THE DECLINE OF INFANT MORTALITY IN EUROPE

- 1800-1950 -

FOUR NATIONAL CASE STUDIES

edited by Carlo A. Corsini and Pier Paolo Viazzo

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United Nations Children's Fund
International Child Development Centre
Florence, Italy

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"L'oeuvre de la goutte de lait" (Dr. Variot's consultation at the Belleville Dispensary, Paris). From the painting by M. Jean Geoffroy, exhibited in the Salon in 1903, now the property of the Municipality of Paris. This picture illustrates the three main features of the work of the Goutte de Lait: (1) weighing the babies, (2) medical consultation, (3) distribution of sterilized milk.

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CONTENTS

PREFACE

UNICEF recently launched an important and provocative new series of annual reports on **The Progress of Nations**. The first report asserts that "it is time that the standing and prestige of nations was assessed less by their military and economic prowess and more by the protection they provide for the lives, the health, the growth and the education of their children". **The Progress of Nations** will record each year national achievements in child survival, health, nutrition, education and other areas of social progress.

It is no accident that special emphasis is placed in this landmark publication on improvements in infant and child survival. The reduction of infant and child mortality is defined as "the measure of all things", as it is "directly affected by the income and education of parents, the prevalence of malnutrition and disease, the availability of clean water and safe sanitation, the efficacy of health services, and the health and status of women".

However, the very fact that child survival depends to differing degrees on so many social, economic and cultural factors can make it difficult to disentangle the diverse influences of the various forces at work. Indeed, even the causes underlying the decline of infant mortality in the industrialized world between 1800 and the 1950s are still poorly understood. While some scholars give credit to the general rise in living standards for the decline in infant and child mortality levels, others maintain that social interventions associated especially with public health reforms must take the lion's share. What is unanimously agreed upon however is that in order to correctly identify the factors responsible for the decline it is essential to collect and analyse data in a far more systematic way than has been the case to date - and that an international project is, from this point of view, badly needed.

A first step towards meeting such a need was made in 1991 by the Florence-based *Istituto degli Innocenti*, which invited a small number of leading experts in the field to take part in an international workshop on the historical decline of infant mortality in Europe. The twofold purpose of this meeting was to assess the current state of research and to discuss the feasibility of a large-scale comparative research project. Organized by the *Istituto*

degli Innocenti in collaboration with the UNICEF International Child Development Centre, the Department of History of the University of Essex (Colchester, UK) and the Wellcome Trust (London), the workshop took place in Florence at the *Spedale degli Innocenti* on 9-11 April 1992 and was attended by over twenty scholars from eleven European countries and the United States. The results of the workshop were most encouraging. All the participants expressed their willingness to create and sustain a collaborative research network, and a large-scale project is now under way. It involves fourteen European research centres with the *Istituto degli Innocenti* acting as the central secretariat of the project.

Although conclusive, or at least better, answers to the many open-ended questions can only be expected from the final results of the project, the papers presented at the Florence meeting clearly showed that a substantial amount of work has already been carried out at the national level, as illustrated by the four "national case studies" published in this volume.

For United Nations reports such as **The Progress of Nations**, social statistics which reach back three or four decades are considered adequate to gauge major trends in infant and child survival. In assessing progress in terms of meeting the child (under-five) mortality goal set at the 1990 World Summit for Children (to 70 per 1,000 or less in all countries by the year 2000), **The Progress of Nations** found it useful to point out that Sweden did not achieve this goal until about 1935, France around 1955 and Italy not until 1960 or so. It also shows that the infant mortality rate (IMR) in San Francisco is 7, the same as in Norway, while the IMR in Washington D.C. is more than twice that rate, the same as in Jamaica and higher than in Cuba.

Thanks to the persistent, often painstaking efforts of historians and demographers, such as those to whom we pay tribute in this monograph, we are now able to analyse with greatly improved data and methodological tools much longer historical trends than has been possible until recently. It is hoped that these longer perspectives will help cast light on the search for clearer explanations of the forces and causal relationships lying behind the "progress of nations" in reducing the still tragic incidence of preventible infant and child deaths in many parts of the world today. Improved understanding then needs to be converted into strengthening the political will and mobilizing the necessary resources to prevent such deaths. UNICEF and the *Istituto degli Innocenti*, the latter since its establishment in the early fifteenth century, are proud to be part of this ongoing struggle.

Francesco Arrigoni
President
Istituto degli Innocenti

James R. Himes
Director
UNICEF International
Child Development Centre

THE HISTORICAL DECLINE OF INFANT MORTALITY: AN OVERVIEW

by Carlo A. Corsini and Pier Paolo Viazzo

The basic facts about the secular decline of infant mortality in Europe have been known for nearly a century. Vital registration series are available for most European countries from the 1870s, and for virtually all of Europe from 1900. They show that the levels of infant mortality in the late nineteenth century were still extremely high and could vary quite markedly from one country to another, ranging from about 100 per 1,000 live births in Norway and Sweden to 200 or even 250 per 1,000 in countries such as Germany, Austria and Russia. At the turn of the century, however, infant mortality began to fall almost right across the continent. As the decline was steeper in the countries with higher mortality levels, a certain degree of convergence to lower levels can already be detected in the first decades of the twentieth century. By the 1950s, when national rates of infant mortality ranged between 20 and 50 per 1,000, the process of convergence was nearly completed. The fall in infant mortality, which was paralleled by a simultaneous and equally pronounced decline of fertility, was responsible for raising life expectancy in many European countries by more than 10 years over a remarkably short period of time.

While the basic facts are quite clear, the reasons accounting for the decline are anything but certain. Improvements in infant and child survival have long been assumed to be broadly associated with advances in health care and rising living standards. But until fairly recently, surprisingly few attempts have been made to unravel the diverse influences of the social, economic and public health factors which have supposedly played a part in lowering infant mortality in Europe.

The first major effort to break with a well-established but stagnating tradition in social and medical history was made some twenty years ago by the British physician and historical demographer, Thomas McKeown, whose highly controversial book *The Modern Rise of Population* was published in 1976. McKeown's thesis was that improvements in nutrition due to greater food supplies was the single most important causal explanation of mortality changes over the last three centuries. Although he acknowledged that from the second half

of the nineteenth century a substantial reduction of mortality followed the introduction of public health measures, such as the purification of water and improved sewage disposal, he ultimately tended to play down the importance of these factors. Immunization and other medical interventions for the prevention or treatment of diseases, according to McKeown, played a negligible role in reducing mortality levels prior to 1935 when sulphonamides became available[1].

McKeown's iconoclastic views are worth mentioning not only because they have been fuelling debate among demographic, economic and medical historians for nearly twenty years, but also because of the influence they have exerted outside the academic world. As one observer has remarked[2], a number of programmatic statements issued in the late 1970s, and in particular the emphasis laid on the notion of 'primary health care', suggest that many policy makers, aiming at enhancing the survival chances of infants and young children in contemporary developing countries of Africa, Asia and Latin America, were impressed with McKeown's assertion of the historical inefficacy of therapeutic medicine and, to some extent, of preventive medicine as well. The main implication of McKeown's thesis was that the reduction of infant mortality was primarily an economic problem. This suggested that instead of investing money in sophisticated medical technology or perhaps even in public health measures, it was preferable to promote programmes aimed at increasing the nutritional level of the whole population; in this way, the resistance of its younger members to the aggression of germs and parasites would be strengthened.

In the past two decades, the spectacular development of historical demography and its allied disciplines has deeply changed our perception of the population history of Europe. New research has, among other things, revealed the existence of serious empirical and methodological flaws in McKeown's theoretical construction, thereby calling into question much of what had rapidly become received wisdom in the study of mortality decline. As Roger Schofield and David Reher have recently written, "it would be only a small exaggeration to say that our understanding of historical mortality patterns, and of their causes and implications, is still in its infancy". They also point out that the main reason we know far less about mortality than fertility is that, while our knowledge of the decline of fertility in Europe has been decisively enhanced by the results of the highly successful Princeton European Fertility Project launched in the 1960s by Ansley Coale, nothing similar has yet been attempted for mortality[3]. The study of infant mortality, in particular, has remained a piecemeal affair. Many excellent individual studies have been conducted over the past 15 years, as demonstrated by the richness and quality of the papers presented in 1992 at the Montreal conference on "Child and Infant Mortality in the Past", organized by the International Union for the Scientific Study of Population. But there is clearly a pressing need to adopt a more comprehensive and systematic approach through an international project to collecting and analysing data relating to the decline of infant mortality in Europe.

For this reason, a meeting was held in Florence in the spring of 1992, with the twofold aim of reviewing the state of the art in the study of the decline of infant mortality in Europe and, rather more ambitiously, of laying the foundations for a coordinated research enterprise along the lines of the Princeton project.

The first realization to emerge from the Florence meeting was that the data which form the basis of present views on the decline of infant mortality cannot provide satisfactory answers to a number of fundamental questions. As noted earlier, infant mortality series derived from vital registration data exist for most European countries from the

1. McKeown, 1976.
2. Boulanger, 1980, pp. 388-92.
3. Schofield and Reher, 1991, p. 2.

1870s, and in some cases they are only available from about 1900. The lack of longer time-series offering information on levels and trends of infant mortality in the more distant past makes it impossible to ascertain at present whether declines occurred before the late nineteenth century, nor can the exact timing and extent of mortality reduction be established. As a consequence, our understanding of the momentous progress achieved in the twentieth century remains seriously inadequate.

One major conclusion reached in Florence therefore concerns the need to extend national infant mortality series as far back in time as possible. Admittedly, this is no easy task: in some cases it may only be possible to rely on samples drawn from ecclesiastical sources or to use local instances for illustrative purposes. That the effort is nevertheless well worth making is illustrated by the four national studies published in this volume. Originally presented at the Florence meeting, these papers were selected for publication in this monograph primarily because they are based on unusually long time-series. Each of these national series has been obtained by very different means. The French figures, covering more than two centuries from 1750 to 1987, were obtained by applying the 'family reconstitution' method to a large sample of parishes. The English series, which extends back to the mid-sixteenth century, was estimated from calculations of life expectation at birth published by Tony Wrigley and Roger Schofield in their pathbreaking reconstruction of the population history of England since 1541[4]. The remaining two series, for Sweden and Austria, were extracted directly from official sources, stretching back to 1819 for Austria and to 1750, year of the foundation of the oldest national statistical bureau in the world, for Sweden. These four series unmistakably show that before the end of the nineteenth century national trends could vary widely and the presumed uniformity of the secular decline of infant mortality in Europe is more apparent than real, the result of a sort of optical illusion caused by the insufficient chronological depth of most national series.

The Swedish case is a useful starting-point, not only because vital registration data are available for the whole national territory since 1750, but also because it provides a yardstick to measure the high degree of variability of the European experience. As Anders Brändström notes in his chapter, one remarkable feature of the Swedish pattern of decline is that infant mortality started to fall very early, in the first decades of the nineteenth century. No less importantly, infant mortality declined at a relatively slow and constant pace: from a level of about 200 per 1,000 live births in 1800 to 150 some fifty years later, to just under 100 at the end of the nineteenth century. Interestingly enough, signs of early decline can also be detected in France between 1795 and 1825. However, infant mortality levelled off in the following decades, and a steep and persistent downward slope becomes visible only after 1880. The case of France appears to be similar in this respect to those of England and Austria, where an undulating plateau gave way to a precipitous decline in the last quarter of the nineteenth century.

A comparison of the four national series shows that differences in levels were no less marked than differences in trends. We have seen that the English and Austrian patterns of decline are fairly similar. However, the estimated values for England suggest that from 1550 to 1900 infant mortality rates mostly hovered between 150 and 200 per 1,000. These values are comparable to those estimated for France from 1750 to 1900 and to the rates recorded in Sweden in the second half of the eighteenth century. In Austria, by contrast, before the inception of the secular decline, infant mortality ranged between 275 and 300 per 1,000.

This is a striking difference. But variations become even greater when infant mortality is observed on a smaller geographical scale. Indeed, one of the main achievements of recent research has been to bring to light the existence of huge spatial differences in mortality levels in most European countries. It has of course long been known that national

4. Wrigley and Schofield, 1981.

or even regional figures could hide significant local variations. Brändström informs us that as early as the 1880s the attention of one of the pioneers of Swedish medical statistics, Johann Hellstenius, had already been attracted by the very considerable differentials in infant mortality that could be displayed, even among neighbouring rural parishes. Students of infant mortality are now focusing much more closely on this issue and are searching more attentively for the underlying causal factors.

It is unanimously agreed that both national and regional variations in the level of infant mortality can largely be accounted for by differences in infant feeding patterns. Indeed, if we consider the four national cases presented in this volume, we see that breastfeeding, whose beneficial effects on infant mortality are well known[5], was widespread (though not universal) in Sweden, France and England, whereas it was only rarely practised in Austria. However, much work remains to be done in order to reach a clear understanding of the relationship between infant feeding and infant mortality. Social and demographic historians will first have to determine the reasons why mothers in some parts of Europe undertook prolonged periods of breastfeeding while those in other regions did not. It will also be necessary to verify whether fluctuations in the levels of infant mortality correlate with changes in the duration and intensity of lactation or any other alterations in feeding practices. While accepting that feeding patterns strongly influenced mortality levels and that they are able to explain regional and local continuities, many scholars suspect that feeding practices are unlikely to have changed sufficiently quickly or radically to have caused the often abrupt start of the secular decline of infant mortality.

In any case, feeding habits were not the only factor behind spatial variations in infant mortality. The results of some comparative studies of adjacent Swedish localities reported by Brändström indicate, for example, that the contrasting life and work patterns of the nomadic and settled sectors of the population were more important than the practice of breastfeeding in explaining differentials in infant mortality. In a rather different vein, it should also be recalled, as Robert Woods pointed out at the Florence meeting, that a certain proneness to treating unequal geographical units as though they had equal significance may easily lead infant mortality analysts to overlook the distortions created by population distribution, and particularly the effects of urbanization. In fact, regional variations can in many cases be explained simply by the different weight of the urban component in the population, for it is well known that in historic Europe infant mortality was higher in towns and cities than in the surrounding rural areas. This was primarily due to the inferior urban public health environment and to overcrowding, which facilitated the spread of airborne and contagious diseases much more than in the sparsely populated countryside. But several other factors also had a part: differences in the social and occupational structures of the population, and especially in the participation of women in the labour market; differences in household structure; and generally higher levels of illegitimacy. The reversal of this broad tendency towards a greater risk of infant mortality in urban areas than in the country was one of the main aspects of the secular decline.

The paper written by Woods for this volume, in collaboration with Naomi Williams and Chris Galley, emphasizes that the 'urban effect' may be crucial in explaining not only geographical variations but also aggregate trends. In the nineteenth century, the city of Stockholm was infamous for its appallingly high levels of infant mortality. But as Sweden remained a predominantly rural country, national figures were influenced only to a very limited extent by Stockholm's exceptionally high levels. By contrast, in 1850 England was already a predominantly urban country with a number of very large cities. This meant that circumstances in just a handful of these cities could affect the entire national picture. There

5. For a survey of the historical evidence on the relationship between breastfeeding and infant mortality, see the two essays by Matthews Grieco and Corsini, 1991.

can be little doubt that the lack of significant decline in infant mortality levels in England in the nineteenth century was largely due to changes in the spatial distribution of the population. Indeed, one could expect that the massive population shift from rural to urban areas would have caused a deterioration in national averages; that this does not appear to have occurred represents, according to Woods and his colleagues, a triumph of child care and especially of breastfeeding.

This is a very interesting point, all the more so if we consider that the higher infant mortality levels recorded in towns and cities are often partly attributed to a general tendency for urban women to breastfeed for shorter periods than rural women. More detailed information on the prevalence and evolution of infant feeding in urban settings is clearly needed. But this is only one of several assumptions about the causes of urban disadvantage which either require qualification or more careful investigation. It is commonly thought, for instance, that infant mortality tended to increase with the size of towns. The detailed evidence assembled by Woods, Williams and Galley for large, medium and small English towns fails, however, to reveal significant differences. It is also generally maintained that the lower mortality levels of rural populations was due less to the healthiness of life in the countryside than to the disadvantages of the urban environment. Traditional explanations based on notions of fresh air, pure water and sunlight have been dismissed as vague, simplistic or plainly 'mythical'. Yet the data presented by Josef Kytir and Rainer Münz in their chapter on the decline of infant mortality in Austria suggest that such explanations should not be ruled out too hastily.

One of the most striking features of Austria's demographic history is that infant mortality was consistently lower in the mountain districts of the Alps than in the rural areas of the surrounding hills and plains until the mid-twentieth century. The most likely explanation for this disparity is that the Alpine climate made infants less vulnerable to bronchial and pulmonary diseases and also lessened the risk of gastrointestinal disorders during the summer months, a risk which was further reduced by the fact that the uplands water was less contaminated than in the lowlands. This points to the existence of a specific 'mountain advantage' attributable to a set of favourable climatic and other environmental factors ultimately related to altitude. Lower levels of mortality in the mountains than on the plains had already been suggested two hundred years ago by writers as different as Buffon and Malthus. Kytir and Münz's data for Austria, supported by the results of a spate of studies recently carried out in a number of Alpine localities, now appear to corroborate this view. Although it remains to be seen whether the same was true of the other mountainous regions in Europe, this evidence from the Alpine area is a useful reminder that there is more to the study of spatial variations in infant mortality than the analysis of regional patterns and urban-rural differentials.

The chapters in this monograph on England and Austria, which deal extensively with the effects of sharp environmental contrasts, show very effectively that the secular decline of infant mortality was chiefly achieved through environmental improvements in the more disadvantaged areas (towns and cities in England, the lowlands in Austria) and that this was clearly reflected in the impressive reduction of post-neonatal mortality. This is not to say, however, that the study of the historical evolution of neonatal mortality should be slighted. Many aspects of its decline remain in the dark, and deserve to be examined with greater accuracy. It is surprising, for instance, that historical demographers and medical historians have paid virtually no attention to prematurity. Yet, the proportion of premature births appears to have varied over time and there is intriguing evidence that prematurity was more frequent in urban areas than in the countryside[6]. This could partly explain why differences in neonatal mortality, however small, were usually to the advantage of the urban

6. Cf. Dupâquier, 1992.

populations. More generally, the example of an important but neglected subject like prematurity provides yet another indication of the need for a finer-grained analysis of infant and child mortality and its changing structure in the past.

The relationships between infant and child mortality, in particular, require careful exploration. It is becoming increasingly evident that infant mortality (defined as mortality under 12 months of age) was not always paralleled by mortality levels among young children aged between one and five years. The two trends actually depart so markedly from one another at times that there is some justification for treating infant and childhood mortality as almost unrelated phenomena. It is obvious, on the other hand, that largely the same circumstances affected mortality in the months before and after the first birthday. This has implications that have been underlined very neatly by recent studies of mortality by month of birth, which indicate that "infant mortality measures conventionally limited to the first year of life must be extended at least to the second year"[7]. This is a highly desirable step forward in the analysis of infant mortality, one that is unfortunately very difficult to achieve in many cases owing to the fact that the overwhelming majority of statistical documentation available in print follows the conventional distinction between infant and child mortality.

That our understanding of infant mortality has been thwarted by severe data problems is unfortunately a recurrent complaint among historical demographers. If some light is eventually to be shed on such major issues as the all-important but still elusive link between infant mortality decline and the beginnings of fertility control, or the relationship between infant mortality and social class, detailed information is required at the individual, family and social group level. Such evidence, however, can hardly be expected to come from vital registration systems mainly devised to produce data for large geographical areas. Valuable information can sometimes be derived by applying appropriate demographic methods and statistical techniques to the existing material. As Samuel Preston and Michael Haines have remarked, their recent monograph on infant and child mortality in late nineteenth-century America could have been a publication from the United States census of 1900, "had Census officials only possessed modern means of processing and interpreting the data they had collected"[8]. In most cases, however, entirely new datasets will have to be constructed and it is to be hoped that the international project launched in Florence will play an important role in this direction. As Catherine Rollet and Patrice Bourdelais compellingly demonstrate in their discussion of French sources, a preliminary but essential step will consist in a very careful assessment of the quality of available information. Particularly in the study of infant mortality, it is essential to know as exactly as possible the degree of reliability and completeness of the raw material on which direct and indirect measures of mortality will ultimately be based. This is all the more necessary when such measures are intended to provide comparative results for highly differentiated historical situations.

Clearly, there is still a very long way to go. A number of interesting indications do nonetheless emerge from the essays in this volume, especially concerning the relationship between infant mortality and social class. Data supplied in the chapters on Sweden and England appear to confirm what many scholars have long suspected; namely that in preindustrial Europe, wealth was not necessarily accompanied by lower infant mortality. The benefits of economic advantage could, of course, be partly or totally offset by the reduced mortality associated with rural living. This probably explains why English agricultural labourers suffered lower infant mortality than the urban-based professional classes as late as the 1890s. But the urban-rural gap is not the only basis for explanation. Scandinavian studies

7. This point has been made by Breschi and Livi-Bacci, 1992.
8. Preston and Haines, 1991, p. xvi.

of rural village communities reveal that infant mortality was often lower in the families of landless farmhands than among landed peasants, suggesting that this resulted from different durations of breastfeeding. Similarly, the finding that before 1700 the highly privileged British peerage had very similar infant mortality levels to those of the rest of the population is almost certainly accounted for by a strong tendency to place infants with wet nurses. In fact, once maternal breastfeeding became fashionable among the British upper class, infant mortality fell below that of the general population.

Also of great value are the estimated rates of infant mortality by father's social class furnished by Woods, Williams and Galley for England between 1895 and 1910. These figures show that in the crucial period which witnessed the beginning of the secular decline in infant mortality a strong inverse relation existed between infant mortality on the one hand and social class, income and occupation on the other. It is worth noting, however, that one of the main conclusions reached by Preston and Haines in their study of infant and child mortality in the United States around 1900 is that occupational differences were far less pronounced than in England where early industrialization had probably created an unusually differentiated class structure. Differentials by ethnic group, which probably reflected different customs in infant feeding and child raising, were decidedly more significant. While comparable data are unfortunately still rare, there is an obvious need for studies in other Western countries as well as in contemporary Third World countries in order to ascertain whether income, class and occupation, besides affecting the levels of infant mortality, are also critical in explaining the pace and timing of decline.

These are only some of the many questions on the research agenda of historical demographers and social and medical historians for the next decade. It can be expected that much attention will be devoted to a reassessment of the role of the public health movement and of the contribution made by medicine and medical science, which, as noted earlier, was belittled by McKeown[9]. In their chapter on infant mortality decline in France, Rollet and Bourdelais emphasize the importance of the social reforms and public health initiatives which led to improvements in the milk supply, to the introduction of both ante-natal and post-natal assistance and to higher standards of maternal and infant care. This chapter shows that our knowledge of such matters can be greatly enhanced by a more systematic study of the voluminous literature on infant mortality produced in the nineteenth and early twentieth centuries. Writers of the time, though generally very knowledgeable about the circumstances impinging on infant mortality, were not well placed, however, to pinpoint the often far from apparent factors responsible for a secular decline. The benefit of hindsight can help present-day scholars to disentangle the effects of the various forces which were simultaneously at work. In order to do so, we first need to establish an accurate chronology of change. It will also be essential, as Rollet and Bourdelais keenly recommend, to deepen our understanding of the public health movement by focusing more sharply on the differences between private and state initiatives, on their degree of centralization, and on the amount of popular support given to health and sanitation programmes.

The issue of popular support to public health initiatives touches on a number of complex but fundamental questions which family historians are beginning to tackle. Recent studies would seem to suggest that before the late nineteenth century parents in both Europe and North America regarded serious illness and the ensuing mortality of infants and young children as inevitable. The first great successes scored by medical science contributed, however, to creating a widespread awareness that many infant deaths were preventible. This, in turn, increased popular support for sanitation and public health programmes

9. The need for a reappraisal of the role of medicine in the decline of infant and child mortality is underlined by Schofield and Reher, 1991, pp. 14-15.

and generated a growing expectation that society at large must assume responsibility for a child's survival[10]. The idea that changes in parents' emotional response to the early deaths of their children might have played a role in the reduction of infant mortality was intimated by Jacqueline Hecht in 1980. Her survey of a large range of literary evidence on this subject pointed to a major shift from an attitude of Christian resignation bordering on indifference to one of bitter sorrow[11]. A balanced approach is clearly needed when investigating such delicate problems as the causes and consequences of what some family historians have called the 'invention of parental love', particularly in light of the constant danger of overestimating the importance of the family as an agent of change. Brändström's account of the measures taken by the Swedish government to curb infant mortality reminds us that as long ago as the late seventeenth and early eighteenth centuries statesmen, administrators, physicians and the forerunners of modern statistics were already convinced that many infant deaths could and ought to be prevented. Certainly one of the historian's most fascinating and important tasks is to try to determine whether, and to what extent, the rate of infant mortality decline was influenced by the parents' growing awareness that their children had both the possibility and the right to survive the dangerous first months and years of their life.

10. Cf. Preston and Haines, 1991, pp. 26-36.
11. Hecht, 1980.

References

Boulanger, P.-M., "Les grandes orientations de la lutte contre la mortalité des enfants", in P.-M. Boulanger and D. Tabutin (eds), *La mortalité des enfants dans le monde et dans l'histoire*, Liège, Ordina Editions, 1980.

Breschi, M. and M. Livi-Bacci, "Month of Birth as a Factor of Children's Survival", paper presented at the IUSSP conference on "Child and Infant Mortality in the Past", Montreal, October 1992.

Dupâquier, J., "Pour une histoire de la prématurité", paper presented at the IUSSP conference on "Child and Infant Mortality in the Past", Montreal, October 1992.

Hecht, J., "L'évaluation de la mortalité aux jeunes âges dans la littérature économique et démographique de l'Ancien Régime", in P.-M. Boulanger and D. Tabutin (eds), *La mortalité des enfants dans le monde et dans l'histoire*, Liège, Ordina Editions, 1980.

Matthews Grieco, S.F. and C.A. Corsini, *Historical Perspectives on Breastfeeding*, Florence, UNICEF International Child Development Centre and Istituto degli Innocenti, 1991.

McKeown, T., *The Modern Rise of Population*, London, Edward Arnold, 1976.

Preston, S.H. and M.R. Haines, *Fatal Years. Child Mortality in Late Nineteenth-Century America*, Princeton, Princeton University Press, 1991.

Schofield, R. and D. Reher, "The Decline of Mortality in Europe", in R. Schofield, D. Reher and A. Bideau (eds), *The Decline of Mortality in Europe*, Oxford, Oxford University Press, 1991.

Wrigley, E.A. and R.S. Schofield, *The Population History of England 1541-1871*, London, Edward Arnold, 1981.

INFANT MORTALITY IN SWEDEN
– 1750-1950 –
PAST AND PRESENT RESEARCH INTO ITS DECLINE

by Anders Brändström*

Background

The decline in infant mortality, which began in the first decades of the nineteenth century, constituted the main component in the overall fall of the crude death rate in Sweden. Between 1800 and 1900, levels fell from 200 deaths per 1,000 live births to 100 per 1,000 (Figure 1). Unlike England or Germany, where infant mortality began to drop only towards the end of the century, Sweden displays a pattern of early and fairly steady decline throughout the nineteenth century. (No less significantly, in both England and Germany, infant mortality, besides falling later than in Sweden, did not have the same weight in accounting for the overall decline of mortality). As fertility remained high until the 1870s, while crude death rates started to decline in the early 1800s (Figure 2), the increase in population was considerable, from approximately 2,350,000 inhabitants in 1800 to over 5,000,000 in 1900. Indeed, the Swedish case was chosen by F.W. Notenstein as a model of the demographic transition[1].

