CA and EDI**.
- Findings highlight the need for **public health interventions** targeting **vulnerable populations** and CA prevention.