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Foreword

Marie C. Nelson

We are very pleased to be able to present this thematic issue of *Hygiea Internationalis* which features studies of infant mortality in the Nordic countries. Texts are included from Denmark, Iceland, Norway and Sweden, the results of a Nordic project.

The introductory article by Anders Brändström, Sören Edvinsson and John Rogers draws together some of the main trends. At the same time the individual survey articles provides us with syntheses on the national levels: Brändström, Edvinsson and Rogers on Sweden, Ólöf Garðarsdóttir and Loftur Guttormsson on Iceland, and Gunnar Thorvaldsen on Norway. Magdalena Bengtsson presents a detailed study of the development of cause of death among infants in Sweden, while Eli Fure gives us insight into the use of computer analysis in studies of infant mortality in her methodological contribution.

National studies of infant mortality have been with us for some years, but it is only more recently that attempts have begun to be made to present syntheses of research results that have been produced. If our research and local studies are to have further value, then it is important to reach beyond national borders, to see how regions cut across political boundaries and how various regions of Europe exhibited similarities and differences. This issue is an important step in reaching a more unified understanding of the developments in the Nordic countries.

One of the features of this issue is the visual experience provided by the extensive maps. The opportunities now available in this respect allow the use of maps as an analytical tool in ways not previously available. We are only beginning to explore the possibilities here.

During the next few weeks, we will be changing the composition of our editorial group. While I will be taking over the primary responsibility for the journal, Peter Berkesand will continue as our technical editor. His new position with Linköping University Electronic Press ensures both the production of the journal, as well as participation in the new developments associated within the field. We are also hoping soon to be able to add an administrative assistant to our ranks.

Developments within the field of electronic publications, to say the least, are occurring at a pace that not many of us could have imagined just a few years ago.

Therefore, it is very important that we reconsider the ways in which this journal operates. Of course, we want to present quality work on the pages of the journal. At the same time, the mere presentation of articles alone does not fully utilize the potential of this medium. The question that we have is how could the journal be used in a more innovative way? This is where our readers come in. What ideas and suggestions do you have about how the journal could be developed? Let us know what thoughts and ideas you have. How would you like to see a medium of this kind used? Please contact either Peter Berkesand or me at the addresses listed on the main page of the International Network for the History of Public Health.

Finally, the next issue of our journal will contain papers from the 2001 combined conference held in Norrköping, Sweden and will focus on occupational health. This thematic issue will include presentations from several parts of the globe.

We hope to hear from our readers. Send us your ideas.

Introduction

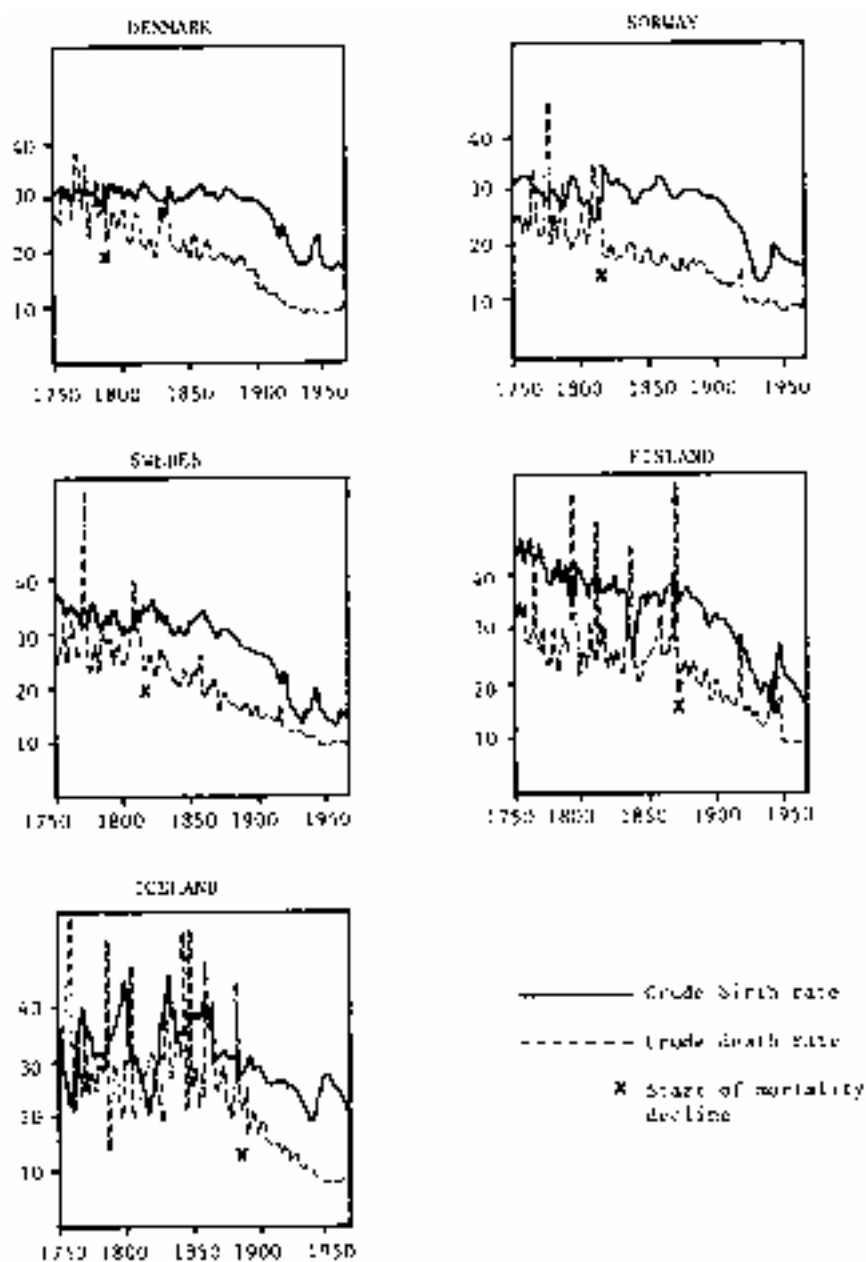
Anders Brändström, Sören Edvinsson, and John Rogers

One of the most successful achievements in improving the health of populations has been the reduction of infant mortality. In many European countries infant mortality rates have declined from levels often above 200 infant deaths per thousand live births to less than ten within the time span of a century. Furthermore, it is clear that the reduction of mortality among young children was to a very large extent due to human intervention. In this context the Nordic countries have been and continue to be in the forefront.

In all of the Nordic countries the secular decline in mortality was to a large degree due to a reduction of infant deaths. This is not to say, however, that the decline of mortality followed the same pattern in each country. If we consider the timing of mortality in the demographic transitions of the Nordic countries, we find that mortality started to fall at very different points in time. In Denmark the crude death rate began to fall in the last decade of the eighteenth century. In Sweden and Norway the downward turning point started at the beginning of the nineteenth century. For Finland and Iceland mortality declined much later, during the latter half of the nineteenth century (Figure 1).

Information on infant mortality varied among the Nordic countries. For Sweden and Finland time series exist from 1749 onward. Denmark began publishing national statistics on infant mortality in 1835, Norway in 1836 and Iceland in 1838 (Figure 2). Infant mortality trends and levels differed considerably in the Nordic countries. In Finland a pattern with constant high rates and large annual fluctuations is found from 1749 to the late 1860s. Sweden's infant mortality was slightly lower than Finland's in most years during the eighteenth century. In the first decade of the nineteenth century infant mortality fell in Sweden and the gap between the two countries increased. Compared to the other Nordic countries, Norway had significantly lower infant mortality and less pronounced annual fluctuations. Infant mortality was higher in Denmark than in Norway, and very similar to Sweden from 1830 onward. Iceland, on the other hand, had extremely high rates of infant mortality, among the highest in Europe, with certain years exceeding 400 deaths per thousand live births. Iceland did not reach levels similar to the other Nordic countries until the 1880s. In summary, Denmark Norway and

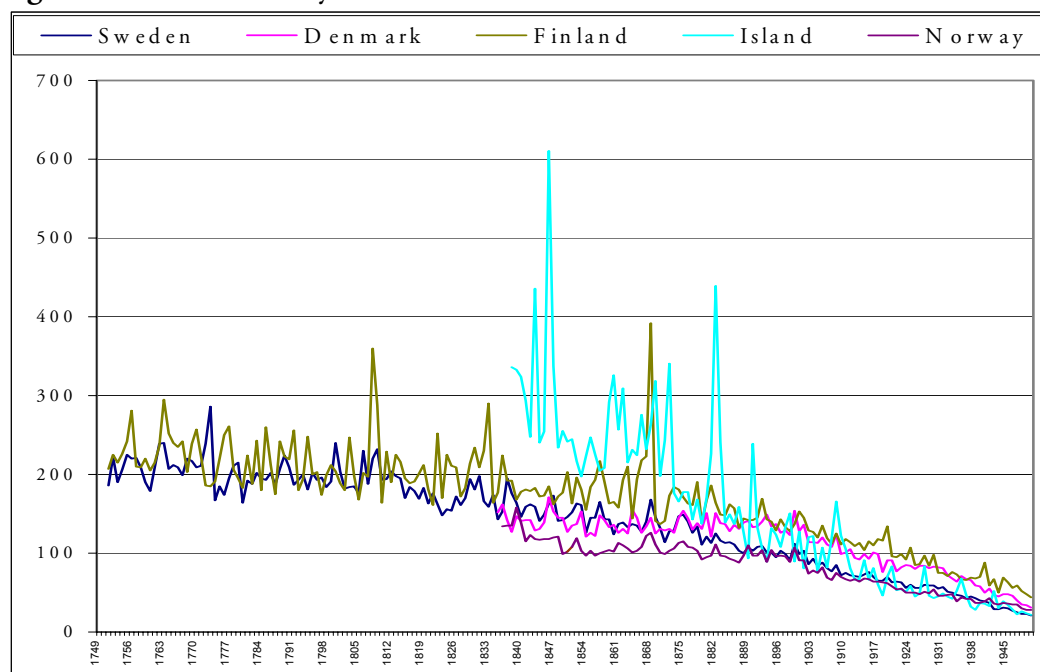
Figure 1. The demographic transition in the Nordic Countries.



Source: Ståle Dyrvik, "Comment," *Scandinavian Population Studies*, 5 (1979), 99.

Sweden exhibited similar patterns during most the nineteenth century. In Iceland and Finland infant mortality declined first during the second half of the nineteenth century. At the turn of the nineteenth century, infant mortality in all of the Nordic countries converged, although Finland and Denmark continued to have slightly higher infant mortality rates. If twentieth century infant mortality in Europe is

Figure 2. Infant mortality in the Nordic Countries, 1749–1950.



Source: *Historisk Statistik för Sverige 1720–1967* (Stockholm 1969); B. R. Mitchell, *European Historical Statistics 1750–1970* (London, 1978); Oiva Turpeinen, “Fertility and Mortality in Finland since 1750,” *Population Studies*, 33:1 (1979); *Hagskinna. Icelandic Historical Statistics*, eds. Guðmundur Jonsson and Magnus S. Magnusson (Reykjavik 1997).

compared, all of the Nordic countries are in the group characterized by the lowest level of infant mortality throughout the entire period.¹

However, national figures are only averages and often conceal very different mortality regimes. The results from several historical studies undertaken in the Nordic countries, some conducted already in the nineteenth century, clearly indicate that infant mortality varied considerably within each country. As was commonplace elsewhere, urban infant mortality was higher than rural infant mortality until the twentieth century. In Norway, Sweden and Finland a coast-inland pattern appears to have existed with higher rates on the coast. Furthermore, infant mortality was higher in northern Finland, Sweden and Norway compared to the central and southern parts of the respective countries.

Several micro-demographic studies on infant mortality have been published in the Nordic countries during the last 20 years.² They have used quite different

1 Goodelieve Masuy-Stroobant, “Europe: Infant Health and Infant Mortality,” in Carlo A. Corsini and Pier Paolo Viazzo, *The Decline of Infant and Child Mortality. The European Experience: 1750–1990* (UNICEF 1997), 5.

2 For a review of research on infant and child mortality in Sweden, see, John Rogers,

methodologies and points of departure, making comparisons difficult. Furthermore, very different explanations as to why infant mortality started to decline are put forth. Some stress the importance of nutrition and economic development (for instance, changes in income and grain prices); others suggest changes in social structure, childcare, or feeding practices. However, all agree that no single cause explains the mortality decline. Rather, a very complex web of factors contributed to the decline in infant mortality. This, in turn, clearly indicates that a comparative approach, adopting a common research agenda and using similar methodologies, is necessary.

The need for such an approach led to the creation of a Nordic comparative research project: "The development of a welfare society. The decline of infant and childhood mortality in a Nordic and European perspective, ca 1750–1950." The project was launched in 1995 and organized as a forum or a meeting place for several national research projects. The project received financing from the Joint Committee of the Nordic Research Councils for the Humanities (NOS-H) for annual project meetings during a four-year period. Five meetings, or workshops have been held, two in Umeå, Sweden, one in Copenhagen, Denmark, one in Stockholm, Sweden, and one in Madrid, Spain as a joint venture together with an international research project.

In order to facilitate comparison, three main factors or aspects of particular interest for an analysis of the development of historical infant and childhood mortality were considered.

Regionality: Central to the comparison is an analysis of regional differences in infant mortality within each country. Detailed maps showing the development of infant mortality in time and space for each participating country have been created. Maps for selected points in time, where data of similar quality and level of aggregation is available, are also included.

Child feeding practices: Previous research has shown that breastfeeding and/or the use of artificial feeding differed substantially among social groups and between regions. As breastfeeding often had positive effects so strong that they could counterbalance the effects of poverty and other negative influences on infant mortality, an analysis of breastfeeding patterns has been included in the comparison.

Illegitimacy: In nearly all studies of infant mortality, children born out of wedlock experienced a lower chance of survival. This is true, regardless of religion, social

"Nordic Family History: Themes and Issues, Old and New," *Journal of Family History*, 18:4 (1993), 291-214 and a workshop paper by Sören Edvinsson, Marie C. Nelson and John Rogers, "Dying Young: Swedish Infant and Childhood Mortality in Review," *Hygiea Internationalis* [<http://www.liu.se/tema/inhph/journal/>]

class, economic position or country of origin. The percentage of illegitimate births of all live births often differed considerably within each Nordic country. Differences in infant mortality between legitimate and illegitimate children were often substantial, indicating that this also is a key factor in any comparative analysis of infant mortality.

Within the project an inventory of relevant sources for an analysis of the causes of death was undertaken, as well as the development of a common coding scheme for such an analysis.

Many of the research results of the Nordic collaboration have been presented in various articles and papers.³ This volume constitutes the final report of the research project. The three factors, regionality, infant feeding practices and illegitimacy, are discussed in reports on developments in the respective countries. Also included are two special case studies. One considers social differences in infant mortality in the parishes of Asker and Bærum in Norway where levels of infant mortality were relatively low. The other is a methodological study on the causes of death among infants in Linköping, a town in Sweden. Each article thus contributes in a different way toward a better understanding of the mortality decline in the Nordic countries during the last two hundred years and draws attention to important factors which stress similarities as well as differences between countries and between regions within each country.