The key role played by infant mortality in determining the growth rate of the Swedish population was known to statesmen and scientists as early as the mid-1700s. Sweden was a mercantilistic state with a well-organized bureaucracy and a state-controlled Protestant Church. Only the official religion was permitted, and the clergy functioned as an extension of the government. The government thus had both the organization and the means to control every single household in the society.

With the intention of maximizing population growth and productivity, the government created a monitoring system, the Central Bureau of Statistics (*Tabellverket*). Founded in 1749, it was the first national statistical body in Western Europe. Pre-printed forms were circulated, and clergymen were required to keep annual records of vital events — births,

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1. Notenstein, 1953.

Figure 1
Infant Mortality in Sweden, 1751-1965
(Source: BiSOS. Historisk statistik, Befolkningen)

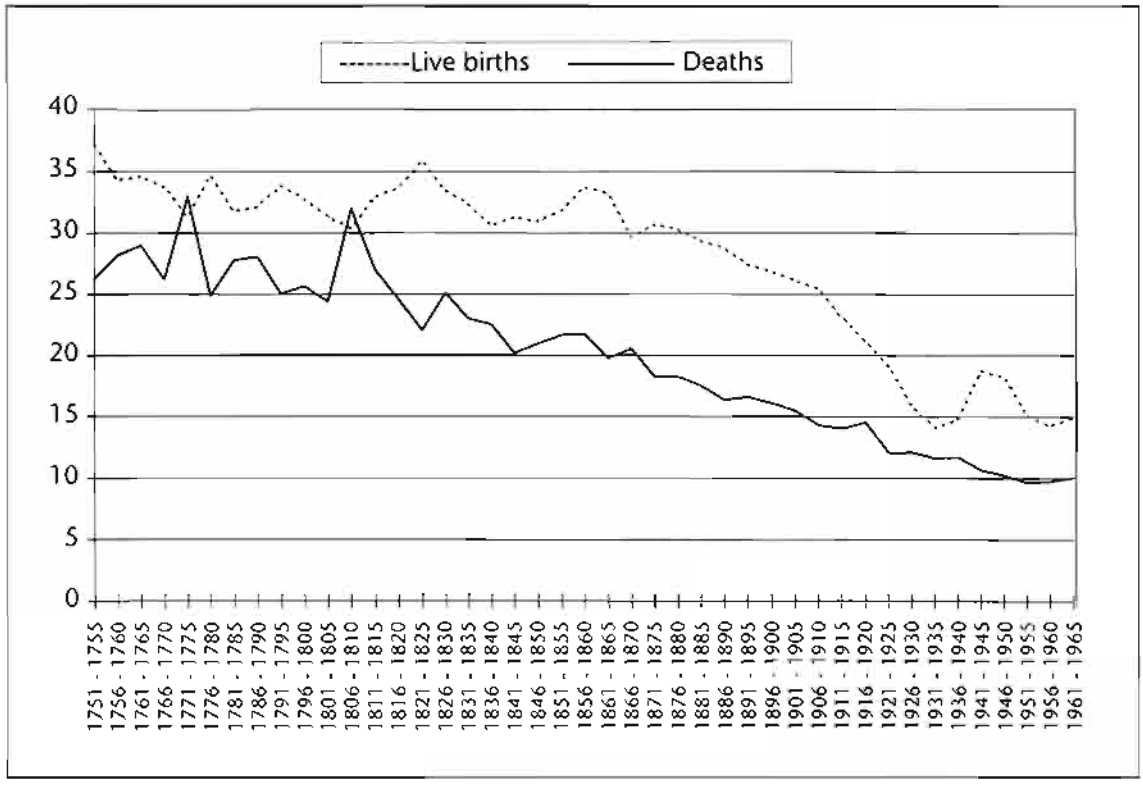


Figure 2
Crude Birth and Death Rates in Sweden, 1751-1965
(Source: BiSOS. Historisk statistik, Befolkningen)

deaths (including their causes) and migrations — and to prepare a 'census' every five years, showing the age structure and the social composition of their parishes. Copies were sent to the dean who summarized the information in 'deanery tables', which were then sent to the Central Bureau of Statistics where county — and national — level statistics were produced.

The first Bureau reports were published in 1755 and 1761. Because they revealed that the Swedish population was much smaller than previously estimated, they were immediately classified as 'top secret' for reasons of national security. Restrictions were later abolished and figures were published in scientific journals. As noted earlier, the high level of infant mortality was identified as the cause of the slow population growth. A number of eminent physicians, among whom the famous Swedish paediatrician Nils Rosén von Rosenstein, estimated that more than 30,000 lives could be saved each year if health care were improved. Such arguments could not be ignored by the Swedish government, which subsequently declared:

> *By carefully examining the reasons for the slow population increase, we have found that the causes are to be found in a lack of physicians, proper drugs and proper care of the newly born. We will commit ourselves to take prompt action to change these conditions, as is always required of a wise government*[2].

It would take several decades before a sufficient number of doctors were trained. In the meantime, the Government also addressed the problem of inadequate infant care, which it considered could best be counteracted through education and social control.

Four different strategies were put into effect:

1. Literature and pamphlets on child care and children's diseases were written and circulated to the parishes. The popular annual *Almanacs* reached almost every household and contained articles on child care and the treatment of illnesses.

2. Larger numbers of doctors were trained, thanks to increased government funding of the national medical association, the *Collegium Medicum*, founded in 1663. Provincial physicians were appointed; as state employees, their activities were regulated by specific directives which appeared in 1744, 1766 and 1774. New local districts were also established.

3. Clergymen, traditionally involved in health matters, now received specialized training in medicine and child care. Linnaeus, among others, held seminars for the clergy. The local church assistants (*klockare*, literally bell-ringers) were given training in inoculation against smallpox. Medical literature was written specifically for ministers and *klockare*. Ministers were required to keep medical books in their parish libraries, to announce public health measures at the end of the service, and to maintain a small pharmacy.

4. Midwives were placed under a central state directorate. According to official 'calculations', "out of 651 women dying in childbirth [each year], at least 400 could have been saved if only there had been enough midwives". It was decided that women would receive one year's training as midwives, after which they would have to sit an examination in Stockholm to qualify for a licence to practice. Only licensed midwives would be allowed by law to assist women in childbirth. They were also given responsibility for postnatal assistance, including educating new mothers in sound child-care practices and regularly monitoring their progress. As a result of these new policies, midwives began to play a more important role in many parishes. For instance, in areas where artificial feeding practices were common, midwives often helped doctors to promote breastfeeding. They could also explain the importance of proper hygiene to mothers and instruct them in the home-treatment of common illnesses. Since midwives were usually from farming communities, it was easy for them to communicate with the local population and gain their acceptance. They could, therefore, more readily provide child and maternal health care, while acting as 'messengers' of official medicine. Licensed midwives were occasionally even credited with contributing to the decline of local infant mortality[3].

2. Ständerförsamlingen, 1876. Printed in Hjelt, 1892, p. 158.
3. Brändström, 1984.

A farmer's wife and daughter in Sweden, circa 1900. Infant mortality varied greatly in rural areas, the most astounding case being that of the neighbouring counties of Jämtland and Västernorrland. The former had the lowest infant mortality rate in mid-nineteenth-century Sweden while the latter had the highest.

The central medical authorities could make education and licensing compulsory for midwives, but were not allowed by the local government to *force* the parishes to send women to training courses. The most that they could do was to issue proclamations to be announced in church or at parish meetings urging parishioners to rely only on licensed midwives. The debate continued until about the 1850s, with local parish boards staunchly opposing the *Collegium Medicum* (from 1816, *Sundhetskollegium*).

Therefore, the distribution of licensed midwives was uneven on Swedish territory: some parishes - especially in towns - already had licensed midwives by the late eighteenth century, while others resisted adhering to state edicts until the middle of the nineteenth century. By 1890, however, the numbers of licensed midwives had increased markedly, and the goal set as far back as the 1750s — that each parish should have access to a licensed midwife — was finally attained.

When employed in a new parish, licensed midwives seem to have quickly displaced traditional birth attendants. This changeover occurred without the intervention of official authorities; unlicensed midwives were, for example, almost never charged in court. It appears that licensed midwives merely came to be viewed as more 'appropriate' than unlicensed ones to assist women in childbirth. To some extent, there could also have been an economic incentive for using the services of a state-provided midwife, since they were obliged to assist the poor without charging a fee[4].

Past and Present Research and Sources

In 1862, The Central Bureau of Statistics started its own journal, *Statistisk Tidskrift*, where leading statisticians could present their findings. Many excellent historical studies were published, which outlined county and national trends in infant mortality from 1749 onwards. Some of these studies, although they usually lacked an analytical approach, are still unsurpassed by modern historical demographers in Sweden.

The decline in infant mortality remains a central topic in the field of Swedish historical demography. In the last two decades, several studies have dealt with the problem. However, most previous analyses have had their limitations. First, they have basically been local studies, each using different methods and generally incomparable classification schemes. A second limitation has been that they have not sufficiently taken into account the regional differences in infant mortality.

Basic knowledge about infant mortality in Sweden has been pieced together from information found in parish registers. During the eighteenth and nineteenth centuries, it was strongly believed that all Christians needed to be able to read and understand the word of God. It eventually became compulsory for parishioners to take an examination testing this ability, and a so-called Church Examination Register was kept to ensure that every member of the parish did, in fact, fulfil this religious duty. The ledger contained a report on every individual in the community, arranged by family and household. Parts of the register were updated annually, which made it possible to keep track of each person's movements. The Church also kept other, better-known registers: a birth register; a register of migrants (unique to Sweden and Finland); a marriage register; and a death and burial register. By combining the Church Examination Register with these registers of vital events, the historian can reconstruct life-histories for almost everyone in the population.

The parish registers thus provide complete information for the study of infant and child mortality: the exact date of birth, the cause and date of death, whether the child was born in or out of wedlock, the ages of the parents, their occupations and residence. Even stillbirths are recorded with reasonable accuracy.

4. Brändström, 1992.

Past studies have interpreted the decline in infant mortality in different ways. Emphasis has been placed on: the interrelationship between infant mortality and the general nutritional status of the population (as measured by grain consumption or wage index); the expansion of general health services; changes in the social structure of the population; and the quality of infants' diets.

Generally, there is evidence of only a weak correlation between social structure and infant mortality in nineteenth-century Sweden. In some studies, farmers have a higher infant mortality rate than crofters and other landless groups; in other studies, the opposite is true[5]. Edvinsson found almost no social inequality with respect to infant deaths in the town of Sundsvall[6]. Only a tenuous and indirect correlation has ever been made between wage levels and infant mortality. The only 'social' correlation that seems to exist throughout Sweden can be found in areas dominated by textile industries where female employment is high. Thus, studies that have aimed at monocausal explanations of trends in infant mortality have fast proven unsatisfactory: infant mortality is clearly conditioned by a combination of social, cultural, biological and economic factors. To this list can be added attitudinal factors, for it has been shown that the concept of infancy and attitudes towards child-rearing can be determinants of infant mortality.

Spatial Variations

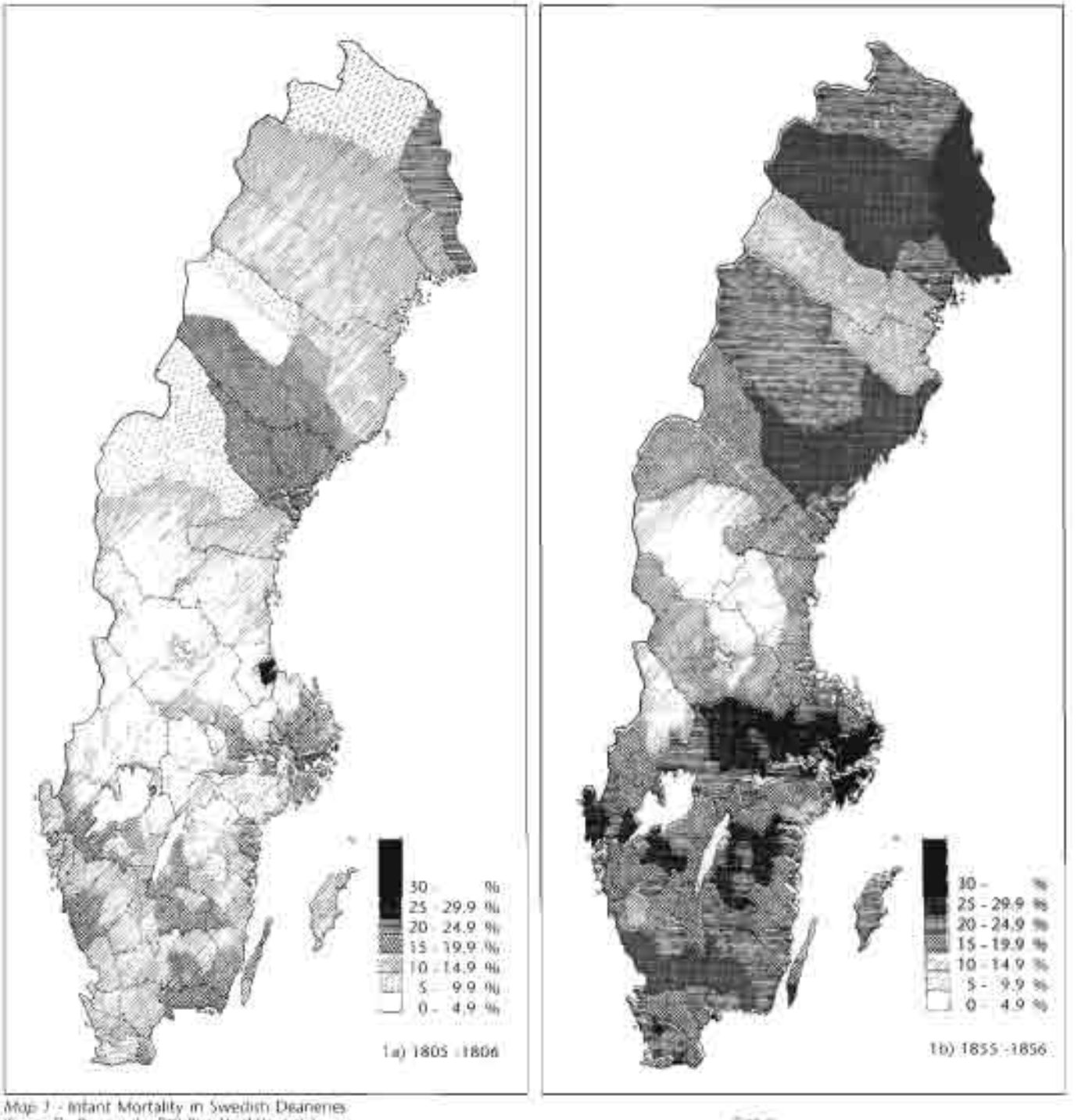
The spatial aspect of Swedish infant mortality is also considerable, and research into regional distribution has received renewed attention in recent years. Figures showing differences in infant mortality among different counties were published by the Central Bureau of Statistics as early as the middle of the nineteenth century. From data collected at the county level, it was evident that conditions for infants were especially severe in Stockholm and other cities. However, differences among rural counties were also striking. The contrast between the two neighbouring counties of Västernorrland and Jämtland was extreme: Västernorrland had the highest infant mortality rate in mid-nineteenth-century Sweden, while Jämtland had the lowest! Between 1860 and 1882, the average infant mortality rate for Västernorrland was 177.9 per 1,000 live births compared with only 96.6 per 1,000 for Jämtland. The national average was approximately 135 deaths per 1,000 births at that time.

Taking these differences as his point of departure, Johan Hellstenius, a physician and statistician of the time, conducted an investigation in the two counties. An even more diversified picture emerged when parish data were considered. Hellstenius showed that infant mortality was at its highest in the coastal parishes, decreasing gradually the further inland one went. However, the pattern was broken by 'enclaves' or parishes with a significantly different infant mortality rate from the surrounding parishes. Parishes dominated by iron foundries had much *lower* infant mortality rates than rural parishes (in some cases below 92 per 1,000 live births); parishes dominated by nomadic populations had significantly *higher* infant mortality rates than neighbouring areas (the highest recorded infant mortality rate was 293 per 1,000 live births). Hellstenius did not conduct a thorough investigation into *why* these differences existed. However, he did suggest that the causes should be sought in disparities in child-care and infant-feeding practices. Referring to female sawmill workers in coastal parishes, for instance, he noted that by working in industries, poor urban women were unable to care for their children properly[7]. His empirical evidence was not detailed enough to support such an argument, which appears to be representative of

5. For instance, cf. Martinius, 1977; Winberg, 1975; Brändström, 1984; Brändström and Sundin, 1981.
6. Edvinsson, 1992.
7. Hellstenius, 1884.

the tendency of many intellectuals in the mid-nineteenth century to see the negative effects of industrialization and a changing culture.

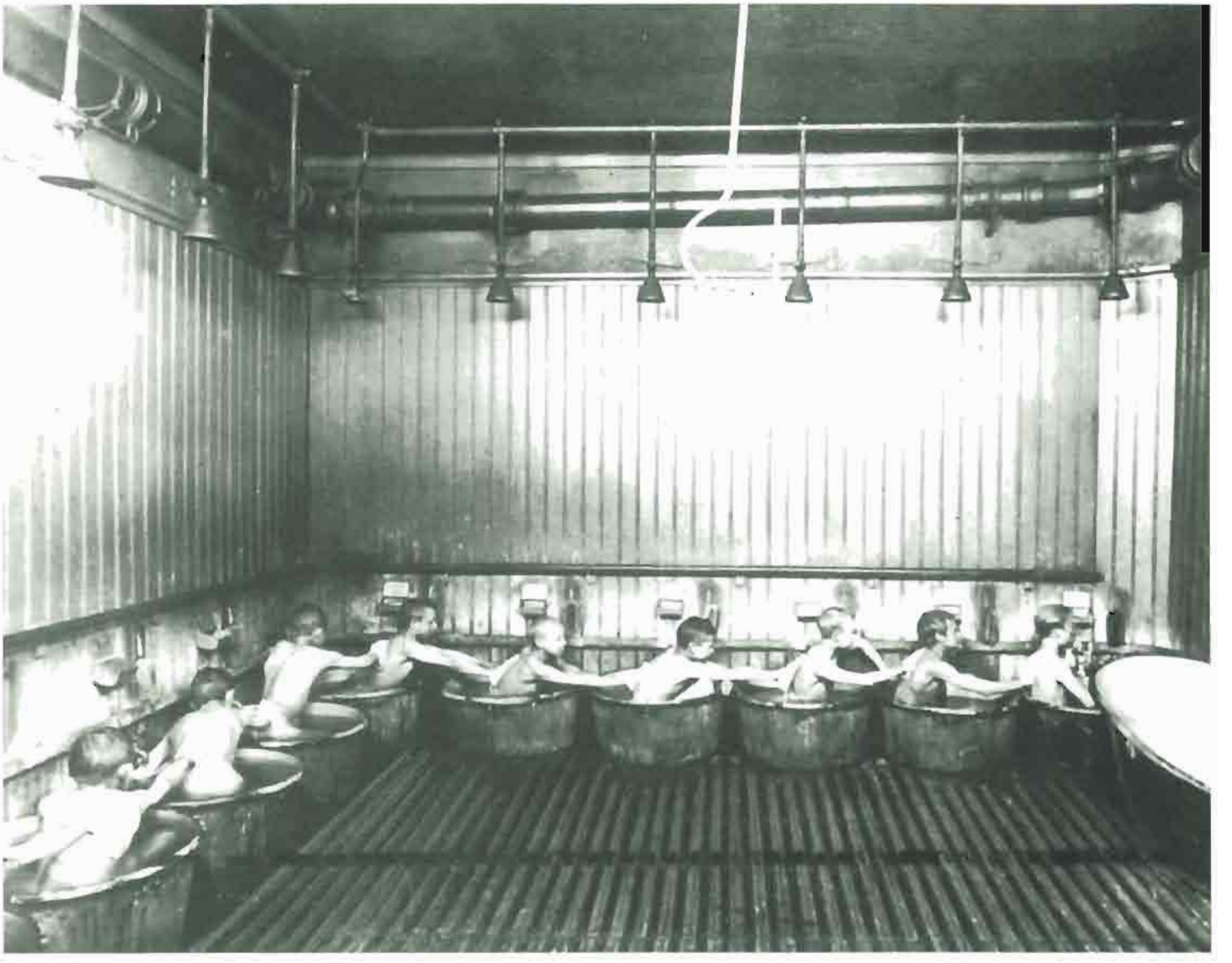
It took nearly a century before historical demographers in Sweden went beyond the findings of Hellstenius. With the help of a computer register of statistics from the Central Bureau of Statistics for the years 1805-06 and 1855-56, they have been able to produce population maps for Sweden (Maps 1a and 1b)[8].



Map 1 - Infant Mortality in Swedish Deaneries
(Source: The Demographic Data Base, Umeå University)

Erratum
The legends on maps 1a) and 1b) should be inverted.

8. The Demographic Data Base in Umeå is currently continuing the registration of the population statistics from the Central Bureau of Statistics, however, on a more detailed level. All annual tables with vital statistics and the five-year censuses at *parish level* are computerized. The project will be concluded in Spring 1994 when it will be possible to produce annual maps of infant mortality at parish level for the *entire* nation from 1749-1859.



Bathtime in a rural public school, Sweden 1897. Figures showing sharp regional differences in infant mortality were published by the Swedish Central Bureau of Statistics as early as the mid-nineteenth century.

The two maps put in evidence the extremely wide regional differences in infant mortality. They also serve to underline the difficulties involved in incorporating various local infant mortality levels with changes in general nutritional status or economic standing. The northernmost parts of the country were haunted by high infant mortality rates, as were large areas in the Lake Mälar region (the parishes west of Stockholm and around Lake Mälaren). Two 'dark fields' also stretched across southern Sweden. Areas around Jämtland showed a low infant mortality rate, as did the islands of Gotland and Öland. The northern parishes around the Lule River valley (stretching from Luleå near the coast to the parish of Jokkmokk) also witnessed favourable rates. When the two maps are compared, similarities between the spatial distribution of infant mortality are striking. Infant mortality was generally at a lower level in 1855-56, but the regional distribution seems to be the same. Thus, the first map appears to indicate a fairly stable pattern rather than a random fluctuation. However, it is not easy to find a common denominator: different rates occur almost regardless of the degree of urbanization and often despite very similar levels of industrialization. For instance, agricultural regions dedicated to livestock production display the whole range of infant mortality rates.

Causes

The increasing interest shown in cultural or psychological factors as determinants of infant mortality has promoted an interdisciplinary approach to the problem[9]. Arthur E. Imhof has associated regional variations in infant mortality with mental attitudes towards newborns and their chances of survival. Other scholars have tended to emphasize the importance of changes in the sexual division of labour, paying special attention to female labour conditions and their effect upon breastfeeding. This latter emphasis might at a first glance present a more convincing explanation of regional differences than '*mentalités*'. However, this argument also has its difficulties and has led different historians to come up with contradictory results.

It is always arduous to get a clear-cut definition of what students of infant mortality mean when they talk about 'cultural' factors. According to David Kertzer, "demographers treat 'culture' as a grab-bag of non-demographic, non-economic characteristics that influence behaviour, without themselves being susceptible of economic or demographic explanation"[10]. Whenever a traditional analysis of infant mortality is conducted where something 'inexplicable' remains, as often occurs in the causal chain, a residual or 'cultural' label is attached to it. However, most scholars mention breastfeeding and child care when they talk about culturally dependent factors.

How, for instance, can the regional patterns noted earlier be explained? What factor or factors have caused infant mortality rates to be relatively stable over time? Norberg, Norman and Åkerman discuss mortality in relation to the notion of 'ecotypes'; that is, areas characterized by different climatic, social and economic conditions. They also stress the importance of the influence exerted by the parents themselves in child-rearing[11]. Child care and breastfeeding practices seem again to be the key factors associated with regional variations in infant mortality. Most scholars agree upon the importance of breastfeeding, but it still remains to be seen whether this aspect can be identified as 'the factor' behind the regional differences.

The use of cow's milk, meal pap or other substitute feeding practices has long been considered the direct cause of regional differences in infant mortality in nineteenth-

9. Cf. Imhof, 1981, pp. 343-382; Lee, 1984; and Lithell, 1988.
10. Kertzer, 1992.
11. Norberg, Norman and Åkerman, 1979, p. 68.

Rural schoolchildren. Sweden, circa 1900. Further research needs to be carried out to provide a clearer understanding of the effect of urbanization on infant mortality levels. Urban areas such as Stockholm presented exceedingly high death rates during the nineteenth century, while levels were surprisingly low in a number of small towns.

This photograph from northern Sweden, dated 1943, shows a nurse weighing a newborn baby at home. The government began taking steps to combat infant mortality at the end of the eighteenth century, ensuring, amongst other things, that midwives received proper training in child and maternal health care.

century Germany[12]. In a study of some nineteenth-century Finnish parishes, Ulla-Britt Lithell similarly concludes that nursing practices were "the main factor most directly acting upon and determining infant mortality levels in the past"[13]. Implicit in this statement is the premise that fluctuations in infant mortality must have been determined by changes in infant-feeding practices. Since infant mortality decreased during the nineteenth century, it was sustained, breastfeeding practices must have spread across the country and, for instance, counterbalanced the negative effects of urbanization. How could such a hypothesis be tested? Were high infant mortality rates in various parts of Sweden due to the absence of breastfeeding? Was the rapid decrease in the level of infant mortality during the nineteenth century a result of changes in these practices?

Unfortunately, there are no Swedish statistics on breastfeeding habits before the twentieth century. There are no equivalents to the kind of quantitative information that was gathered by midwives and by the *Bayerisches Statistisches Landesamt* in Germany, or by hospitals such as *Fødelsestiftelsen* in Norway[14]. The only information available in Sweden is based on qualitative statements made by provincial doctors. From the eighteenth century, this information can be found in their annual reports to the central medical authorities. However, descriptions of feeding practices were not systematic. To get a clearer picture, the National Board of Health requested every provincial physician in 1869 to provide detailed descriptions of the causes of infant mortality and to list preventive measures taken. For several years, information was sent to the National Health Board, but it was never systematically analysed, although abridged versions of single reports were occasionally published. The original material still exists, and with its help an estimate of breastfeeding habits for late nineteenth-century Sweden can be made[15].

