

The determinants of Infant and Childhood Mortality: a Complex Tangle in the Historical Research

Le Determinanti della Mortalità dei Bambini: un Complicato Intreccio nella Ricerca Storica

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Riassunto: Questo contributo riflette le conoscenze acquisite in letteratura nello studio della mortalità dei bambini in Italia nel XIX secolo e nei primi decenni del secolo successivo, con speciale riferimento al tema delle determinanti della sopravvivenza infantile. La prima parte è una rassegna delle principali ipotesi avanzate a quest'ultimo riguardo dagli studi "ecologici". Partendo da queste ipotesi, si definiscono alcuni potenziali fattori di rischio che potevano condizionare la salute dei bambini nelle diverse fasi dei loro primi anni di vita. Nella parte finale di questo lavoro vengono presentati i risultati preliminari di recenti studi condotti a livello individuale.

Keywords: infants' survival, ecological studies, individual level analyses

1. Introduction

The relevance of infant and childhood mortality in the Italian health transition is beyond discussion. Until the late 19th Century the general pattern of mortality in Italy was typical of a very backward country: the expectancy at birth was low, infant and child mortality rates were very high and infectious and parasitic diseases were prevalent.

Around 1880, IMR was above 200 thousand in Italy, while it was about half as much in Norway (104‰), Scotland (120‰) and Sweden (128‰); England (145‰), Belgium (153‰) and France (165‰) were at a lesser distance, but still in a much better position (Breschi M., Derosas R., 2000). What is more remarkably, mortality rates were particularly high also during childhood.

It was only during the last decades of the 19th Century that mortality began to decline sharply and incessantly on a national scale. Infant and child mortality was responsible for much of this decline even if gains in life expectancy affected all age groups. Furthermore infant and child mortality played a crucial role in the variation of the health transition patterns which characterised the Italian sub-regions: the departure time and quickness of the decline in IMR and CMR were territorially highly differentiated.

Therefore it's not surprising that considerable research has been done on infant and child mortality transition in terms of temporal evolution, geographical differences, cause specific structure, and gender differences¹.

However, we still know very little about the determinants of infant and child mortality rates in Italy: most of the literature has been more descriptive than analytical.

¹ Recent studies have showed that particularly high mortality in early childhood was a characteristic of Mediterranean countries (see Ramiro Fariñas D. Sanz Gimeno A., 1999 and Pozzi L., 2000). Until now, in my opinion, insufficient attention has been paid to the analysis of mortality in the years of childhood each one year considered separately.

Past research has also suffered, for a long time, from the lack of a theoretical interdisciplinary framework necessary to identify the different multilevel (collective, individual, family and societal level) risk factors affecting the health of each baby.

Much debate has focused on the possibility of moving from a mere description of the differences observed to the identification of the underlying factors. The studies on these topics have mainly adopted an ecological approach and availed of aggregate data (derived from official sources) about populations or groups of individuals. The specific features of these populations are analysed on the basis of indicators which are not specific risk factors, but proxies often represented by contextual variables. The use of aggregate data don't allow us to go beyond a mere description and a possible formulation of various hypotheses. These studies suffer from the drawback of describing the average behaviour of the group; and they can't consider the time it takes for one variable or explanatory factor to have impact on the process leading to a death.

Even if there has been a great deal of confusion between an explorative approach and an explanatory one, we cannot deny the relevance of the ecological studies. The hypotheses formulated have oriented the future research and permitted a first formulation of a framework for the study of infant and child mortality determinants in the past.

Recently the use of individual biographies, deriving from the collection of new data sets, through more appropriate statistical methods, has offered useful tools in shedding lights on the complex factors affecting the mortality in the first years of age.

This paper reflects the state of knowledge in the analysis of infant and childhood mortality in Italy during the 19th and early 20th centuries with special reference to the determinants. The first part of the paper is a review of the main hypotheses advanced to this regard on the basis of the ecological studies. Moving from these hypotheses, we define then a set of risk factors which could affect survival in the different ages of infancy and childhood. The final part of the paper presents preliminary results of the recent studies carried out at the individual level.