3 A full list of articles and papers from the project is found in the appendix to this volume.

Illegitimacy, Infant Feeding Practices and Infant Survival in Sweden 1750–1950

A Regional Analysis

Anders Brändström, Sören Edvinsson and John Rogers

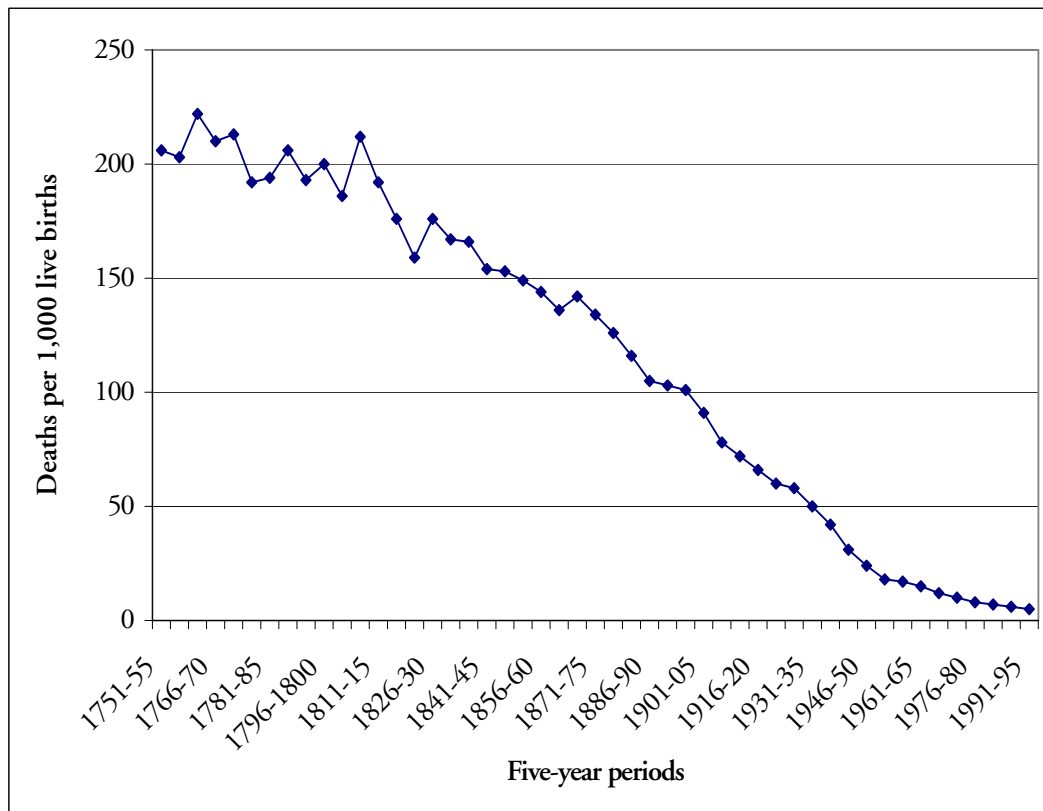
The general decline of mortality in Europe after 1750 constitutes one of the great puzzles of historical demography. We now have a vast amount of information on various aspects of the decline, although much of it has come into being in an *ad hoc* fashion. Some ten years ago Reher and Schofield pointed out in their review of the status of research on the European mortality decline, “it would only be a small exaggeration to say that our understanding of historical mortality patterns, and of their causes and implications, is still in its infancy.”¹ After a decade of further research their statement is still valid.

In the context of the Swedish demographic transition, infant mortality played a key role in the general decline in mortality. Deaths among children under one year of age contributed to almost 30 percent of the total number of deaths in the middle of the eighteenth century. By the middle of the nineteenth century the proportion of infant deaths had decreased to 22 percent and by the end of the century to 17 percent. By the middle of the twentieth century infant deaths constituted only 2.7 percent of all deaths. The decline of mortality observed in the model is thus, to a large extent, the result of the long and steady decrease in infant mortality (Figure 1). Infant mortality in Sweden during the second half of the eighteenth century fluctuated around 200 deaths per 1000 live births (200‰). After the first decade of the nineteenth century infant mortality declined steadily reaching 150 per thousand by the middle of the century. Rates dipped below 100 per thousand at the beginning of twentieth century and now constitute less than five infant deaths per thousand live births. This gradual decline was atypical in a European context, where child mortality often played a more central role.²

1 Roger Schofield and David Reher, “The Decline of Mortality in Europe,” in *The Decline of Mortality in Europe*, eds. R. Schofield, D. Reher and A. Bideau (Oxford, 1991).

2 A. Perrenaud, “The mortality decline in a long-time perspective,” in *Pre-industrial*

Figure 1. Infant mortality rates in Sweden, 1750–1995.



Source: *Historical Statistics for Sweden. Part 1. Population* (Stockholm 1969)

In Sweden attention has focused to a large part on the analysis of the causes of infant mortality in local areas for specific time periods.³ Attempts to generalize from

population change: The mortality decline and short-term population movements, eds. T. Bengtsson, G. Fridlitzius and R. Ohlsson (Stockholm, 1984); Roger Schofield and David Reher, "The Decline of Mortality in Europe," in *The Decline of Mortality in Europe*, eds. R. Schofield, D. Reher and A. Bideau. (Oxford, 1991); *The decline of infant and child mortality: The European Experience, 1750–1990*, eds. C. A. Corsini and P. P. Viazzo (Florence, 1997).

3 There is a great deal of controversy concerning the causes of the decline in infant mortality in Sweden. See, for example, Christer Ahlberger and Christer Winberg, "Biologi, medvetet handlande och struktur," *Historisk tidskrift* (1987:3), 357–382; Ulla-Britt Lithell, "Amning och äktenskaplig fruktsamhet," *Historisk tidskrift* (1988:2), 231–238; Christer Winberg, "Amning, teorier och hypoteser," *Historisk tidskrift* (1988:2), 239–243. See also, Ingrid Eriksson and John Rogers, *Rural Labor and Population Change. Social and Demographic Developments in East-central Sweden during the Nineteenth Century* (Uppsala, 1978); Anders Brändström, "De kärlekslösa mödrarna" *Spädbarnsdödligheten i Sverige under 1800-talet med särskild hänsyn till Nedertorneå* (Umeå, 1984); Magdalena Bengtsson, *Det hotade barnet. Tre generationers spädbarns-*

these local studies have provided explanations that tend to be time specific: for example the late eighteenth and early nineteenth century government information campaigns for improved childcare were thought to be important for the early decline in mortality. It has also been suggested that public health measures in the late nineteenth century and infra-structural improvements in health care in the twentieth century positively influenced the survival of children. The results from these local studies indicate that more work must be done on a regional analysis of infant mortality and that this must be done in a more systematic fashion.

The purpose of this study is to examine regional variations in infant mortality and how these were related to the improvements in the survival of infants.⁴ Were there distinct regional differences in infant mortality during the early nineteenth century, that is, at the outset of the decline of infant mortality? Did these patterns change as mortality declined? One of the most important factors influencing levels of infant mortality is related to infant feeding practices, in particular breast-feeding. Are variations in the frequency of breast-feeding related to regional variations in infant mortality? Illegitimate infant mortality has been shown to be consistently higher than legitimate infant mortality. Were there variations in illegitimate infant mortality and did these change as infant mortality declined?

Provincial Level Data on Infant Mortality

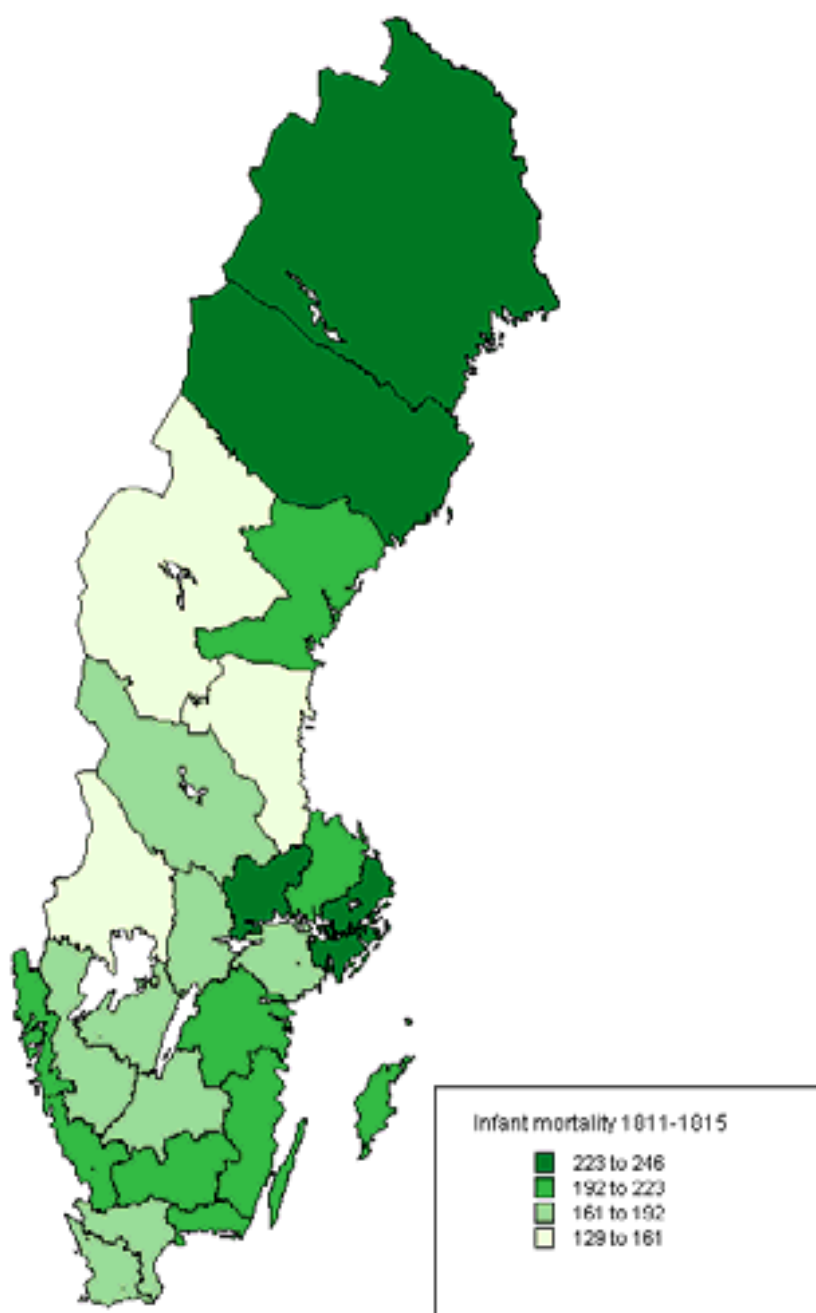
If we consider patterns and trends on a provincial level during the period of the demographic transition, we find that there was a significant amount of variation in infant mortality.⁵ The sources include both published and unpublished data on a provincial level (*län*) in Sweden from 1811 to 1972.⁵ Boundary changes, while they did occur, were generally small and do not affect levels or trends in the comparisons. Because of the varying nature of the sources, infant mortality rates for both

och barnadödlighet i 1800-talets Linköping. (Linköping, 1996); For a review of research on infant and child mortality in Sweden, see, John Rogers, "Nordic Family History: Themes and Issues, Old and New," *Journal of Family History*, 18: 4 (1993), 291–214.

4 The Swedish project is supported by the *Bank of Sweden Tercentenary Foundation*. This project "Toward a better society" treats numerous aspects of the decline of infant mortality in Sweden, such as regionality, fertility, illegitimacy, social and economic conditions, family relations, environmental aspects, etc. In order to be able to compare results, we have limited the analyses in this paper to three main aspects – regionality, child feeding practices and illegitimacy.

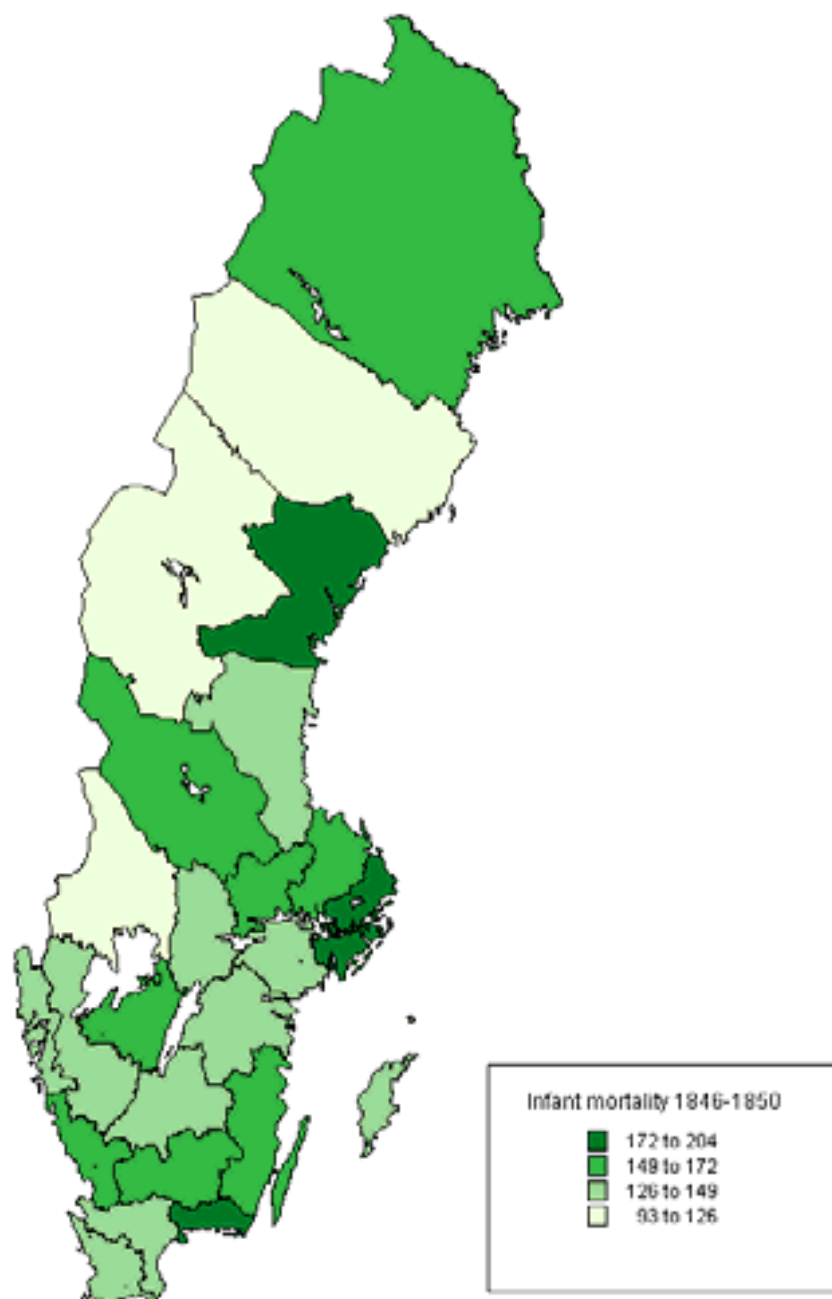
5 The Swedish administrative unit *län* is generally translated as county but *province* is a more appropriate term. For listing of the provinces and their location, see Appendix 1.

Map 1. Infant mortality rates (per 1,000 live births) for the provinces of Sweden, 1811–1815.



Source: Tabellverket. Provincial statistics. National Archives.

Map 2. Infant mortality rates (per 1,000 live births) for Swedish provinces, 1846–1850.



Source: Tabellverket. Provincial statistics. National Archives.