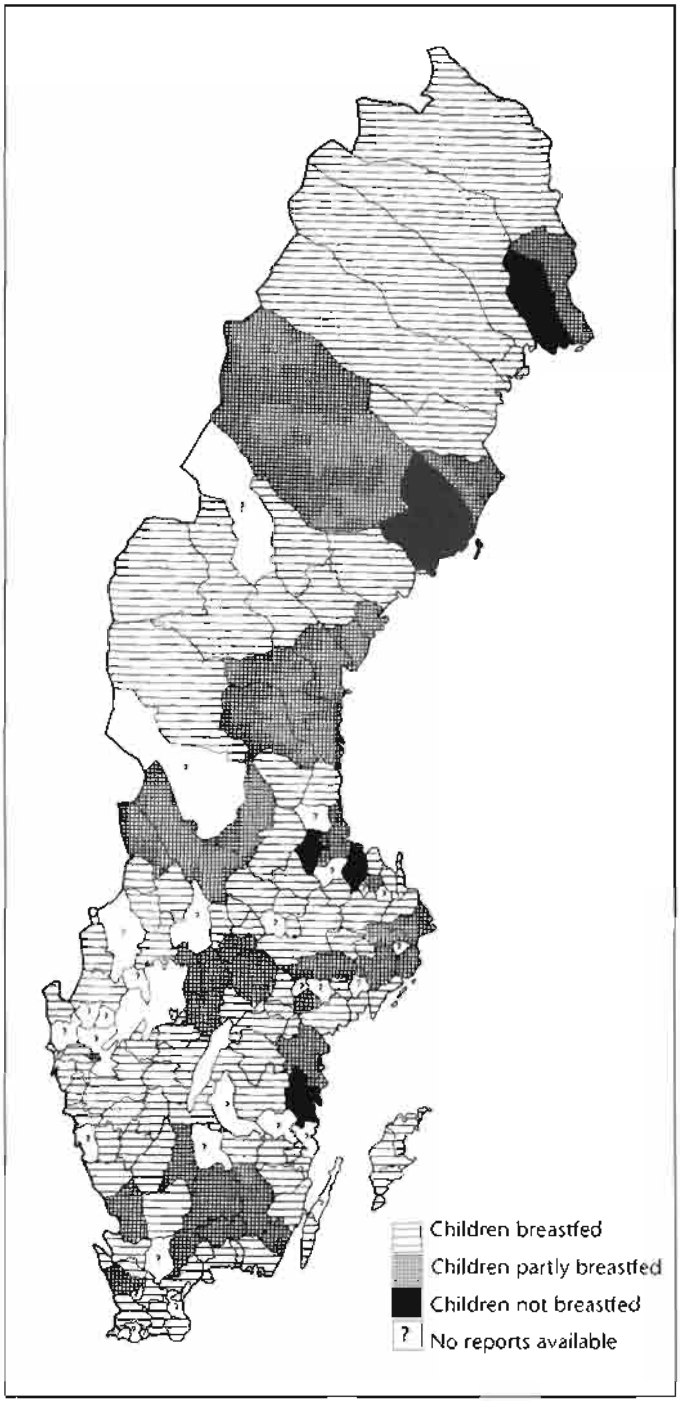
Infant feeding practices showed considerable variation by region (Map 2). Areas where substitute or mixed feeding practices were common were reported from the north of Sweden, across the county of Västerbotten, the Sundsvall sawmill region by the coast of the county of Västernorrland, the Lake Mälar region, and across southern parts of the country. If Map 2 is compared with Maps 1a and 1b showing infant mortality rates for 1805-06 and 1855-56, respectively, several similarities are obvious. The coastal region of northern Sweden was characterized both by a high infant mortality rate and substitute feeding. The same pattern appears in the county of Västerbotten, in the Lake Mälar region and in southern Sweden. At the same time, a contradictory pattern can be found in other regions, such as the mountainous hinterland of the Lule valley in northern Sweden, parts of the Sundsvall sawmill region, and areas in northern Bohuslän.

Clearly, breastfeeding was an important determinant of infant survival in nineteenth-century Sweden, but it was not the only factor. The difficult conditions in which women worked have also been linked to high infant mortality, as also shown by Lithell using material collected in Finland[16]. Moreover, infant mortality could still be high even when children were breastfed. However, the opposite seems not to have been as common: areas where substitute feeding was prevalent do not display *low levels* of infant mortality. Microdemographic studies of specific parishes confirm this pattern[17]. It is also interesting that a clear connection does not seem to exist between levels of fertility and infant mortality[18].

Maps 1a and 1b show that in Jokkmokk, a very large parish in the northern part of the Lule valley, extremely high levels of infant mortality had been reached while Map 2 reveals that breastfeeding was pervasive in the same region. The reason for this contradiction may

12. Knodel, 1974; Knodel and van de Walle, 1967.
13. Lithell, 1981, p. 60.
14. Knodel and van de Walle, 1967, pp. 116; Rosenberg, 1988, p. 49.
15. Brändström, 1984.
16. Lithell, 1988, p. 91.
17. Brändström, 1984, p. 179.
18. Larsson, 1988, p. 77

be attributed to the nomadic nature of the population of that region. As suggested by Hellstenius for the counties of Jämtland and Västernorrland, and confirmed in studies by Sten Wahlund[19], the nomadic population had a much higher level of infant mortality than the 'settled' population. The same pattern applies for Jokkmokk where infant mortality was twice as high among the nomads as among the settled population. This could not be explained by genetic differences, but was instead the result of the special working condi-



Map 2
Breastfeeding in Swedish Provincial Physicians Districts, 1869-1874
(Source: Provincial Physicians Annual Reports 1869-1874, Board of Health, The National Archive, Stockholm)

tions of the nomads. Infant mortality for the nomadic population followed an extreme seasonal pattern. Rather than in the winter when the nomads *moved* with their herds of reindeer, infant mortality was concentrated in the summer when labour was most intense. The

19. Wahlund, 1932.

reindeer were kept high in the mountains where the climate was cool. The herd had to be monitored on a 24-hour basis, which required the participation of the entire household. It was found that children born during the summer had extremely low life expectancies. For instance, neonatal mortality reached almost 250 per 1,000 live births in July. During the rest of the year, infant deaths were fairly low among the nomads since their children were breastfed, often for several years. Prolonged breastfeeding was also probably used to control fertility. A reduction of up to 40 per cent from the average annual level was achieved[20].

Towards Future Research

A brief presentation of current historical research into infant mortality could serve equally as a list of topics *in need of* investigation, since, in almost all instances, substantial knowledge is lacking or results have been contradictory. One cause of this situation could perhaps be the methodology used in studying infant mortality. The point of departure, whether aggregate statistics or family reconstitution data have been utilized, has always been the individual. Infant mortality has been studied by considering each child separately. Although parent-child relationships have received some attention, relations with *siblings* have been left out of the picture. However, it is becoming increasingly clear 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 upon individual characteristics as well as on the fate of previous siblings. We know that the death of a child is often followed closely by a new pregnancy of the mother. Short intervals between pregnancies lead to increased death risks not only for the mother but also for the child. A preliminary analysis of family-specific child deaths in regions with extremely high infant mortality rates confirms that infant mortality was not evenly distributed among families, but was instead concentrated on a few families which had very high average rates of infant death. In regions with an average infant mortality rate of 300 per 1,000 live births, families with several children have been identified in which no single child died, while in other families most of the children died before they reached their first birthday. Family-specific conditions also stretched further into the 1-15 age-bracket, determining the chances of survival[21]. This strongly suggests that future studies on infant mortality must consider the family, not the individual, as the point of departure. Life-course analysis has proved to be a suitable method for such an approach[22].

Infant mortality in urban areas is another field where much more research is needed. Almost nothing is known about the mechanisms which govern differences in infant mortality in urban areas and how the urban-rural population exchange has affected mortality. It is known that infant mortality was exceedingly high in large urbanized areas such as Stockholm. At the same time, infant mortality was surprisingly *low* in a number of small towns, for instance in northern Sweden[23]. In the mid-1800s, the parish of Nedertorneå had an infant mortality rate that was four times as high as the town of Haparanda. This seems to be a general pattern in northern Sweden, though the differences were not always as

20. Brändström, 1988.
21. Brändström, 1984, p. 143; Brändström and Stenflo, 1987.
22. The group for economic demography at the Department of Economic History in Lund is among the forerunners in the use of these methods in the analysis of infant morality in Sweden. Cf. for instance, Bengtsson and Ohlsson, 1984; and Bengtsson, 1984. A more methodological approach to the use of life-course analysis in demography is basically conducted by Göran Broström in the Department of Mathematical Statistics in Umeå. Cf., for instance, Broström, 1987.
23. Edvinsson, 1992, finds fairly low levels of infant mortality rates in the town of Sundsvall and difficulties in establishing a clear 'social' pattern. A majority of the infants in the town died from diarrhoeal diseases. These early deaths are probably explained by feeding practices which do not seem to be simply economically determined.

extreme as in Nedertorneå[24]. The social composition in the towns does not provide us with an explanation. The urban poor often had lower levels of infant mortality than farmers[25].

The level of urbanization does not provide a clear answer. Why does the average infant mortality rate in Swedish towns decrease below the level of rural parishes when urbanization increases? Neither, for example, does there seem to be a clear correlation between the installation of sewage systems and a decline in mortality. It is obvious that towns and cities had special mortality regimes that have to be studied in greater detail.

In addition to micro-demographic studies into the family and into urban areas, the macro-demographic level also deserves attention. The maps of Sweden in 1805-06 and 1855-56 provide important 'snap-shots' in the discussion of infant mortality in Sweden. We can see the differences and changing levels between the two points in time, but we have no detailed information on the long-term trends in time and space. In which part of the country did infant mortality start to decline first? What were the causes behind this initial process? Which part of Sweden was affected last, and in which milieus did infant mortality *rise* during the nineteenth century? Could these trends and shifts be correlated with fertility, industrialization or proletarization?

Similarly, a clearer distinction must be made in *what* is being analysed - a distinction between *levels* and *trends* in infant mortality. First, a correct chronology of the mortality decline needs to be set out; second, investigations need to be made into the factors that are prevalent in order to produce the observed level of infant mortality. For instance, which component, or components, are necessary to produce high infant mortality rates of more than 250 per 1,000 live births? Perhaps high mortality levels cannot be attributed to single causes, but to the *additive effects* of several negative factors?

There seem to have existed *thresholds* of mortality which could not be crossed until a number of negative elements had been removed or counterbalanced. Only then was the secular decline in infant mortality triggered, often very abruptly. In nineteenth-century Swedish parishes or towns, where pregnant women had a reasonably good nutritional level, where infants were breastfed, where hygiene was fairly good, and where severe epidemics did not threaten the population frequently, infant mortality still seldom reached levels under 100 infant deaths per 1,000 live births. This baseline level *was* lower in some particular areas, but only for short periods of time. It was only *after* the turn of the nineteenth century that infant mortality fell to levels under 100 per 1,000 live births in Sweden. The same development seems to have occurred in many other European countries at about the same time. Could this second major decline in European infant mortality be due to modern medicine and medical technology? The answers are still unknown.

24. Brändström, 1984, p. 125.
25. Brändström, 1984, p. 127.

References

Bengtsson, T. et al. (eds), *Pre-Industrial Population Change. The Mortality Decline and Short-Term Population Movements*. Stockholm, Almqvist & Wiksell International, 1984.

Bengtsson, T. and R. Ohlsson, "Population and Economic Fluctuations in Sweden 1749-1914", in T. Bengtsson, et al. (eds), Stockholm, Almqvist & Wiksell International, 1984, pp. 277-298.

Bengtsson, T. "Harvest Fluctuations and Demographic Response: Southern Sweden 1751-1858", in T. Bengtsson, et al. (eds), 1984, pp. 329-356.

Brändström, A., *'De kärlekslösa mödrarna'. Spädbarnsdödligheten i Sverige under 1800-talet med särskild hänsyn till Nedertorneå* ('The Loveless Mothers'. Infant Mortality in Sweden during the Nineteenth Century, With Special Regard to Nedertorneå). Dissertation with a summary in English. Stockholm, Almqvist & Wiksell International, 1984.

Brändström, A., "The Impact of Female Labour Conditions on Infant Mortality: A Case Study of the Parishes of Nedertorneå and Jokkmokk, 1800-1896", *Social History of Medicine*, 1, 1988, pp. 329-58.

Brändström, A., "Medical Professionalisation and its Value as an Explanatory Tool — Midwifery in Nineteenth Century Sweden", paper presented at the workshop "Social History. Research and Innovation in the 1990s: The State of Social History of Medicine Today", University of Essex, 8-9 January 1992.

Brändström, A. and G. Stenflo, "Dependence Between Birth Intervals and Infant Mortality: The Case of Nedertorneå 1818-1896", paper presented at the European Population Conference in Jyväskylä, Finland, 11-16 June 1987.

Brändström, A. and J. Sundin (eds), *Tradition and Transition. Studies in Microdemography and Social Change*, The Demographic Data Base, Umeå, 1981.

Brändström, A. and L.-G. Tedebrand (eds), *Society, Health and Population during the Demographic Transition*, Stockholm, Almqvist & Wiksell International, 1988.

Broström, G., "The Influence of Mother's Death on Infant Mortality: A Case Study in Matched Data Survival Analysis", *Scandinavian Journal of Statistics*, 14, 1987, pp. 113-123.

Edvinsson, S., *Den osunda staden. Sociala skillnader i dödlighet i 1800-talets Sundsvall* (The Unhealthy Town. Social Inequality in Relation to Mortality in Nineteenth-Century Sundsvall). Disssertation with a summary in English. Reports from the Demographic Data Base, no. 7, Umeå, 1992.

Hellstenius, J., "Barnadödligheten i Västernorrlands och Jämtlands län 1860-1880", *Statistisk Tidskrift*, 1884.

Hjelt, O., *Svenska och finska Medicinalverkets historia 1663-1812*, Part 1, Helsingfors, 1893.

Imhof, E., "Unterschiedliche Säuglingssterblichkeit in Deutschland 18. bis 20. Jahrhundert - Warum?", *Zeitschrift für Bevölkerungswissenschaft*, 6, 1981, pp. 343-382.

Kertzer, D.I., "The Role of Culture in Historical Demographic Explanation", paper presented at the Workshop on the "Decline of Infant Mortality in Europe 1850-1950", Florence, 9-11 April 1992.

Knodel, J., *The Decline of Fertility in Germany* 1871-1939, Princeton, Princeton University Press, 1974.

Knodel, J., and E. van de Walle, "Breast Feeding, Fertility and Infant Mortality: An Analysis of Some Early German Data", *Population Studies*, 21, 1967.

Larsson, M., "The Old in the New: Spatial Patterns in the 19th Century Demographic Change", in Brändström and Tedebrand (eds), 1988.

Lee, W.R., "The Impact of Agrarian Change on Women's Work and Child Care in Early-Nineteenth-Century Prussia", in J.C. Faut (ed.), *German Women in the Nineteenth Century. A Social History*. London, 1984.

Lithell, U.-B., *Breast-feeding and Reproduction. Studies in Marital Fertility and Infant Mortality in 19th Century Finland and Sweden*, Uppsala, Almqvist & Wiksell International, 1981.

Lithell, U.-B., "Childcare - A Mirror of Women's Living Conditions. A Community Study Representing 18th and 19th Century Ostrobothnia in Finland", in Brändström and Tedebrand (eds), 1988.

Martinius, S., *Peasant Destinies*, Stockholm, Almqvist & Wiksell International, 1977.

Norberg, A., H. Norman and S. Åkerman, "Regional and Local Variations of Mortality in Sweden 1750-1900", *Scandinavian Population Studies*, 5, 1979.

Notenstein, F. W., "The Economics of Population and Food Supplies: Economic Problems of Population Change", *Proceedings of the Eighth International Conference of Agricultural Economists*, London, 1953, pp. 13-31.

Rosenberg, M. "Birth Weight, Breast-Feeding, Postpartum Amenorrhoea and Infant Mortality in Three Norwegian Cities during Late Nineteenth and Early Twentieth Century", in Brändström and Tedebrand (eds), 1988.

Wahlund, S., *Demographic Studies in the Nomadic and Settled Population of Northern Lapland*, Uppsala, 1932.

Winberg, C., *Folkökning och proletarisering*, Lund, Göteborg, Cavefors, 1975.

INFANT MORTALITY IN ENGLAND
– 1550-1950 –
PROBLEMS IN THE IDENTIFICATION OF LONG-TERM TRENDS AND GEOGRAPHICAL AND SOCIAL VARIATIONS

by Robert Woods, Naomi Williams and Chris Galley*[1]

The identification of very long-term trends, together with geographical and social class variations, in the rate of infant mortality poses a considerable challenge to the historical demographer. However, England offers rich sources of data and the benefit of the *longue durée* is without question, even if speculation and a certain amount of statistical licence are required. This process of investigation began with a paper by Woods, Watterson and Woodward which was particularly concerned with the causes of infant mortality decline in England and Wales in the decades immediately before the First World War[2]. The paper traced infant and early childhood (ages one to four in completed years) mortality rates from 1840 to 1940 and showed that although childhood mortality had been falling from the 1850s, as indicated in Figure 1a, for infants the distinct turning-point occurred some decades later, in 1899-1900. However, much of this early work begged the question, 'Would the end-of-century turning-point still appear so significant if a longer period of time were to be considered?'. Here we hope to extend the analysis backwards by several centuries while also continuing to examine geographical and social variations to see what they may tell us of the causes and consequences of mortality variation in general.

Long-Term Infant Mortality Trends

Following the introduction of civil registration in England and Wales in 1837, national, regional and sub-regional series of infant mortality rates may be calculated relatively easily

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2. Woods, Watterson and Woodward, 1988, 1989.

using information published by the Registrar General. Before this date, estimates of infant mortality must be derived from parish registers using the time-consuming process of family reconstitution; consequently, infant mortality may only be determined in discrete locations, usually selected by the quality of their parish registers[3]. Given that relatively few family reconstitution studies have been carried out and these show infant mortality to have varied substantially between seemingly similar places, an alternative way of proceeding is necessary if national levels are to be assessed[4]. Figure 1b offers one approach: it uses five-year periods; relates to England only; and for the period before 1841 relies on estimates of infant mortality derived from Wrigley and Schofield's calculations of life expectation at birth[5]. The significance of Figure 1b lies not so much in its detailed accuracy, or lack of it, but in the more generalized picture it sketches of long-term stability in England's infant mortality rate. With Figure 1a it helps to confirm the importance of 1899-1900 as a turning-point, but the series is by no means completely immobile before this date, with a cyclical upturn in the late seventeenth century, decline in the eighteenth century and secular decline in, but not before, the twentieth century.

The national series may be supplemented with two other long-run series: Hollingsworth's for the British peerage and Galley's for the provincial city of York[6]. These appear in Figure 2 alongside Wrigley and Schofield's estimates based on 13 English parish reconstitutions[7]. The York data illustrate some of the advantages and pitfalls of attempting this sort of analysis. Before 1840, the infant mortality rates are based on the nominal record linkage of York's registers; while from 1840, they are calculated from the Registrar General's reports with the application of a seven-year moving average[8]. Prior to 1700, there is sufficient evidence to conclude that infant mortality remained virtually constant throughout the city. Between 1700 and 1840, the calculated infant mortality rates fell steadily, but most of this was apparent rather than real since York's parish registers became increasingly less accurate as the delay between birth and baptism caused a substantial under-recording of infant births and burials. However, the chance survival of a more accurate Quaker register reveals a much higher infant mortality rate between 1776 and 1793 and this suggests that levels of infant mortality remained high from 1550 to at least 1800. Throughout the nineteenth century, a substantial and significant decline occurred and this accelerated after the 1899-1900 turning-point[9].

The British peerage series appears to tell a different story again. While an undulating plateau is evident before 1700, steady and sustained decline, with an especially sharp drop after 1750, occurred until 1950. Although Hollingsworth's sample consisted of the social élite, they clearly did not always experience the lowest infant mortality rates. The reason for this is probably connected with the almost universal employment of wet nurses by the peerage in the period prior to 1700. During the eighteenth century, maternal breastfeeding became fashionable among the upper classes, and it is surely no coincidence that infant

3. Wrigley, 1966. A simpler, but less accurate, method linking baptisms and infant burials may also be used; see Wrigley, 1977, pp. 292-96.
4. Wrigley and Schofield, 1983; Jones, 1976, 1980; Landers, 1990, 1993; Vann and Eversley, 1992.
5. Wrigley and Schofield, 1981, p. 57. The series in figure 1b has been estimated assuming that the relationship between infant and adult mortality remained constant. The five-yearly figures have been smoothed using a 7-point moving mean. See Woods, 1993, for the origin of these estimates.
6. Hollingsworth, 1977, p. 326; revised from Hollingsworth, 1964, p. 66. Galley's (1991) data come from his continuing research on the demography of York.
7. Wrigley and Schofield, 1983.
8. See Galley, 1991, pp. 96-126 for a detailed discussion of infant mortality between 1561 and 1700. From 1840, three registration sub-districts covered the city of York although each also contained a substantial rural hinterland; hence, the calculated infant mortality rates probably underestimate the purely urban rate; see Armstrong, 1974, pp. 79-82.
9. Short-term variations in infant mortality often occurred, although these may be lost in the search for generalized long-term change. During the seventeenth century, York's annual infant mortality rate varied between 114 and 359 (per 1,000 live births) while during the nineteenth century, rates ranged from 135 to 222. Some of this variation resulted from the small number of events recorded in each year, although epidemics, possibly influenced by climate, also occurred.

mortality rates fell accordingly[10]. Concurrently, steady improvements in sanitary conditions and general child care practices also contributed towards the steady decline in infant mortality which continued until 1950. Wrigley and Schofield's data again suggest the existence of a high plateau of infant mortality with periodic increases occurring during the eighteenth century[11].

However, these data mask considerable geographical variations. While the general pattern is repeated in each parish, seventeenth-century levels within individual parishes varied from 90 per 1,000 live births for the isolated rural parish of Hartland to 222 per 1,000 live births for the small market town of Gainsborough[12].

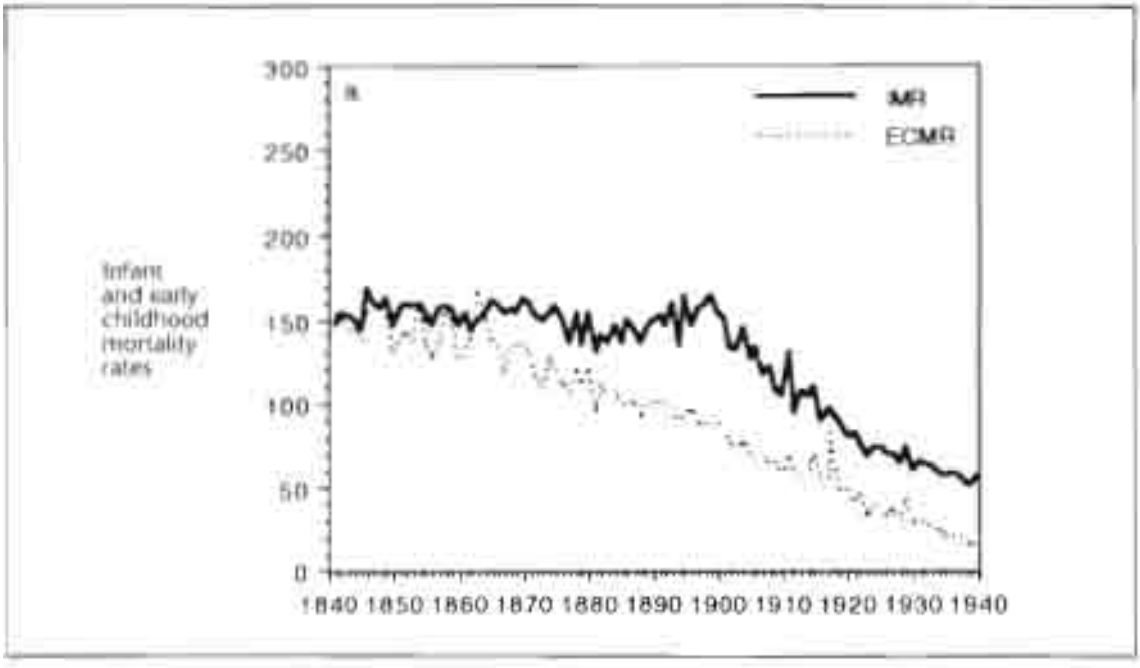


Figure 1a
Annual Infant and Early Childhood Mortality Rates for England and Wales, 1840-1940

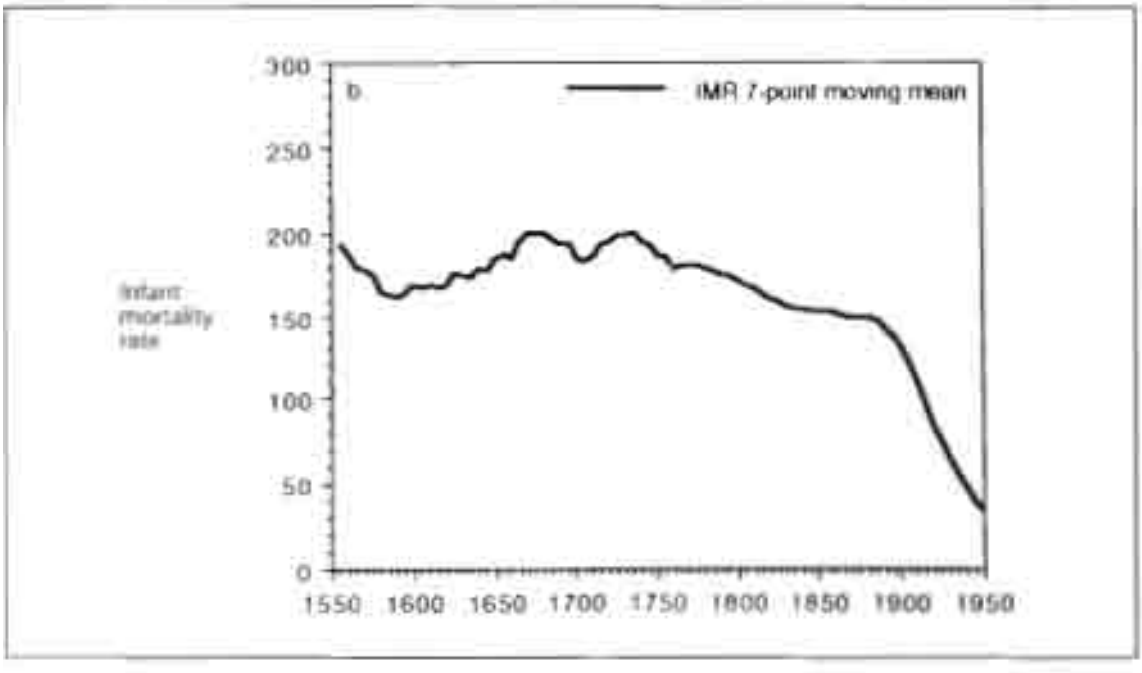


Figure 1b
Smoothed Long-run Infant Mortality Rates for England, 1550-1950

10. Fildes, 1988, pp. 79-100, 111-126; Stone, 1977.
11. The early eighteenth-century increase in infant mortality is also evident in London; see Landers, 1990, p. 39.
12. Schofield and Wrigley, 1979, p. 222.

Insanitary court housing, Liverpool. The entrance to Court No. 10, Smithfield Street in which there were eight houses. Poor hygiene posed a constant danger to newborn babies, and was responsible for the spread of disease

Infant's Milk Depot, Liverpool. At the beginning of the twentieth century a number of towns established Municipal Infant Milk Depots to ensure that artificially-fed infants received clean, unadulterated milk. The Liverpool Depot was the only one to reach a substantial number of working-class infants however.

The four long-term series reflect some of the methodological problems in the estimation of national infant mortality rates before 1840 and they often provide seemingly contradictory evidence. Nevertheless, some patterns do emerge. Before 1750, infant mortality was high, although subject to periodic variation. There were also significant geographical variations together with considerable urban-rural differences. From 1800, there was decline which accelerated after the unique turning-point of 1899-1900. Social variations in infant mortality persisted throughout the period, although they are often more difficult to identify and, as Hollingsworth's data show, the rich were not always advantaged[13].