2. The hypotheses derived from the analysis of Italian infant and child mortality territorial differences in the past

Immediately after the National Unification, two different models of high infant mortality are evident in the Italian provinces (Del Panta, 1997; Pozzi and Robles González, 1997)². The first one is peculiar of some provinces in the North-East and the Centre of the country, the other one is a typical feature of the Southern provinces. The age structure (and cause specific structure) of these two models is completely different.

In the first one the very high level of IMR is mainly linked to an unusual frequency of babies who died within the first month. In the other one post-neonatal mortality represents the basic and most important component³. In this second area also CMR is particularly elevated.

²If we analyse infant mortality at the regional level we find the highest IMR rates in five close regions of the North-Centre of the country: Lombardia, Veneto, Emilia Romagna, Umbria and Marche. In the following ages of childhood, mortality was more elevated in the South. Only a more detailed analysis of infant mortality, in terms of age and territorial specification, clarifies the geographical variation described above.

³ Some discrepancies between the various regions could derive from different classifications of stillbirths; even considering though still birth + neonatal mortality together, the territorial models described above are still evident. The Northern provinces are also characterised by a higher proportion of still births.

This geographical pattern began to change very quickly since about the 1880's. Infant mortality, and in particular neonatal mortality, had a more rapid decline in the Northern regions. By the beginning of the 20th century, these territorial differences had been largely deleted, and during the first half of the new century IMR –as well as CMR- became one of the clearest indicators of the social and economic backwardness of the Italian Southern areas.

If we try to focus our analysis on the investigation of the factors which may determine territorial differences in infant and child mortality, we need to deal with cause-specific mortality measures. Unfortunately cause specific mortality data allow for a detailed analysis only at the national level. In fact national data on deaths are available classified by age and cause, while regional and provincial data are classified only by age or only by cause. Anyhow, it is possible to verify that cause-mortality structure, as far as typical child and infant diseases are concerned, is remarkably differentiated at the territorial level.

Consequently we can affirm that the risk of dying in the first month of life was mainly due to particular diseases of early infancy and respiratory diseases. Neonatal mortality was also probably affected by foetal development and the problems associated with the delivery. On the other hand, gastro-enteritis, childhood infections and parasitic diseases (measles, scarlet fever, etc.) whose fatality was particularly high during the weaning period, were responsible for post-neonatal mortality rates.

As far as the high neonatal mortality rates are concerned, Breschi and Livi Bacci (1986) have advanced the hypothesis that a relevant weight might be attributed to climatic factors. The probabilities of dying during the first month were much higher for babies born in the winter season, because they were exposed to respiratory diseases. However, different cares towards infancy seems to be able to substantially modify such risks. Breschi and Livi Bacci also found that the summer season could be a very dangerous one, but this was mainly true in the Southern regions and with reference to post-neonatal mortality risks. The hot season was very insidious especially if coinciding with weaning. Caselli (1991) has showed that the ratio between infant and child mortality was strictly dependent on different climatic conditions. On the one hand, the winter season produced a dramatic selection: cold temperatures, in connection with poor protection, no house-heating and harmful behaviours all contributed to cause a death of a child out of 5 in the first month among infants born from December to March (Breschi, and Livi Bacci, 1986). On the other hand, postneonatal and child mortality were relatively high in the South where weaned children were particularly exposed to intestinal diseases during the hottest period of the year.

For regions which showed, in the first decades after National Unification, very high mortality levels within the first month of life a complementary hypothesis, related to maternal malnutrition, has been advanced (Pozzi, 1991). These regions, indeed, were largely characterised by a great diffusion of pellagra, which was closely linked to a condition of malnutrition of the poorest part of the population caused by the almost exclusive assumption of maize polenta. The link between maternal malnutrition and neonatal mortality is well known. A temporal coincidence between the improvement in nutritional standards in maize areas, the elimination of pellagra (starting at the end of 19th Century) and the sharp decline in infant mortality rates has also been noticed.