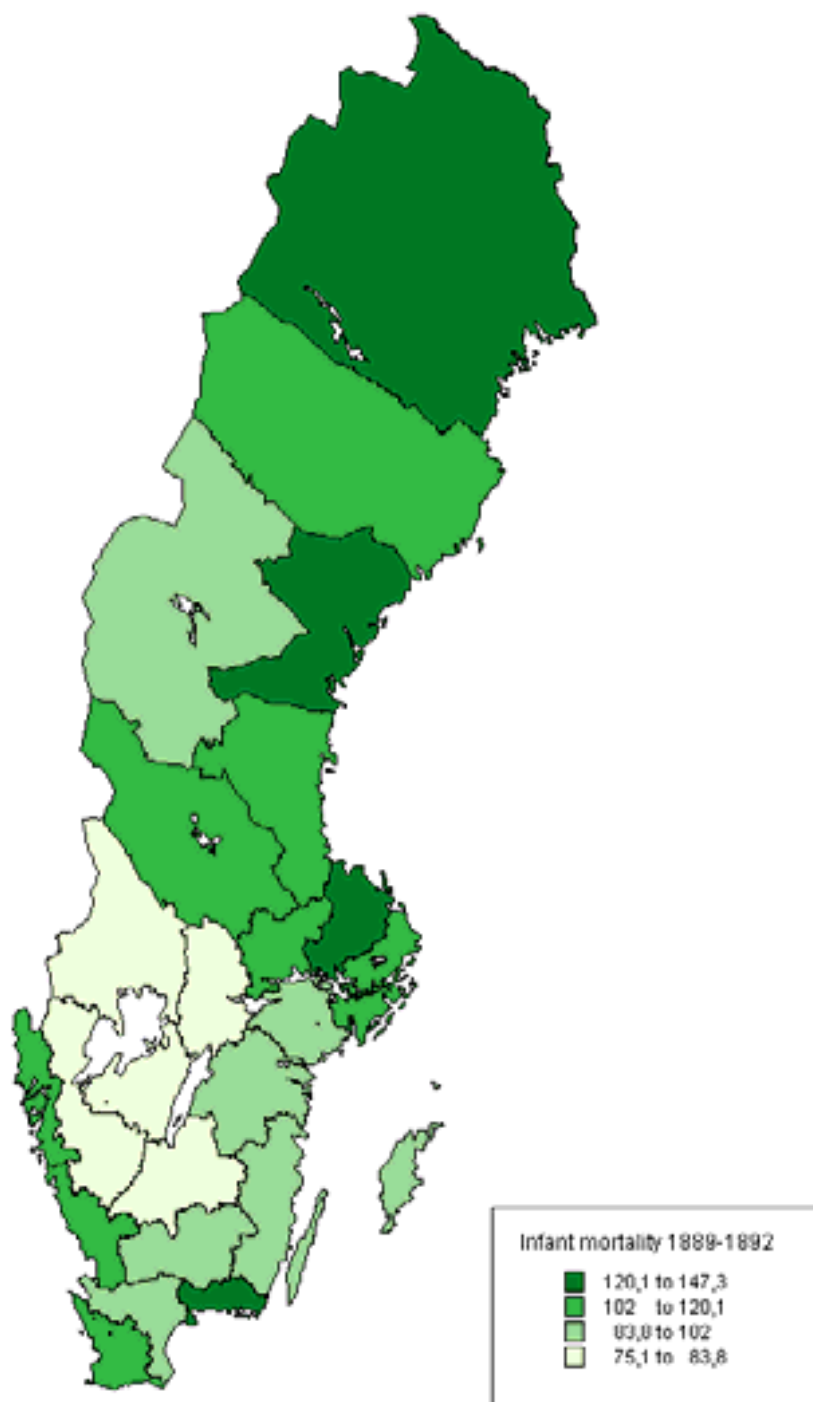
sexes combined will be used. The maps are constructed so that the scale increase or decreases with one unit of standard deviation from the mean of provinces.

At the beginning of the nineteenth century (Map 1) high rates of infant mortality are observable in the far north, in the vicinity of the capital, Stockholm, and in a u-shaped band of provinces stretching along the west coast through the southern part of the country to the east coast. During the first half of the nineteenth century infant mortality declined, with the highest rates dropping from 246 to 204 per thousand and the lowest from 129 to 93 per thousand. By mid-century (Map 2) regions of high mortality in the north and south had been reduced somewhat, and the area of high mortality originating near the capital had expanded westward. The provinces of Jämtland and Värmland (see Appendix 1) had low rates at both these points in time.

There was no clear relationship with population density during the period. Urban infant mortality rates were significantly higher than rural rates, but because the country was so little urbanized during this period, that fact is not reflected in the figures for the provinces. Only some ten percent of the population resided in urban areas, and the capital, with a population of about 93,000 in 1850, was the only city comparable in size to other major European cities. From the middle of the nineteenth to the middle of the twentieth century regional patterns of infant mortality changed as levels declined considerably (Maps 3 and 4). Again, there was no clear relationship with either population density or level of urbanization. However, national level figures show that in the 1920s and 1930s a shift in urban-rural differentials took place. Urban infant mortality is now lower than rural. The earlier relationship between urbanization and therefore high population density and high infant mortality is reversed. A possible explanation is that the medical infrastructure expanded more rapidly in urban areas. After 1950 mortality levels and the difference between the highest and lowest rates continued to diminish. The more densely populated areas, which also coincided with the most urbanized areas, had the lowest levels of infant mortality. The only consistent pattern over a longer period of time is that the northernmost provinces registered the highest rates.

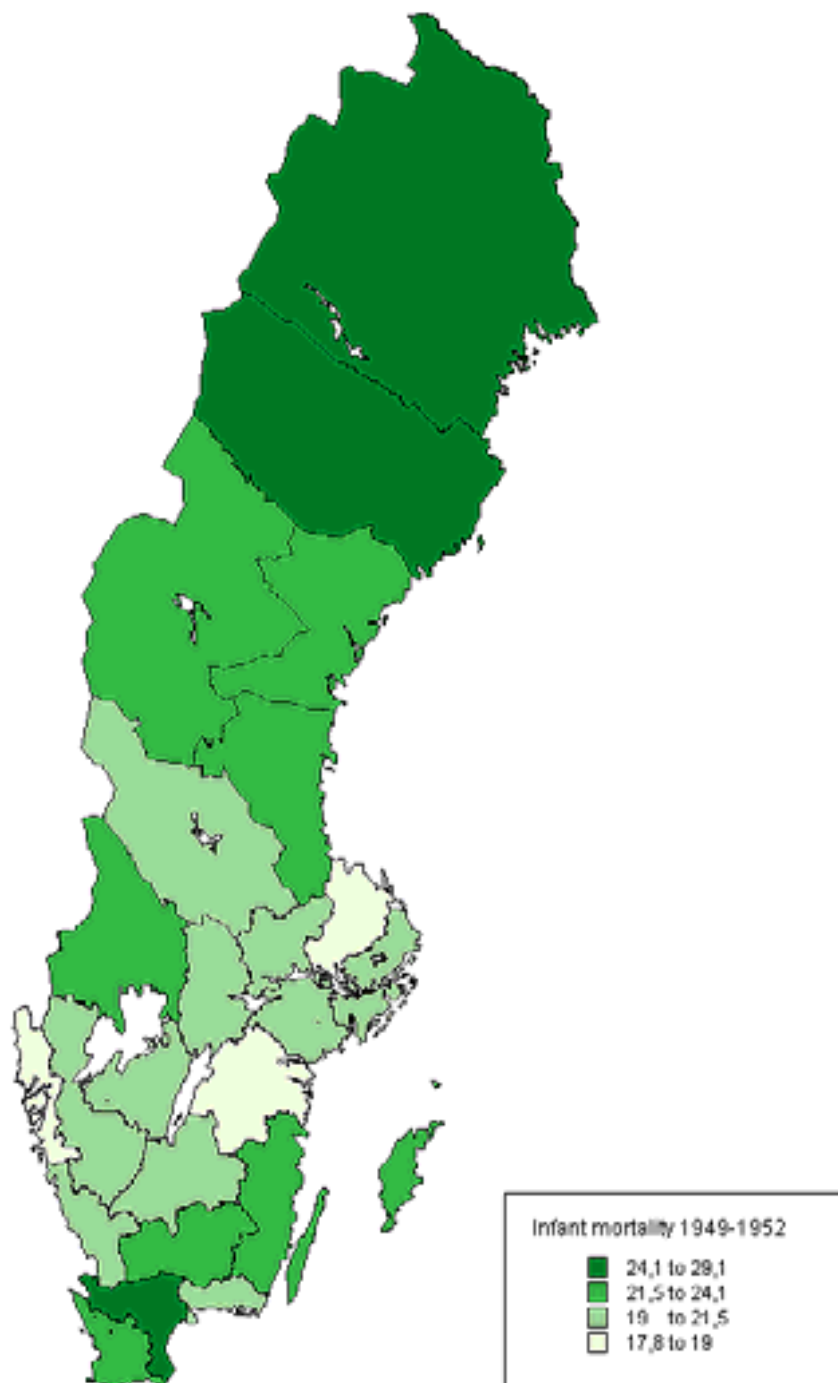
Another way of illustrating these regional trends is with contour shape maps. Figure 2 shows the development of indexed infant mortality for eleven provinces between 1811 and 1972. The index is calculated by dividing infant mortality by the national average rate, 1811–1815. Clearly there were large regional variations in development over time. Jämtland had very low infant mortality already during the eighteenth century. During the first half of the nineteenth century the province remained well under the national average; 1811–1815 infant mortality in the province was 60–80 percent of the national average and in the years 1831–1835 about half. However, during the last half of the century the relative position of Jämtland remained unchanged. By the end of the nineteenth century infant mortality in several other provinces, such as Värmland and Skaraborg, improved,

Map 3. Infant mortality rates (per 1,000 live births) for Swedish provinces, 1899–1902.



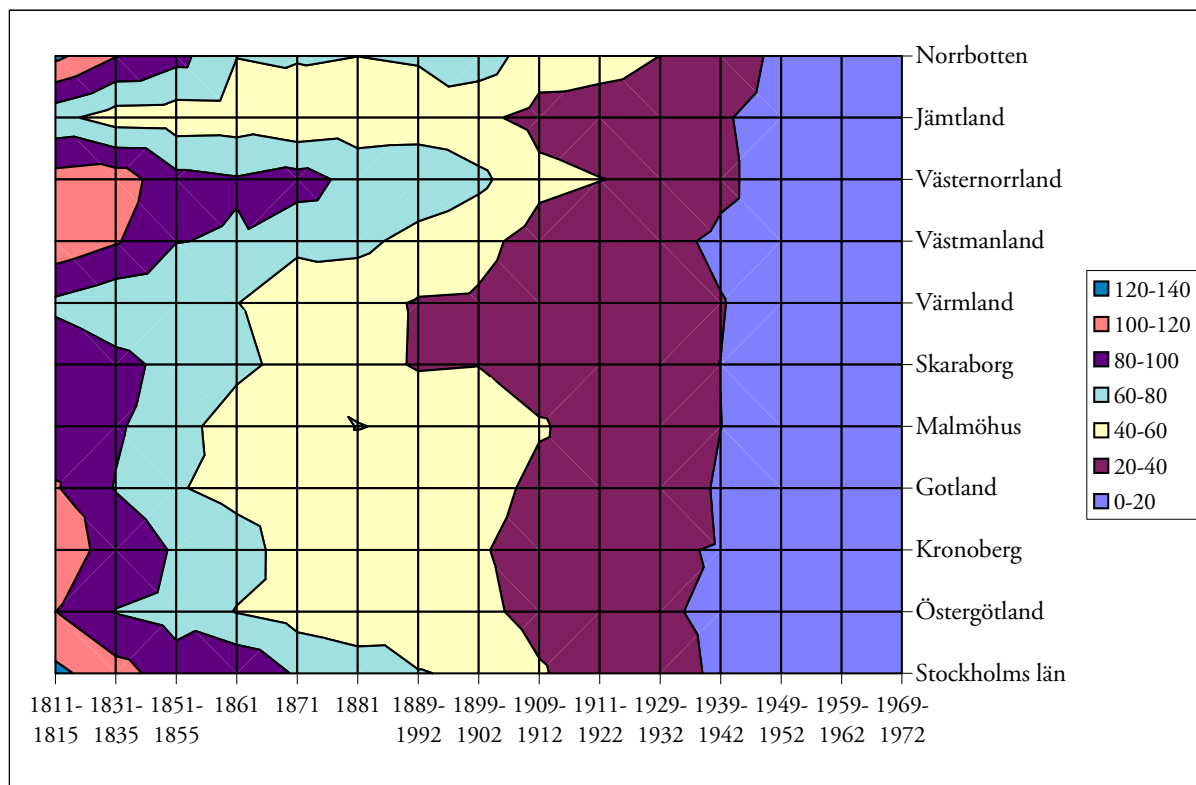
Source: Erland Hofsten and Hans Lundström, *Swedish Population History. Main Trends from 1750 to 1970* (Stockholm, 1976).

Map 4. Infant mortality rates (per 1,000 live births) for Swedish provinces, 1949–1952.



Source: Erland Hofsten and Hans Lundström, *Swedish Population History. Main Trends from 1750 to 1970* (Stockholm, 1976).

Figure 2. Indexed infant mortality for eleven Swedish provinces, 1811–1972. National average 1811–1815=100.



Source: Tabellverket. Provincial statistics. National Archives; Erland Hofsten and Hans Lundström, *Swedish Population History. Main Trends from 1750 to 1970* (Stockholm, 1976).

reaching the same 20–40 percent level as Jämtland. In contrast to Jämtland developments in the adjacent province of Västernorrland were strikingly different. Infant mortality was above the national average in 1811–1815 with declines coming very late in Västernorrland. It was not until the early twentieth century that Västernorrland reached the same level that Jämtland had experienced in 1831–1835. A similar slow development also characterised the provinces of Stockholm and Norrbotten. In the latter, Sweden’s northernmost province, infant mortality did not fall below 40 percent of the national index until 1929–1932. With the exception of Norrbotten, regional differences on a larger scale ceased to exist after 1911–1922.

The fact that there is no apparent relationship between population density and urbanization and regional variations in infant mortality indicates that specific regional factors were affecting the survival of infants and that these factors varied from place to place and over time. A study of infant mortality on the parish level in the province of Västerbotten in the 1860s by the physician and statistician Johan Hellstenius clearly revealed one of the major problems in working with provincial level data. Hellstenius found that parishes with large Saami (Lapp) populations had higher infant mortality rates and that the populations of districts where there were

iron works had lower rates than the average for the province.⁶ The provinces in Sweden are generally so large that highly divergent economic and social structures as well as distinct cultural areas may be found in one and the same province.

