European Population Conference 2010

Session 31

Infant and child mortality and fertility:
reproduction in 19th and early 20th century Europe

The first phase of life in a coastal town of Sardinia (1866-1920)

Massimo Esposito, Marco Breschi, Stanislao Mazzoni, Lucia Pozzi

University of Sassari

Preliminary draft – Please do not quote

Abstract

In the decades following the National unification mortality rates in the first phase of life showed very different regional trends, even though marked by a generalized considerable reduction. To this respect, the Sardinian experience is particularly interesting: while the mortality rate in the first year of life is generally lower than elsewhere in Italy, it increases in the second year onwards, exceeding the national average and declining slowly in the first half of the 20th century.

Many social, economic, cultural and sanitary factors contribute to such a trend, but it is not easy to evaluate their effects on mortality, especially in Sardinia, characterized by relevant territorial differentials.

The relationships between mortality, socioeconomic and environmental context in Sardinia are still almost unexplored, if we exclude few studies referring to specific areas of the island.

Therefore we propose here an analysis of mortality in Alghero, a coastal town in North West Sardinia. In this work we use a micro-analytical approach, which allows us to reconstruct the life stories of the cohorts born from 1866 to 1920, in order to measure mortality in the first years of life. Combining civil records with other sources available, we will be able to estimate how social and economic conditions of the family as well as short-term changes in context factors influence mortality levels.

Introduction

Mortality in the first years of life in Italy during 19th and 20th century shows an evolution marked by a reduction (with the exception of the years around the first world war and the Spanish flu) experienced by the cohorts born after the National Unification (1861). This trend becomes more accentuated for the cohorts born in the 1890s, characterized by a profound change in mortality structure. Indeed the ratio between infant and child mortality doubled, due to sanitary and environmental improvements, which allowed a substantial reduction of death risks not linked to new-born fragility.

In particular, survival at the 5th birthday, that in the 1860s accounted for 60% of the total, increased to 80% in the 1920s. However, in this context of general reduction, Italian regions present very different patterns, causing geographic differentials sometimes relevant, and not necessarily coincident with the dichotomy North-South. Indeed in Piedmont low mortality levels were observed, but not in the near Lombardy; on the opposite were Calabria and Sicily (Breschi, Fornasin 2007).

Sardinia is an exceptional case, because it shows a mortality model considerably different from that of the other Southern regions: since the first years after Unification the island was the region with the lowest infant mortality rates and, although surpassed by other Northern and Central regions, maintained a mortality level lower than the Italian average.

The island advantage attenuated progressively, and during the first decades of the 20th century a relative worsening took place with respect to other Italian regions (Gatti 2002).

Mortality in the first month was the main responsible for this advantage (Pozzi 2000, Gatti 2002), while post-neonatal mortality rate was near to the national value. Stillbirth rate also was lower than Italian average, as well as in other Southern regions.

However these differences may at least partially depend on the different quality of the data, particularly in the first years following the introduction of Civil Status recording procedures, because of the well known problems in the measure of stillbirth. An erroneous distinction between still-births and deaths in the first hours of life has been pointed out (Raseri 1897; Guzzoni degli Ancarani 1913; Bellettini 1976; Pozzi, Robles González 1996; Pozzi 2000).

Therefore analysis of neonatal mortality and stillbirth in Sardinia, and its territorial differentials should be led carefully; anyway, persistence in the island of high values of survival in the first month of life and constant and low stillbirth allowed us to be sufficiently confident on the corresponding measures of the past.

Characteristics of mortality in the first years of life in Sardinia were described by Coletti in 1908: on the basis of researches personally carried out, he hypothesized that prolonged breastfeeding was

the main reason of low infant mortality; furthermore he stressed the relevance of the infant cares ensured to newborns by the mothers, not attending in extra-domestic works. Then, because of weaning with inappropriate food, new death risks took place, as gastrointestinal diseases, that reduced starting advantages. Moreover second birthday often coincided with the birth of a new baby in the family, who received most of maternal cares. (Gatti 2002).

After one hundred years, these considerations are still unsurpassed because it is very difficult to synthesize the complex case of Sardinia, as well as there are not micro-analytical studies referring to sufficiently numerous populations.