Dealing with explanatory hypotheses concerning post-neonatal and child mortality rates, Del Panta (1997) stressed the relevance of the subsequent factors: house conditions, demographic density, forms and duration of breastfeeding, nursing habits, and es-

pecially the time and the way of weaning as well as the babies diet in this delicate phase. He analysed the main results of a National Health Survey, carried out in all the communes of the Italian kingdom in 1885 (DIRSTAT, 1886), and found postneonatal mortality rates positively correlated with some indicators which were symptomatic of poor sanitation and hygienic conditions, crowding, etc. The correlation is completely absent in case of neonatal mortality rates.

Postneonatal mortality was almost surely influenced by infant feeding practices, the length of breastfeeding, weaning and the general health conditions. Gastro-enteritis was the most important cause of death and this was especially true in the post-neonatal period and in the years of childhood; it was also the most relevant disease in the decline of mortality in Italy and the main responsible of the territorial differences between Italian sub-regions. Gastro-enteritis is frequently called “weaning diarrhoea” because the syndrome is most often precipitated by weaning to unsanitary and low-protein content food. Most babies acquire some form of diarrhoea at weaning because all non sterilised food contain some parasites to which the baby’s digestive system has to become accustomed. When hygienic standards are good, so that bacteria counts are reduced or when children are weaned to a balanced high-protein diet, diarrhoea attacks may not be serious. However when both sanitation and nutrition are poor, mortality due to gastro-enteritis is high⁴. This disease is symptomatic of poor environmental sanitation and poor nutrition of recently weaned or bottle-fed babies (Newell Hoffman, 1981).

The importance of these intestinal disturbances especially in the South is indirect evidence of the influence of breastfeeding and infant feeding practices, in a general context of poor hygienic conditions (probably exacerbated by hot climate).

Geographical evidence of the key role of breastfeeding is offered by the case of Sardegna. At the turn of the 20th Century, the region was characterised by a particular low level of infant mortality (both neonatal and post-neonatal) rates. The risk of dying in the third year of life was exceptionally high in comparison with the low level of mortality in the first two years. Coletti (1908) explained this anomaly as a consequence of universal breastfeeding on the island. He also stressed the relevance of other cultural factors. Women did not work at all when pregnant and breastfed their babies for one year at least. The mother and the baby were under the family protection and there was a kind of worship for the breastfeeding mother.

It is important to stress the mirror-like case of Lombardia, which is particularly interesting because it is one of the areas of earlier agrarian and industrial development, while its infant and child mortality levels, very high at the moment of National Unification, show a very slow decline. The provinces of Lombardia were also characterised by an extreme frequency of gastro-enteritis.

It has been stressed that the increasing presence of women in industrial activities might have caused a worsening of nutritional levels and health conditions of mothers during the pregnancy, as well as an increase of the practise of putting out children to nurse, and a lesser care in the delicate phase of weaning (Pozzi, 1991; Pozzi, Rosina, 2000).

Breschi and Pozzi (1997) reviewed the main results of the late 19th and early 20th Centuries official surveys, the studies on occupational medicine as well as the research carried out in the maternity homes and gynaecology departments.

⁴ When children are poorly nourished, non-fatal attacks of gastro-enteritis may set up a synergism with other children’s diseases significantly raising mortality due to those diseases as well. Medicine research has remarked a strong synergism with measles and protein calorie malnutrition (kwashiorkor)

The early 20th Century medical surveys taken in the maternity homes about the health conditions of new-born babies (in terms of weight and height) according to the mother's occupational category offer interesting information, even not free of distortions⁵.

The occupational categories revealed a rough gradient in the babies weights and heights from housewives' children (top of the list) to the factory workers children. The agricultural workers' children are most of the time in the middle of the list, with no few exception though. These studies pointed out that factory workers' children, on average, weighted less and were smaller at birth. We cannot accept this result with full confidence, but it is pertinent to stress the consistency between these data and the data on stillbirths and miscarriages, which showed the same list accordingly to women's occupational categories. The results are often contradictory and not completely reliable⁶.

There are also many surveys about infant and child mortality differentials according to mother's professional condition. These results too are quite contradictory even if generally consistent with the hypothesis of a negative impact of mothers' work on children's survival. The statistical data included in these sources do not permit any definite conclusions.