Parish Level Data on Infant Mortality

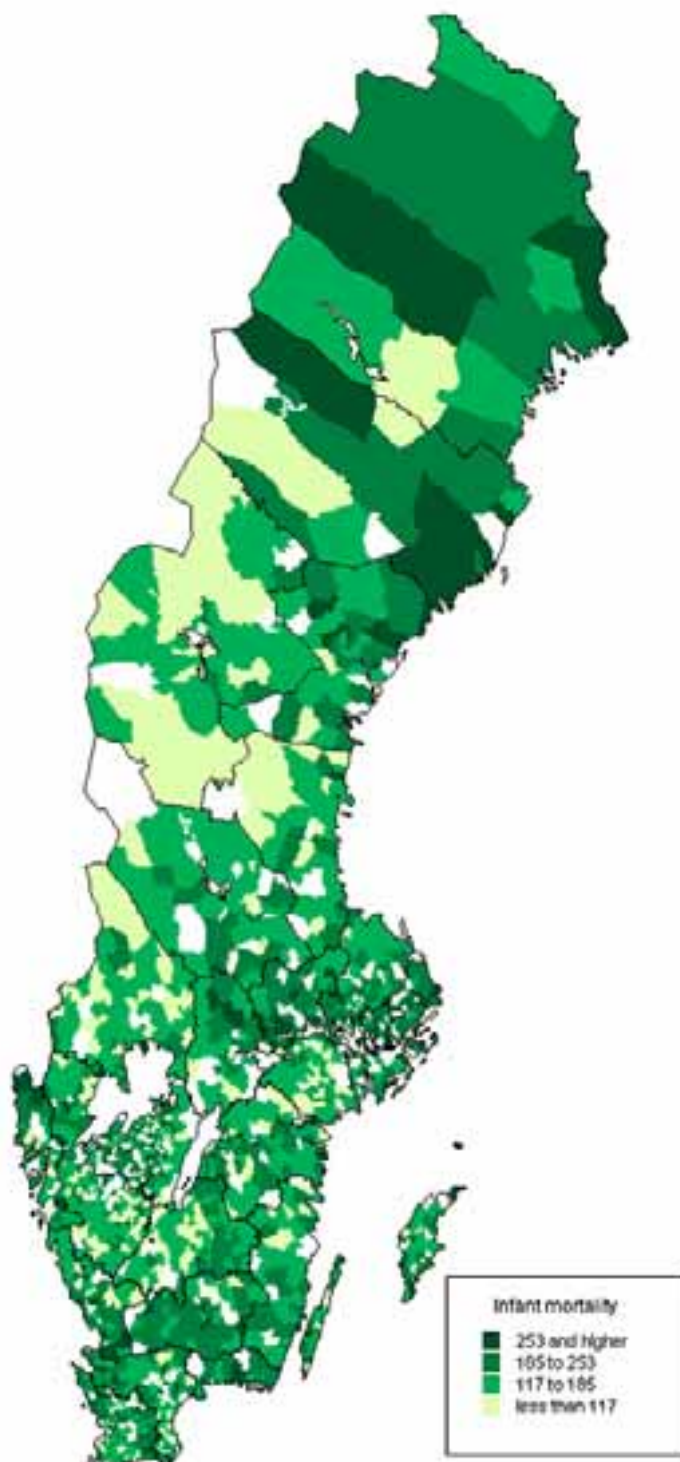
While provincial level data indicate that the story behind the gradual decline in infant mortality on a national level in nineteenth century Sweden is complicated, it is clear that even these figures conceal considerable variations in both levels and trends. To address this problem we need to create regions based on infant mortality rates that are not delimited by larger administrative boundaries, but are based on parish data. A usable source material for this purpose is parish level data compiled by *Tabellverket* containing demographic information on fertility and mortality on an annual basis from 1749 to 1859. Population data is available for various years (annually between 1749–1751, every third year from 1754, and every fifth year from 1775). The material is now available in digitalized form at the Demographic Data Base at Umeå University, Sweden. The data sets in this article include information on approximately 2,400 parishes.⁷ Data on two periods, 1803–1807 and 1848–1852 (later referred to as 1805 and 1850), are available. The 1805 analysis falls within the pre-transitional period in Sweden, while the 1850 study reflects a phase when infant mortality had significantly decreased.

In this study we have created regions of high, moderate, and low infant mortality based on parish data. The maps are constructed so that the data values break one standard deviation above or below the mean. The rates produced are for both sexes combined. Infant mortality rates are calculated by dividing the number of infant deaths in a given period by the number of live births during that same

6 Johan Hellstenius, "Barnadödligheten i Västernorrlands och Jemtlands län, 1860–1882," *Statistisk tidskrift*, 73 (1884), 153–168.

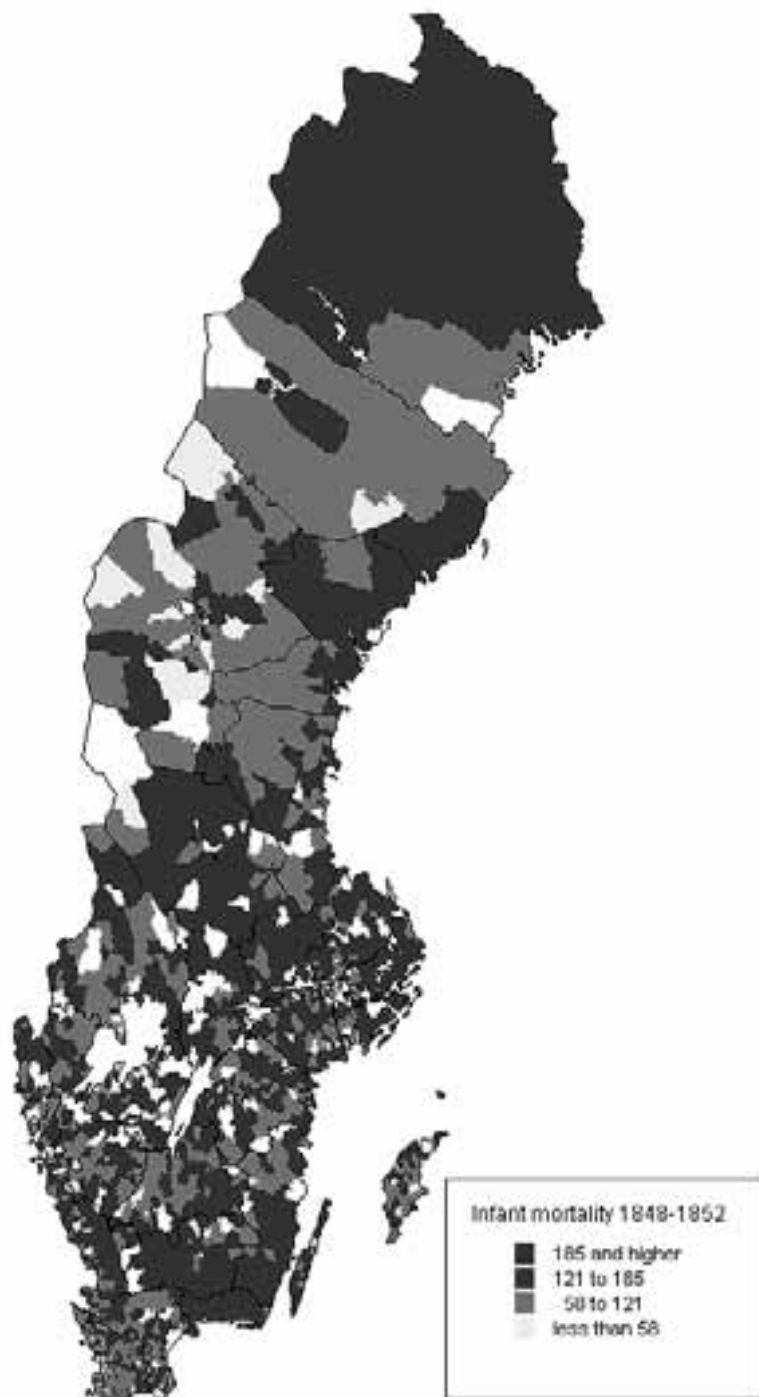
7 The source material consists of forms sent in by the parish ministers to *Tabellverket*. A number of those forms are missing, and others include information on more than one parish. For the first period, we lack information for 358 parishes (14.7%) and for the second period, 264 parishes (10.8%). The problem of the missing data was not systematic, but it did affect some parts of the country more than others. In northern Sweden, the parishes tended to be large and sparsely populated, and the effect of missing data in such parishes is more pronounced when the results are presented in cartographic form.

Map 5. Infant mortality rates (per 1,000 live births) for regions created using parish-level data, 1803–1807.



Source: Tabellverket. Parish statistics, The Demographic Data Base, Umeå University

Map 6. Infant mortality rates (per 1,000 live births) for regions created using parish-level data, 1848–1852.



Source: Tabellverket. Parish statistics, The Demographic Data Base, Umeå University.

period.⁸ Rates are computed for five-year periods surrounding those years with available population figures.⁹

The distribution of high, moderate and low infant mortality observable in the maps using provincial data (Maps 1 and 2) is reflected in the maps based on parish data (Maps 5 and 6). The parish level data also changes between the two time points observable on the provincial level. Comparing Maps 1 and 2 with Maps 5 and 6, we see that northernmost Sweden had generally high levels of infant mortality, whereas the provinces of Jämtland and Värmland exhibited low levels both at the beginning and in the middle of the nineteenth century. The expansion of the high mortality region westward from the capital, Stockholm, is also apparent in the parish-based maps. The contracting of the u-shaped band of high mortality provinces is, however, not evident in the maps using parish level data. Instead of a u-shaped region we find a flat band of parishes with high infant mortality in the south stretching from coast to coast. By mid-century the parish-based regions of high infant mortality tended to be more concentrated on the east coast. Furthermore, the regional distribution in some parts of the country changed markedly. However, in other parts of the country, for instance in northernmost Sweden, along the coast of the provinces of Västernorrland and southern Västerbotten, in the plains region northwest of Stockholm, and in southeastern Sweden, we observe relative stability.

Mapping parish level data has shown that the provincial regional patterns include a great deal of variation. All of the regions, whether they had high, low, or moderate rates, include smaller areas (larger than a single parish) with divergent levels of infant mortality. The fact that areas with low infant mortality located in regions with high or moderate rates display similar low levels at both points in time indicates that we are not picking up traces of random fluctuation. This is also true for the other combinations (i.e., high mortality areas in moderate or low infant mortality regions and moderate areas in high and low level regions).

In the context of Swedish research on infant mortality a number of important points can be made. In general, the mix of high, moderate, and low is apparent

8 The statistical tables that form the basis for the database used here do not allow the compilation of infant mortality rates following all individual births for one year in a given period. The birth and death registers on which the statistical tables are based, however, do allow rates to be calculated in that manner. A comparison of the two methods showed that discrepancies were not large, except for parishes with very small numbers of births. Anders Brändström, Sören Edvinsson and John Rogers, "Infant Mortality in Sweden. Creating Regions from Nineteenth-Century Parish Data," *Historical Methods*, 33:2 (2000), 105–114.

9 Because some of the original tables are missing or damaged, calculations for a small number of parishes are based on periods of less than five years.

nearly everywhere, a fact missed by earlier research. For example, the province of Jämtland, which has continually produced the lowest rates in the country, is divided into areas of high, moderate, and low mortality. This makes it necessary to modify the earlier attempts at explaining the low rates, for example, by arguing that the province was isolated and thus less susceptible to infectious diseases. Another point of interest is the fact that in the plains area south of the capital in east-central Sweden and in the plains area in Skåne in southern Sweden (provinces of Kristianstad and Malmöhus) several smaller regions with low rates of infant mortality are observable. This is all the more remarkable since both areas were densely populated, on the main routes of communication, and contained no significant natural barriers such as large forests or lakes to separate different areas.

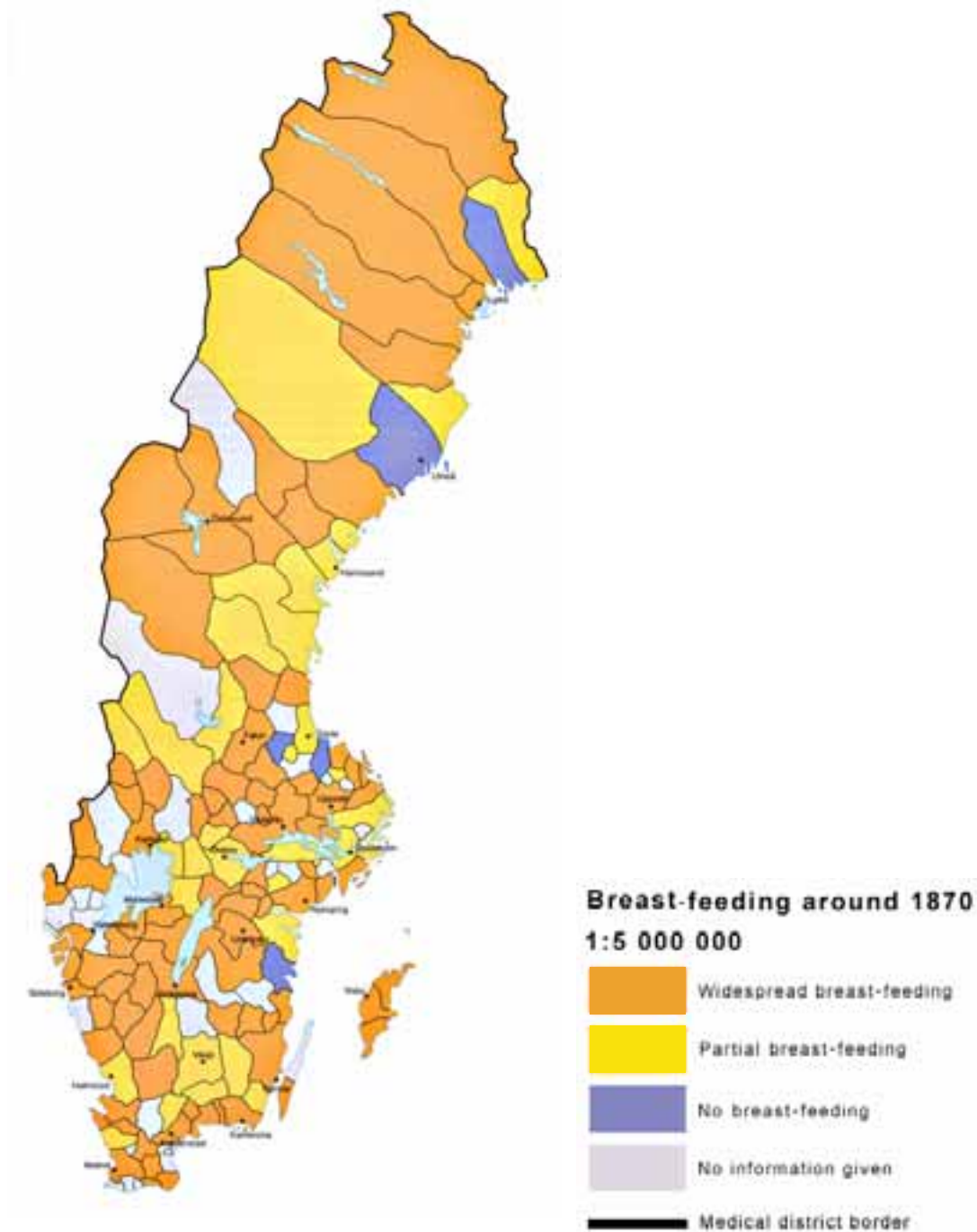
Infant Feeding Practices and Infant Mortality

Studies of infant mortality in both historical and modern populations have shown that one of the most important factors affecting levels of infant mortality is the manner in which babies were fed. It is clear from these various studies that artificially fed infants were more likely to die during their first year of life than infants that were breast-fed. Breast-feeding increases the chances of survival in several ways. Breast milk provides the necessary nutritional needs of infants, particularly during the first six months after birth. Children artificially fed, on the other hand, run a higher risk of being under-nourished and with malnutrition the risk for infections increases significantly. Breast-feeding also helps build up the immune system of a newborn baby. Through breast-feeding, antibodies against infectious diseases are transferred from mother to child. Artificially fed babies are more likely to come into contact with contaminated food, thus exposing them to infectious diseases. This is particularly a problem in areas where sanitary and hygienic conditions are of a low standard. Breast-feeding also functions as a contraceptive measure, prolonging the length of birth intervals. Shorter birth intervals, the result of children being artificially fed and dying as infants, also increase the chances that the next child will die young. Research has shown a clear association between shorter birth intervals and higher rates of infant mortality.¹⁰ Clearly, variations in breast-feeding patterns influence levels of infant mortality and, to some extent, explain observed regional differences in levels of infant mortality.

Historical evidence on breast-feeding patterns is scarce and often beset with problems of interpretation. In the second half of the nineteenth century the

10 Katherine A. Lynch and Joel B. Greenhouse, "Risk Factors for Infant Mortality in Nineteenth-Century Sweden," *Population Studies*, 48:1 (1994), 117–133.

Map 7. Breast-feeding in the districts of Swedish provincial physicians 1889–1874.



Source: Anders Brändström and Sören Edvinsson, "From the past to the present – dramatic improvements in public health," in *National Atlas of Sweden. Public Health and Health Care*, Special eds. Gudrun Lindberg and Måns Rosén (Uppsala, 2000).