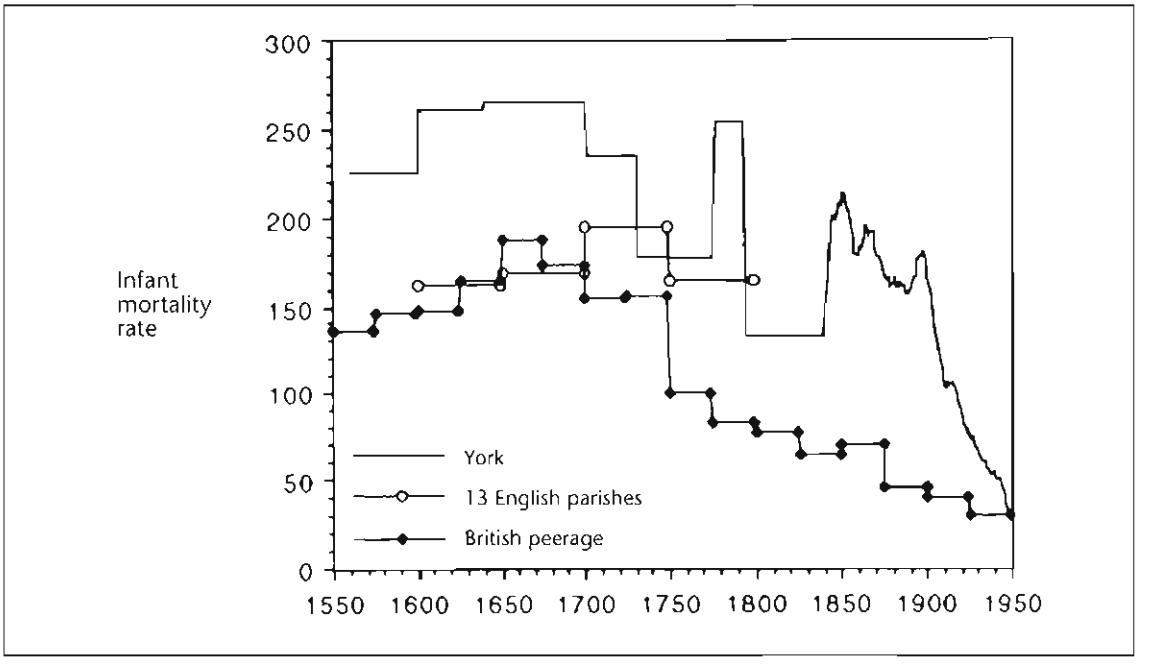


Figure 2
Estimated Long-run Infant Mortality Series for Three British Populations, 1550-1950

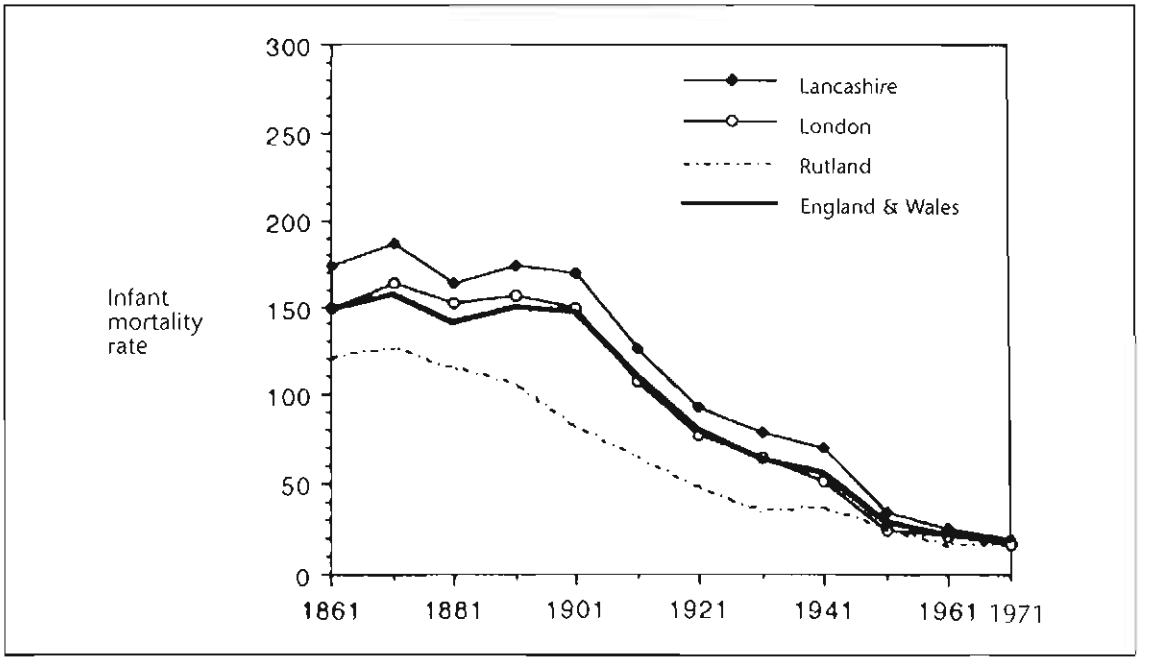


Figure 3
Infant Mortality Rates for Census Years, Selected English Registration Counties, 1861-1971

13. Also, see Finlay, 1981, pp. 83-110.

The causes of infant mortality are difficult to determine although family reconstitution studies reveal that individual families appear to have had markedly different success in raising infants. Thus, factors connected with the feeding and care of infants probably had the greatest influence on overall rates, while sanitary conditions and changes in our knowledge of diseases also affected rates, especially in cities. Thus, a variety of both family-specific and exogenous factors influenced levels of infant mortality, and these probably explain differences within the individual series. For the period before 1840, more work needs to be done in order to determine the extent and cause of geographical and social variations in infant mortality; whereas, for the period after 1840, some of these problems may be addressed directly.

Geographical Variations in Infant Mortality in the Nineteenth Century

Rural-urban differences in infant mortality persisted throughout the nineteenth century and only began to narrow with secular decline after 1900. Rates remained highest in London and the industrial towns of the north of England, whereas in many rural parts of southern England they were already under 100 per 1,000 by the 1860s. High population densities and poor sanitary conditions clearly placed all towns at a disadvantage, and even small towns in southern England experienced substantially higher levels of infant mortality compared with surrounding rural areas. There were some exceptions to this general pattern, however. In several rural districts of eastern England (notably Norfolk, Lincolnshire and the East Riding of Yorkshire), particularly high levels of illegitimate fertility, female agricultural employment, together with the alleged widespread use of opium, combined to raise infant mortality to a level comparable to that of the northern manufacturing towns, at least until the 1870s[14].

The significance of these rural-urban differentials can only be appreciated when one considers that England was an overwhelmingly urban country, certainly by European standards. Even at the beginning of the nineteenth century almost one fifth of the total population was living in towns and cities of over 20,000 inhabitants[15]. With continuing urbanization during the nineteenth century, the effect of rural-urban differentials on national infant mortality became increasingly important. The redistribution of the population from the countryside towards large towns not only ensured that a much greater proportion of the population was exposed to these high-risk environments; but once urban mortality began to account for a disproportionate share of total mortality, the experience of just a few large towns was sufficient to affect national levels and trends[16]. The levelling-out of the national series during the nineteenth century, illustrated in Figure 1, masks the fact that national levels of infant deaths were increasingly being driven by behaviour patterns in towns and cities. Even regional analyses of infant mortality, by avoiding the distortions created by population redistribution, will fail to capture adequately the enormous significance of urban areas upon late-nineteenth century national trends. A recent paper by C. H. Lee raises the issues involved, but it also illustrates several potential limitations[17].

Lee uses infant mortality rates over the period 1861-1971 for 10 Scottish administrative regions and 45 English and Welsh counties as a device to chart long-term changes in health inequalities for Britain. For these 55 units, three-year average infant mortality rates were calculated for 1861, 1871 and so forth to 1971 (that is, 12 points). Lee challenges the con-

14. Woods, Watterson and Woodward, 1988.
15. Law, 1967. By 1851, 38 per cent were living in towns of over 20,000; and by 1901, the proportion had risen to 61 per cent.
16. Woods, Watterson and Woodward, 1988.
17. Lee, 1991. See also Laxton and Williams, 1989.

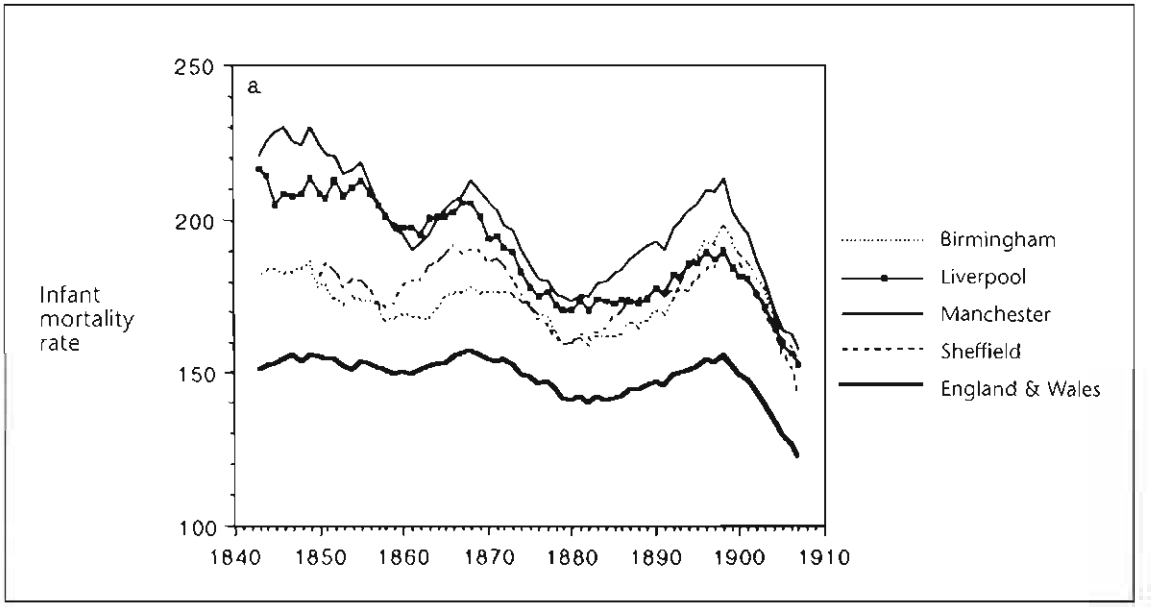
clusions drawn in the Woods et al. paper and argues that "these regional rates do not support the popular notion that trends in infant mortality were 'remarkably consistent' throughout the country"[18]. He notes that much of rural England not only had lower levels of infant mortality than the urban localities in the late nineteenth century, but the decline appears to date from an earlier period, rather like childhood mortality in the national series, as indicated in Figure 1a. Figure 3 uses Lee's data to illustrate the point for Rutland, a predominantly rural county.

Lee's analysis illustrates two fundamental problems. The treatment of unequal geographical units as though they had equal significance is reminiscent of the problem faced by the Princeton European Fertility Project; namely, how can London and Rutland be given equal weight? The key to understanding the causes of variations and trends in infant mortality in Britain, at least between 1850 and perhaps 1930, has already been emphasized: Britain was overwhelmingly a country of very large cities; and circumstances in only a handful of these localities could affect the nation as a whole. The second problem concerns the use of a methodology which gives undue attention to equally-spaced observation points; in this case, three-year averages centred on the year of the decennial census. Intervening periods are ignored, which becomes especially troublesome if one suspects the existence of turning-points. Lee argues that "the regional pattern of change...suggests that too much attention has been given to the apparent discontinuity at the turn of the century"[19]. However, his own observations for '1901' (based on the mean of 1900, 1901 and 1902) just miss the apparent turning-point in the national series. His rates for '1901' may therefore appear equal to or just less than those for '1891'.

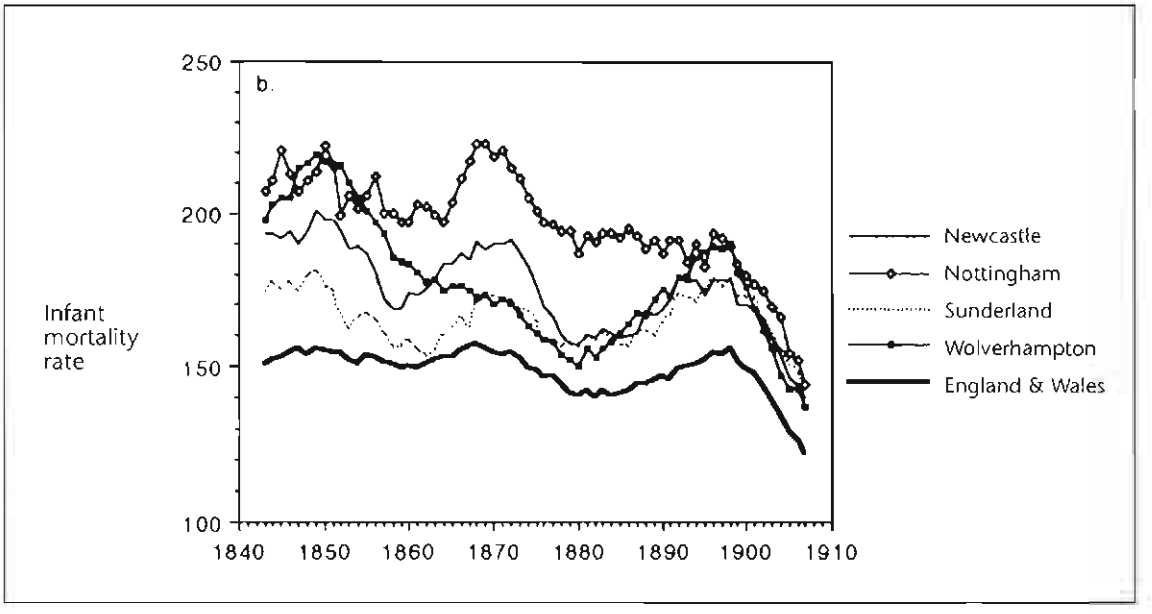
Figures 4a, 4b and 4c offer one possible solution to these problems and highlight some of the advantages of using more refined geographical and temporal units of analysis. They show infant mortality rates between 1840 and 1910, based on vital registration data and supplementing the time series presented by Woods et al., for a selection of large, medium and small towns, respectively. Before any further comment can be made on these graphs, the perennial problem of under-registration needs to be raised because, certainly for the first two decades of the series, there is a strong possibility of incomplete vital registration. The reporting of infant deaths was probably more complete than births; and a declining infant mortality rate, illustrated for many towns in the 1840s and 1850s, would be entirely consistent with a gradual improvement in the coverage of birth registration. However, there is still much to be learned about the extent to which under-registration varied geographically, and particularly in urban areas where the suspicion is that deficiencies may have been greatest. Nonetheless, it appears likely that from the 1860s onwards the series are considerably more reliable. Figures 4a, 4b and 4c show interesting differences in overall levels of infant mortality among towns, which were not simply a function of the size of a town. In a number of small towns, including Preston, infant mortality rates during the second half of the nineteenth century were consistently above those of large cities such as Liverpool and Manchester.

The differences most probably reflect a particular combination of economic, social, cultural and environmental factors which varied from town to town. Although breastfeeding seems to have been the norm in the late nineteenth century and possibly kept urban infant mortality rates at a lower level than would otherwise have been the case given the nature of prevailing sanitary conditions, it is likely that further variations among towns reflected differences in a wide range of factors including: housing provision; sanitary arrangements (and especially whether a town was served by privy-middens or water-closets); and patterns of female employment. The differences in levels of infant mortality

18. Lee, 1991, p. 56.
19. Lee, 1991, p. 61.



4a)



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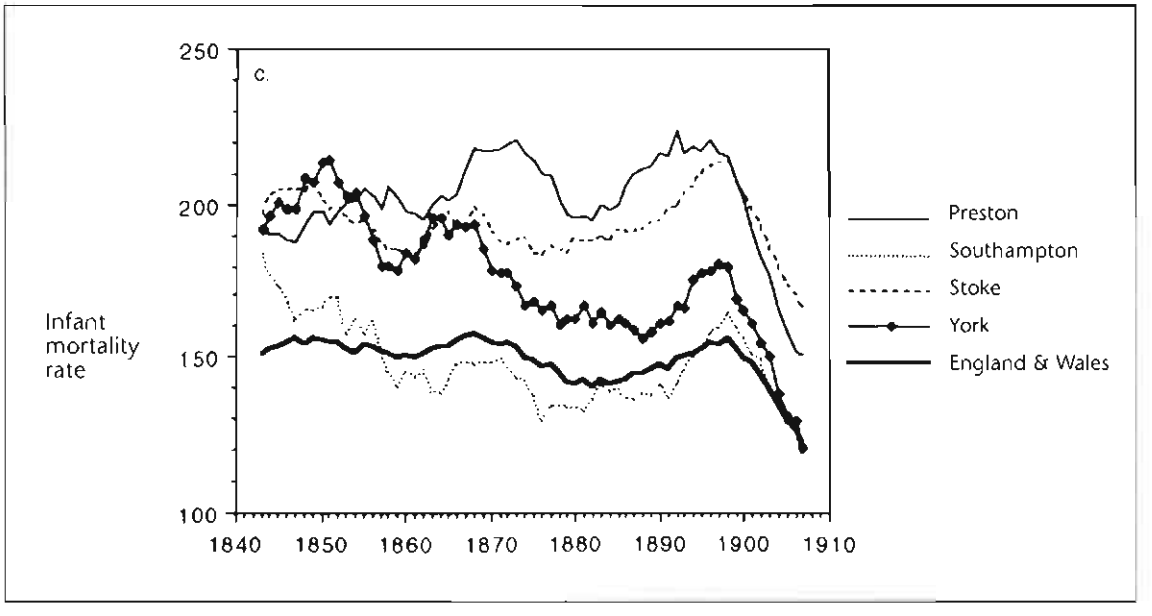

4c)

Figure 4
Infant Mortality Rates for a Selection of Large, Medium and Small English Towns, 1840-1910 (7-year moving means)

among towns, and indeed between urban and rural areas, were most pronounced in the post-neonatal period (during the second to the twelfth month after birth). This was the most volatile element of infant mortality. Neonatal mortality (during the first month after birth), which reflected the health of the mother and conditions during the pregnancy and at birth, only accounted marginally for the differences among localities in the late nineteenth century and fluctuated very little from year to year. Whatever the combination of factors that gave some towns distinct advantages over others, these differences persisted until the very end of the nineteenth century, after which they were sharply reduced. Indeed the graphs illustrate the 1899-1900 turning-point particularly well, when an undulating pattern gave way to a rapid and continuous downturn in infant mortality. All towns shared in this improvement. The conspicuous convergence to lower levels during the first decade of the twentieth century is a clear reflection of the fact that the secular decline of infant mortality in England and Wales, as in other European countries, was predominantly achieved through a reduction in post-neonatal mortality.

Although local environmental conditions and cultural factors regarding infant-feeding practices, operating mainly through post-neonatal mortality, determined overall levels of infant mortality, they do not explain why towns with very different levels of infant mortality should show such a close correspondence in the timing of short- and medium-term movements in rates. In figures 4a, 4b and 4c the remarkable simultaneity in the timing of upturns and downturns in infant mortality before 1900 suggests that a more general set of factors operated throughout the entire urban system at the same time. Of these, climate may have been particularly important, especially because of the poor living conditions. That a series of unusually hot and dry summers could bring substantial increases in diarrhoeal mortality among infants, particularly those living in towns, is clear from the overall increases in infant mortality which occurred in the late-1890s. Woods et al. have stressed the enormous significance of this temporary, predominantly urban, upturn in mortality: it prevented any decline in the national series and served to accentuate the rapidity of the decline after 1900. Indeed, they suggest that if the increases of the 1890s are viewed more as a temporary 'hiccup' and if excess diarrhoeal mortality is removed from total infant mortality, the turning-point appears to date not from 1899-1900, but rather from the mid- to late-1880s. The simultaneous upturns are not confined to the late 1890s, however. Figures 4a, 4b and 4c, by extending the time series back several decades before the 1870 cut-off point adopted by Woods et al., capture an earlier but similar increase in most towns during the late-1860s. This may also have been a result of the 'urban-sanitary diarrhoeal effect'; however, with lower levels of urbanization at this date, the proportionate effect of this upturn on national infant mortality would have been much less than that in the late 1890s.

Socio-Economic Differentials in Infant Mortality

Although geographical differences in infant mortality can be easily identified and measured for the period after 1837, socio-economic differentials are considerably more difficult to tease out. Comments have already been made on Hollingsworth's estimates for the British peerage which suggest that, before 1700, social élites also experienced high levels of infant mortality, possibly as a result of the widespread practice of wet-nursing. That wealth was not necessarily accompanied by low infant mortality is supported by a number of other European studies which show that varying infant feeding practices were sufficiently important to have given even the most economically disadvantaged groups relatively favourable levels of infant mortality[20].

20. Lithell, 1981; Brandström, 1988.

These two photographs were taken by a local Medical Officer of Health in order to illustrate the benefits of breastfeeding. In the first photograph, the spaces between the children represent positions where other children in the family had died, presumably because they were artificially fed.

Once child-care practices among the British peerage improved and maternal breast-feeding became fashionable, however, infant mortality fell to a level below that of the general population, and the absence of any marked upturn in infant mortality in the late-1890s among this group is surely significant. Yet by documenting only an extremely small segment of the population, the British peerage data offer no more than a glimpse into the nature of socio-economic inequalities in infant mortality. For the bulk of the population we have very few clues, even for the period after 1837 and the advent of civil registration. Indeed, although the father's occupation - the variable usually employed to represent socio-economic standing - was recorded on the death certificate, the first official statistics of infant mortality tabulated by socio-economic status were not published until 1911. However, using the 1911 Census, which asked married couples retrospective questions about their fertility experience and the number of their children that had died, Patti Watterson has produced class-specific estimates of infant mortality for the period 1895-1911[21]. Table 1, which is based on these estimates, shows that there was a strong and inverse association between infant mortality and socio-economic status.

Table 1 - **Estimated Infant Mortality Rates by Father's Social Class, England and Wales**

Father's socio-economic group		1895-1897	1901-1903	1907	1910	Change index 1895-7 to 1911
I	Professional	121	95	67	59	139
II	Intermediate (I-III)	138	129	103	92	103
III	Skilled workers	147	138	111	97	106
IV	Intermediate (III-V)	149	140	117	105	91
V	Unskilled workers	166	165	143	127	72
VI	Textile workers	164	155	135	123	78
VII	Miners	169	164	148	132	68
VIII	Agricultural labourers	110	105	91	87	65

Note: Change index: [(1895-7 - 1910)/1895-7]/k] x 100, where k is the equivalent rate of change of national infant mortality between 1895-97 and 1910 (i.e. 0.32).

The three residual occupational classes - VI, VII and VIII (defined separately in 1911 but subsequently consolidated in I to V) - shed additional light on the pattern of variation but also draw attention to the notorious difficulties of interpreting national-level data when a substantial rural-urban gap in mortality exists. The children of low-paid agricultural labourers were better-placed in 1895-97 than those of the professional classes. It would seem that the reduced mortality risks associated with rural living outweighed the benefits brought by a higher income for those living in urban areas. Although these estimates are certainly suggestive, there is still much to be learned about the magnitude of class differentials within both urban and rural areas. Rowntree's social survey of York in 1899 revealed a much sharper class differential than these national data. Among three groups of working-class families, infant mortality rates ranged from 247 among the poorest households, to 184 among the middle group, and 173 among the highest, compared with an infant mortality rate of only 94 for the servant-keeping class[22]. This differential is certainly of comparable magnitude to the one found when the infant mortality rate for the most favourable rural location is compared with that of the most unhealthy city. Attempting to untangle the

21. Watterson, 1988. See also Woods, Watterson and Woodward, 1988, and Woods, 1992.
22. Rowntree, 1901, p. 26. His later survey of 1936 revealed a similar differential of 78, 75 and 41 for the three groups of working-class families. The rate for the whole city was 56; see Rowntree, 1941, p. 297.

effects of class and environment is especially difficult, but recent work has suggested that within urban areas themselves, class differentials in mortality were greatly accentuated in neighbourhoods where environmental conditions were particularly poor[23].

As seen in Table 1, the change index suggests that when infant mortality did begin to decline, class differentials - initially at least - were exacerbated. By the turn of the century, the professional classes, favoured by improving urban conditions, had already replaced agricultural labourers in having the lowest infant mortality; and by 1910, the gap between these two groups had widened still further. Again by 1910, there was still a conspicuous gap between professional groups and skilled workers on the one hand, but also a further differential between skilled and unskilled workers on the other. Spree's work on Germany suggests a similar widening of the gap, with white-collar workers and the liberal professions benefiting disproportionately from the improvement in infant mortality at the turn of the century, while the life chances of infants born into working-class families not only failed to improve, but were actually reduced[24]. For England and Wales, there is still much to be learned about the magnitude of socio-economic inequalities in mortality at a time when infant mortality was declining.

Implications

It may appear from the above observations in this short chapter that rather a lot is known about long-term trends in infant mortality in England, and even about certain geographical and social variations. If a comparison is made with what is known of early modern Scotland, Wales and Ireland, this claim would probably be justified. Historical demographers are now able to draw the general outline of the various patterns involved. But several important problems remain even at the mere level of description, let alone of explanation. It may be valuable to review briefly three of these problems: (1) registration quality and variability; (2) secular and cyclical trends, and turning-points; and (3) convergence and divergence.

What of the various registration systems, ecclesiastical and civil? How did their quality vary in the recording of live births and deaths in infancy? The worst period for registration would appear to be from 1770 to 1870 when the Anglican parish registers are least reliable, especially in the growing towns, and civil registration has not yet reached full effectiveness (for example, York in Figure 2). This could have serious implications. If it is assumed, for instance, that births were under-registered by 5 per cent and that each of these unregistered infants also died within the first year of life, then infant mortality rates of about 150 would have to be increased to around 190. If births were unregistered by 10 per cent, the increase would be from 150 to approximately 230[25]. However, this may be an extreme and unreasonable assumption. There may even have been circumstances in which infant deaths were fully recorded, but live births were not, thus inflating the apparent rate of infant mortality.

It is evident even from Figures 1 and 2 that a perspective of 400 years does allow the identification of cyclical and secular trends. The end of the Victorian era is still a remarkable turning-point, but there had been a substantial reduction in the national rate of infant mortality even before 1899-1900. Figure 1a also encourages further thoughts on the changing relationship between infant and early childhood mortality and, for that matter, neonatal and post-neonatal mortality. Although the infant mortality and early childhood mortality rates were similar in the middle of the nineteenth century and diverged thereafter, this

23. Williams, 1992.
24. Spree, 1988, p. 67.
25. Glass, 1951; Teitelbaum, 1974.

This photograph, from the beginning of the twentieth century, illustrates a childcare class for mothers. It was hoped that better knowledge of maternal care would lead to lower infant mortality rates.

need not imply that they were similar before the 1850s and 1860s. Neonatal mortality was especially affected by foetal development and the problems associated with delivery; post-neonatal mortality was influenced by feeding practices, the problems linked with weaning and the general sanitary environment; and early childhood mortality was determined by the major childhood diseases, particularly measles, scarlet fever, whooping cough, and so forth. Each of these three sets of factors could have varied in a semi-independent fashion in the past.