Most of the authors agreed on the key role of breastfeeding and feeding habits; this is not the place to analyse all these sources in detail. However one survey, about the city of Milan, is particularly interesting and worth mentioning (Schiavi, 1908). This study showed much higher infant mortality rates are obtained among the children of working mother. The study found this to be highly correlated with the absence of nursing by the mother (required of necessity to leave home to work); working class infants who were nursed by their mother had lower death rates.

An infant ran a high health risk if he were either consigned in a wet nurse or given cow's milk under unsanitary conditions. The death rate of upper class infants whose mothers chose not to nurse them approached that of working class infants whose mothers could not nurse them. Varying infant feeding practices were sufficiently important to have given the most economically disadvantaged groups relatively favourable levels of infant mortality rates (Tilly, 1973).

The medical doctors and the observers of the early 20th Century sharply discerned the complexity of factors affecting child survival and they know very well the difficulty of measuring the specific effect of social factors.

"We can take for sure these facts: a) higher child mortality in the families with more children; b) higher child mortality in the lower class; c) higher child mortality in case of alcoholic and tuberculous, or criminal parents. These conditions being equal: the higher parent's salary, the lower child mortality. However the information we have at our disposal does not allow us to measure, with precise figures, the specific effects of parents' professional condition on child survival (Carozzi, 1913).

Mother's work, especially weary and stressing work in factories, as well as in the farms, meant one risk more for the unborn and the new-born baby. However one should take into account all the other risks connected with the woman's biological characteristics, her age, the number of previous pregnancies, her health, nutritional status, but also the housing and environmental conditions, family structure and dimension, etc.

⁵ Women who gave birth in the maternity homes were probably a very selected group. Almost all the surveys give only information on the average weight and height, with no distinction on sex, birth order, etc.

⁶ The main reasons are: the methodology used in the data collection, the characteristics and the small dimension of the sample analysed, their selectivity, the lack of comparable data, etc.

All these factors are inter-related and their effect concomitant. Single factor explanations for infant mortality decline, especially in societies where rates varied highly regionally, had to come to terms with the fact that explanatory factors never operated alone, but functioned interactively with other influences that could register positive and negative effects upon infant survival. Part of the difficulties of studying the complex mechanisms affecting survival in a more organic way derived from the exclusive use of official sources and from the aggregate level of analysis.

The researches just mentioned have described single factors relevant for child survival without considering the complex mechanisms through which these factors of different origin affected the survival in the first years of life. Most of these studies were descriptive: the questions and issues they opened are suggestive and worth mentioning, but a different approach is necessary to measure the specific effect of biological, social, economic, etc. factors on children's survival.

3. The determinants of infant and child mortality

Survival in the first years of life resulted from a combination of many factors (ecological, economic, social, cultural, ecc.), all interrelated. In a simplistic way one could say that the major result achieved by Italian historical demographers through the aggregate approach is a clear awareness of the great complexity and variety of factors affecting infants' survival as well as a precise consciousness of the different role of each factor in the various phases of infants' life.

It's also clear that factors affecting survival chances among individuals should not be assumed to have identical impact. For instance the effect of breastfeeding and weaning depends on the hygienic and sanitary conditions, the adequacy (in terms of protein and calorie content) and sterility of alternative foods. The structure of the relationships, indeed, is not fixed and varied over time and space.

A precise comprehension of these mechanisms is necessary to define the set of intermediate variables for the study of the determinants of child mortality. The factors of various origin which influenced mortality operated through a number of intermediate variables which directed affected the risk of morbidity and mortality (Mosley and Chen, 1985). Pozzi and Robles González (1997) have individuated three large categories of intermediate variables.

The first category includes *maternal factors*, like age of the mother, her health, birth interval, parity, etc.

The second category refers to *infant feeding practices*. Breastfeeding is universally accepted as the healthiest alimentation for the baby. The new-born has a very weak immunity, but the active biological substances in the mother's milk are highly protective. It is also well known that the weaning period is a delicate phase, especially when hygienic conditions are poor, and alternative foods are low proteine/calorie foods.