In this paper we propose a micro-analytical study of mortality in the first years of life in the coastal town of Alghero, in North-West of Sardinia, for the cohorts born from 1866 to 1920. The analysis, based on individual and family biographies, aims to specify the determinants of infant survival in Sardinia after the National Unification. In particular, our goal is to break mortality in the first years of life in order to understand different effects of interactions among biological, epidemiological, environmental, economic, social and cultural factors (Derosas, 2002).

Socio-economic and sanitary context

At 1861 Italian census Alghero was the third largest town in the province of Sassari, with 8,419 inhabitants, a figure which had risen to 12,510 by 1921. The territory includes the plain of Nurra, scarcely populated and infested by malaria.

At the turn of the 19th century, Sardinian economy was based on agriculture, sheep-farming (probably the most productive sector), and mining, which employed almost two-thirds of the male population. Farming was not intensive because of the island's under-population, and was traditionally limited to olives, vines, fruits, cereals, and legumes. The cultivation and production techniques were extremely rudimentary, giving rise to poor yields and unprofitable produce. Land use was organized according to a long-standing, semi-feudal land tenure system that was still prevalent in the final decades of the 19th century. Farmers had especially low standards of living, and often were obliged to supplement their modest earnings with additional activities, such as sheep-farming or handicrafts. The quality of these handicrafts was sufficient for domestic consumption only, while most external trading was controlled by outsiders resident on the island (Coda 1977).

The male occupation pattern which emerges from civic marriage records reflects the regional economic structure, with the addition of specifically sea-related activities, given Alghero's coastal location (about 15%-20% of male spouses).

Sardinia was also characterized by very low levels of education: even in 1881, about 75% of the population over six years of age could neither read nor write (MAIC, Direzione Generale di Statistica 1883). Accordingly, illiteracy proves to be a significant social component in Alghero during this period: almost half of the marriage certificates were not signed by spouses, 26% were signed by one spouse only, and a mere 23% were signed by both.

Sanitary conditions in Alghero were extremely alarming: an inquiry drawn in 1860 denounced great problems of water potability and sewer system (Casu 1860). 25 years later, another inquiry pointed out that most of roads was provided with sewage, but water and houses were still "of bad quality and insufficient" (MAIC, Direzione Generale di Statistica 1886).

In Alghero worked 6 doctors, 3 chemists and 3 "authorized" midwifes; according to a law emanated in 1888, in every commune the poor assistance should be guaranteed by the presence of a medical doctor, a midwife, a health officer and a provincial veterinary, but in Sardinia these measures were adopted entirely only after 1900: the island was the region with the lowest obstetrical assistance (Putzolu 1993).

Sources

Demographic data of Alghero are drawn by civil registers of births, marriages and deaths, available from 1866 to 1925. Information held in these acts have been collected in nominative form; we have achieved cross checks to reconstruct individual biographies and family histories. However, because in early period of analysis it was not possible to link some of births to a family, in our study we deal only with those individuals whose family is known, which represent about 70% of the total.

We have gathered several information from these acts, as day, month and year of birth and death, age at death, father's profession; we did not utilize the mother's one, because her professional condition does not allow to define the social structure of population of the past. Most of women, indeed, are qualified generically as "housewife", so we cannot characterize their effective functions. In a few cases we could integrate such data with other sources, as military registers and population census (1921).

For simplicity reasons the population of Alghero was divided into four groups: "farmers", the most numerous one (about half of the total), which includes all the works connected to farming (independently of possession and relation length); "fishermen", which includes also coral fishers (typical activity of the town) and seamen; "artisans", which includes shopkeepers, merchants and employees; "upper class", which includes local noblemen, officials and professional men.

In most of death acts, age at death was expressed in years, months and days, so we could utilize it, or that calculated after linking death act with the corresponding birth act, indifferently (the average difference is less than 13 days).

In reconstructing mortality dynamics we have dealt with the well-known problem of stillbirth measure: it is a complex question, because of real difficulties in classifying stillborns when births occurred without medical assistance. Moreover in Italy, after Unification, was in use the criterion of "legal vitality": a newborn was considered alive if he/she showed viability until the presentation to civil officer (to be done within 5 days after the birth). A newborn who died before birth declaration was classified as a stillborn from a legal point of view.

It was, thus, a criterion contrasting with that of ascertainment of viability at birth. Indeed in the 1870s some provisions of law were issued: newborns dead before registration had to be considered alive if they had given a sign of life at birth. Most likely this difference between law and statistical criteria of data collection caused a variety of behaviours from civil officers.