The levels of infant mortality to be found in the best and the worst environments probably changed very little before the twentieth century, but the relative distribution of the population living in those places did alter radically. The rural-urban shift in the late eighteenth and nineteenth centuries should have caused national averages to deteriorate. That they do not appear to have done so to any very marked extent represents the triumph of child care - especially breastfeeding - over sanitation.

Each of these three problems raises important side issues and questions which will require further research before the foregoing descriptions of change and variation over time can be accepted with full confidence.

While demonstrating that bottle-fed babies were more likely to die than their breastfed peers at any given time, this campaign poster of 1918 highlights the dramatic increase in infant mortality during the hot summer months, accusing inadequate hygiene as the main cause of death.

References

Armstrong, A., *Stability and Change in an English County Town*, Cambridge, Cambridge University Press, 1974.

Brändström, A., "The Impact of Female Labour Conditions on Infant Mortality: A Case Study of the Parishes of Nedertorneå and Jokkmokk 1800-96", *Social History of Medicine*, 1, 1988, pp. 329-58.

Fildes, V., *Wet Nursing*, Oxford, Blackwell, 1988.

Finlay, R., *Population and Metropolis*, Cambridge, Cambridge University Press, 1981.

Galley, C., *Growth, Stagnation and Crisis: The Demography of York, 1561-1700*. Unpublished PhD Thesis, University of Sheffield, 1991.

Glass, D.V., "A Note on the Under-Registration of Births in Britain in the Nineteenth Century", *Population Studies* 5, 1951, pp. 70-88.

Hollingsworth, T.H., "The Demography of the British Peerage", *Supplement to Population Studies*, 18, 1964.

Hollingsworth, T.H., "Mortality in the British Peerage Families Since 1600", *Population*, 32, 1977, pp. 323-52.

Jones, R.E., "Infant Mortality in Rural North Shropshire, 1561-1810", *Population Studies*, 30, 1976, pp. 305-17.

Jones, R.E., "Further Evidence on the Decline in Infant Mortality in Pre-industrial England: North Shropshire, 1561-1810", *Population Studies*, 34, 1980, pp. 239-50.

Landers, J., "Age Patterns of Mortality in London during the 'Long Eighteenth Century': a Test of the 'High Potential' Model of Metropolitan Mortality", *Social History of Medicine*, 3, 1990, pp. 27-60.

Landers, J., *Death and the Metropolis*, Cambridge, Cambridge University Press, 1993.

Law, C.M., "The Growth of the Urban Population of England and Wales 1801-1911", *Transactions of the Institute of British Geographers*, 41, 1967, pp. 125-43.

Laxton, P. and N. Williams, "Urbanization and Infant Mortality in England: A Long-term Perspective and Review", in M. C. Nelson and J. Rogers (eds), *Urbanization and the Epidemiologic Transition*, Uppsala, 1989, pp. 109-35.

Lee, C.H., "Regional Inequalities in Infant Mortality in Britain, 1861-71: Patterns and Hypotheses", *Population Studies*, 5, 1991, pp. 55-65.

Lithell, U.-B., "Infant Mortality Rate and Standards of Living in the Past", *Scandinavian Journal of History*, 6, 1981, pp. 297-315.

Rowntree, B.S., *Poverty. A Study of Town Life*, London, Macmillan, 1901.

Rowntree, B.S., *Poverty and Progress*, London, Longmans, 1941.

Schofield, R.S. and E.A. Wrigley, "Infant and Child Mortality in the late Tudor and Early Stuart Period", in C. Webster (ed.), *Health, Medicine and Mortality in the Sixteenth Century*, Cambridge, Cambridge University Press, 1979, pp. 61-95.

Stone, L., *The Family, Sex and Marriage in England*, 1500-1800, London, Weidenfeld and Nicolson, 1977.

Spree, R., *Health and Social Class in Imperial Germany. A Social History of Mortality, Morbidity and Inequality*, Oxford, Berg, 1988.

Teitelbaum, M.S., "Birth Underregistration in the Constituent Counties of England and Wales: 1841-1910", *Population Studies*, 28, 1974, pp. 329-43.

Vann, R.T. and D. Eversley, *Friends in Life and Death*, Cambridge, Cambridge University Press, 1992.

Watterson, P.A., "Role of the Environment in the Decline of Infant Mortality. An Analysis of the 1911 Census of England and Wales", *Journal of Biosocial Science*, 18, 1986, pp. 457-70.

Watterson, P.A., "Infant Mortality by Father's Occupation from the 1911 Census of England and Wales", *Demography*, 25, 1988, pp. 289-306.

Williams, N.J., "Death in its Season: Class, Environment and the Mortality of Infants in Nineteenth-century Sheffield", *Social History of Medicine*, 5, 1992, pp. 71-94.

Woods, R.I., *The Population of Britain in the Nineteenth Century*, London, Macmillan, 1992.

Woods, R.I., "On the Historical Relationship between Infant and Adult Mortality", *Population Studies*, 47, 1993, pp. 195-220.

Woods, R.I., P.A. Watterson and J.H. Woodward, "The Causes of Rapid Infant Mortality Decline in England and Wales 1861-1921", Population Studies, 42 1988, pp. 343-66, and 43, 1989, pp. 113-32.

Wrigley, E.A., "Family Reconstitution", in E. A. Wrigley (ed.), *An Introduction to English Historical Demography*, London, Weidenfeld and Nicolson, 1966.

Wrigley, E.A., "Births and Baptisms: The Use of Anglican Baptism Registers as a Source of Information about the Numbers of Births in England before the Beginning of Civil Registration", *Population Studies*, 31, 1977, pp. 281-312.

Wrigley, E.A. and R.S. Schofield, *The Population History of England, 1541-1871: A Reconstruction*, London, Edward Arnold, 1981; Cambridge, Cambridge University Press, 1989.

Wrigley, E.A. and R.S. Schofield, "English Population History from Family Reconstitution: Summary Results, 1600-1799", *Population Studies*, 37, 1983, pp. 157-84.

INFANT MORTALITY IN FRANCE
– 1750-1950 –
EVALUATION AND PERSPECTIVES

by Catherine Rollet* and Patrice Bourdelais**

Introduction

International public opinion no longer accepts as inevitable the statistics documenting the large number of infant deaths in Ethiopia, Somalia, Southern Iraq and elsewhere in the world. Attitudes no doubt are conditioned by the low levels of infant mortality achieved by industrialized countries today; they are also the product of an evolution of ideas and practices which began in the late eighteenth century. Especially since Pasteur's discoveries, the general perception of infant mortality has undergone a radical change: an inexorable sense of fatality has given way to a new confidence in the efficacy of child care.

In France, public health officials have calculated that towards the middle of the nineteenth century, out of a yearly total of 150,000 infant deaths, as many as 50,000 to 60,000 infants died unnecessarily, merely because they lacked adequate care and health treatment. A survey of foundlings and other children receiving public welfare in 63 *départements* from 1857 to 1887 shows that two thirds died before 20 years of age[1]. Towards the turn of the century, health officials and progressive leaders led a movement in favour of public assistance for mothers and infants as a means to combat depopulation. Many investigations were undertaken until the 1940s on the demographic and social realities of infant mortality. However, although voluminous, this body of research is by no means definitive. Indeed, a whole new field of research on the subject has opened up during the past few years as fresh hypotheses have been formulated and attempts made to answer new questions and to analyse the interrelationships among multiple factors.

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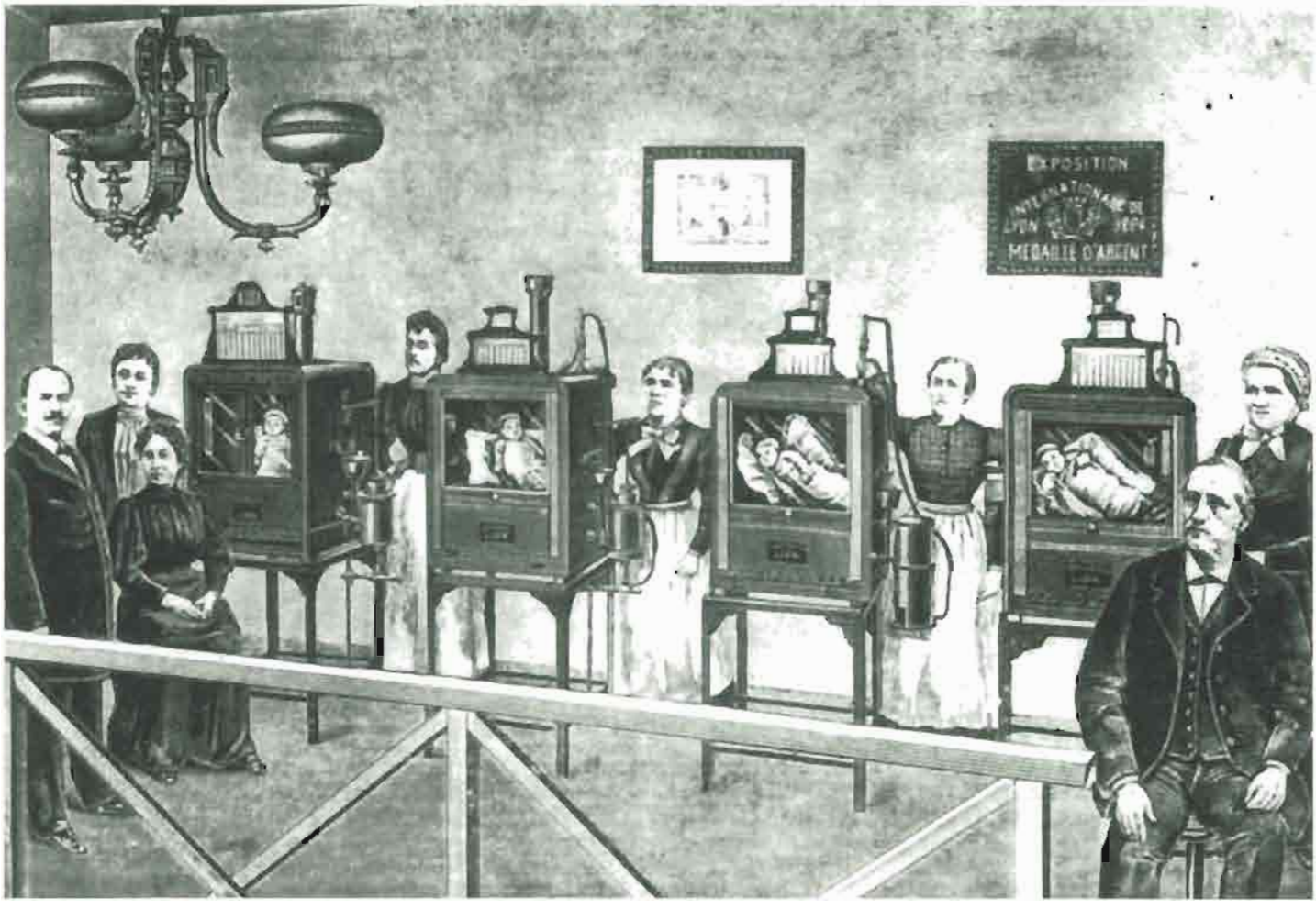
1. Monod, 1889, Table 1.



An early French innovation in the form of an incubator to improve the chances of survival of babies who were poorly at birth.

Over the past thirty years, the French school of historical demography has been primarily concerned with the demography of the *Ancien Régime* and, more recently, with that of the nineteenth and early twentieth centuries[2]. Historians and demographers have profitably collaborated to identify and evaluate sources from these periods, assess their level of completeness and the extent of under-registration, and then correct the data and rectify the series[3]. In the international comparative perspective of this publication, this is an issue of fundamental importance. Accordingly, the following section contains a discussion of the sources and the quality of data used. It shows that because of the availability of reliable national series today, researchers can confidently attempt to trace the evolution of infant mortality and determine which periods were decisive for its decline.

France is located at the crossroads of northern Europe and the Mediterranean and has geographical disparities that are of particular interest, especially because the uncorrected departmental data have long been more indicative of cultural attitudes than of demographic realities. However, apart from these local or departmental reconstructions, which are indispensable for the first half of the nineteenth century, and despite - or rather thanks to - recent studies[4], many questions still remain unanswered. Some relate to the differential analysis of the decline in infant mortality, others to the mechanisms and factors leading to this decline.

Sources and Data Quality

Sources dating from the *Ancien Régime*

Parish registers predating 1792 are not an ideal source for the study of infant mortality. Under-recording of infant deaths was frequent, and figures can be used only if corrections are made, as pointed out by Louis Henry in his pioneering study of the population of Crulai[5]. The differences between the uncorrected mortality rate, obtained directly from burial registers, and the corrected value seems to have been much higher prior to 1668. Registration generally improved in the eighteenth century, although there were important regional variations.

For the 39 parishes included in the family reconstitution study conducted by the *Institut National d'Études Démographiques* (INED), Jacques Houdaille has proposed applying a correction coefficient ranging from 1 to 5.5 to the uncorrected rates for the period 1690-1779; and even after 1750, the average proportion of unregistered infant deaths still amounts to 31 per cent[6]. Thus, figures from parish registers must be used cautiously. At the national level, the INED study carried out by Yves Blayo provides corrected and adjusted data which constitute reliable series for the entire 1750-1829 period[7].

Sources dating from the nineteenth and twentieth centuries

The study of infant mortality was not suddenly made easier by the coming of the 'age of statistics'. Behind the apparent simplicity of obtaining rates by relating the number of infant deaths to the number of live births, many problems still remain. Some difficulties are associated with the quality of the sources and the Registry Offices'

2. Cf. Dupâquier, 1988.
3. In particular, Blayo, 1975.
4. Rollet, 1990.
5. Henry, 1958.
6. Houdaille, 1984. Regional differences are considerable: one fifth of all infant deaths are unregistered in northern France, whereas in southern France the proportion increases to about one half.
7. Blayo, 1975.

methods of collection, which affect the construction of national and departmental series; others concern the definition of 'live births'.

Two large groups of published series are available, at both the departmental and national levels. The *Statistique Générale de la France* began in about 1853 to publish annual summaries of the returns (*bordereaux*) sent by the prefect of each department to the Minister of the Interior. Unfortunately, the data published at the departmental level were far more concise than the original series. Until 1876, only births, stillbirths and deaths were registered. Within these groups, only two subgroups were identified: infant deaths (0-1 year) and child deaths (1-4 years). From 1877 onwards, infant deaths are divided into many more subgroups: 0-7 days, 8-15 days, 15-30 days, 1-6 months and 6-12 months. It is not until the twentieth century that a similar breakdown is available for child deaths.

At the national level, the data are more detailed. In the mid-nineteenth century, for example, infant deaths were again classified as 0-7 days, 8-15 days and 15-30 days; thereafter, categories were established for deaths at 1 month, 2 months, 3-5 months, 6-8 months and 9-12 months, with an annual table of child mortality up to 5 years of age. However, headings varied through the second half of the nineteenth century, so that the series of indexes to be reconstructed are not homogeneous. It is only from 1888, for example, that deaths of children over the age of 1 year are listed by age at death. Most studies on infant and child mortality have been based on these published statistics[8].

The manuscript sources kept in the National Archives are much richer. The departmental tables, for example, list deaths by age and month in which they occurred; the deaths under 1 year of age are subdivided into groups (0-3 months, 3-6 months, and 6-12 months). Unfortunately, this series is only available for the first half of the nineteenth century[9], as the *bordereaux* after 1863 disappeared from the National Archives.

A third group of publications contains series relating to specific categories of infants. These were occasional studies, carried out in a limited geographical context and over a period of no more than a few years[10]; they often related to child abandonment, wet-nursing and conditions in public nurseries. Departmental statistics on wet-nursing were only collected after the enactment in 1874 of the so-called Roussel Law which provided for the protection of infants; national statistics on wet-nursing were compiled still later, towards the end of the century. Much remains to be done in terms of utilizing the data in the registers of nurseries, crèches and other institutions - data which is of great interest in the analysis of infant mortality occurring in a century marked by infectious diseases.

Statistics grouped by social categories are rare. Generally dating from the beginning of the twentieth century, they were constructed using data gathered through the retrospective questions included in population censuses. A study carried out in Lille in 1898-99, for example, disaggregates infant mortality by the mother's occupation; a study in Paris in 1900 contrasts infant mortality in socially disparate neighbourhoods (*quartiers*). However, the methods used by the authors to measure the phenomena are often not specified.

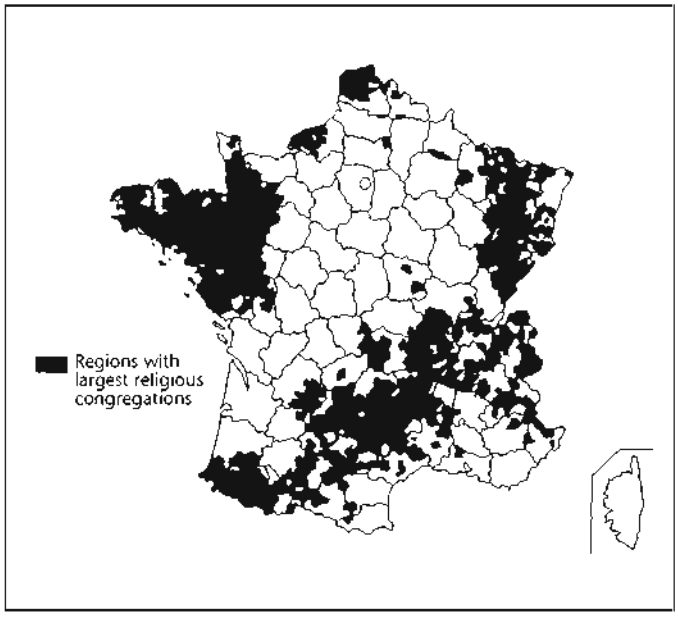
The registration of births and deaths is determined both by law and by social and cultural practices. For many years, parents regularly reported births but often failed to report infant deaths, bending the law to conform to these cultural practices. In the department of the Basses-Pyrénées, for example, infant mortality increased from 107 per 1,000 live births in 1806-10 to 167 per 1,000 live births in 1821-25, without there

8. For example, Nadot, 1971, and van de Walle, 1974.
9. These tables constitute the basis of Rollet, 1975, and Preston and van de Walle, 1978.
10. For example, the vast study on abandoned infants ordered in 1860 by the Home Office, and repeated subsequently in successive stages; or the study launched by the prefect of Pas-de-Calais on infant mortality and the causes of death in the 904 communes of the department in the period 1897-1901.

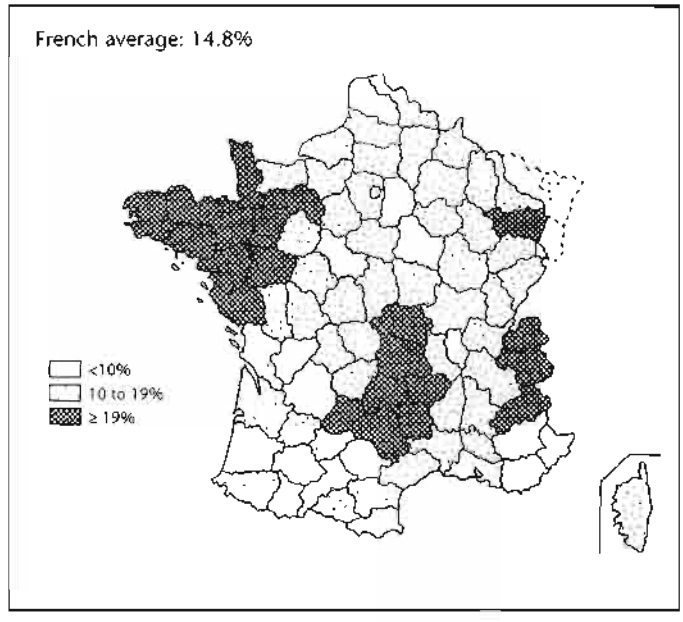
This 1899 painting illustrates a French family sharing a meal. Infant mortality rates for hand-fed babies in the South of France were often higher in the summer because of intestinal infections brought about by the heat and exacerbated by poor hygienic conditions.

being any evidence of epidemics or a deterioration in living conditions. This increase was probably a direct consequence of an improved registration system.

The civil code allows parents three days to declare the birth of a child and generally considers dead neonates to be stillborn, whether or not this was actually the case. Under these circumstances, it is not surprising that the distinction between real stillborns (those who had never breathed) and false stillborns (those who had breathed and were thus to be classified among the live births) was often lost. Although directives about the classification of these two categories were issued in the early 1800s, the proportion of stillbirths to live births continued to rise between the mid-1830s and 1860. Registration then improved, even if it is unlikely that it became fully comprehensive. Surely this is the main conclusion to be drawn from the map of false stillbirths in 1907-10, which shows that geographical areas where Catholicism was strongly felt had the highest number of false stillborns. Since only infants who had breathed were baptized, the most fervent Catholics watched over newborns in order to detect the slightest sign of life and thus ensure their spiritual survival. The proportion of false stillborns should be considered as an indicator of religious sociology rather than as a demographic fact (Maps 1 and 2).



Map 1 - Religious Observance in Rural France, early 20th century



Map 2 - Proportion of False Stillborns in France, 1907-1910

In about 1880, one fifth of the 40,000 reported stillbirths were probably false and should have been added to the number of actual births (more than 900,000) and infant deaths (approximately 150,000). The underestimation of the rates of infant mortality when such a correction is not made would be approximately 4 per cent.

The methods used to calculate the annual rates of infant mortality generally follow the rule suggested by the classic manuals of demographic analysis: one third of all deaths recorded in a particular year relate to births occurring in the previous year, whereas two thirds relate to births occurring in the year in course. In the series reproduced here, Jacques Vallin and France Meslé have opted for a different proportion for male and for female infants[11].

A major conclusion that can be reached from the above consideration of sources is that corrected and reliable data relating to the history of infant mortality are available from 1750 to the present day.

11. The authors are very grateful to J. Vallin and F. Meslé who provided them with the annual life-tables that they calculated for the nineteenth and twentieth centuries. A general introduction of the study can be found in Vallin and Meslé, 1989.

On a less positive note, one particular problem is represented by the tendency of nineteenth-century authors to measure infant mortality by relating the number of deaths to the average population of infants under the age of 1 year. The ensuing rates were higher than those obtained by comparing the number of infant deaths to live births. Another problem arises because the vocabulary of this period was imprecise, the language fluid and the definitions hazy, especially when used by social observers, doctors and politicians. Thus, at the 1876 International Congress of Health and Child Survival in Brussels, Dr. Kuborn compared the French and English infant mortality rates (216 per 1,000 and 170 per 1,000, respectively) without pointing out that the gap was largely due to differences in the methods used to measure infant mortality[12].

Imprecision also stems in part from the uncertainty of contemporary observers when faced with the problem of infants sent out to nurse in the country. In practice, deaths were recorded in the registry offices of the place of death. This led to artificially high mortality rates in rural departments receiving infants and, conversely, low rates in the cities from which infants had migrated. Because of these distortions, it is particularly difficult to comment on or draw infant mortality maps[13]. Using statistics collected after the Roussel Law came into force, demographers could correct maps dating from the late nineteenth and early twentieth centuries and, it is hoped, arrive at 'purer' results. A different method was followed by Samuel Preston and Etienne van de Walle, who corrected data relating to the migration of infants by studying censuses. It would be interesting to compare the results obtained using the two methods of correction. After the First World War, statistics began to specify the 'domicile' of deceased infants, which makes it possible to measure the precise impact infants sent out to nurse had on mortality rates. However, as wet-nursing entered into a marked decline precisely during this period, this new level of detail loses much of its interest[14].

The methodological problems involved in the study of the mortality of particular groups or categories of young children (such as orphans, children receiving public welfare, infants sent out to nurse, or infants in public nurseries) are more subtle because the children were under, or out of, observation at different dates and ages. Contemporary observers sometimes calculated rough indicators that did not take into account these specific factors. This resulted, for example, in mortality rates of as low as 3 per cent for children aged 0-2 years sent out to nurse, which logically would seem to indicate that it was better to bring up children in the countryside with a wet nurse rather than in the city with their parents[15]! At the end of the 1880s, Jacques Bertillon proposed a method which took into account these distortions, based on a calculation of the number of days actually lived. A simplified version of this method was applied by the *Statistique Générale de la France* from the end of the nineteenth century up to the First World War.

Long-Term Evolution of Infant Mortality Rates

The decline in infant mortality over the past two centuries represents the greatest revolution ever experienced. Rates have fallen from 300 per 1,000 live births to 10 per 1,000 live births. The age-old waste of young lives has ceased, while life expectancy at birth has risen spectacularly. This huge reduction in infant mortality constitutes the first element of the demographic transition, both chronologically and in terms of its importance in the overall process. Infant mortality rates by gender for the period 1750-1987 show that: (a) rates for

12. Cf. Gazette hebdomadaire de Médecine et de Chirurgie, 3 November 1876, p. 696.
13. Bourdelais and Raulot, 1978.
14. Rollet, 1975.
15. Rollet, 1990, p. 426.

males have been consistently higher than those for females over the entire period; and (b) the relative difference between the two series tends to increase in this century (Figure 1).

Four distinct periods can be identified in the battle won against death. During the first

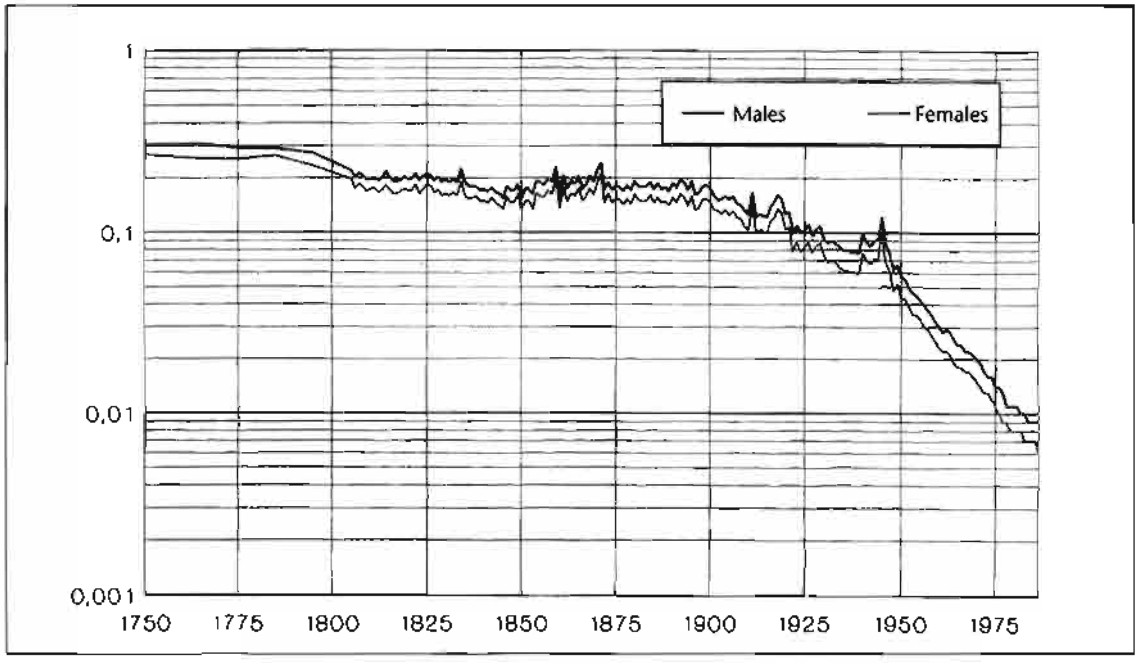


Figure 1
Evolution of Infant Mortality in France, 1750-1987 (semi-logarithmic scale)

period, which lasted until the French Revolution, the infant mortality levels were still high. The second period began in the 1790s when rates fell abruptly. This sudden downturn has often been attributed to the poorly kept records of the new registry offices. However, this theory does not account for the persistence of the decline, which continued until the July Revolution of 1830. It would therefore seem that infant mortality actually did decrease during this period.