National Board of Health (*Sundhetcollegium*) conducted a survey among state-employed medical officers on infant feeding practices. The study was carried out in order to evaluate the effectiveness of various governmental campaigns promoting breast-feeding. Doctors were urged to make general statements such as “In my district all children are breast-fed” or “Women in the district do not breast-feed.” No exact measure of the frequency of breast-feeding was provided in the survey. Map 7 shows the result of the survey. Although several source critical problems are associated with the survey, it does provide information on how the different districts were related to one another with regard to breast-feeding patterns.

If we compare variations in breast-feeding (Map 7) with regional variations in infant mortality (Map 6), we find no clear-cut association between the two. In the northernmost part of the country, the province of Norrbotten, breast-feeding was widespread and was associated with high levels infant mortality. The same is true for the province of Blekinge in the southeastern part of the country. On the other hand, the province of Jämtland in the middle of the country on the Norwegian border is an example of the expected association, i.e. low infant mortality associated with widespread breast-feeding. Another region where the expected association appears is along the coast in the northeastern part of the country in the province of Västerbotten. Here high infant mortality is associated with artificial feeding practices.

In 1914 the government attempted a new survey based on a questionnaire sent out to approximately 2,500 state-employed midwives. Because the questionnaire only required the midwives to answer in very general terms, similar to the survey of the doctors in 1869, the results are difficult to interpret. Both studies, however, indicate that there was a significant amount of variation in breast-feeding in Sweden during the nineteenth and early twentieth century.

Historical studies of infant mortality have shown that several factors influenced the relationship between breast-feeding and child survival. One of the more important aspects was related to the socio-economic position of the family. Local studies from mainly nineteenth century agrarian environments provide contradictory results. In some areas the better-situated had the expected lower infant mortality compared to those further down on the social scale. In other areas infant mortality was lower among the landless than among the land-owning peasantry (Appendix 2).

From these local studies a number of points about variations in breast-feeding can be made. Mothers in families that were better off generally had more time to nurse their children. Although the workload of women among the land-owning peasantry was often significant, such families generally had sufficient resources to allow mothers to care for small children. Servant girls could be employed or other family members could help out. In families with limited resources, the need for a woman to contribute to the family's income more often came into conflict with childcare. Relatives generally did not reside in such households. Artificial feeding

provided an alternative. Such practices, such as providing cow's milk in "feeding horns," often proved detrimental to the infant's health. However, several other factors may also have influenced feeding practices. In some areas it appears that the poorer families were so poor that the only available food source for infants was breast milk, which in turn resulted in better child survival. In this case the beneficial effects of breast-feeding were the result of poverty. In areas with cottage industries and in industries employing women, breast-feeding also tended to be limited.

In other areas cultural factors played an important role. Traditional feeding practices, such as the early introduction of solid foods, often meant that breast-feeding diminished or was stopped altogether. Often the nutritional value of food given to small infants was deficient. The practice of chewing food before giving it to an infant is associated with the transfer of various bacteria that produced deadly infections. In such areas even the better-situated families followed such traditional feeding practices. The key factors affecting breast-feeding appear to have been related to cultural considerations, in particular long-standing traditions, and to the need for a woman's labor on the household level and/or her participation in the labor force. There is, as such, no straightforward association between regional differences and variations in socio-economic structures. Regions dominated by, for example, well-to-do peasants could have high, moderate or low levels of infant mortality depending on how important cultural factors such as traditional feeding practices tended to be.

Illegitimacy and Infant Mortality

The level of illegitimacy must be considered in any attempt to explain regional differences in infant mortality. Historically, illegitimate infant mortality has always been higher than legitimate infant mortality. The illegitimacy ratio increased in most European countries during the nineteenth century. In Sweden, approximately 62 out of every 1,000 live births (62‰) were illegitimate, 1811–20. By 1851–60 their numbers had increased to 90 per thousand, and by the turn of the century, to 110 per thousand. Illegitimacy was mainly an urban phenomenon in Sweden with rates in towns often exceeding 200 per thousand. Even though the countryside displayed comparatively lower ratios, illegitimacy was still considered a large problem, both by medical men and, of course, church officials.

Several explanations for this increase in illegitimacy during the nineteenth century have been advanced. According to Edward Shorter, there is a relationship between economic change, mainly the introduction of capitalism, and an increase in illegitimacy. Women from the lower classes were drawn into a new monetary economy, which allowed them a greater degree of personal freedom, including sex-

ual freedom. They no longer had to depend on their parents or a husband for support.¹¹ Shorter has received a great deal of criticism, mainly because he has presented little empirical evidence supporting his assumptions. Tilly, Scott and Cohen find that women's salaries were so low that they could hardly have contributed to their economic independence. Instead, they suggest that the increase in illegitimacy was the result of traditional values colliding with new norms in a rapidly transforming society.¹²

Peter Laslett has put forward a completely different explanation, arguing that the observed increase in illegitimacy was mainly due to the emergence of a subculture within the lower classes of society. Among these classes "official" social norms were generally viewed with suspicion. With little to gain from society came also the notion that there was nothing to gain from following the *rules and norms* of that society. Restrained sexuality was one of these norms. Naturally, belonging to the lower social classes did not necessarily lead to a promiscuous life, but many found an identity in a "deviant" way of life. Therefore, an increase in illegitimate births was not an effect of an increase in the *number* of women that gave birth to these children, but instead the result of women from specific segments of society giving birth to *more* illegitimate children.¹³

The Swedish ethnologist Jonas Frykman reached a conclusion similar to Shorter concerning the rise of illegitimacy in Sweden. Frykman interpreted the increase as the result of new ideas associated with the development of capitalism clashing with old social norms. Traditional values upheld by the church played a less significant role in the changing economy of the late nineteenth century. Instead, emotions came to play an increasing role in the selection of marriage partners. Both women and men experienced a new kind of freedom when they were no longer dependent upon inheriting a farm for their existence.¹⁴ In a rapidly changing society, old traditions such as bundling, collided with increased geographical mobility. According to Orvar Löfgren, bundling was an almost institutionalized form of social interaction between young, unmarried men and women. They met in situations that were potentially very sexual, but social norms and Christian values kept restraints on the couple. If a young woman happened to become pregnant, she could still count on marriage.¹⁵ However, when social control was weakened and geographical mobility

11 Edward Shorter, "Female emancipation, birth control and fertility," *American Historical Review*, 78:3 (1973), 612.

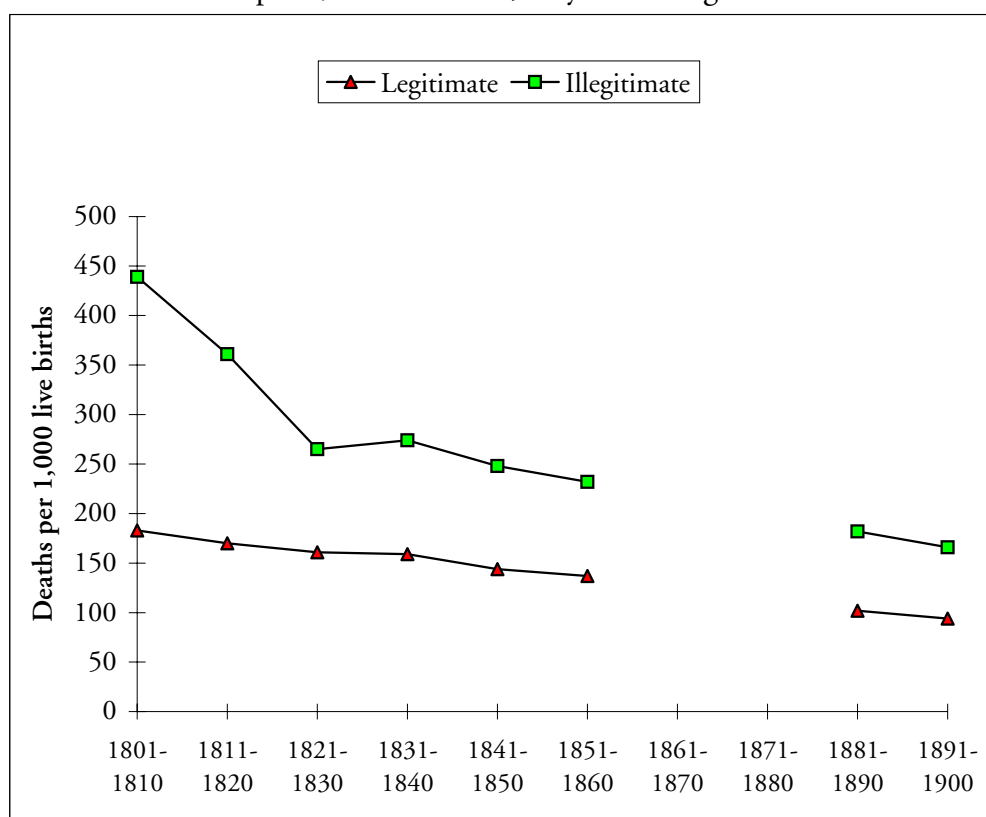
12 Louise Tilly, Joan Scott and Miriam Cohen, "Women's Work and European Fertility Patterns," *Journal of Interdisciplinary History* (1976), 461.

13 Peter Laslett, *Bastardy and its Comparative History* (London, 1980), 217.

14 Jonas Frykman, "Sexual intercourse and social norms," *Etnologia Scandinavica* (1975).

15 Orvar Löfgren, "Från nattfrieri till tonårskultur," *Fataburen* (1969). See also Michael

Figure 3. Infant mortality among legitimate and illegitimate children in Sweden 1801–1900. Deaths per 1,000 live births, 10 years averages.



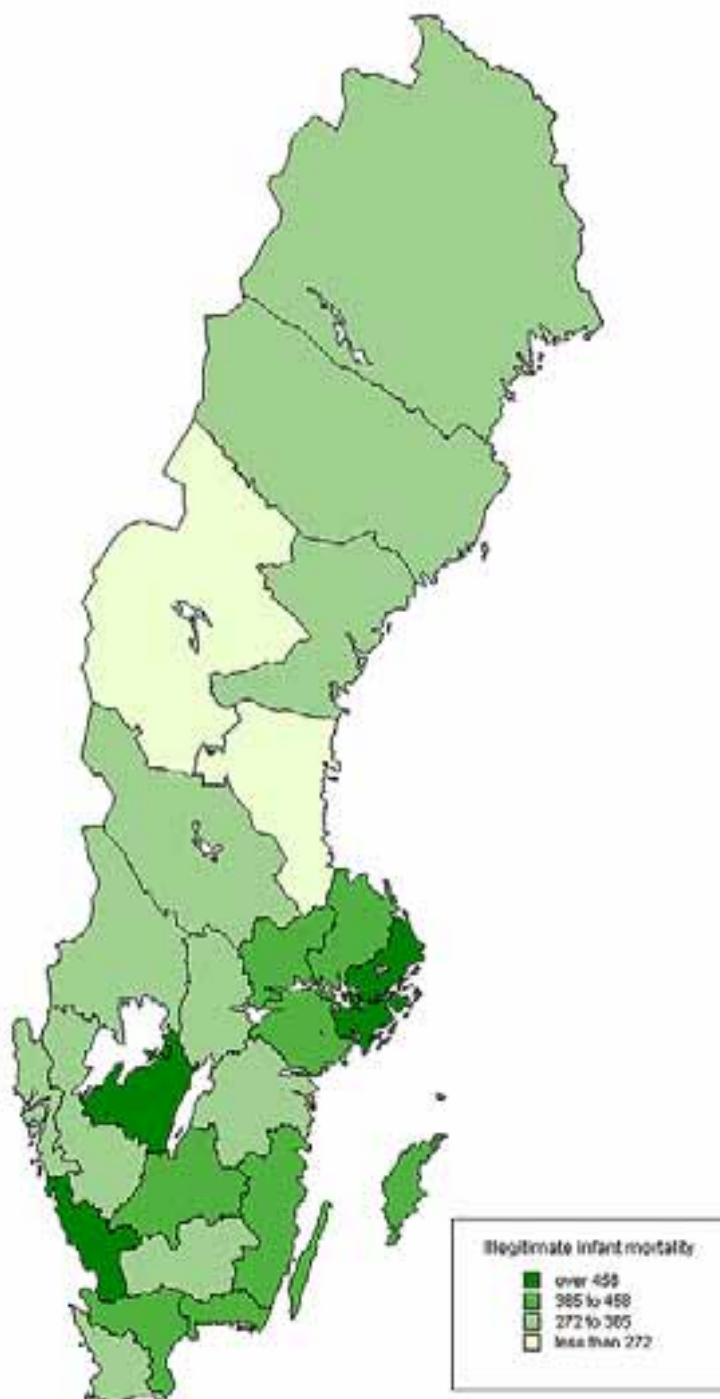
Source: Historical statistics for Sweden. Part 1. Population (Stockholm 1969), Tab. 41. The missing data indicates that no national data exists.

increased, traditional bundling resulted in a rapid increase in illegitimate births.¹⁶ In the eyes of the Swedish Lutheran Church the mother of an illegitimate child was not “pure” and could not take part in normal religious activities. She had to be purified according to the church law of 1686. Initially, the purification process was public. The unwed mother had to face the parishioners in the church, admit her sins and receive forgiveness. This was converted into a private rite in 1741, the unwed mother being compelled to face the minister alone and admit her sins. Mercantilist Sweden was alarmed by the high death rates among illegitimate infants, who were potential contributors to the wealth of the nation. It was hoped that a change in the church law would lessen the social stigma of an illegitimate birth and decrease risks to the child, thereby increasing the population. Purification was

Mitterauer, *Ledige Mütter. Zur Geschichte unehelicher Geburten in Europa* (München, 1983) who discusses the role of bundling as part of a wider northern European culture.

16 Jonas Frykman, *Horan i bondesambället* (Lund, 1977).

Map 8. Illegitimate infant mortality in Swedish provinces, 1811–1813, per 1,000 live births.



Source: Tabellverket. Provincial statistics. National Archives.

officially abolished in 1855, but the practice continued on the local level for several decades.