Also the Alghero population registers show these problems: from 1866 to 1884 4% of the birth acts report the wording "not alive" after verification of necroscopical medical, which made not necessary the presentation to civil office. Such a wording does not allow us to establish if the child was stillborn or born alive and then dead before declaration. Moreover for these newborns it was not compiled the death act, that might help us to solve the problem, at least with respect to age at death.

Afterwards, from 1884 to 1891, although new specific laws were emanated, our difficulties in dealing with stillbirth persist: civil officers tried to apply them using, in addition to wording "not alive", further definitions, as "born and dead during the childbirth" and "stillborn".

However, such a goal was pursued only after 1892: indeed most of birth acts contain the only wording "stillborn", and in the remaining cases of newborns dead before declaration the age at death was reported (expressed in days and hours). Note that in whole period of analysis only 120 death acts for children dead within 5 days were compiled.[1]

Mortality in the first years of life in Alghero

In the last decades of 19th century, with respect to most of European countries, in which mortality rate in the first year was higher than that between the second and the fifth year, in Mediterranean ones, whose transition process started late, these ratios were almost equal (e.g. in France and Belgium the ratio was more than double, in Italy 1.2 times, in Spain close to 1). In Italy strong

[1]We will deal with the problem of stillbirth in a next and more detailed paper.

territorial differentials were measured: in Southern regions the "Mediterranean" component was particularly stressed (Pozzi 2000).

Moreover, we know that the mortality from second year onwards should reduce before that in the first one, but Italian context appears in effects more complex: the first post-unitary generations knew a reduction of the probabilities of death more accentuated in the first year, in comparison to the following ages immediately, while the contrary occurred at the beginning of the 20th century (Del Panta 1994). Among the factors that could have caused regimes with high mortality after the first year of life Woods, Williams and Galley (1993) hypothesize breastfeeding duration and diffusion, hygienic conditions, environmental pollution and also the prevalence of typically infant diseases.

On the other hand, as well-known in the literature, the influence of the social conditions increases the effect of the affiliation to the different social classes, together with decline of mortality. Some studies have recently afforded this subject at the micro-analytical level for some Italian communities (Breschi, Manfredini, Derosas 2004; Breschi, Manfredini, Wells 2004; Derosas 2002 and 2004). These researches have shown a transition from a prevalence of biological determinants to a progressive influence of exogenous factors during the first year of life.

Infant mortality is also influenced by environmental constraints, whose interaction with other factors could determine very different effects on children survival according to social, economic and occupational context.

As for Alghero, we have divided the 55 generation examined (1866-1920) into three groups: 1866-1885, 1886-1905, 1906-1920, in order to homogenize the number of births given the problem of reconstruction of family origin, and to describe the phases in which mortality reduction evolved. Table 1 contains, for each period, the survival probabilities in the first five years of life, disaggregated for age and family socio economic status (SES).

Table 1: *Survival probabilities in the first 5 years of life, Alghero 1866-1920*

	1866-1885					1886-1905				
	TOT	Farmers	Fishermen	Artisans	Upper class	TOT	Farmers	Fishermen	Artisans	Upper class
1st month	925.9	936.7	924.0	901.0	901.8	925.4	925.6	916.5	927.8	969.5
1st year	800.0	801.3	812.8	775.0	857.1	808.8	798.6	802.3	819.9	946.6
24 months	689.7	680.3	700.1	687.3	750.0	705.7	693.5	696.8	713.9	900.8
60 months	605.6	589.6	620.1	613.0	669.6	632.6	617.4	619.6	653.3	801.5
q_0/q_{1-4}	0.75					0.83				

	1906-1920				
	TOT	Farmers	Fishermen	Artisans	Upper class
1st month	946.5	945.1	943.9	951.2	966.3
1st year	837.3	825.0	845.9	843.4	943.8
24 months	753.1	740.0	755.6	767.1	921.3
60 months	690.4	674.3	689.9	713.2	876.4
q_0/q_{1-4}	0.86				

While the first cohorts show a death selection typical of pre-transitional regime, for the last ones we can appreciate the survival gain due to mortality reduction, especially after the first year, as well as in Italy: indeed probability of surviving at the age of 5 rises from 61% to 69%, that of reach the first year only from 80% to 84%.