Various other explanations have been given for this trend. Some historians sustain that greater attention was paid to newborn infants during this period; others, that the decline of wet-nursing was a key factor. The importance of the lengthening intervals between the great epidemic crises is generally recognized. It has also been suggested that infectious diseases in general took fewer lives because of the overall improvement in nutrition.

Mortality declines occurred simultaneously in numerous European regions during the 1790s, as pointed out by Alfred Perrenoud[16]: in Geneva and its environs, in Flanders and in parts of Germany. He also sustains that to be so widespread, this decline must have been caused by a general phenomenon, such as the warming of winters, which began around 1790, or changes in disease patterns.

During the third period, which lasted for the rest of the nineteenth century, progress ceased. This pattern was also found in other European countries and could have been the result of the accelerated rhythm of urbanization and industrialization, two processes which, initially at least, were hardly conducive to improvements in living conditions and mortality levels. In particular, the spread of artificial feeding deprived infants of the antibodies present in breastmilk, making them especially vulnerable in the deteriorated urban environment.

Three pinnacles stand out in the nineteenth century: 1834 and 1859 with the spread of epidemic outbreaks (cholera in southern France and influenza throughout the territory); and *'l'année terrible'* of 1870-71, when epidemics of smallpox, measles and dysentery raged.

16. Perrenoud, 1992.

Scientific progress at the end of the nineteenth century led to heightened awareness regarding hygiene in infant-feeding practices. This photograph illustrates a nurse sterilizing milk in a children's hospital in France.

The last period, beginning at the turn of the century and extending to the present, is characterized by a marked fall in infant mortality. Male infant mortality rates drop from 185 per 1,000 live births around 1895 to 127 per 1,000 in 1910, reaching 13 per 1,000 in the 1970s. Once again, this pattern is not uniquely French, but can be found, for example, in Belgium as well.

Annual variations have become increasingly less significant, which indicates that climatic and epidemiological conditions have less influence on mortality rates than previously. Nevertheless, crisis years are still apparent up to the mid-twentieth century. The 1911 peak is explained by mortality resulting from an exceptionally hot summer. The First World War triggered an increase in infant mortality, beginning in 1916, and above all in 1918 and 1919 with the Spanish influenza. The 1940s were marked by the difficult conditions of the Occupation. The final mortality peak occurs in 1945 when an unusually harsh winter coincided with an economic situation that was strained by military operations and the disorganization of exchange circuits. The tendency towards a reduction in climatic and epidemic risks in the twentieth century is confirmed by the calculation of the standard deviation of the series, which in practice decreases from over 2 per cent in the mid-1800s to less than 0.5 per cent after 1948, and even to 0.1 per cent since 1970. But if the decline in the level of mortality from 15 to 1 is taken into account, the results seem less optimistic. In fact, if ratios between standard deviations and means are calculated, it becomes apparent that the tendency is actually towards an increase. Undoubtedly, this is the consequence of the very low level of infant mortality now reached; however, it also suggests that annual fluctuations are not completely under control.

Is France original?

Although it has been firmly established that France was among the first nations to experience the demographic transition[17], this primacy does not necessarily extend to infant mortality. Apart from the Germanic countries, where levels as high as those seen in France during the *Ancien Régime* persisted up to the mid-nineteenth century, the levels in Sweden, as well as in England and Wales, were very similar to those in France until 1850. Thereafter, the evolution of infant mortality differs until the 1960s (Figure 2).

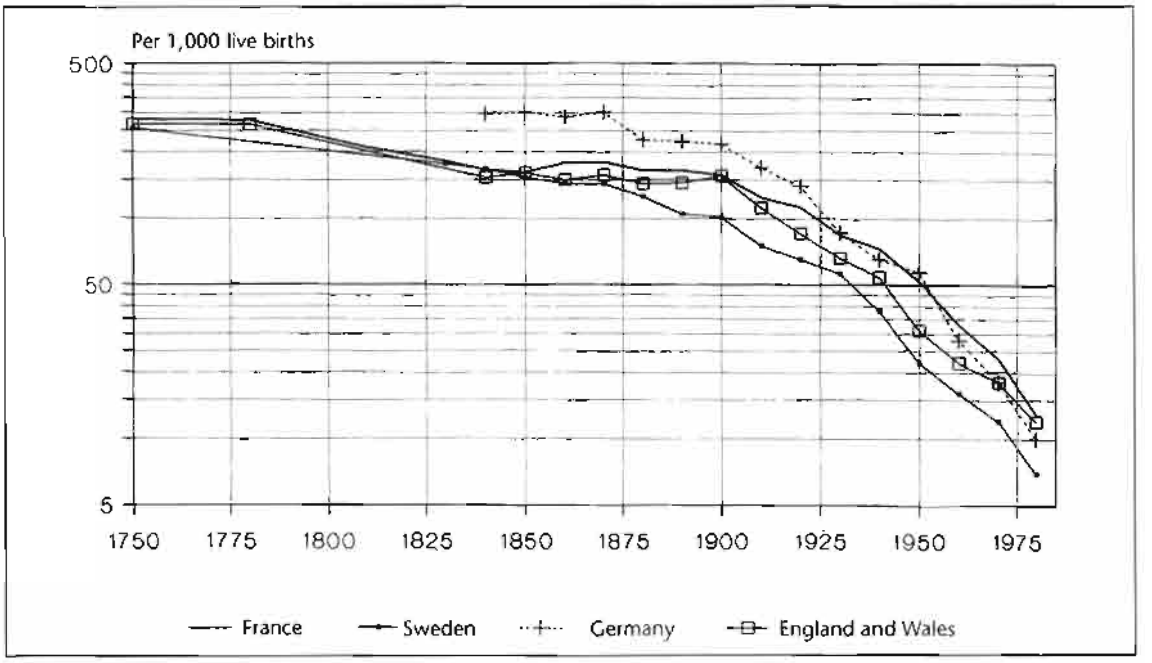


Figure 2
Evolution of Infant Mortality in Four European Countries (semi-logarithmic scale)

17. Bourdelais, 1993, ch. 5.

The slight increase in infant mortality between 1850 and 1880 is particularly evident in France, and is similar to the situation in England and Wales where a long period of stagnation continued until 1900. From 1900-05, a new period of decline began in these countries, more pronounced in England and Wales than in France. In Sweden, the turning point appears to have taken place in the 1870s. By 1900, Sweden's rate was only 100 per 1,000 live births, much lower than rates in France and England which were still at 150 per 1,000 live births. Sweden has continued to lead during the entire twentieth century, maintaining primacy in 1980 with a rate of 7 per 1,000.

In Germany, infant mortality rates were high until the First World War; during the 1930s, they dropped to about the levels prevalent in France; and by the 1970s, they had sunk just below the levels of France as well as of England and Wales.

Thus, contrary to its performance in fertility, France shows no precocity in terms of infant mortality. Its levels even appear slightly higher than in other countries in the second half of the nineteenth century and during most of the twentieth century. Additional analyses are needed to explain this contradictory performance.

The Turning Point of about 1900

As was seen in Figure 1, the turn of the century marks the beginning of the decline in infant mortality that has continued until now. In Figure 3, the two trend-curves for the periods 1885-99 and 1900-10 clearly show the break in the slope that occurred during the first years of the twentieth century. What are the causes?

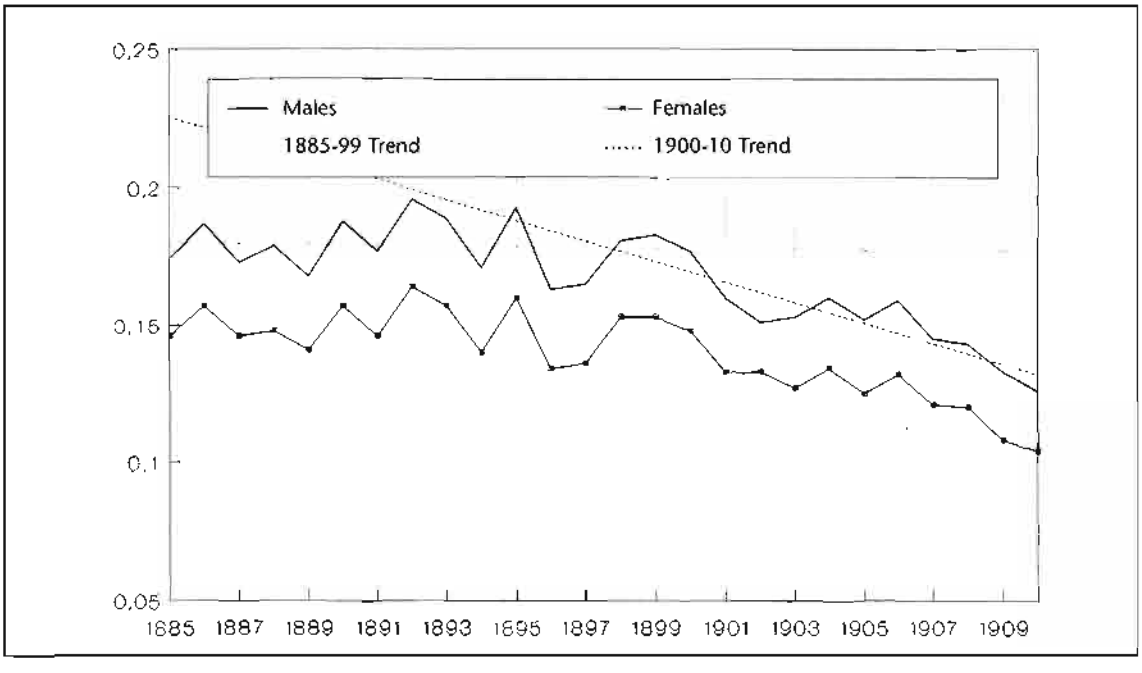


Figure 3
Levels and Trends of Infant Mortality in France, 1885-1910

Because data for neonatal mortality are not available, Figure 4 presents curves only for: (a) endogenous mortality; (b) exogenous mortality; (c) mortality in the first 3 months ($_3q'_0$); and (d) mortality from 6-12 months ($_6q'_6$).

The decline in endogenous mortality, which measures the risks involved in delivery and the first days of life, is quite regular (the steep falls in 1836 and 1920 were caused by new methods of registering stillborns). The curve is similar to the one for infants between 6 and 12 months. The major decrease in these two categories preceded the Pasteurian

revolution. Could it be that the training of midwives, which dates back to the eighteenth century, gradually helped avoid the numerous complications which arose during childbirth?

The drop in ${}_5q'_0$ is more difficult to read because of the gap from 1866 to 1885. However, it seems to come later, with the clear break in the slope occurring once again around 1900.

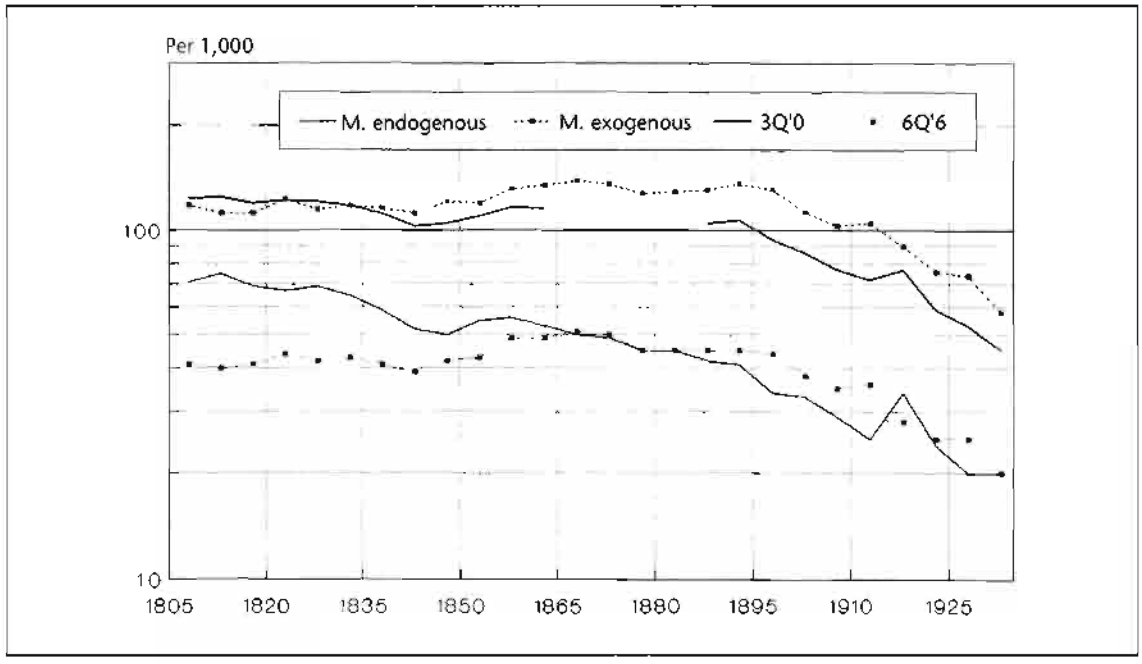


Figure 4
Components of Infant Mortality (semi-logarithmic scale)

Exogenous mortality and ${}_6q'_5$ evolved in a parallel manner: both increased from the late 1850s; then ${}_6q'_0$ decreased from the end of the 1870s whereas exogenous mortality only decreased after 1900. The suddenness of the break and the different chronologies by age suggest that the change in about 1900, which mainly involved young infants, resulted from the diffusion of the scientific advances of the era, especially the pasteurization of milk. In fact, from the mid-1880s, there was a multiplication of public and private interventions promoting better infant-feeding practices[18].

Starting with the efforts of Pasteur himself and of Duclaux, but also in the light of the practical demonstrations of the obstetrician Pierre Budin, public action took various directions from the turn of the century, including controls of the bacteriological quality, conservation and distribution of milk. In Paris, for example, the milk sold to housewives had to include a respectable percentage of cream, a far cry from the watered-down, manipulated and non-nourishing milk of the mid-nineteenth century! Doctors began advising mothers who were unable to breastfeed to sterilize milk procured from a reliable source or to buy milk already sterilized. Various private and municipal organizations, including hospitals, began to distribute pasteurized milk, either free of charge or at low cost. Doctors such as Budin together with Gaston Variot and Léon Dufour started *Goutte de lait* ('Drop of Milk') centres, providing medical consultations to mothers on feeding and weaning schedules and appropriate breastmilk substitutes. On the eve of the First World War, 494 institutions of this type existed, a number which grew in the interwar period to 4,000[19].

18. Rollet, 1990, pp. 432-442.
19. Rollet, 1990, p. 387.

Changes in Causes of Death

The decline in infant mortality in the early years of this century was accompanied by a major change in the distribution of the causes of death, as can be seen in Table 1 which compares national statistics for the years 1912-13 and 1935-36.

Table 1 - **Causes of Infant Deaths***
(1912-13 and 1935-36, in percentages)

	1912-13	1935-36
Digestive tract diseases	27.5	11
Congenital weaknesses	24	29
Respiratory diseases	16.1	19.5
Diseases of the nervous system	5.3	12.2
Other known causes	9.1	6.3
Unknown or poorly specified causes	18	22

* *within the first year of life* (Source: Candiotti and Moine, 1948, p. 46)

In the course of 25 years, the number of deaths due to digestive tract diseases dropped from 45,300 to 9,471. From the most serious threat to infants in 1912-13, claiming 27.5 per cent of young lives, digestive tract diseases became the lowest-ranking cause of death in 1935-36.

Seasonal variations in infant mortality also show a significantly altered pattern. In 1901-05, infant mortality reached its maximum in the summer months as a result of diarrhoeal disease; in 1927, a maximum was reached during the winter months (Table 2).

Table 2 - **Infant Mortality***
Rates, by Month (1901-05 and 1927, per 1,000 live births)

	1901-05	1927
January	135	101
February	150	112
March	144	102
April	133	91.2
May	123	82.7
June	117	71.5
July	154	76.8
August	195	82.3
September	171	72
October	127	64.3
November	105	64.5
December	113	82.5

* *within the first year of life* (Source: Lesage and Moine, 1931, p. 78)

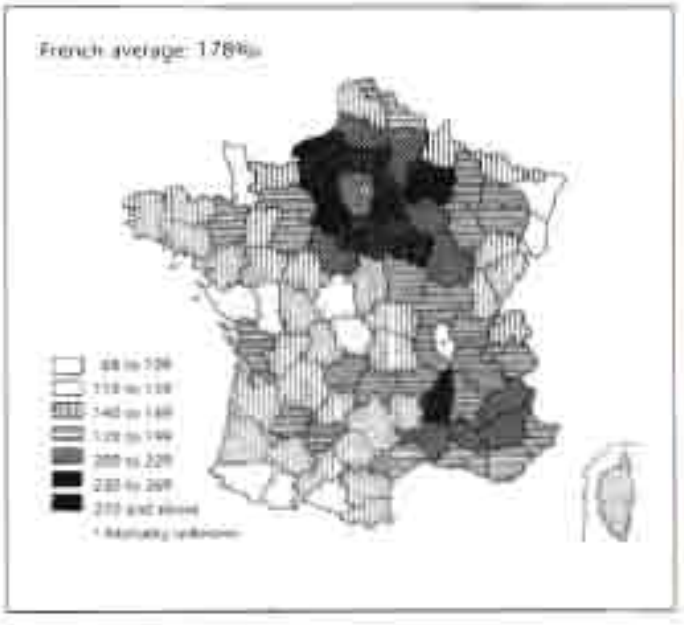
Urban statistics can further the historian's understanding of the main causes of infant mortality at the turn of the century. Infant mortality was extremely high in French cities: in 1886-92, the highest national levels were registered in Rouen (more than 300 infant deaths per 1,000 live births), followed by Rheims (250-300 per 1,000 live births). In these two cities, diarrhoeal disease -mainly caused by unsterilized food, especially milk - was responsible for 50-70 per cent of the deaths of infants within their first year. Data on infant mor-

tality disaggregated by season and cause of death clearly reveal the toll taken by diarrhoea in the summer months: indeed, public officials distributed a circular in 1925 on the 'hygiene of infants during periods of extreme heat'.

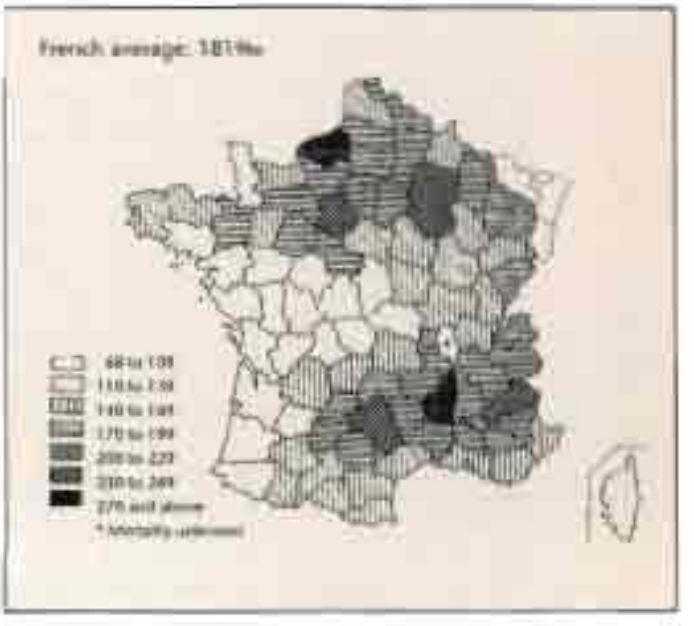
Although it could be expected that other industrial cities with high rates of female employment would have similar infant mortality rates, this was not always the case. At the end of the nineteenth century, the level of infant mortality in districts in northern France where women were employed in the textile industry was certainly higher than in the mining districts where women did not work: 200-250 per 1,000 live births as against 130 per 1,000[20]. But in Creusot, an industrial city where female employment was not widespread, the rate of infant mortality is nevertheless very high (300 per 1,000 live births in about 1860). Additional local studies are needed to understand the specific factors leading to infant mortality in urban areas.

Major Geographical and Social Disparities

Despite the slow evolution of the national average, the geography of infant mortality changed prior to the Pasteurian revolution. Between 1861-65 and 1890-92, infant mortality decreased in about half the French departments, and increased in the other half. The declines were mainly the result of real and general improvements in infant survival in the Parisian Basin. Because this was a region to which a large number of infants were sent to wet-nurse, the Roussel Law may have played an important role in this progress. Increases in infant mortality, on the other hand, may be attributed, in northern and eastern France, to sharp urban growth and widespread female employment; and in south-western France, to the improved quality of registration. Thus, by the end of the nineteenth century, the geography of infant mortality had changed considerably: the two traditional poles of mortality, the Parisian Basin and the valley of Rhône-Provence (Map 3) appear to shift, the first towards the north and the second toward the Mediterranean (Map 4).



Map 3 - Infant Mortality in France, 1857-1866



Map 4 - Infant Mortality in France, 1894-1898

20. Cavillioti, Maine and Moine, 1948, p. 46.

During the interwar period (Map 5), two large zones of heavy infant mortality emerge: the first covers the entire northern half of France, from Brittany to Alsace; the second includes several southern departments of the Massif Central.

This slow rate of decline is generally attributed to cultural factors (a high level of fertility and strong religious practices in Brittany and the southern Massif Central) or to an unfavourable socio-economic context (the industrialization of Pas-de-Calais), although the respective weight of these factors is unclear.

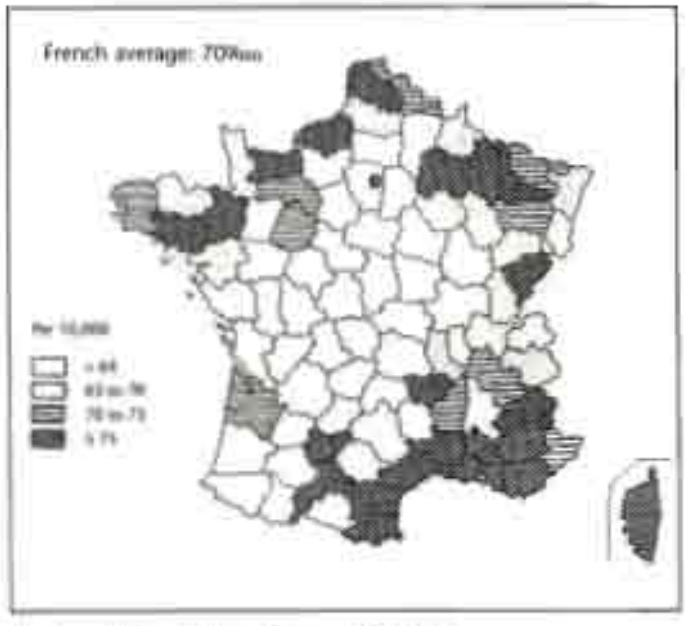
A further, very clear pattern can be detected. Whereas most infant mortality in the nineteenth century was exogenous, in the twentieth century, mortality in the first weeks of life constitutes an increasingly important share of mortality among infants under the age of 12 months.

It should be noted that the distribution of child mortality by region remained static between 1845 and 1950, despite a significant drop in average mortality levels (from 105 to 59 per 1,000 live births). Throughout the period, the Mediterranean department of Midi continued to have the highest mortality levels together with the departments of Seine Inferieure, Marne and Pas-de-Calais (Map 6). In the Midi, causes of death are probably climatic, because the summer heat favoured intestinal infections among hand-fed infants. In the non-Mediterranean departments, the causes lie in the harsh living conditions of families in industrialized areas.

Progress was made in all departments during the twentieth century. Drawing a theoretical curve of decline, Jean Bourgeois-Pichat was able to regroup the departments in various categories, each one constituting a portion of the curve[21]. In the 1930s, regional disparities in infant mortality lessened, mainly because of the slowdown in the rate of decline. However, in the aftermath of the Second World War, the earlier regional patterns again became apparent, with only minor modifications: for example, the endogenous mortality rates in northern France became more pronounced[22].

Rural-urban disparities were as noteworthy as departmental differences. The survival rates of urban infants appear to have been influenced by the size of the city in which they

Map 5 - Infant Mortality in France, 1936-1938



Map 6 - Child Mortality in France, 1930-1932

21. Bourgeois-Pichat, 1946.
22. Pinaux and Vallin, 1978.

Medical consultation centres, such as the one depicted in this 1920 photograph, were promoted throughout France to provide mothers with information and advice on effective infant care.

lived. A study undertaken by Mirman found that infant mortality rates for 1906-10 were approximately 10 per cent higher in cities with over 5,000 inhabitants than in smaller urban areas[23]. Establishing the correlation between social position and infant and child mortality is equally complicated. It is common knowledge that rapid progress may initially exacerbate social differences[24], but that, subsequently, such disparities tend to be reduced. A comparison of mortality differentials between illegitimate children receiving public welfare (the majority from modest social extraction) and the overall child population shows that this levelling-off first became apparent in France in the 1920s. Similar finding have been reported by Frans van Poppel for the Netherlands[25].

Current Research and Perspectives

Because Registry Office records by law can only be consulted after a lapse of 100 years, historians cannot conduct research on the individual and family records dating from the beginning of the twentieth century, which is a crucial period for the study of infant mortality decline. They will, instead, have to 'make do' with whatever published and unpublished aggregate data are available at either a national or a local level, and critically assess the reliability of these sources and their methodology.

Various hypotheses can be tested by using the data bank available for the population of Creusot[26]. Life-tables can be drawn up for most French cities in about 1860 as, quite exceptionally, sources are available for that period. Therefore, not only should it be possible to evaluate rural-urban differences and the disparities within cities, but also to investigate the reasons for certain regional patterns (including the relationship between rural and urban infant mortality). By making a number of comparisons and observing recurrent patterns in this area, which has become a veritable testing ground, historians should be able to identify the causes of infant mortality with a fair degree of accuracy. This situation as analysed can then be compared with the situation in the early 1900s. It should also be possible to relaunch the study of differential mortality and its evolution by social environment.

Catherine Rollet is working to complete her comparative study of European policy measures aiming at reducing infant mortality[27]. To understand more fully the determinants of declines in infant mortality, historians must disentangle the many factors working towards this end, including the role of women in maternal and infant care, and the public or private origin of interventions and their degree of centralization. Another one of her projects is to review the unpublished nineteenth-century data on the causes of death in cities in order to gain a better understanding of the realities of digestive tract diseases on the eve of the epidemiological transition. This exercise would entail studying nominal lists of infants as well as analysing contemporary literature on these infections.