The third category refers to *child care by the family and the community*. This group is very large; first of all it takes into account the habits of bringing up the children, and generally speaking the "forms of attention" towards infancy in the past societies, the "forms of children neglect", the gender discrimination, as well as medical intervention, vaccination, etc. We include here also the relevance the family dimension in terms of household structure, organisation, roles division between its members, as well as the number of siblings, the absence of the mother/father, other female presences in the family. Even the so called "death clustering" falls within this category. It has been properly

stressed that “infant mortality is not simply an individual phenomenon, but something which involves the entire family. The likelihood of a child’s death is dependent on individual characteristics as well as on the fate of previous siblings (Brändström, 1993).

This “framework” as well as the theoretical models proposed for the analysis of infant and child mortality determinants in the developing countries are extremely demanding and they cannot be totally applied in historical studies. Some indicators are very rarely at our disposal, in particular if we use official sources and an aggregate approach.

The most recent researches, carried out at the individual level, show that “it is possible to carry out an analysis of infant and child mortality according to some suggestions drawn by the theoretical models mentioned above” (Breschi M. and Derosas R., 2000).

Breschi, Derosas, Manfredini (1997, 1999) collected new data sets for two rural communities (one in Toscana and one in Emilia), and for the city of Venice in the 19th Century⁷.

The main peculiarity of their data sets is the possibility they offer to correlate the biographies of the individuals to the history of the households where the individuals lived.

The use of Event History Analysis allows the authors to measure the effects of different factors affecting child survival (climatic, biological, social, and cultural, etc.) both separately and combined together. The variables included in a first version of the model, the so-called covariates, describe the context of life of each child in its different component: ecological, biological, economic, social, familiar, and cultural. The covariates included can be grouped into four main levels as showed in the following scheme (Breschi, Derosas, 2000):

- Individual Sex; mother’s age at birth; previous birth interval and vitality of the previous born; multiple birth; conception.
- Family Presence of the parents; presence of older brothers; presence of older sisters; presence of younger siblings; type of living arrangement of the family.
- Household Head’s social status; number of kin outside the household
- Community Religion; Season; Wheat price; period of cholera epidemic.

The approach is (1) individual and longitudinal (2) multivariate (3) based on a segmentation of the first days, months and years of life. This segmentation of the infant life includes different stages; in the most recent specifications of the model they proposed 4 age brackets: the ten first days of life, from the tenth day to six months, from six months to the first birthday, and from 1 to 4 years. The authors justify their choice on the basis of the following assumption: the determinants of health and death change very rapidly at the beginning of the life, moving from genetic and familial factors to social, economic and environmental ones. They give also the reason for the distinction between the first semester and the second one: the try to detect the weaning phase. The contemporary medical literature supports the hypothesis of a short breastfeeding period for some Italian areas. Biological factors remain a primary determinant until weaning, that marks the real transition between infancy and childhood. The authors also expect the effect of some factors on the risk of dying will remain substantially unchanged through the various stages, while others might change direction, and become protective or dan-

⁷ The sources utilised in the data collection were of different origin: two kind of parish registers: list of baptisms, burials, and marriages and the so-called Status Animarum. For the city of Venice the authors used the population register called Anagrafe. For further details see Breschi, Derosas, Manfredini, 1997.

gerous according to the particular age bracket considered. Other factors, while ineffective in a longer age span, actually could play an important role only in specific and more restricted circumstances.

A deep description of all the results would require a long analysis that goes beyond the purpose of this paper. Here we only recall, in a schematic way, the most significant ones.