Distinguishing by SES, excluded the upper class, we do not observe significant differences neither in neonatal mortality nor in infant one, even though the group of artisans tends to recover from a starting disadvantage. Mortality over the first year, instead, seems to be higher for farmers and to a certain extent also for fishermen.

The structural Mediterranean component of mortality is very strong in Alghero: the ratio between infant and child mortality (q_0/q_{1-4}) is always less than 1, also in the last period, when the risks of dying in early childhood began reducing. This mortality model is thus consistent with that formulated by Coletti.

Italian regime of mortality is clearly influenced by climatic fluctuations, at least until the first decades of the 20th century: infant mortality differentials are higher than those measured in other European countries (Breschi, Livi Bacci 1986, 1994). In the second half of the 19th century children born in the winter season ran a risk of death considerably higher (30%) than that one experienced by those born during the summer. However, the season influence was not the same according to age: while winter could be extremely dangerous in the first month of life, summer shows its effects in the period going from the end of first year of life to the beginning of the second one, plausibly in coincidence with weaning.

Italian regions were characterized by different patterns, more accentuated in Veneto (where the seasonal curve of death risk was U-shaped with the winter maximum three times higher than the summery minimum), less significant in Tuscany and Sicily.

According to official statistics, in Sardinia climatic factor does not seem to be relevant in determining a strong selection by birth season. Percentage of survival at the first year was about 82%, with small seasonal differences; even in Alghero only a partial increase of death risk during extreme seasons is observed. Regarding to mortality in the following phase of life, instead, the first summer after the birth often played a negative role, especially if, as mentioned above, it coincided with the passage to ordinary nutrition. In any case, independently of birth season, 72% of born

reached the age of 2: indeed mortality in the first year was higher for children born in autumn and winter, but it was lower in the second one, so that these tendencies compensated each other.

Finally, joint analysis of seasonality and family SES shows some variability in social groups: excluding upper class, neonatal winter mortality was higher for farmers, and in the summer for artisans and fishermen. Most of the last ones lived near the port, probably the unhealthiest area of the town. Such a location would explain risks ran by born in summer: high temperatures and bad hygienic conditions could be facilitate infection spreading since the pregnancy, which threatened child's survival.

Therefore our data seem to confirm a neonatal mortality model in which the winter influence is less important than elsewhere and the maximum is registered during the summer.

Models and results

On the basis of previous considerations, our analysis comes to conclusions with the formulation of a model in which we want to estimate the influence of biological, socio-economic and environmental factors in determining mortality levels until the age of 5. In order to detect more precisely different effects of mortality in the first phase of life we propose a model partition into four groups.

In the first one we specifically deal with neonatal mortality, given the mentioned difficulties in interpreting the phenomenon of stillborns. Our covariates are sex, year and order of birth, destiny of previous child, mother's age and presence, birth season, parents education, and family head's SES. To evaluate the relevancy of stillbirth we propose two distinct models in which we study mortality with and without stillborns, respectively.

In the second group we study mortality between the 2^{nd} and the 6^{th} month, that is, the period of breastfeeding; in addition to factors listed above, we also consider father's presence and current season.

In the third group we analyze mortality going from the 7^{th} to the 24^{th} month, a wide lapse of time including to weaning, which in Sardinia seems to occur later than in other Italian regions. In this model we included as a factor the presence of a sister/brother of at least 8 years aged, who could take care of the child instead of the mother, as well as current season.

These covariates are also included in the last group, referring to mortality in childhood until the age of 5.

Table 2 contains the results of our models (in bold coefficients statistically significant: p-value <0.05); some remarks follow.

Table 2 : *Parameter estimates for logistic models of mortality, Alghero 1866-1920*