It is fitting to conclude this rapid survey of infant mortality in France, which the authors hope will stimulate other research in the field, with a word of caution. Little can be gained by utilizing the data gathered by the statistical services of the period without taking into account why such data were gathered. In the case of France, one should not underestimate the impact of the debates on the decreasing birth rate, nor the dispute between demographers (most notably Jacques Bertillon) and public health specialists about the real benefit to the nation of the decline in infant mortality. Similarly, one cannot

23. Quoted by Rollet, 1990, pp. 439-441.
24. As Perrenoud shows clearly in his discussion of the introduction of Jenner's vaccination in Geneva. See Perrenoud, 1981, p. 334.
25. Van Poppel, 1981.
26. Study conducted by Bourdelais and M. Demonet; presentation of the results in Bourdelais, 1984.
27. Cf. Rollet, 1992, p. 25.

This hostel in Argenteuil sheltered pregnant and breastfeeding mothers and children under four years of age during the difficult period of the Second World War and the Occupation.

disassociate the fight against infant mortality from the context of the moralization of the working classes, the power doctors exercised over women, and myriad other factors. These are all relationships that not only bias the commentaries on the evolution of infant mortality and its causes, but may even lead to certain calculations rather than others. The entire body of statistics resulting from state-initiated inquiries needs to be systematically collected, and analysed within their political and ideological contexts: only then can this data be exploited, using today's methods and posing today's questions.

References

Blayo, Y., "La mortalité en France de 1740 à 1829", *Population, 30 (Special Issue)* November 1975, pp. 123-142.

Bourdelais, P., "L'industrialisation et ses mobilités, 1836-1936", *Annales E.S.C.*, 39, 1984, pp. 1009-1019.

Bourdelais, P., *L'âge de la vieillesse*, Odile Jacob, Paris, 1993.

Bourdelais P. and J.-Y. Raulot, "Géographie de la mortalité infantile en France dans la première moitié du XIX^{e} siècle", in *Les disparités démographiques régionales*, CNRS, Paris, 1978.

Bourgeois-Pichat, J., "La situation démographique", *Population*, 1, 1946, pp. 517-523.

Candiotti, C. and M. and C. Moine, *La mortalité de l'enfant de première année*, Paris, Institut National d'Hygiène, 1948.

Dupâquier, J. (ed.), *L'histoire de la population française*, Paris, PUF, 1988.

Henry, L., *La population de Crulai paroisse normande, étude historique*, INED-PUF, Cahier 33, Paris, 1958.

Houdaille, J., "La mortalité dans la France rurale de 1690 à 1779", *Population*, 39, 1984, pp. 77-104.

Lesage and Moine, *Etude générale de la mortalité de l'enfant de première année*, livre III, 1931.

Lesage-Dugied, A., "La mortalité infantile dans le département du Nord de 1815 à 1914", *L'homme, la vie et la mort dans le Nord au XIX^{e} siècle*, Paris, Editions Universitaires, 1972.

Monod, H., "Enfants assistés, Rapport", *Congrès International d'Assistance*, Paris, 1889.

Nadot, R., "Etude de la mortalité infantile endogène en France dans la deuxième moitié du XIX^{e} siècle", *Population*, 26, 1971, pp. 901-913.

Perrenoud, A., "Les aspects socio-économiques de la mortalité différentielle des enfants dans le passé", *Proceedings of the International Population Conference*, 2, Manila, 1981.

Perrenoud, A., "La mortalité des enfants en Europe francophone: état de la question", paper presented at the IUSSP conference entitled "Child and Infant Mortality in the Past", Montreal, October 1992.

Preston, S. H., and E. van de Walle, "Urban French Mortality in the Nineteenth Century, *Population Studies*, 32, 1978, pp. 275-297.

Prioux, F., and J. Vallin, "Evolution des disparités de la mortalité infantile entre les départements français", *Les disparités démographiques régionales*, Cinquième Colloque national de démographie, 1976, CNRS, 1978.

Rollet, C., "La mortalité infantile en France au XIX^{e} siècle, importance du mode d'alimentation", *L'analyse démographique et ses méthodes*, Cinquième Colloque national de démographie, CNRS, Paris, 1975.

Rollet, C., *La politique à l'égard de la petite enfance sous la III^{e} république*, Paris, INED-PUF, 1990.

Rollet, C., "La lutte contre la mortalité infantile: introduction aux comparaisons internationales", paper presented at the IUSSP conference on 'Child and Infant Mortality in the Past', Montreal, October 1992.

Vallin, J. and F. Meslé, "Reconstitution des tables annuelles de mortalité pour la France au XIX^{e} siècle", *Population*, 44, 1989, pp.391-399.

van de Walle, E., *The Female Population of France in the Nineteenth Century*, Princeton, N.J., Princeton University Press, 1974.

van Poppel, F., *Differential Mortality in the Past*, Working Paper no. 23, NIDI, 1981.

INFANT MORTALITY IN AUSTRIA
– 1820-1950 –
TRENDS AND REGIONAL PATTERNS

by Josef Kytir* and Rainer Münz**

Decline from the Pre-Industrial Era to the 1950s

Until the late nineteenth century, the pattern of infant mortality in Austria was typical of traditional agrarian societies. In the predominantly German-speaking provinces of the Hapsburg empire[1] during the 1820-70 period, overall mortality levels were high, oscillating between 250 and 310 deaths per 1,000 live births (Figure 1)[2]. Rates fluctuated considerably from year to year, influenced not only by political and economic crises but also by epidemics of infectious diseases, particularly cholera. Infant mortality exceeded 300 per 1,000 seven times during the 1820-90 period (in 1834, 1841, 1849, 1855, 1865, 1866 and 1871), while it fell to 250 per 1,000 only rarely (notably in 1824-25 and 1860, years with almost no epidemics).

The year 1873, despite a general economic crisis following a stock market crash, marks a turning-point in the history of infant mortality in Austria and the beginning of a decline that has continued almost uninterrupted to this day. By 1876, infant mortality had dropped to 260 per 1,000 live births; by 1880, it had declined to 252; and by 1912, it had reached 169, the lowest level ever recorded during the centuries-long Hapsburg rule, which ended in 1918. Annual differences were, however, still significant. The First World War led to a temporary upturn in infant mortality, but already by 1919 rates were below pre-war levels. Between 1873 and 1919, the infant mortality rate fell by nearly half, decreasing from 298 to 156 per 1,000 live births.

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1. To a large extent these provinces are geographically identical with the Republic of Austria as its boundaries were defined in 1918-21.
2. Moll, 1914, and Matznetter, 1986, observed that Austria may have had a higher average infant mortality than neighbouring regions because breastfeeding was less common there. Short-term fluctuations must be explained by other factors.

Regional disparities were considerable (Table 1). The region consisting of the present-day provinces of Tyrol, Vorarlberg, Carinthia and Styria had mortality levels far below the national average from 1871-75 until approximately the turn of the century. Lower Austria (including Vienna) and Burgenland, on the other hand, had higher than average rates[1]. In the last decades of the nineteenth century, infant mortality fell throughout Austria, but the pace of decline differed from one province to another, therefore producing significant changes in the regional pattern. The city of Vienna was the area where the rate of decline was fastest, with mortality levels reaching 190 per 1,000 live births during the years 1896-1900, comparable to Vorarlberg (195 per 1,000) and Tyrol (197 per 1,000), the areas with the lowest rates. In contrast, Carinthia and Styria experienced a relatively slow decline in infant mortality.

Table 1 - **Infant Mortality Rates by Federal Provinces**
(Per 1,000 Live Births, 1871-1950)

Period	Austria	Burgenland	Carinthia	Lower Austria	Upper Austria	Salzburg	Styria	Tyrol	Vorarlberg	Vienna
1871/75	287.2	—	242.3	335.3	296.3	303.6	243.5	228.2	237.1	280.1
1876/80	258.9	—	222.9	306.5	275.5	274.7	225.7	208.5	229.8	240.9
1881/85	264.1	—	221.0	315.9	273.6	263.0	248.4	218.6	223.5	241.5
1886/90	256.8	—	227.2	304.0	269.9	244.5	244.6	209.8	195.2	234.5
1891/95	254.5	—	221.6	288.0	262.3	256.0	244.4	203.4	193.4	217.8
1896/1900	224.3	—	217.3	261.0	243.5	235.2	234.3	197.0	193.0	189.7
1901/05	211.5	246.2	213.2	240.8	237.4	218.8	216.1	188.7	173.8	173.4
1906/10	197.4	239.0	194.7	221.5	220.8	207.1	198.8	166.5	154.8	165.7
1911/13	183.8	212.9	186.3	202.9	206.3	182.2	193.3	149.1	150.7	151.1
1914/18	191.2	190.5	204.3	210.6	225.6	185.4	209.2	159.5	135.8	148.0
1919/20	156.6	156.6	179.6	149.1	179.3	153.1	173.5	138.3	102.9	136.0
1921/25	140.0	170.2	165.3	134.3	165.4	138.9	153.9	118.9	100.2	106.7
1926/30	117.2	149.4	131.3	107.5	139.8	119.6	130.0	100.7	77.2	89.7
1931/35	99.0	126.2	114.1	94.2	112.3	96.4	107.4	77.6	66.4	74.8
1936/38	88.2	108.0	98.9	84.1	103.7	95.1	94.9	70.3	57.6	64.1
1939/45	85.9	99.8	82.8	87.9	100.3	79.1	90.2	67.8	58.9	69.8
1946/50	75.6	91.3	77.3	78.0	83.8	67.1	81.1	55.6	50.7	68.7

(Source: Austrian Statistical Office, 1988, p. 143)

In the years between the First and the Second World Wars, infant mortality was again reduced by approximately 50 per cent, going from 157 per 1,000 in 1920 to 73 per 1,000 in 1939. Mortality peaks, which had been characteristic until this point, disappeared. This sharp decline was only interrupted in 1922 (the height of postwar inflation and recession), 1926, 1927, 1932 and 1935. In 1933, for the first time in Austria's demographic history, less than 10 per cent of all infants died within the first year of life. All things considered, mortality

1. Until 1921, the predominantly German-speaking Burgenland (which became a province in the same year and was annexed to Austria) was part of western Hungary but did not exist as a separate administrative unit. Infant mortality rates for Burgenland can only be calculated from 1900. In that year and in the following decades, Burgenland consistently showed very high infant mortality rates.

declined faster during the First Republic (1918-38) than during the latter part of the Hapsburg rule: the mean reduction between 1920 and 1939 was 3.7 per cent per year compared with an average decline of 1.3 per cent per year between 1871 and 1919.

The rate of decline in infant mortality between the wars was roughly equal for all provinces; consequently, regional patterns remained unchanged. In the 1920s and 1930s, Vorarlberg, Vienna and Tyrol continued to have much lower infant mortality rates than the provinces of Upper Austria, Carinthia, Styria and Burgenland.

Towards the end of the Second World War, infant mortality increased considerably in Austria, then a part of Nazi Germany. Rates peaked in 1945, reaching levels registered at the beginning of the century (Figure 1), and remained above pre-war levels until about 1949.

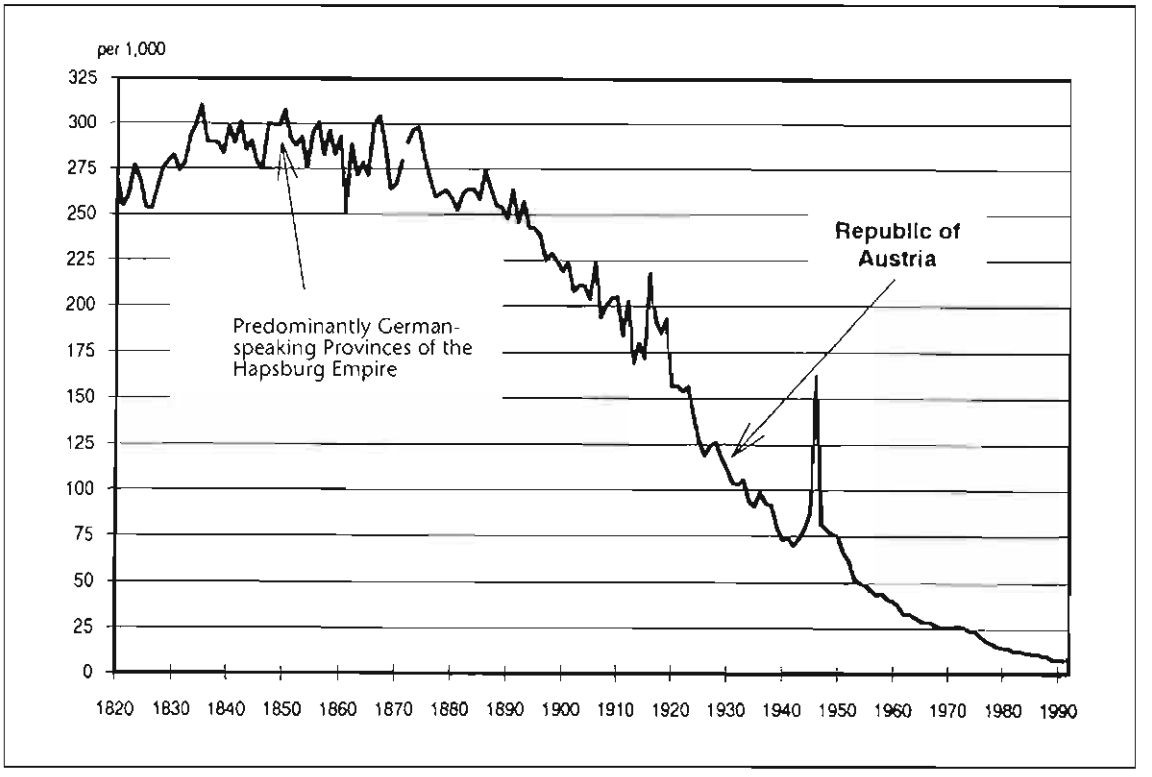


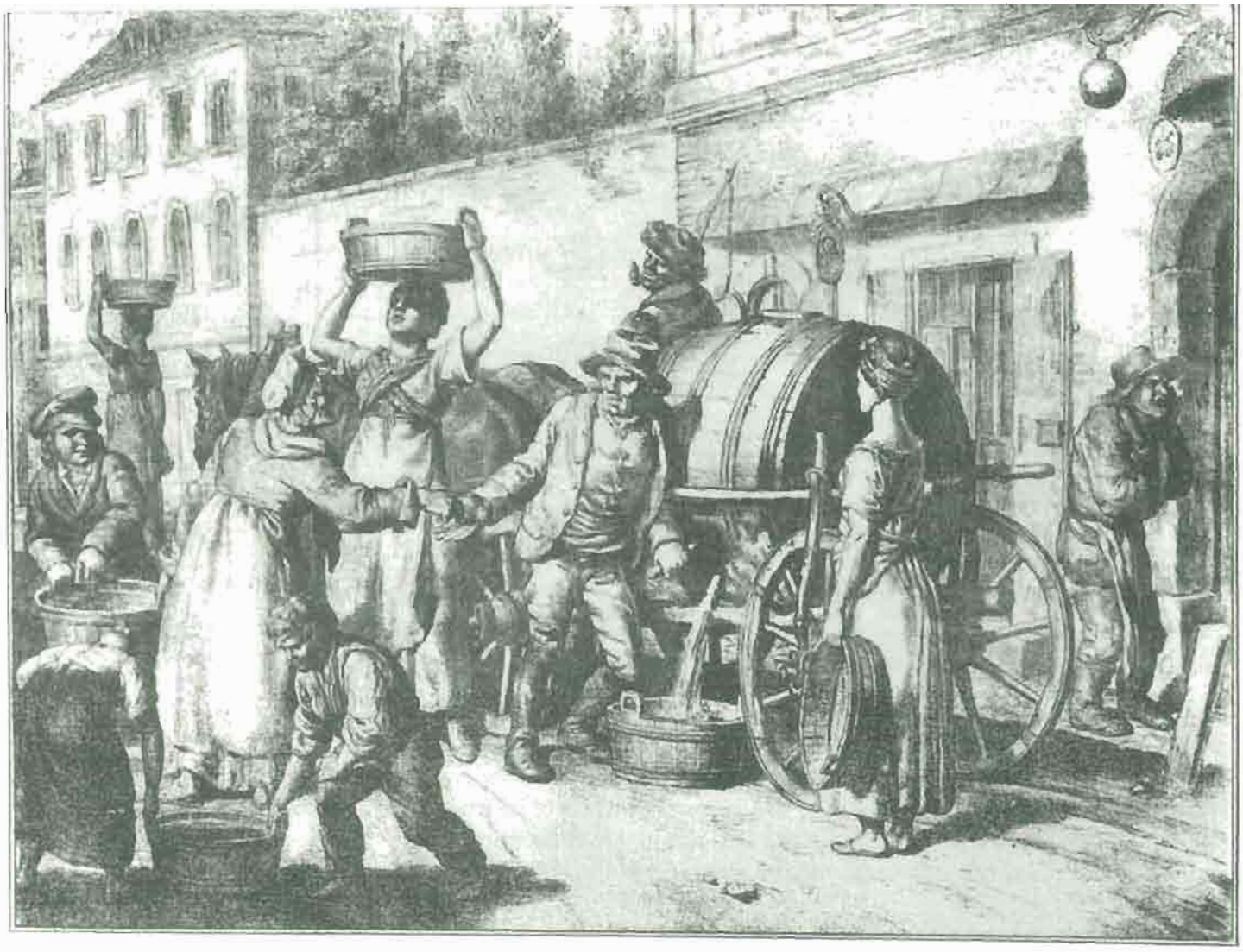
Figure 1
Infant Mortality in Austria, 1819-1991 (rate per 1,000)
(Source: Kock et al., 1988, Austrian Statistical Office, 1991)

It is estimated that declines in infant mortality accounted for approximately 30 per cent of the improvements in the average life expectancy at birth, which doubled between 1880 and 1950. An additional 20 per cent can be attributed to reductions in early childhood mortality (1-4 years of age), whereas the prolongation of the adult life-span played a less important role.

Causes of Infant Mortality: Historical Trends

One can only speculate about the frequency of certain causes of mortality prior to 1870. Age-specific rates for this period are not available, although it is possible to make some inferences from information about the life-spans of deceased infants. Although Austrian mortality statistics were reorganized in 1895, any statements on the relative importance of selected mortality causes are based on questionable data[4]. Even though cause and age-specific infant mortality rates are available from this point on, 60 per cent of all mortality cases were attributed to the residual category 'all other natural causes of death'[5]. Only

4. Friedl, 1979, p. 474.
5. Presl, 1909, p. 664.



In pre-industrial Austria, before urban public water supplies and sewage systems were built, the incidence of disease was much higher since infection could spread easily. Clearly, drinking water was never a problem in the mountains, where it was free from contamination. Water supply was thus one important factor contributing to regional differences in infant mortality rates.

infectious diseases were well documented in the late nineteenth century, probably because of their public health importance. This permits some tentative comparisons with pre-industrial times when epidemics of infectious diseases were the most serious threat to infant health. By the turn of the century, infectious diseases appear to have claimed fewer infant lives. In absolute numbers, mortality due to infections had been reduced by 50 per cent. Nevertheless, some 40 per cent of all infant deaths were traced to infectious diseases, primarily non-epidemic infections of the gastrointestinal and respiratory tract (Table 2). Non-infectious diseases accounted for approximately 15 per cent of all infant deaths, congenital malformations, a mere 2 per cent. The greatest threats to infants were complications during delivery and diseases during the neonatal period (the first month after birth), which together caused 45 per cent of all deaths. Although mortality patterns had changed by the end of the nineteenth century, the average life-span of infants remained stable. Approximately 40 per cent of all infant deaths occurred during the neonatal period and 60 per cent in the post-neonatal period (2nd to 12th month after birth). The high incidence of infectious diseases accounted for the larger share of post-neonatal deaths.

Table 2 - Infant Deaths by Cause and Age
(In percentages, 1900, 1940, 1960 and 1986)

	c.1900*	c.1940	c.1960	1986
Cause of death				
Delivery complications and diseases of the neonatal period	45	37	35	30
Infectious diseases including diseases of the gastro-intestinal and respiratory tract	40	35	29	7
Congenital malformations	2	5	12	26
All other diseases	15	23	24	37
Age				
1st month	40	52	65	60
2nd - 12th month	60	48	35	40
Infant Mortality Rate (per 100)	21	7,5	4	1

(Source: Koch et al., 1988, p. 14)

* Figures for 1900 are approximative

During the early decades of this century, the incidence of infant mortality due to infectious diseases, delivery complications and neonatal diseases continued to decline. By about 1940, infectious diseases accounted for only 35 per cent of infant deaths, delivery complications and neonatal diseases, 37 per cent. In contrast, mortality from congenital malformations had increased to 5 per cent and the residual category 'all other diseases', to 23 per cent.

The percentage of infant deaths occurring during the first hours and days after delivery has increased during this century, and, conversely, the percentage of infant deaths between 1 and 12 months has decreased. In 1900, 60 per cent of infant deaths occurred between the ages of 1 and 12 months, compared with only 30 per cent in 1954.

Since 1925, refinements in mortality statistics have permitted researchers to obtain a more precise breakdown of infant mortality (Figure 2). Again, the greater importance of neonatal deaths can be attributed to deaths during the first day and the first week of life. In 1926, only 25.4 per cent of all children who died during the first year had lived for less than a week; by 1939, this share had increased to 37 per cent, reaching a maximum level in 1970 of 65 per cent. This indicates that there was an improvement from cohort to cohort

from 1900-1970 in the probability of survival of any infant who was carried to term, was born without injuries or congenital malformations, and had survived the first week of life. The duration of pregnancy and the course of delivery have increasingly gained importance as risk factors.

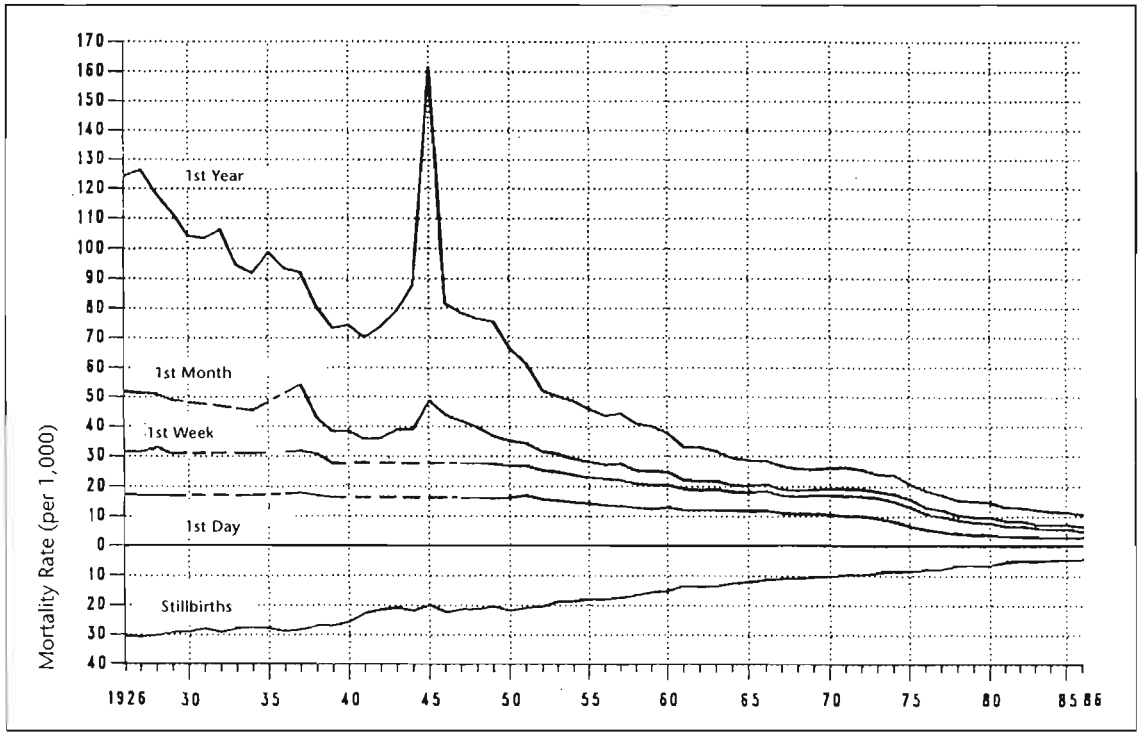


Figure 2
Infant Mortality Rates by Age and Stillbirths, 1926-1986 (per 1,000)
(Source: Austrian Statistical Office, 1991)

Regional and Spatial Patterns of Infant Mortality

In the late nineteenth and early twentieth centuries, the decline in infant mortality was steeper in large cities than in small communities. This differs distinctly from the situation in the pre-industrial era, when urban areas were characterized by very high infant mortality[6]. The lower average mortality in large cities can first be documented in the late nineteenth century, and was largely the result of public health measures taken from 1850 onwards, such as the provision of a public water supply, the construction of a modern sewage system and garbage collection. These measures were responsible for breaking the dreaded chain of infection. From this point on, cholera, typhus and other gastrointestinal epidemic diseases that are primarily transmitted by water and food became less of a threat to infants.

By 1900, not only Vienna, then capital of imperial Austria, but also all other major cities except Innsbruck, had infant mortality rates lower than the national average of 224 and lower than their surrounding rural areas (Figure 3). It is likely that this mortality differential resulted to some extent from the practice of sending infants to wet nurses or foundling homes outside of the city. If these children died, which happened with above-average frequency, their deaths were probably included in rural rather than urban mortality statistics. However, this can only account for a small fraction of the urban-rural differential.

It must also be remembered that there were extreme differences in infant mortality rates within cities. In Vienna at the turn of the century, for example, in middle- and upper-class areas such as the First, Second, Fourth, Sixth and Eighth districts, rates ranged from

6. See van de Walle, 1986, pp. 215-218, and Watterson, 1986.

88 to 148 per 1,000, much lower than in poorer areas where they averaged between 230 and 262 per 1,000[7].