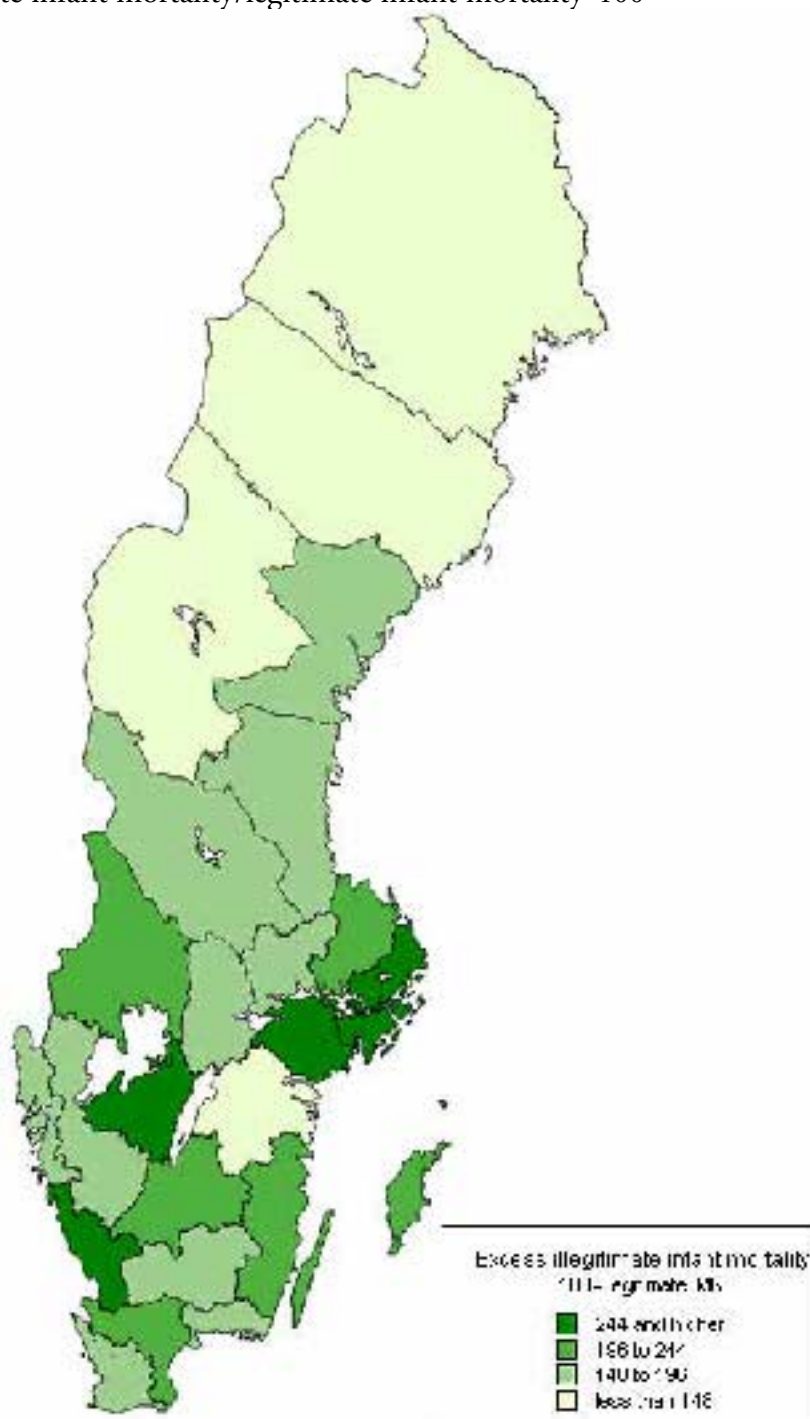
Illegitimacy was also a crime according to a 1734 statute. Punishment was usually a fine to be paid by the man – if his guilt could be proven in court. The law was changed in 1864 so that cases of illegitimacy could only be brought to court if the *woman* pressed charges against the presumed father.¹ From 1865 onwards, illegitimacy was no longer considered a crime by the state church and the Swedish government. However, social norms condemning sex outside marriage continued to exist despite the legal changes. Differences in infant mortality between legitimate and illegitimate children were still considerable as can be seen in Figure 3, which would indicate that, while the situation for single mothers improved in some areas, it remained much the same in others.

On a regional level illegitimate infant mortality differed considerably, with the highest rates in the provinces around Stockholm and in the south (Map 8). A reasonable hypothesis is that a low rate of illegitimacy would result in relatively high levels of illegitimate infant mortality. In areas where illegitimate births were common, they would be regarded with less suspicion and lead to less stigmatization, which in turn would have resulted in lower levels of illegitimate mortality. For instance, the northern province of Västerbotten was strongly influenced by a pietistic religious movement and relatively few children were born out of wedlock. Illegitimate infant mortality should have been high there. In Stockholm, on the other hand, the illegitimacy ratio was an astonishing 358.4 per thousand births at the beginning of the nineteenth century. Stockholm should therefore have provided the most tolerant environment for children born out of wedlock. However, if we compare maps where we have calculated excess illegitimate infant mortality (i.e. illegitimate infant mortality divided by legitimate infant mortality x 100), we find no support for the hypothesis (Maps 9a–b). No correlation was found when the data was analyzed statistically.

In comparison to the first period, the relative level of illegitimate infant mortality increased in northern Sweden and also on the west coast, particularly in the province of Göteborg and Bohus. The area around Stockholm continued to be characterized by high illegitimate infant mortality (Map 10). If we consider excess illegitimate infant mortality for rural Sweden in 1901–1910 (Maps 11a–b) we find a pattern quite similar to the one in 1811–1813. Low levels are again found in the north and high levels around Stockholm and sections of the west coast, indicating that illegitimacy may to a large degree have been culturally rooted. Again, we find no correlation between excess illegitimate infant mortality and the proportion of

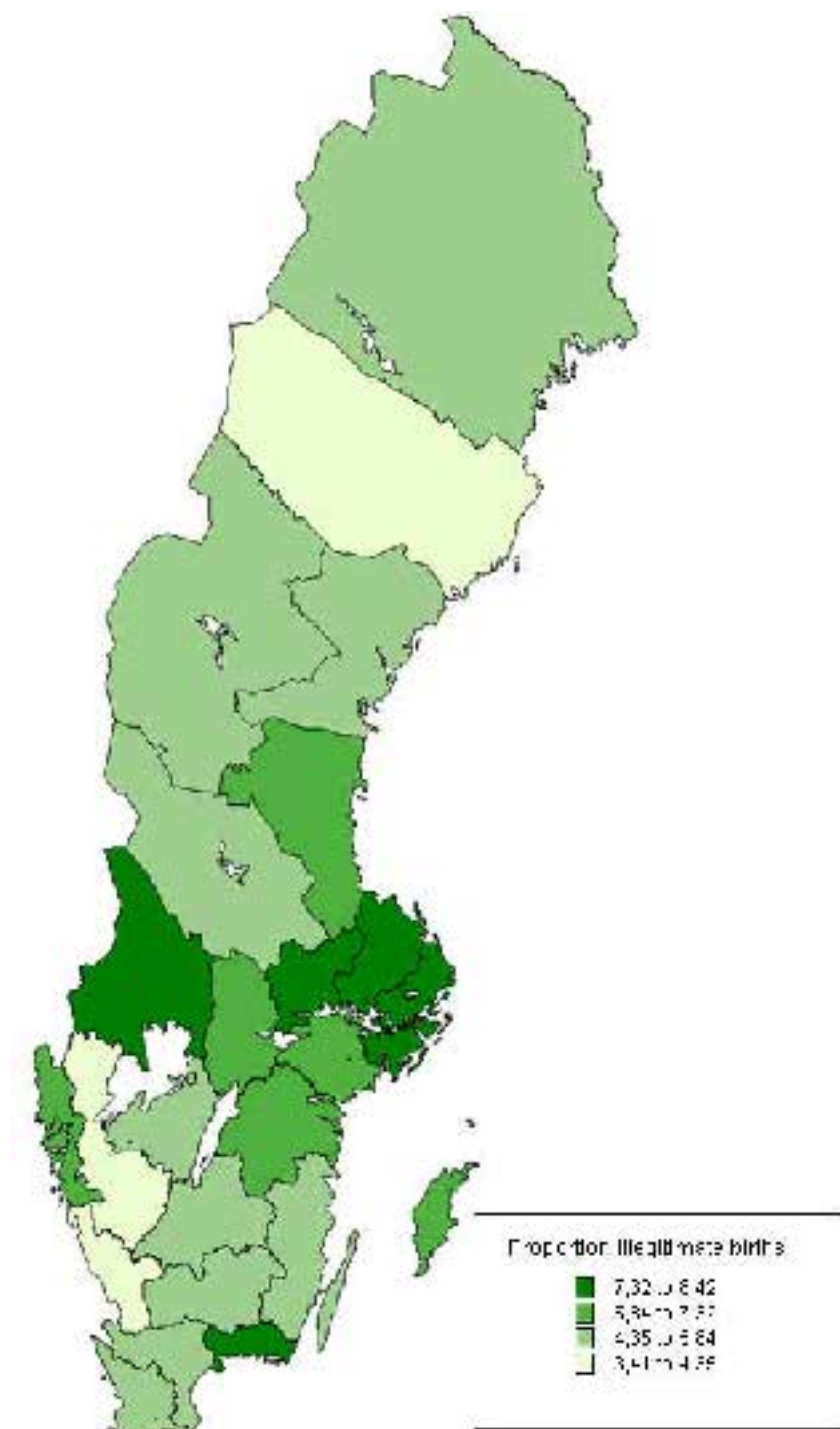
1 Katarina Andersson, “Ogifta mödrar i Östersund under 1800-talet,” (Unpublished paper, Department of History, Umeå University, 1993).

Map 9a. Excess illegitimate infant mortality, Swedish provinces 1811–1813.
 Illegitimate infant mortality/legitimate infant mortality*100



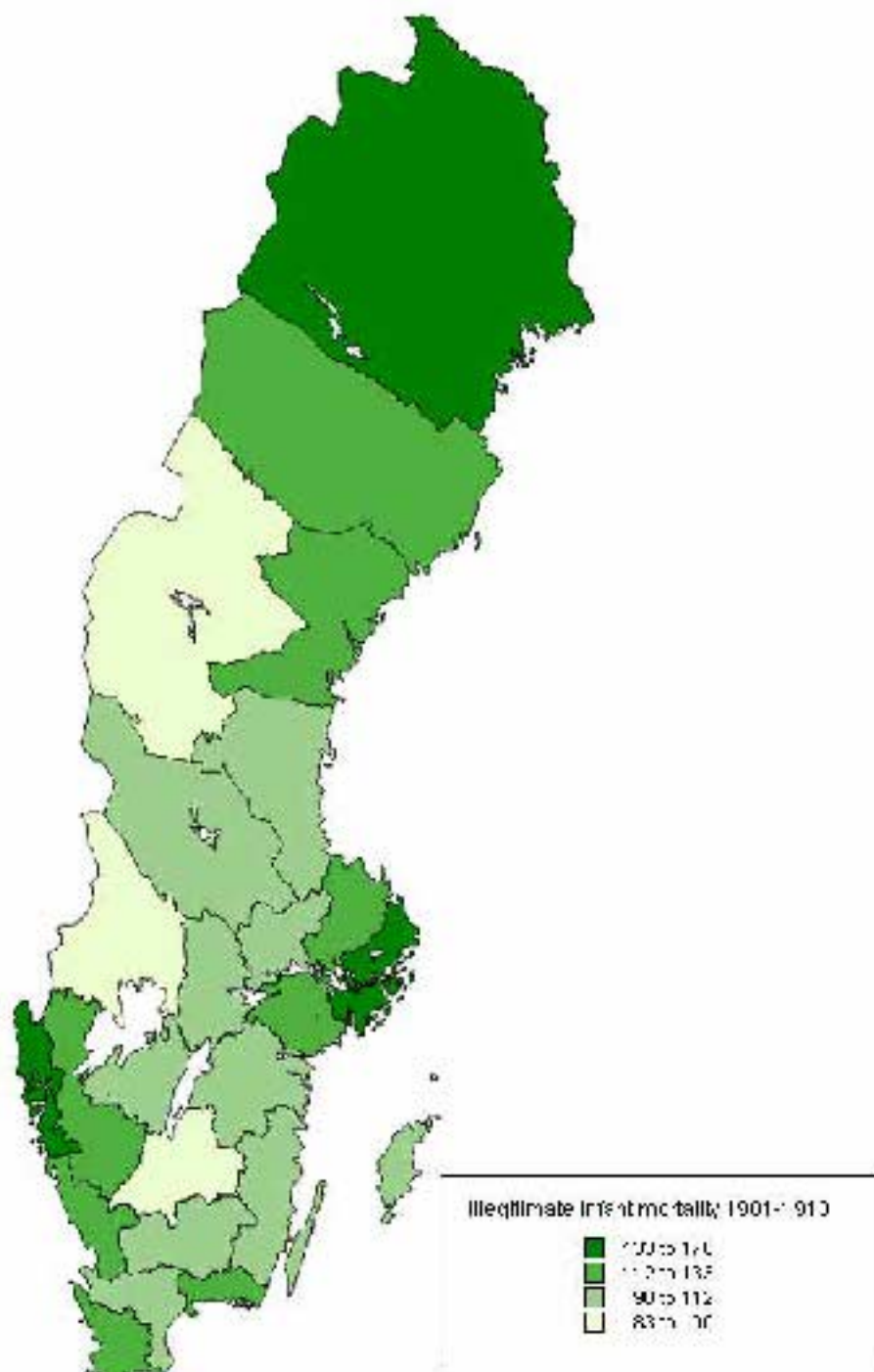
Source: Tabellverket. Provincial statistics. National Archives.

Map 9b. Illegitimacy in Swedish provinces, 1811–1813. Illegitimate births/all births*100.



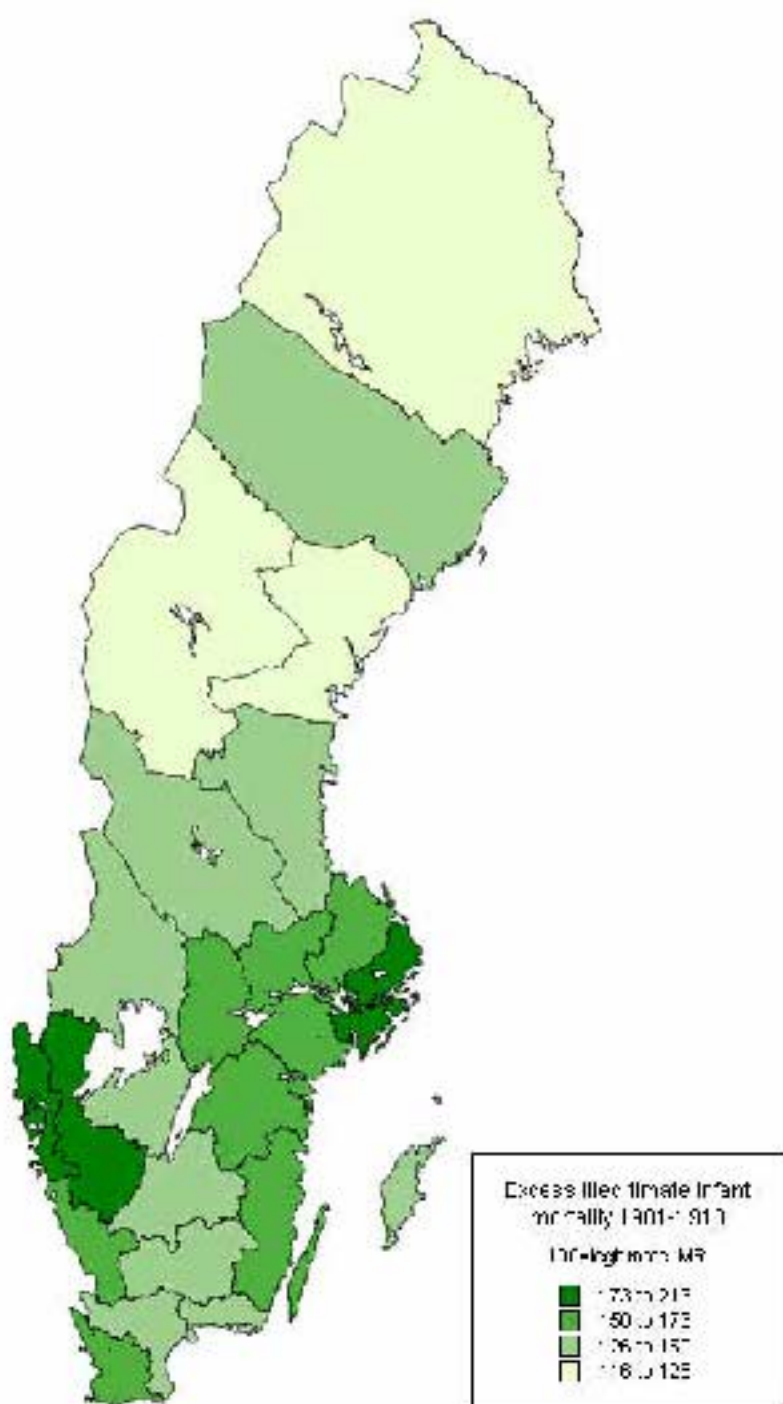
Source: Tabellverket. Provincial statistics. National Archives.