Covariates	**Model 1 1st month – without still-born**		**Model 2 1st month – with still-born**		**Model 3 2 – 6 months**		**Model 4 7 – 24 months**		**Model 5 25 – 60 months**	
	%	Odds	%	Odds	%	Odds	%	Odds	%	Odds
Sex										
Male	51.7	1	51.8	1	51.4	1	51.1	1	50.9	1
Female	48.3	**0.787**	48.2	**0.805**	48.6	0.923	48.9	**0.887**	49.1	0.993
Year of birth		**1.009**		**0.990**		**0.990**		**0.993**		**0.988**
Order of birth		**1.065**		**1.049**		**1.045**		**1.084**		**1.098**
Previous birth										
Child alive	59.4	1	58.9	1	59.9	1				
Child dead	19.6	**1.374**	19.9	**1.738**	19.4	1.156				
First-born	21.0	**1.907**	21.2	**2.117**	20.7	**1.368**				
Sister > 8 years										
Absent							76.2	1	67.5	1
Present							23.8	**0.770**	32.5	**0.682**
Brother > 8 years										
Absent							74.2	1	65.3	1
Present							25.8	**0.801**	34.7	**0.688**
Mother's age										
< 25 years	31.0	1	31.0	1	30.8	1	31.1	1	31.7	1
25 – 35 years	48.7	0.918	48.6	1.065	48.9	0.909	48.7	**1.174**	48.2	**1.238**
> 35 years	19.6	1.030	19.6	1.243	19.5	0.868	19.4	1.151	19.3	1.096
Unknown	0.7	0.303	0.8	0.494	0.8	0.734	0.8	0.916	0.8	1.143
Mother										
Alive	99.8	1	99.7	1	99.6	1	99.3	1	98.0	1
Dead	0.2	**10.597**	0.3	**15.575**	0.4	**4.122**	0.7	**3.493**	2.0	**1.844**
Father										
Alive					99.6	1	98.5	1	95.9	1
Dead					0.4	**2.154**	1.5	**1.402**	4.1	1.058
Birth season										
Winter	28.2	1	28.1	1	28.0	1	28.1	1	28.2	1
Spring	23.8	0.826	23.8	0.942	23.8	0.912	23.8	1.108	23.7	1.030
Summer	20.6	0.853	20.7	1.066	20.6	**0.750**	20.6	**1.155**	20.4	**1.193**
Autumn	27.4	0.795	27.4	0.908	27.6	**0.775**	27.5	1.112	27.7	**0.859**
Current season										
Winter					25.6	1	28.1	1	25.1	1
Spring					27.4	**0.802**	23.8	0.955	24.9	**0.859**
Summer					24.5	1.205	20.6	**1.566**	25.0	**0.715**
Autumn					22.5	1.098	27.5	**1.383**	25.0	0.983
Education										
None	44.0	1	44.0	1	43.8	1	43.5	1	43.0	1
Father	12.7	0.955	12.7	0.982	12.7	0.837	12.8	0.971	12.9	0.876
Mother	15.9	0.750	15.8	0.895	16.0	0.871	16.0	1.067	16.0	0.890
Both	24.1	0.942	24.1	1.044	24.2	0.898	24.4	1.057	25.0	**0.836**
Unknown	3.3	1.212	3.4	0.936	3.3	1.017	3.3	1.041	3.1	**1.356**
Head's SES										
Farmer	52.7	1	52.5	1	52.5	1	52.0	1	51.4	1
Fisherman	22.7	1.172	22.8	**1.242**	22.8	**0.790**	22.9	0.965	22.8	0.983
Artisan	21.1	0.971	21.2	1.133	21.2	0.957	21.3	**0.858**	21.6	**0.834**
Upper class	2.0	0.487	1.9	0.860	2.0	**0.331**	2.2	**0.354**	2.4	0.873
Unknown	1.5	0.467	1.5	0.862	1.5	**0.401**	1.6	**0.479**	1.8	**0.494**
Log likelihood	-1,997.1		-3,642.1		-6,126.7		-14,250.7		-8,586.6	
Months-person	16,509		17,044		93,508		230,031		412,611	

Mortality in the first years of life in Alghero confirms the female advantage both in neonatal and post-neonatal periods; this advantage persists also in the other models, even though not significantly.

Year of birth always is statistically significant, in the sense of reduction of death risk; however, when stillborns' component is excluded, the opposite effect is caused.

In neonatal and post-neonatal mortality, destiny of previous child plays a relevant role: indeed, if he/she was dead, the risk that index child died too is 37% and 15% higher, respectively. As far as mortality after the 7th month is concerned, the presence of a sister or a brother (24 – 35% of the total) determined a lower risk of death: thus daughters (above all) could help mothers (who likely gave birth to other children) to take care of younger brothers/sisters.

Unlike other studies, in the case of Alghero mother's age would represent a determinant factor in influencing mortality levels only for the class 25-35 years and for children aged over 6 months: this surprising result requires further analysis.

On the contrary, as one would expect, parents' presence is extremely important. In particular mother's absence could cause a rise of risk of death from two to fifteen times; father's absence is relevant too, in post-neonatal and early childhood mortality.