During the last three decades of the nineteenth century, the east-west differential in infant mortality was significant. Highest in the eastern-most province of Burgenland, rates

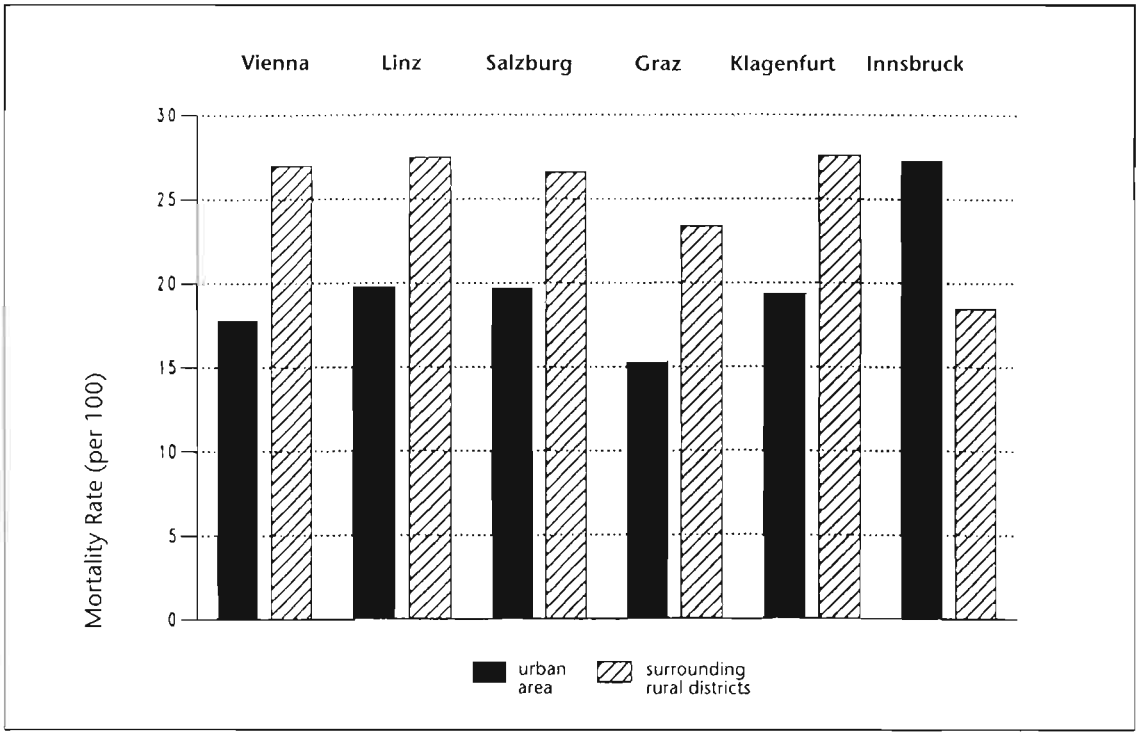


Figure 3
Infant Mortality Rate 1900-1902 in Major Cities and their Surrounding Rural Districts (per 100)
(Source: Köck et al., 1988, p.20)

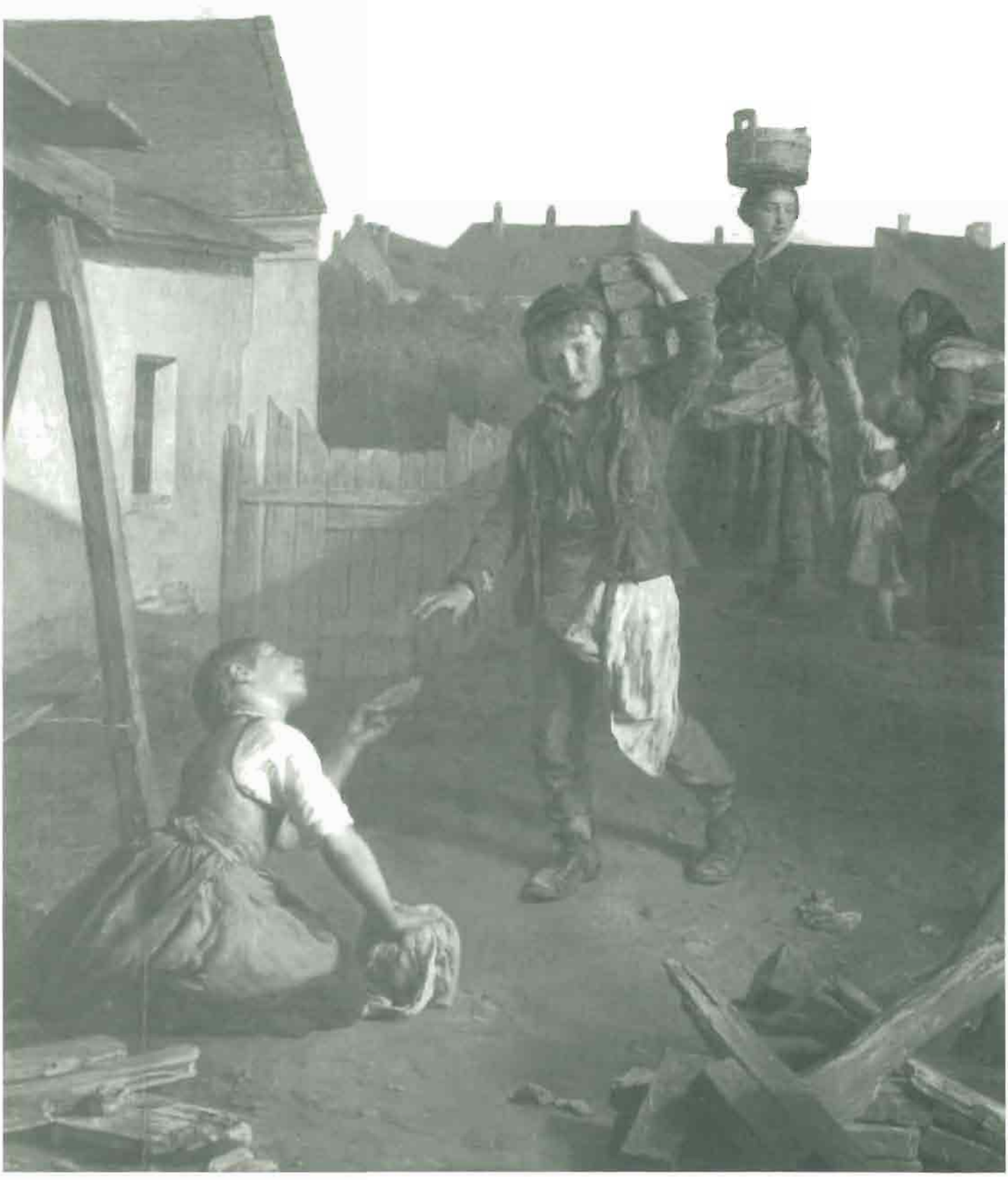
progressively declined the further west areas were situated, reaching their lowest levels in the western-most province of Vorarlberg. However, a Small Area Variation analysis of infant mortality rates for the years 1900-02, with political districts as the units of analysis, reveals another interesting regional pattern (Maps 1a and 1b). Mortality rates in Austria's Alpine regions were generally lower than in non-Alpine areas. In Upper Austria they were above average along the river Inn and north of the Danube (Innviertel and Mühlviertel). The same pattern appears in Lower Austria where mortality was high north of the Danube in the Waldviertel and Weinviertel as well as in the non-Alpine province of Burgenland and the eastern and southern parts of the province of Styria. In comparison, infant mortality rates were much lower in Tyrol (with the exception of Innsbruck), in Vorarlberg, and in the Alpine areas of Salzburg, Upper Austria, Lower Austria and Styria[8].

How can these regional patterns be explained? Why was the probability of infant survival higher in Alpine valleys and cities than in non-Alpine areas?

Data show that differences in mortality rates between Alpine and non-Alpine regions still existed in the early 1950s, despite the marked improvement in the national mortality rate, which by then had plummeted to about one sixth of the pre-industrial levels. Infant mortality rates were highest in the northern and south-eastern Alpine forelands as well as in the non-Alpine hills and lowlands and in the granite uplands.

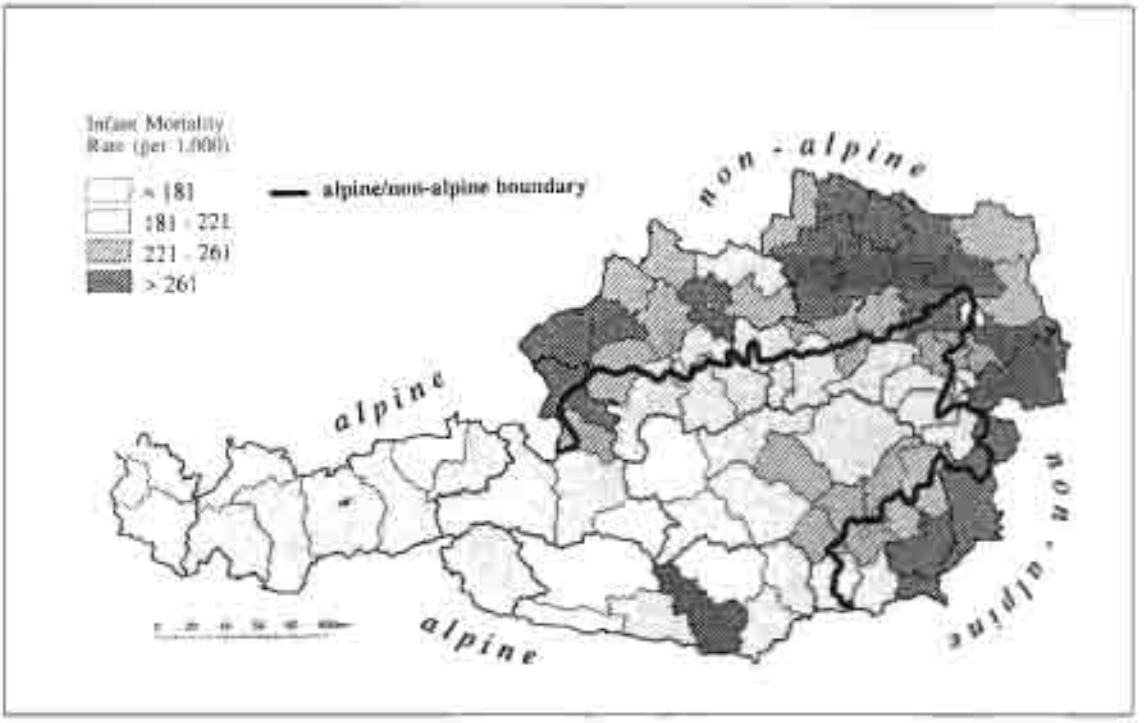
A further analysis of these data reveals a highly uneven distribution of standardized mortality rates when comparing political districts (Maps 2a and 2b)[9]. Compared with the

7. Popp, 1910, p. 11.
8. Viazzo reports similar findings for Italy and Switzerland. Viazzo, 1989, pp. 216-219.
9. In this case, as the analysis only involves deaths from one age cohort (0-1 year), standardized mortality rates (number of deaths over expected number of deaths *100) are identical with index values (Austria = 100).

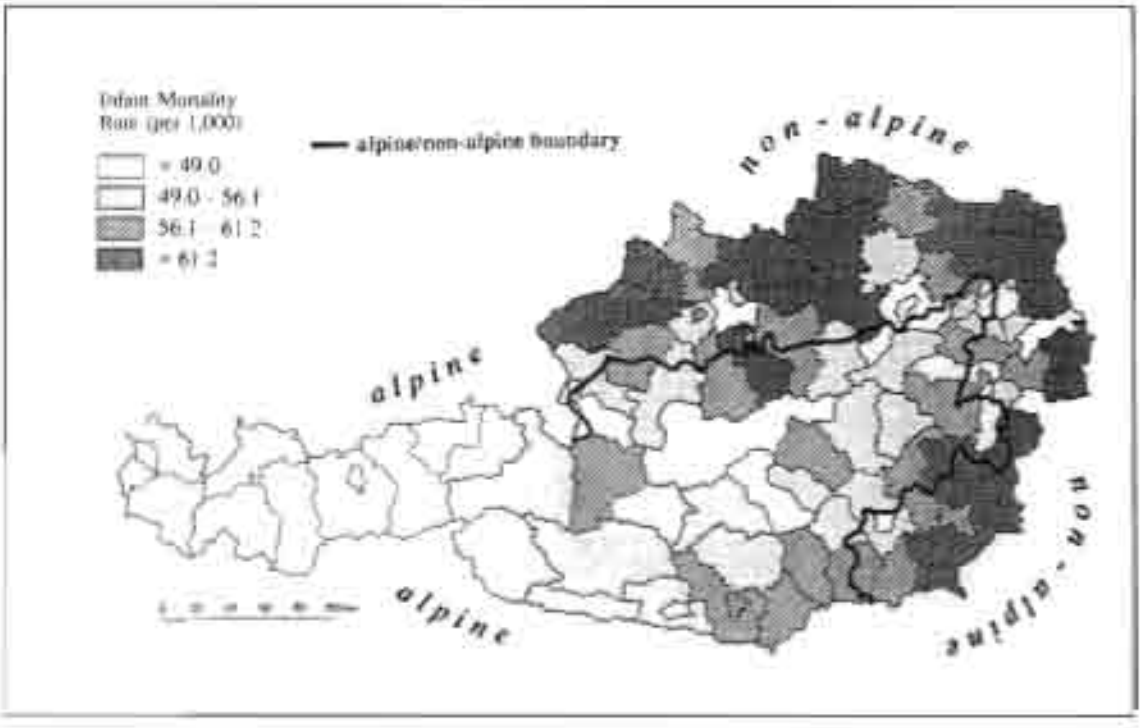


Varying infant mortality rates could be a consequence of the function children had within their individual communities. Alpine dwellers especially relied heavily on children as an essential part of the workforce.

Social factors, such as living conditions and public health measures, obviously played an important role in the decrease of infant mortality in Austria. This nineteenth-century painting depicts the desperation of a homeless family.



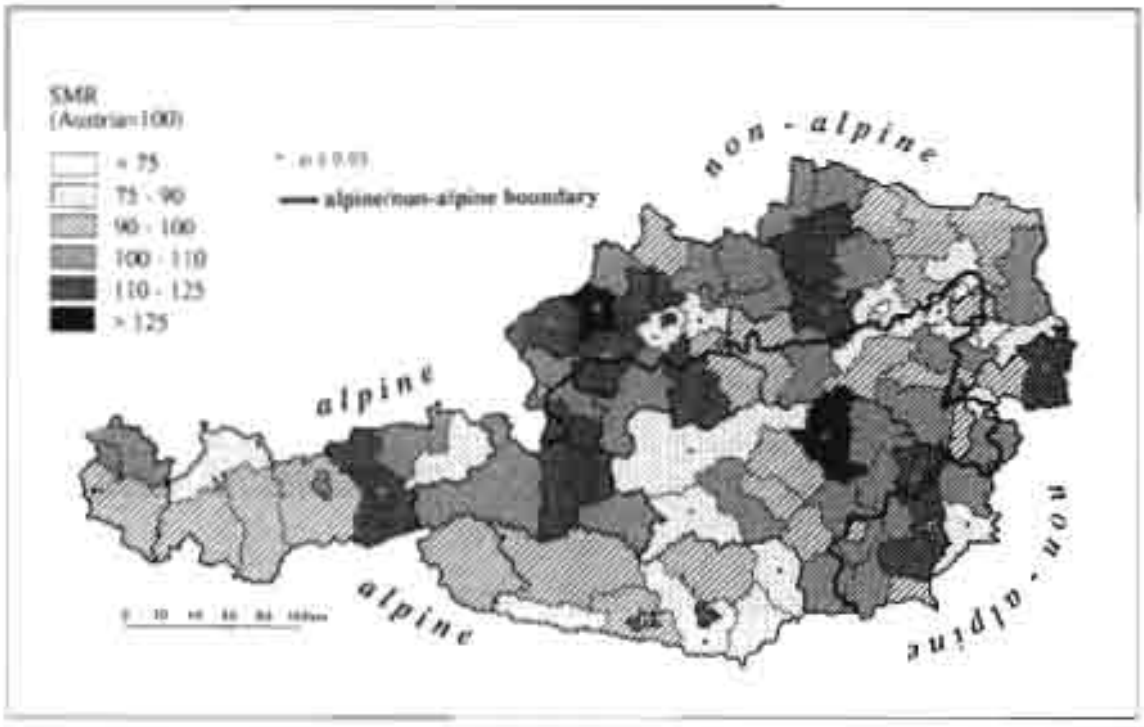
Map 1a
Infant Mortality by Political Districts, 1900-1902 (per 1,000)
(Source: Rosenbaum, 1969, p. 8008)



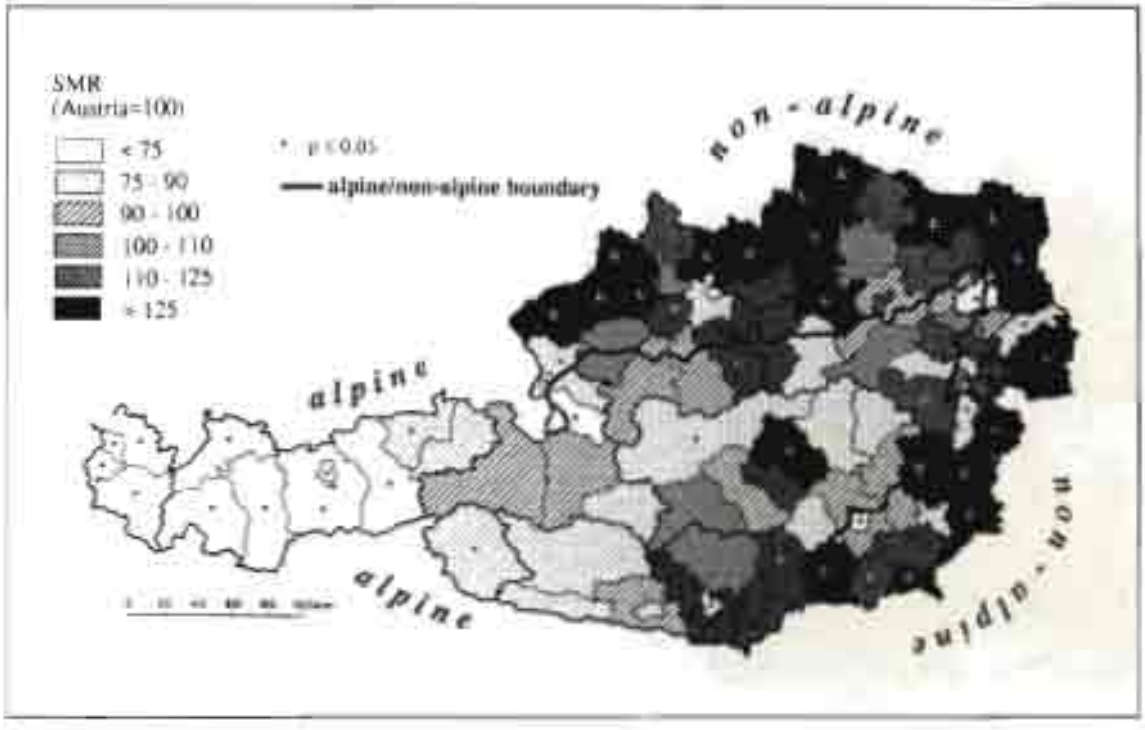
Map 1b
Infant Mortality by Political Districts, 1950-1954 (per 1,000)

standardized rates for perinatal mortality, the difference between the upper and the lower quartile of post-neonatal mortality is three times, the coefficient of variation twice as high. This relatively small regional variation in perinatal mortality affects only about one fourth of all districts, those which, by the beginning of the 1950s, had mortality rates significantly different from the national average[10]. In comparison, the corresponding proportion for post-neonatal mortality was 53 per cent.

10. The Chi-square statistics were used as a test of significance. For a Chi-square = 3.84 or greater, the p-value is ≤0.05. Discussed in Jones and Moon, 1987, p. 59.



Map 2a
Perinatal Mortality by Political Districts, 1950-1954 (Standardized Mortality Rates)
(Source: Calculations based on vital statistics of the Austrian Statistical Office)



Map 2b
Post-neonatal Mortality by Political Districts, 1950-1954 (Standardized Mortality Rates)
(Source: Calculations based on vital statistics of the Austrian Statistical Office)

One conclusion, therefore, is that only a small percentage of all infant mortality cases, those occurring after the first month of life, account for the regional differences in infant mortality rates. Unlike post-neonatal cases, which were strongly determined by regional factors, perinatal cases reveal almost no regional differences.

Explanations for this regional pattern cannot be purely biological because differences in the frequency of congenital malformations would result in differences in perinatal mortality rates. The same holds true for the proportion of infants who, for biological or social reasons, are born prematurely. Moreover, there is no indication in the relevant literature that cultural differences in the behaviour of pregnant women, prenatal care, delivery practices and infant care contributed significantly to mortality risks.

Nurses caring for newborn babies in the infants' wing of a children's clinic. At the turn of the century, complications during delivery and diseases in the first month of life constituted the greatest threat to infants.

A comparison of 1955-59 mortality rates in Tyrol and Burgenland by age and cause of death shows that although perinatal mortality was almost the same in both provinces, post-neonatal mortality was significantly higher in Burgenland where infants were more than three times as likely to die from infectious diseases (Table 3). This finding strongly suggests that traditional regional patterns of infant mortality were primarily influenced by differentials in mortality risks from infections.

Table 3 - **Perinatal and Post-Neonatal Mortality Rates in Burgenland and Tyrol, Relative Risks by Causes of Death**
(Per 1,000 Live Births, 1955-59)

Age/Cause of death	Tyrol rate (per 1,000)	Burgenland rate (per 1,000)	Relative Risk
Perinatal Mortality	37.8	40.9	1 : 1.08
Post-neonatal mortality (total)	11.4	25.6	1 : 2.25
Infectious diseases (total)	4.5	16.3	1 : 3.62
- gastro-intestinal	1.5	4.9	1 : 3.26
- respiratory tract	2.3	8.5	1 : 3.70
- all other infectious diseases	0.7	2.9	1 : 4.14
all other causes	6.9	9.3	1 : 1.35

(Source: Kytir, 1989, p. 62)

Several reasons have been advanced for this risk differential. One is that infants in Alpine areas were less likely than their urban counterparts to die from infectious diseases because they were better fed and had more access to medical treatment. Only limited evidence can be found to support this hypothesis, however. In fact, the quality and quantity of medical treatment appear to have had little effect on the level of infant mortality at the beginning of the 1950s; by extension, they would certainly have been even less relevant in the late nineteenth and early twentieth centuries. Antibiotics, which are essential to the treatment of infectious diseases, became available only after the Second World War.

A more probable explanation is that infants in Alpine regions were less exposed to infectious agents than infants in the non-Alpine hills and lowlands. This difference in exposure could depend on social factors such as better living conditions and better personal hygiene, even though, again, there is little empirical evidence to support the theory that social conditions were significantly different in the two regions.

Most data, instead, point to important environmental differences between the two regions. The first is the quality of the water supply. It has been shown that the provision of a public water supply and modern sewage systems in the late nineteenth century interrupted the chain of infection in lowland cities. In contrast, separating potentially infectious waste water from drinking water was never a serious problem in Alpine villages. The second important difference was in climate and temperature. The colder climate of the Alps made infants less susceptible to diseases of the respiratory tract. Moreover, climatic factors had an even greater bearing on infections transmitted through foods. After weaning, infants were at constant risk of contracting illnesses because of spoiled or contaminated food, particularly cow's milk. In addition, Alpine regions benefited from lower population density and different settlement patterns which might have made epidemics of infectious diseases less likely.

Yet another hypothesis should be mentioned, however, although still based on rather speculative arguments[1]. It has been suggested that differences in infant mortality rates

1) See Arnold, 1981, for a similar theory to explain regional differences in infant mortality in Germany.

A canteen for poor children during World War I in Vienna's 17th district. Adequate nutrition improved children's chances of resisting infectious diseases.

reflect differences in the functional role and economic value of children. Traditionally, children were essential to Alpine economies, which were based on mountain farming, milk and cheese production and long-distance trade. The contribution of children in all of these areas was crucial to the survival of the household; children were, for instance, generally responsible for guarding herds on mountain pastures. The livelihood of non-Alpine dwellers, instead, was based mainly on crop production and vineyards where large numbers of children were less useful as a source of cheap labour. Therefore, non-Alpine pre-industrial society, consciously or unconsciously, may have practised various forms of after-the-fact 'birth control' or delayed infanticide. Mediated by the frequency and duration of breast-feeding, and the general quality of infant care, such economic considerations might have had their effect on mortality statistics.

References

Austrian Statistical Office, *Die natürliche Bevölkerungsbewegung im Jahre ...*, Vienna, Staatsdruckerie (annually 1950-74).

Austrian Statistical Office, *Demographisches Jahrbuch Österreichs*, Vienna, Staatsdruckerei (annually 1975-91).

Bolognese-Leuchtenmüller, B., *Bevölkerungsentwicklung und Berufsstruktur. Gesundheits- und Fürsorgewesen in Österreich 1750-1918*, Vienna, Verlag für Geschichte und Politik, 1978.

Friedl, H.-P., "Die Gesundheitsverhältnisse in Österreich im 19. Jahrhundert", in *Geschichte und Ergebnisse der zentralen amtlichen Statistik in Österreich 1829-1979*, (Beiträge zur Österreichischen Statistik, vols. 550, 551), Vienna, 1979, pp. 471-478.

Gisser, R., "Daten zur Bevölkerungsentwicklung der österreichischen Alpenländer 1819-1913", in *Geschichte und Ergebnisse der zentralen amtlichen Statistik in Österreich 1829-1979*, (Beiträge zur Österreichischen Statistik, vols. 550, 551), Vienna, 1979, pp. 403-424 and pp. 23-31.

Hansluwka, H., "Die regionale Differenzierung der Säuglingssterblichkeit in Österreich", *Mitteilungen der Österreichischen Sanitätsverwaltung*, 9, 1957, pp. 171-177.

Hansluwka, H., "Die Sterblichkeitsverhältnisse in den einzelnen Bundesländern Österreichs", *Mitteilungen der Österreichischen Sanitätsverwaltung*, 1, 1958, pp. 6-11.

Hansluwka, H., "Die Säuglingssterblichkeit in den politischen Bezirken Österreichs", *Mitteilungen der Österreichischen Sanitätsverwaltung*, 2, 1966, pp. 71-82.

Imhof, A.E., "Unterschiedliche Säuglingssterblichkeit in Deutschland, 18. bis 20. Jahrhundert - Warum?", *Zeitschrift für Bevölkerungswissenschaft*, 3, 1981, pp. 343-382.

Jones, K. and G. Moon, *Health, Disease and Society. An Introduction to Medical Geography*, London, Routledge & Kegan Paul, 1987.

Köck, C., J. Kytir and R. Münz, *Risiko Säuglingstod. Plädoyer für eine gesundheitspolitische Reform*, Vienna, Deuticke, 1988.

Kytir, J., "Regionale Unterschiede der Säuglingssterblichkeit in Österreich", *Mitteilungen der Österreichischen Geographischen Gesellschaft*, 131, 1989, pp. 47-76.

Matznetter, T., "Brststillen aus regionaler Sicht", *Zeitschrift für Bevölkerungswissenschaft*, 1, 1986, pp. 133-152.

McKeown, T., *The Modern Rise of Population*, London, Edward Arnold, 1976.

McKeown, T., *Die Bedeutung der Medizin*, Frankfurt, Suhrkamp, 1982.

Moll, L., *Säuglingssterblichkeit in Österreich*, Vienna, Leipzig, 1914, pp. 13-16.

Popp, A., *Schutz der Mutter und dem Kinde*, Vienna, 1910.

Presl, F., "Die Säuglingssterblichkeit in Österreich", *Statistische Monatsschrift*, 1903, pp. 651-680.

Rosenfeld, S., "Die Säuglingssterblichkeit in Osterreich", *Statistische Monatsschrift*, 1909, pp. 638-645 and pp. 671-710.

Spree, R., *Soziale Ungleichheit vor Krankheit und Tod*, Göttingen, Vandenhoek & Ruprecht, 1981.

Viazzo, P.P., *Upland Communities. Environment, Population and Social Structure in the Alps Since the Sixteenth Century*, Cambridge, Cambridge University Press, 1989.

van de Walle, F., "Infant Mortality and the European Demographic Transition", in A.J. Coale and S.C. Watkins (eds), *The Decline of Fertility in Europe*, Princeton, N.J., Princeton University Press, 1986.

Watterson, P.A., "Role of the Environment in the Decline of Infant Mortality: An Analysis of the 1911 Census of England and Wales", *Journal of Biosocial Science*, 18, 1986, pp. 457-470.

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