

Survival differences of the oldest old in Sardinia: which, where, why, and what?

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Introduction

Sardinia, for a number of years now, has been the focus of an intense debate on centenarians. Their numbers are higher than elsewhere in Italy (Caselli and Rasulo, 2004) and many of them are particularly concentrated in a small area, featuring sex characteristics that have sparked widespread curiosity among demographers, geneticists, gerontologists and clinical doctors whose task it is to identify the genetic code map (DNA).

Certain scholars are of the opinion that the existence of a greater or a lesser number of centenarians largely depends on mortality features between 80 and 100 years and in particular on mortality for circulatory diseases (Vaupel et Jeune, 1995; Passarino *et al*, 2002; Robine and Paccoud, 2004). This study aims to cast light on our knowledge of elderly mortality differentials in Sardinia, and attempts to verify this hypothesis. To do so, an analysis is conducted of age and sex mortality trends over time at province and commune level. As the need is felt to also provide some answers, the analysis includes mortality by cause of death.

In particular, section one describes the data and methodology used. Section two analyses outcomes of geographical differences observed during the period in question. For the regional and province level analysis an indicator that is the mirror image of morality is used: life expectancy at different ages. For differences at communal level a spatial analysis of standardised elderly mortality rates is conducted (SMR for over 80-year olds) for total mortality and by cause of death. Hence, by applying a smoothing process, data for the different communes can be aggregated according to those characteristics that identify geographical continuity. In section three focus is given to the analysis of geographical and gender differentials taking causes of death that generate the observed differences. Section four discusses the principal results.

1. Data and methods

Data regarding deaths are available for each geographical level (by commune, province and region), by single age and calendar year since 1975. Complete life tables were constructed up until 99 years old, for the four Sardinian provinces for 1975-77, 1978-80, 1981-83, 1984-86, 1987-89, 1990-92, 1993-95 and 1996-97, 1998-2000. Regarding the 377 communes (municipalities) reference is made to standardised rates (SMR for over 80-year olds) for 1981-89 and 1990-1994. Mortality by cause refers to deaths for 1975 to 2000.

Methodology regards methods used to: construct life tables, with a particular regard for mortality probabilities for the oldest old (estimated with the Kannisto variant logistic function, KVLFF); mortality and survival indicators used in the analysis; spatial analysis methods used to define homogenous geographical areas for mortality among the old (Kernel method).

2. Mortality and Survival in Sardinian provinces and communes for the oldest-old

First of all, this section compares Sardinian life expectancy at 0 and 80 and at 100 years with average life expectancy for other regions and Italy. Results are similar to the Italian average for life expectancy at birth while, at 80 and 100 years, survival for Sardinian men is higher and that for women slightly lower than national values.

At province level taking the four Sardinian provinces, Sassari (North of the island) and Nuoro (Centre-east) from the '70's until today have a higher life male expectancy at 80 years. In Sassari, however, unlike Nuoro, female life expectancy at the same age is lower than elsewhere. Taking ISTAT data on centenarians from the last census, Nuoro is the province with the largest number of centenarians, followed by Sassari, although in Nuoro the number of male centenarians is much higher (1,4 per 10000 compared with 0,9 in Sassari) and almost double the regional average (0.8 per 10000). Focusing on the province level analysis, separate by sex, the hypothesis that the lowest mortality areas after 80 years are those with the highest number of centenarians is more or less confirmed for Nuoro.

As the province embraces a variety of communes that are often quite different from each other, subsequent population heterogeneity hinders any explanatory analysis. Hence the utility of a spatial analysis of mortality characteristics for over 80-year olds using a communal indicator. Given the availability of SMR for 80 and over year olds, for men and women separately, for each of the 377 communes and for two periods, by applying a smoothing procedure the existence of adjacent areas with similar mortality can be detected. For men and women the area with the lowest mortality includes communes along the East of the island, from North to South, involving communes in Sassari, Nuoro and Cagliari. Within this relative low mortality zone a number of disadvantaged communes emerge in Nuoro and Sassari, along or near the coast. By comparing men and women, the geographies of the lowest mortality only partly coincide. The most notable differences regard South-west communes in Cagliari that on average have relative lower female mortality, but higher male mortality.

A 2001 analysis of Sardinian centenarians as part of the AKEA1 project (Deiana et al, 1999) showed that the area with the largest number of centenarians was to be found among internal communes to the Centre-north of the island comprising the provinces of Nuoro, Oristano and Sassari, completely excluding communes in the province of Cagliari. An analysis of the geography of mortality does not state that the lowest mortality areas are only inland. This result calls for caution when hypothesising a correspondence between low mortality and a high number of centenarians.

3. Mortality by cause

The main findings show, as is to be expected, that apart from some rare exceptions the geographic features of over 80-year old mortality for circulatory diseases is similar to total mortality (section 3.1). The main exceptions are coastal communes in Cagliari, with an on average higher total mortality, while included in the area of relatively lowest mortality for this

cause. By considering ischemic heart diseases separately, these communes are again found in the lowest mortality area, the geography for these being exactly the same as those for cancers. Cancers also help penalise the small area of highest mortality in Nuoro, while the disadvantage in communes along the west coast of Oristano and Sassari is caused by higher mortality for circulatory diseases. Moreover, among North-west communes in Sassari a further effect is caused by higher mortality from cancer. Higher mortality from cancers is found among communes in the North-west (Gulf of Asinara, Sassari) and South-west (Carbonia, Cagliari), where there are several coal mines.

Biologists and geneticists involved in this research agree on the importance of the fact that communes in Nuoro with the largest number of centenarians are those where low mortality after 80 years is due to a relatively low mortality for cardio-circulatory diseases, and particularly non ischemic diseases, and for certain cancers. Equally important is the fact that elderly mortality for circulatory diseases is lower in Sardinia than in the rest of Italy.

An overview of mortality differences that would also permit a study of more specific causes of death was considered useful and that would re-examine the distances between Sardinia and Italy, between the Provinces of Sardinia and the region as a whole, and between men and women for each province (section 3.2.). Early results are encouraging. Sardinian over 80-year olds are at an advantage compared with Italians for mortality from all causes, apart from cerebral-vascular diseases and infectious diseases of respiratory tract. With regard to these latter two Sardinian women are more at a disadvantage compared with the Italian average than Sardinian men. Similarly, for all other causes, their advantage is less than that of the male counterparts. At a province level, men from Nuoro, especially aged 80-89 years, enjoy the lowest mortality levels for circulatory diseases, apart from ischemic heart complaints, while men from Cagliari are the most disadvantaged for almost all causes. For women, the most advantaged for leading causes are those from Oristano, and the most disadvantaged those from Sassari.

What particularly penalises over 80-year old men regardless compared with women, be it in Sardinia or elsewhere, is mortality from ischemic diseases and from respiratory or digestive tract tumours. Following a province level comparison, the narrow gap found in Nuoro between the two sexes, compared with the rest of Sardinia, would appear to be due to a relatively lower male mortality for cancers. In Sassari, however, this reduced gap is to be traced to higher cancer mortality among women.

4. Discussion and concluding remarks

Speculation will be made in this section on the results obtained, with reference to the initial hypotheses described, and providing explanations that will take into account further analyses performed within the AKEA group on centenarians by biologists, geneticists and gerontologists.

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