Birth season does not show significant effects on neonatal mortality, so that extreme temperatures would not generate increases in death risk; summer and autumn become determinant in other models, representing a critical moment for child survival. Children born in these seasons present a lower post-neonatal mortality: hot season, if faced in the starting phase of breastfeeding, did not result excessively dangerous for children destiny.

With respect to current season, double role played by summer is more evident: the hottest period confirms to be critical for children during the weaning, let us to prefigure a severe impact of diseases connected with the passage to ordinary nutrition. In early childhood, instead, winter was the most dangerous season, because of respiratory diseases, whose consequences were enhanced by bad quality of houses.

To obtain a measure on family educational level we have considered the presence or vice-versa the absence of the signature on the parents marriage certificate or on their children birth acts[2]. A condition of illiteracy produces on a whole negative effects on child survival, even though statistically not significant, except in the case of mortality over 2 years. In this last case, a reduction of the death risk of 16% is estimated, when both parents could read and write.

[2] In most of cases father declared the birth: his state of illiterate is deduced every time this signature was not affixed, "for affirming the father illiterate".

Finally, family SES confirms the advantages of the upper class, especially during breastfeeding and weaning; artisans also seem to benefit of a lower risk during weaning and in early childhood. Somewhat surprising is what one observes for fishermen: their children death risk is the highest in the model including stillborns, but it reduces considerably going to the period of breastfeeding.

As showed by our models, several factors influence mortality levels, even though in different ways and times; partition of first phase of life into groups helped us to highlight their effects. However there are some aspects not enough clear that we want to deepen. In order to improve our understanding of this complex phenomenon we wish to utilize also other sources, as parish, scholar and military registers.

References

M. Breschi, R. Derosas, C. Lagazio, M. Manfredini 1999, *L'influenza del contesto familiare sulla sopravvivenza dei bambini. Risultati di indagini micro demografiche sull'Italia dell'Ottocento*, «Bollettino di Demografia Storica», 30/31, 187-212.

M. Breschi., R. Derosas, M. Manfredini 2000a, *Fatal seasons in children's survival. Italy 19th century*, in A. Bideau, P. Bourdelais, J. Legaré (eds.), *De l'usage des seuils. Structures par ages et ages de la vie*, «Cahiers des Annales de Démographie Historique», 2, 73-88

M. Breschi, R. Derosas, Manfredini 2000b, *Infant mortality in nineteenth-century: Interactions between ecology and society*, in T. Bengtsson, O. Saito (eds.), *Population and Economy. From Hunger to Modern Economic Growth*, Oxford University Press, Oxford, 457-449.

M. Breschi, R. Derosas, Manfredini 2004*, Mortality and environment in three Emilian, Tuscan, and Venetian communities, 1800-1883*, in T. Bengtsson, C. Campbell, J.Z. Lee (eds.), *Life under Pressure. Mortality and Living Standards in Europe and Asia, 1700-1900*, The Mit Press, Cambridge, Massachussets, London, 209-151.

M. Breschi, A. Fornasin 2007, *La mortalità per genere nei primi cinque anni di vita, Italia 1864-1959*, Forum, Udine, 243-272

M. Breschi, M. Livi Bacci 1986, *Saison et climat comme contraintes de la survie des enfants. L'experiènce italienne au XIX siècle*, «Population», 41, 1, 9-35.

M. Breschi, M. Livi Bacci 1994, *Le mois de naissance comme facteur de survie des enfants*, «Annales de Démographie Historique, 169-185

M. Breschi, M. Manfredini, L. Pozzi 2004, *Mortality in the first years of life: socio-economic determinants in an Italian nineteenth century population*, in M. Breschi, L. Pozzi (eds.), *The Determinants of Infant and Child Mortality in Past European Populations*, Forum, Udine, 123-137.

M. Breschi, L. Pozzi 1997, *Un problema di mortalità differenziale: mortalità infantile e condizione socio-economica*, in *Disuguaglianze, stratificazione e mobilità sociale nelle popolazioni italiane (dal secolo XIV agli inizi del secolo XX)*, Tomo 2, Clueb, Bologna, 285-310.