Map 10. Illegitimate infant mortality in the rural parts of the Swedish provinces, 1901–1910, per 1.000 live births.



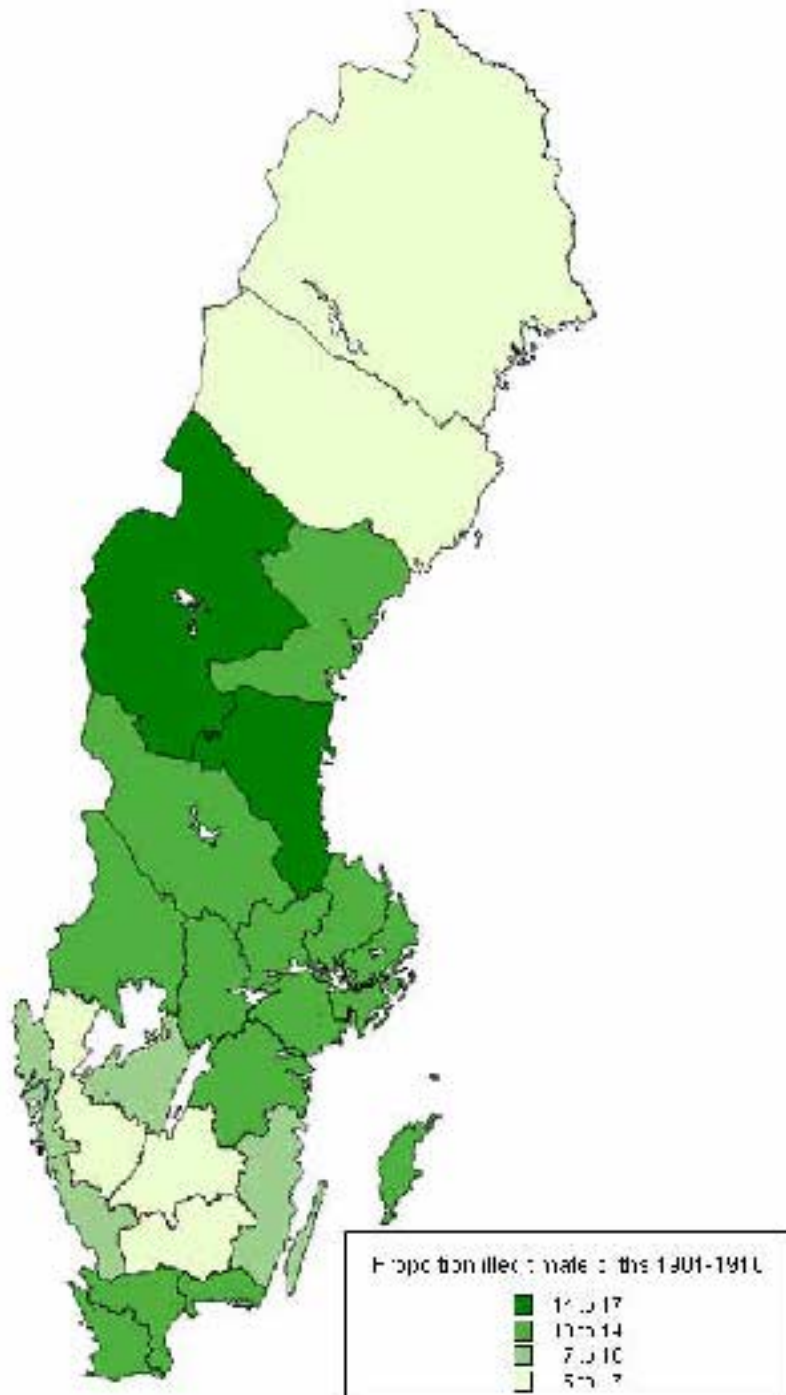
Source: *Statistiska Meddelanden* Ser A, Band I:4. Utom äktenskapet födda barn (Stockholm, 1914).

Map 11a. Excess illegitimate infant mortality, Swedish provinces, 1901–1910. Illegitimate infant mortality/legitimate infant mortality*100.



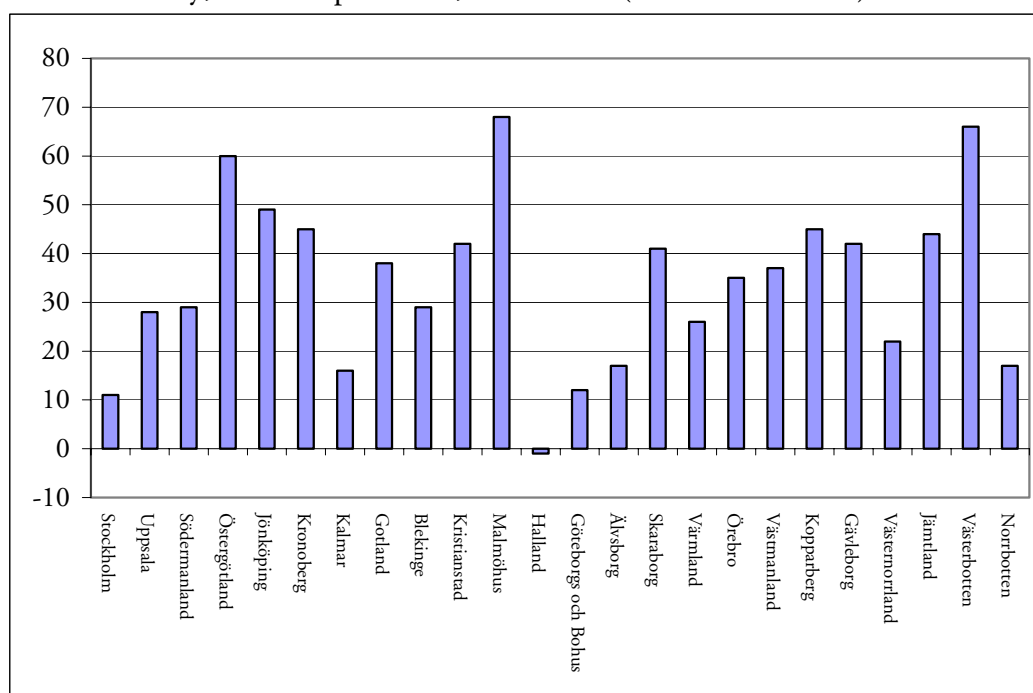
Source: *Statistiska Meddelanden* Ser A, Band I:4. Utom äktenskapet födda barn (Stockholm, 1914).

Map 11b. Illegitimacy in Swedish provinces, 1901–1910. Illegitimate births/all births*100.



Source: *Statistiska Meddelanden* Ser A, Band I:4. Utom äktenskapet födda barn (Stockholm, 1914).

Figure 4. The relationship between rural and urban areas in excess illegitimate infant mortality, Swedish provinces, 1901–1910 (0 = No difference).



Source: Statistiska Meddelanden Ser A, Band I:4. Utom äktenskapet födda barn (Stockholm, 1914).

illegitimate births in the provinces. For instance, the province of Norrbotten in the north, which had very high illegitimate infant mortality, had a low level of excess illegitimate mortality as well as a low proportion of illegitimate births. In contrast, provinces around Stockholm and on the southeast coast had relatively high levels of illegitimate infant mortality, high levels of excess infant mortality and a high proportion of children born out of wedlock.

As mentioned above, illegitimacy was mainly an urban phenomenon, especially toward the end of the nineteenth century. Excess illegitimate infant mortality was also an urban phenomenon. Figure 4 displays the difference between excess mortality in urban versus rural parts of the Swedish provinces in 1901–1910. Here we find that urban centers, with the exception of the province of Halland, had an average of approximately 35 more illegitimate deaths per 1000 live births compared to rural areas. To conclude, the regional analyses on the provincial level have shown that illegitimacy was a relatively stable phenomenon over time. No direct correlation existed between the proportion of illegitimate births and an excess mortality among children born out of wedlock except in urban areas. However, as in the case of the regional analysis of infant mortality, provincial-level data appear to be too crude to allow any conclusions to be drawn on how illegitimacy and infant mortality interacted. In order to obtain a clearer picture of the mechanisms

which determine a high infant mortality for illegitimate children, an analysis of 2,569 women who gave birth to illegitimate children in the Sundsvall region has been carried out. The complete reproductive life histories of these women have been reconstructed using the registers of 16 parishes surrounding the town of Sundsvall in the province of Västernorrland.¹⁸ A control group of 4,529 married women who never experienced an illegitimate birth was also extracted from the same registers. The two groups are matched on age at first birth, social class at first birth, parish at birth of first child and their presence in the parish during the same period. The unwed mothers gave birth to 5,749 children and mothers in the control group to 18,395 children. In all, the analysis includes a total of 24,144 births between 1808 and 1900. The analysis of the town of Sundsvall is restricted to the second half of the nineteenth century.¹⁹

Women who at some point in time gave birth to illegitimate children were followed from the birth of their first child to their last child or to age 50, or to the period if their histories were somehow truncated. Usually, the illegitimate births were the initial ones in the reproductive history. The study focuses primarily on comparing risks of dying for children born out of wedlock with the legitimate children born later in the same family. The fate of these children, in turn are compared with those from families in which no illegitimate births occurred. The analysis relies on techniques based on collective event histories, such as logistic regression. Each child that died as an infant was followed (together with its mother) until the date of death and compared with those who survived infancy. Each new child in the family, illegitimate or legitimate, formed a new record in the analysis. One problem with the method, however, is that it to some extent disregards the fact that several children are related, and we know that infant mortality is highly family dependent.²⁰ But, statistically, it is difficult to include such dependence in this type of analysis. To partially compensate for this, a number of “family” variables relating to the

18 Four of the parishes existed as separate parishes for only shorter periods: Lögdö, Galtström, Lagfors and Svartvik. The four parishes early had foundries, but contained large sawmills during the second half of the nineteenth century. When included in the analyses, however, they are generally treated as part of one of the larger parishes that surrounded them.

19 All the registers in the town before 1860, with the exception of the catechetical examination register, were destroyed in a large fire in 1888. Since the catechetical registers at times fail to include newly born children, they cannot be used for studies of infant and childhood mortality.

20 Anders Brändström, “*De kärlekslösa mödrarna*” *Spädbarnsdödligheten i Sverige under 1800-talet med särskild hänsyn till Nedertorneå* (Umeå, 1984); Katherine A. Lynch and Joel B. Greenhouse, “Risk Factors for Infant Mortality in Nineteenth-Century Sweden,” *Population Studies*, 48:1 (1994), 117–133.

Figure 5a–c. Survival functions for legitimate and illegitimate children in the town of Sundsvall, industrialised parishes and agrarian parishes in the Sundsvall region. First 365 days after birth.

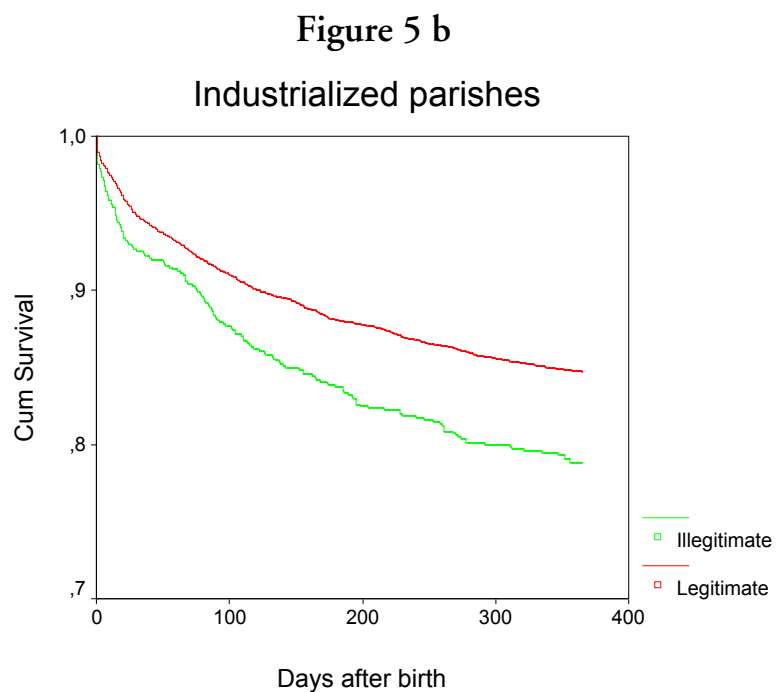
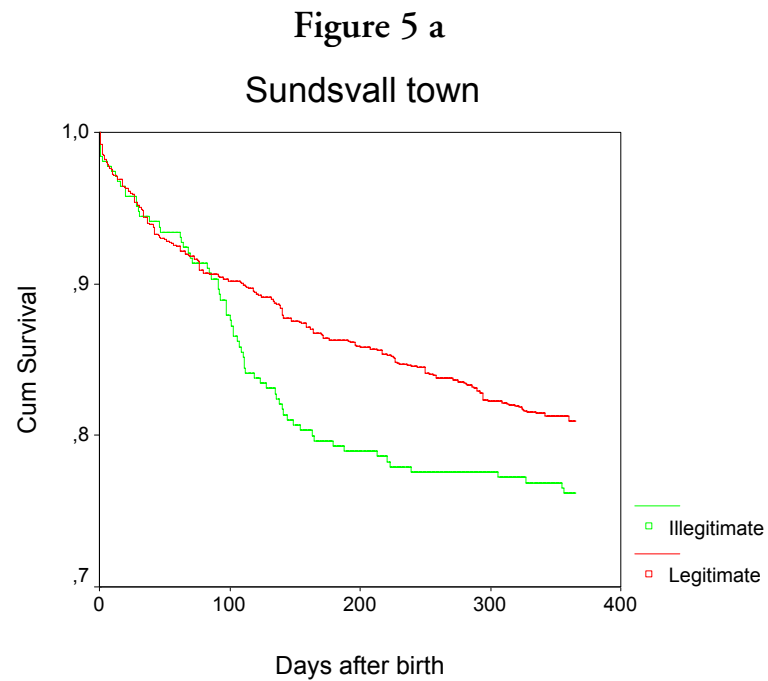
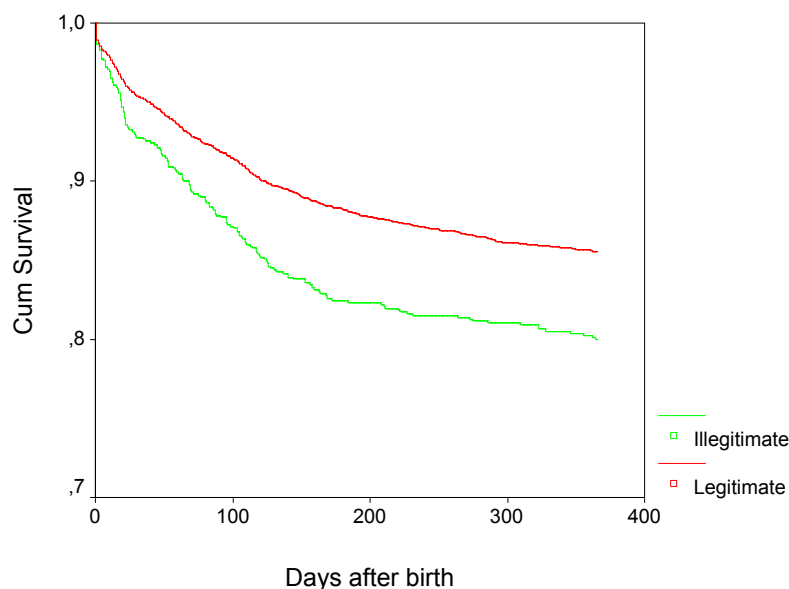


Figure 5 c

Agrarian parishes



Source: The Demographic Data Base, Umeå University.

complete life history of the mother were attached to every child, such as parity and the total number of legitimate and illegitimate births in the family.

