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GIS Data Model to analyze mortality trends in Sardinia (1992-2015).

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The aim of this study was to analyze the trends in municipal mortality in the island of Sardinia, Italy, and the relationship with a deprivation index in order to identify geographical mortality patterns and municipalities with a high risk of death.

For this purpose, we have created a GIS Data Model with mortality, population, and socioeconomic data. Two different data sources have been used:

1. In order to calculate standardized mortality rates, a comprehensive and complete database has been created from data provided by the Italian National Statistical Institute (ISTAT).
   Individual death entries for the period 1992-2015, broken down by municipality and sex, were used as case source.
   Municipal populations, broken down by age group (20 five-years groups) and sex are obtained for each year. The person years for each period were calculated by adding the population of each year.
   To calculate the number of expected cases, overall Sardinian specific age group, sex and period mortality rates were multiplied by each municipal person-years for the same age, sex and period pattern. Standardized mortality ratios (SMRs) were calculated as the ratio of observed to expected deaths.
   Smoothed municipal relative risks (RRs) with their corresponding 95% credibility intervals, were calculated using the conditional autoregressive model proposed by Besag, York and Mollie. The Bayesian estimation of the models was obtained using Markov Chain Monte Carlo (MCMC) simulation methods.
   We have used the ISTAT shapefile with municipal administrative boundaries (2016), using the reference system ED1950 UTM Zone 32 and taking into account in the analysis the changes in the municipal boundaries during the study period.

2. On the other hand, we used the 2001 deprivation index created by Caranci et al [1] as indicator of socioeconomic level.
   This index classifies municipalities into five levels, according to several variables: (i) low level of education, (ii) unemployment, (iii) non-home ownership, (iv) one parent family and (v) overcrowding.
   This classification is based on the quintiles of the distribution of factor scores, where level one municipalities are the richest ones and level five municipalities the least rich ones.

1. Caranci N, Biggeri A, Grisotto L, Pacelli B, Spadea T, Costa G. L'indice di deprivazione italiano a livello di sezione di censimento: definizione, descrizione e associazione con la mortalità. Epidemiol Prev 2010; 34 (4): 167-176

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DATASET

Simple Feature class: COM2016_E50			Geometry: Polygon		
Field name	Data type	Allow nulls	Default value	Domains	Length
FID	Object ID				
SHAPE	Geometry	Yes			
COD_REG	Long	No			
COD_CM	Long	No			
COD_PRO	Long	No			
PRO_COM	Long	No			
COMUNE	Text	No			100
SHAPE_Length	Double	Yes			
SHAPE_Area	Double	Yes			

RELATIONSHIP CLASSES

Table: Municipal Data			
Field name	Data type	Allow Nulls	Length
OBJECTID	Object ID	Yes	
PRO_COM	Long	No	
COMUNE	Text	No	100
OBSERVED_CASES	Long	Yes	
REFERENCE_RATE	Double	No	
EXPECTED_CASES	Double	Yes	
SMR	Double	Yes	
POPULATION	Long	No	

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Relationship class: Municipal Data	
Type Composite Forward Cardinality 1-1 Notification Forward	Label: Municipal_to_COM2016 Backward Label: COM2016_to_Municipal
Origin Feature Class: COM2016_ED50	Destination Table: Municipal Data
Primary key: PRO_COM Foreign key: PRO_COM	

Table: Socioeconomic Level			
Field name	Data type	Allow Nulls	Length
OBJECTID	Object ID	Yes	
PRO_COM	Long	No	
COMUNE	Text	No	100
SOCIOECONOMIC LEVEL	Short	No	

Relationship class: Socioeconomic Level	
Type Composite Forward Cardinality 1-N Notification Forward	Label: Socioeconomic_to_COM2016 Backward Label: COM2016_to_Socioeconomic
Origin Feature Class: COM2016_ED50	Destination Table: Socioeconomic Level
Primary key: PRO_COM Foreign key: PRO_COM	

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TOPOLOGY

Feature class	Rank
COM2016_ED50	1

Origin feature class	Topology Rule	Comparison feature class
COM2016_ED50	Must no overlap	
COM2016_ED50	Must no have gaps	