M. Breschi, S. Mazzoni, P.M. Melis, L. Pozzi 2007, *Nuove indagini per l'analisi della mortalità nei primi anni di vita in Sardegna*, Forum, Udine, 195-220

P.M. Casu 1860, *Relazione della visita sanitaria eseguita nel 1860 nel Circondario di Alghero dal chimico farmacista Pietro Maria Casu*, n.i., Torino.

L. Coda 1977, *La Sardegna nella crisi di fine secolo. Aspetti dell'economia e della società sarda nell'ultimo ventennio dell'Ottocento*, Editrice Libreria Dessì, Sassari.

F. Coletti 1908, *La mortalità nei primi anni di età e la vita sociale della Sardegna*, Fratelli Bocca, Torino.

L. Del Panta 1994, *Mortalité infantile et postinfantile en Italie du XVIII au XX siècle. Tendences à long tèrme et différences régionales*, «Annales de Démographie Historique», 45-60.

R. Derosas 2002*, La demografia dei poveri. Pescatori, facchini e industrianti nella Venezia di metà Ottocento*, in *Storia di Venezia. L'Ottocento e il Novecento*, Istituto dell'Enciclopedia Italiana Treccani, Roma, 711-770.

R. Derosas 2002*, Infant Mortality Broken Into Pieces: A Case Study on Venice in Mid-Nineteenth Century* In Società Italiana di Statistica, Atti della XLI Riunione Scientifica, pp. 65-76

R. Derosas 2004, *Socio-economic factors in infant and child mortality: Venice in midnineteenth century*, in M. Breschi, L. Pozzi (eds.), *The Determinants of Infant and Child Mortality in Past European Populations*, Forum, Udine, 105-122.

R. Derosas 2009, *The joint effect of maternal malnutrition and cold weather on neonatal mortality in nineteenth-century Venice: An assessment of the hypothermia hypothesis,* Population studies, 63: 3, 233-251

A.M Gatti 2002, *La mortalità infantile tra Ottocento e Novecento. La Sardegna nel panorama italiano*, «Quaderni del Dipartimento di Ricerche Economiche e Sociali dell'Università di Cagliari. Sezione di Statistica».

A. Guzzoni Degli Ancarani 1913, *Mortalità del neonato*, in *XVII Congresso della Società Italiana di Ostetricia e Ginecologia*, Roma.

M. Manfredini, L. Pozzi 2004, *Mortalità infantile e condizione socio-economica. Una riflessione sull'esperienza italiana fra '800 e '900,* «Revista de Demografía Histórica», XXII, 2, 127-156.

Ministero di Agricoltura, Industria e Commercio (MAIC), Direzione generale della Statistica 1883, *Censimento della popolazione del Regno d'Italia al 31 dicembre 1881*, vol. II, *Popolazione classificata per età, sesso e stato civile e istruzione elementare*, Tipografia Bodoniana, Roma.

Ministero di Agricoltura, Industria e Commercio (MAIC), Direzione Generale della Statistica 1886, *Risultati dell'Inchiesta sulle condizioni igieniche e sanitarie nei comuni del Regno*. Parte seconda: *Notizie date per ciascun comune*, Tipografia dell'Ospizio di San Michele, Roma.

L. Pozzi, E. Robles González 1996, *L'analisi della mortalità infantile negli anni della transizione: una riflessione sull'esperienza italiana e spagnola*, in P. Giorgi, S. Strozza (a cura di), *Studi di popolazione. Temi di ricerca nuova. Secondo convegno dei giovani studiosi dei problemi di popolazione*, Roma, 147-171.

L. Pozzi 2000, *La lotta per la vita. Evoluzione e geografia della sopravvivenza in Italia fra '800 e '900*, Forum, Udine.

F. Putzolu 1993, *Prime tappe dell'ostetricia in Sardegna*, in L. Orrù, F. Putzolu (a cura di), *Il parto e la nascita in Sardegna. Tradizione Medicalizzazione Ospedalizzazione*, CUEC, Cagliari, 25-66.

E. Raseri 1879, *Sulla mortalità dei neonati*, «Rivista d'Igiene e Sanità Pubblica», VIII, 303-315.

R. Woods, N. Williams, C. Galley 1993, *Infant mortality in England 1550-1950. Problems in the identification of long-term trends and geographical variations*, in C.A. Corsini, P.P. Viazzo (eds.), *The Decline of Infant Mortality in Europe, 1800-1950. Four National Case Studies*, Unicef and Istituto degli Innocenti, Florence, 35-50.