- First of all, these studies seem to confirm the impression that the factors affecting neonatal mortality rates were quite different from the determinants of post-neonatal mortality rates.
- Biological and climatic factors played a crucial role in affecting neonatal mortality. The risk factor “constitution at birth” in the theoretical models is considered the essential determinant of death in the first days of life and the Italian authors include sex, previous birth interval, mother’s age. Let us consider here this last variable that plays a very relevant role for infants’ survival in the first semester of life. Mortality among babies born of mothers aged 35 or more is much higher than that of the other children of younger mothers. The effect of this variable is quite complex and has been discussed in the literature. Mother’s age is, indeed, associated with other risk factors: high birth rank, large number of children in the household, short birth interval. The Italian authors are not able to control for all these dimensions, but their models include at least the previous birth interval. The recent medical literature provides evidence on the congenital weakness of children born from mother of advanced age. In the past these “biological” risks were amplified. As stated before, the first Italian meetings on mothers’ and children’s health emphasised the precarious health conditions of working mothers who were exhausted by the many pregnancies and hard work. The authors don’t have direct evidence that a similar situation was at work in their sample, but they point out that the sex differential in mortality rates (from the age of 20 to the age of 50) gives further evidence of the precarious women health conditions. Furthermore, the risk of the index baby tended to be amplified (by 2 or 3 times) in case of death of the previous born in the family. This fact could suggest the effect of biogenetic factors: some parents could be more likely to generate weak children; but such a circumstance could also suggest the effect of social and environmental factors. Repeated pregnancies exhausted mothers’ health.
- During the neonatal period, mother’s age, her health condition (approximated through age and birth spacing), and her presence play a decisive role. These maternal factors keep their influence in postneonatal period, but this phase of life is characterised by an increasing importance of exogenous factors. For instance, belonging to the highest social classes is a protective factor for children’s survival. “Being the son of a day-labourer in Casalguidi or in Venice means to run a risk of dying that is 1.5 times higher than that of the children of sharecroppers or wage-earners. Being the child of small landowner reduced by half the risk of dying, in comparison with the children of sharecroppers. The main relevance of the socioeconomic variable indirectly shown also by the increasing weight of father’s presence. In fact, in the first phase of life the mother’s presence was determinant, later on the importance of father’s seem to prevail” (Breschi M. Derosas R., 2000).
- On the whole period from the birth to the fifth birthday the climatic conditions were clearly the most important determinant of death. Interestingly enough, their effect is far from homogeneous both in the different age groups and in the different case studies considered. Winter is a very dangerous period at the beginning of life but an

adequate protection (clothes, heating, etc.) can counteract efficiently the weather conditions. On the contrary, in the second semester of life, it is now summer that becomes extremely dangerous for the health of the children, more than doubling their risk of dying during the winter, and 50 percent higher in the fall (Breschi M., Derosas R., Manfredini M., 1999). Such a transition after six months of life was also observed at the national level in Italy (Breschi and Livi-Bacci 1994, 178). Though attenuated, the negative influence of summer continues through early childhood in Venice; the effect is, instead, more persistent in Casalgudi and appears in Madregolo. These differences in the various stages of life between the three areas analysed are probably an indirect evidence of a different length of breastfeeding.

- Cultural factors were relevant in each phase of baby's life. The authors introduced the variable Religion in the analysis of Venice and found a great protective role played by the Jewish population. A baby born among the Jewish population has, in the first month of life, a much more lower risk of dying compared to a catholic baby. The cultural side still represents a protective factor for children in post-neonatal period and one of the most relevant characteristics of the urban population of Venice. It should be very interesting to verify whether other cultural factors could determine differences in the risks of dying.
- In the Italian areas analysed the household structure played a crucial role. The presence of large family network in the rural areas decreases the risk of dying. Since the socio-economic factor is under control, the result may reflect the contribution in helping and substituting the mother in house and field work, that only larger family could provide. The nuclear family was prevalent in the city of Venice, but the relevance of the family cannot be dismissed: for instance the presence of older sisters in the family decreases the baby's risk of dying.

These results seem to be consistent with the hypotheses on infant and child mortality differentials advanced in the past Italian literature. These more recent studies are still in progress: the authors are currently experimenting with different model specifications. Their findings cannot be emphasised too strongly, because they are preliminary and mainly suggest potential lines for further inquiry and investigations.

This new general approach which combines the issue of individual biographies with proper statistical tools is promising, but there is still a long way to go. The results already obtained demonstrate the interest of this approach, "which may not necessarily lead to better answers but at least to better questions" (Breschi M., Derosas R., 2000).

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