Illegitimate infant mortality was very high in the town of Sundsvall: 200 per thousand during the period 1860–1879 and 216 during the 1880–1892 period. For children born out of wedlock, when compared to legitimately born children, the increased risk of dying was in the range of 70–80 percent.²¹ Figure 5a–c show the survival function for legitimate and illegitimate children born in three Sundsvall settings: the town of Sundsvall, agricultural parishes and industrial parishes.²² In all three cases illegitimate children had a lower rate of survival. Both legitimate and illegitimate children in the town of Sundsvall had lower survival rates compared to children in the other two areas. Approximately 25 percent of the illegitimate children died within a year after birth, while the rate was 20 percent in the other areas. The corresponding figures for legitimate children were 18 percent in the town and 14–15 percent in the industrialized and agricultural parishes. Interestingly, the chances of survival in the less healthy urban environment affected legitimate and

21 Sören Edvinsson, *Den osunda staden. Sociala skillnader i dödlighet i 1800-talets Sundsvall* (Umeå, 1992), 172.

22 Except for the small iron foundries that were established in some parishes, no real industrialization took place in the region before 1850.

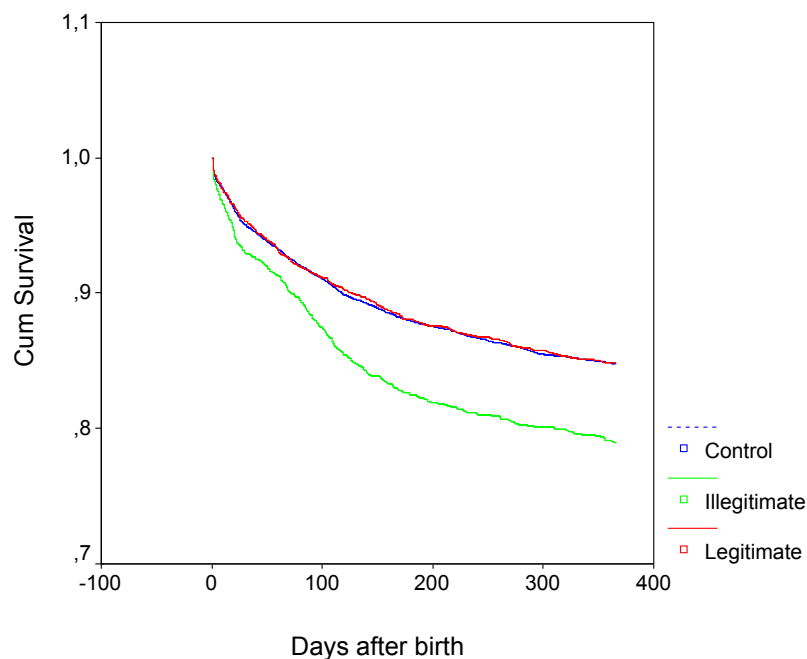
illegitimate children equally during the first three months after birth. Only after that age were the illegitimate children in a less favorable position.

A majority of the women in Sundsvall managed to marry despite the fact that they had experienced one or more illegitimate births. In most cases they also managed to marry within their social class – mainly because most of them already belonged to the lowest social strata in society. The chances of survival increased considerably for children born after their mother married.²³ However, the fact that children born in a complete family had a better chance of surviving infancy compared to their siblings who were born out of wedlock does not necessarily mean that conditions were normalized. The question is whether children born in previously incomplete families survived *equally* as well as other children in Sundsvall? If this was not the case, that is, if mortality remained at a higher level, it would indicate that even if these women managed to marry, they still lived under conditions which negatively affected the survival of their children. Marriage probably improved many things, but it may not have completely eliminated the negative consequences of their previous reproductive history, that is, they may have found themselves in economic and social circumstances similar to those when they were single mothers.

In Figure 6 the chances of survival are plotted for illegitimate children and their legitimate siblings born in the Sundsvall region (town excluded) after their mothers married. Also included are the survival chances for children from a control group of women with no illegitimate births in their fertility history. These are matched for age, class, parish of origin and time period. The poor survival rates for the illegitimate children are quite obvious in comparison with the fate of their siblings born after their mothers married. Marriage meant that the chances of survival improved to a level equal to that of children from the control group. The two curves are as closely matched as they can possibly be. Illegitimacy in Sundsvall tended to be a life cycle phenomenon, something that happened relatively early in the reproductive career with clear negative consequences. However, the majority of unwed mothers eventually married with the result that their social and economic circumstances improved to a level that would equal other women of their age and class. Similar patterns are found in the agricultural and industrialized parishes. The town of Sundsvall is a special case (Figure 7). In the urban environment children born to women with previous illegitimate births continued to suffer. From approximately the second month after birth their cumulative survival chances decreased. The difference, although not substantial (only 5%), indicates that the social isolation of such women, often termed marginalized, cannot be completely ruled out as a factor in the urban environment. However, the combined results speak in favor of an

23 Anders Brändström, "Life histories of single parents and illegitimate infants in nineteenth century Sweden," *The History of the Family*, 1: 2 (1996), 205–226.

Figure 6. Survival functions for the illegitimate and legitimate children of women with illegitimate children and for children in a control group where women have not given birth to an illegitimate child in industrialized and agrarian parishes in the Sundsvall region. Groups matched for age, class, parish of origin and time period. First 365 days after birth.



Source: The Demographic Data Base, Umeå University.

interpretation where poverty negatively influenced the chances of survival for children born out of wedlock more than the fact that such women were socially ostracized.

Several factors affect an infant's chances of survival after birth. Such factors may be *social* or *cultural* in nature, for example, social status, childcare practices, breast-feeding, personal hygiene, hygiene within the family, or religion. They may be *economic* and related to family income, female labor, standard of living, nutritional status, or they can be *environmental* and include such factors as population density and/or sanitation (piped water and sewage systems). *Medical* factors include the organization of health care, quality of health care, and medical technology. *Biological* components such as mother's age, parity of the child, birth intervals, disease panorama, virulence and exposure must also be considered. Together they form a very complex web of explanatory factors that both interact and counteract in different historical contexts. Most attempts to model these factors stress the importance of the care and protection an infant receives from its mother and the

help rendered by family, relatives and friends.²⁴ This, in turn, is closely related to the opportunities for such care: that is, does the child live in a family or alone with its mother? Do relatives and friends who can help live nearby? The degree and quality of this care is determined by the above factors. The importance of a complete family for the chances of survival for a child has been underlined in several studies. The lack of one parent had immediate negative effects on the child's chances of survival. If it was the mother, the child faced an almost certain death unless the father soon remarried or other relatives stepped in to help. The loss of the father was less critical, but still affected the child's chances of survival.²⁵ Children born out of wedlock normally did not live in complete families and we have noted the negative effects on their chances of survival in the Sundsvall region.

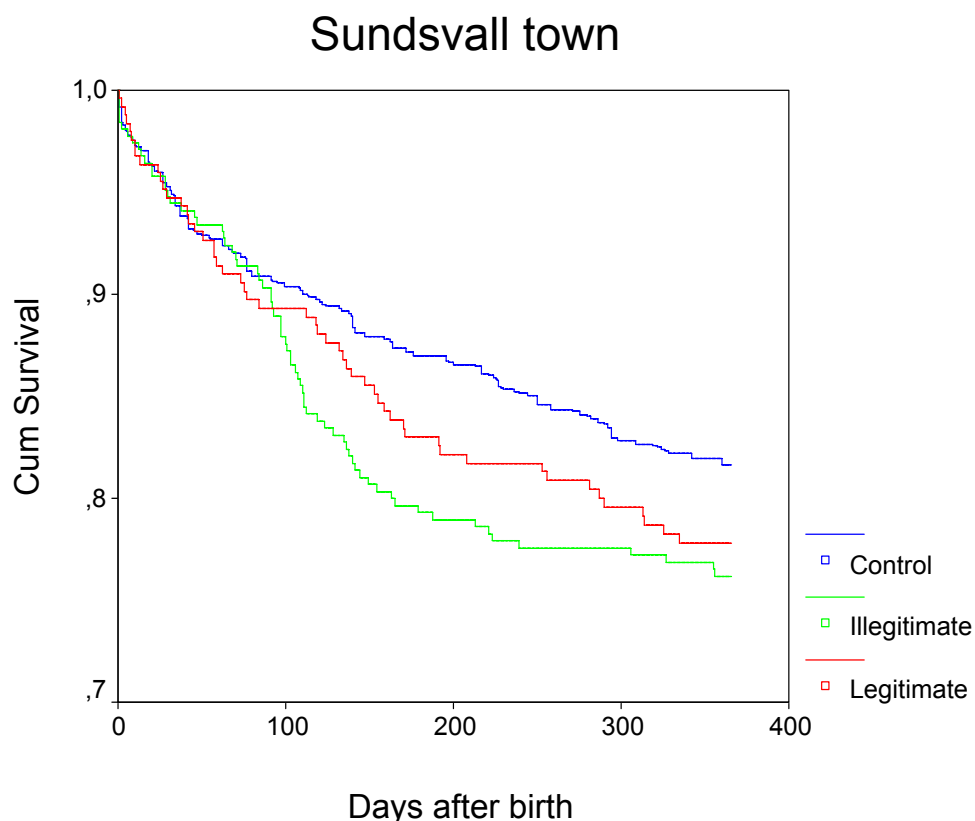
However, even illegitimate children may have had access to a social network which could lend a helping hand to single mothers by providing economic assistance or caring for the child if the mother was required to work. It could be a network of kin or a network of friends or a combination of both. A "sub-culture" within the population with a high degree of tolerance may also have served as a substitute and provided support. The availability of such resources should have had a positive impact on the survival of the child. However, if the available social network did not tolerate such behavior, protecting instead traditional family values, then it may have served rather as a repressive mechanism which would have marginalized these women, worsening their situation. If the hypothesis about marginalization is correct, women with illegitimate children should have moved away from their home parish (here defined as their own parish of birth). If poverty were an important cause, we would expect to find a migratory stream in the other direction.

In the following we shall consider what impact the availability of a kinship network, primarily parents, had for a single mother. Unfortunately, such networks can seldom be measured directly. One means of approaching the problem is to consider survival rates for children born in the *home parish* of their mother. A check has confirmed that the woman's parents almost always were living in the woman's home parish. Since the mean age at first birth is 23.9, we may also assume that the parents were still at an age where they *could* support their daughter in some way.

24 See, for example, Naomi Williams and Chris Galley, "Urban-Rural Differentials in Infant Mortality in Victorian England," *Population Studies*, 49 (1995), 401–420; Magdalena Bengtsson, *Det hotade barnet. Tre generationers spädbarns- och barnadödlighet i 1800-talets Linköping* (Linköping, 1996), 60.

25 Increased death rates for children in incomplete families were reported in *Orphans and foster-children. A history and crosscultural perspectives*, ed. Lars-Göran Tedebrand (Umeå, 1996).

Figure 7. Survival functions for the illegitimate and legitimate children of women with illegitimate children and for children in a control group where women have not given birth to an illegitimate child in the town of Sundsvall. Groups matched for age, class, parish of origin and time period. First 365 days after birth.



Source: The Demographic Data Base, Umeå University.

Other forms of kin support might also have existed – brothers, sisters, aunts, uncles – but it has not been possible to confirm the presence of such relatives in the available material. As such, we can only measure the *theoretical* availability of such a network. The fact that parents or other relatives lived in relatively close proximity does not automatically mean that they also gave support.

The results of the analysis are striking and, as can be seen in Figure 8, giving birth in the home parish of the mother had clear *negative* effects on the child's chances of survival! The difference is not large, only two to three percent, but the pattern is consistent in all three settings in the Sundsvall region – the town, the industrialized parishes and the agrarian parishes. The results do not support the hypothesis that a kin network provides support for unwed mothers. Instead, they suggest that it was more advantageous for an expectant mother to migrate to another parish. It speaks in favor of social stigmatization as a factor in explaining

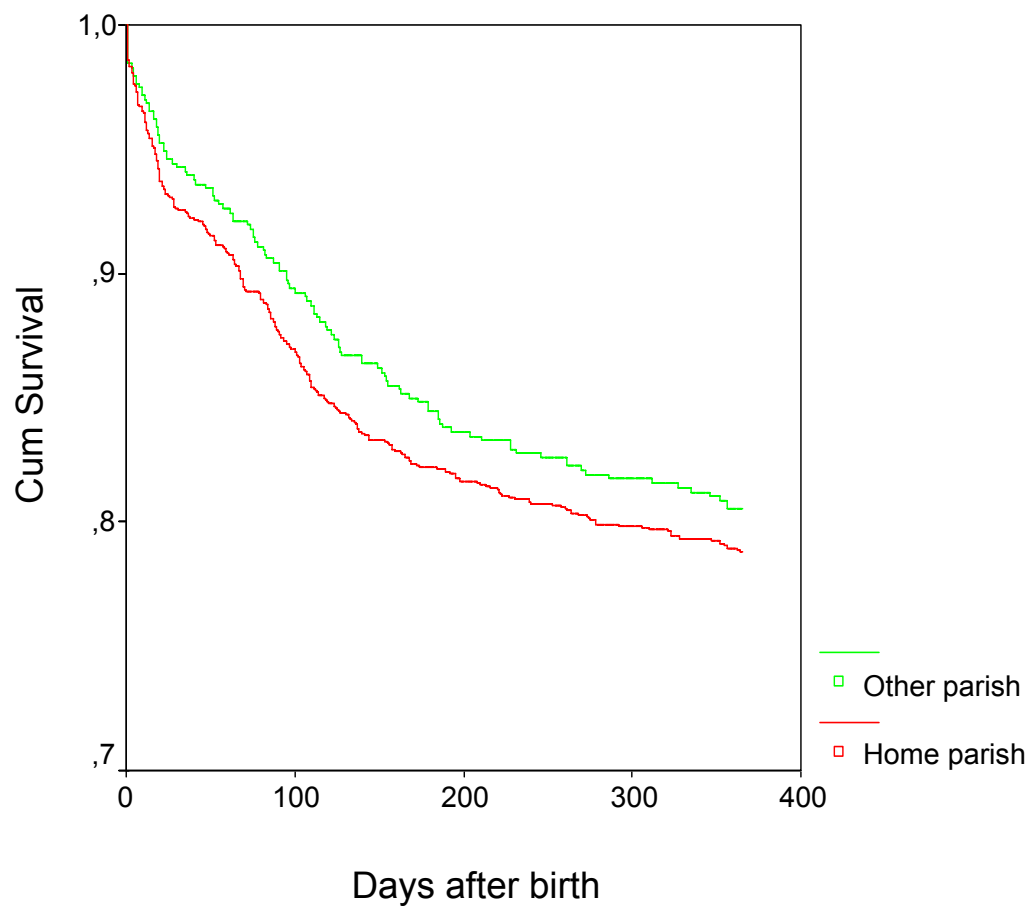
the survival of illegitimate children. Relative anonymity seems to have favored an unwed mother in her attempts to give her child proper care. However, we might consider another explanation. The analysis could be picking up the biological effects of mother's age and parity. Early motherhood is more common in the home parish: 70.9 percent of all first illegitimate births in the Sundsvall region took place in the parish where the mother was also born. As her life progressed, the likelihood of migration increased, and the figure was reduced by five percent for each additional illegitimate birth that she experienced.

Using logistic regression analysis allows us to control for such variables as parity and age and to better determine if a "kin network" is significant for an illegitimate infant's chances of survival. A variable called "place" has been created which indicates whether or not the birth took place in the home parish. This variable is entered into the equation together with a set of "biological" explanatory variables or covariates such as mother's age, parity of the child, birth intervals and sex of the child. Two "social" variables are also included in the full model, type of birthplace (i.e., whether the child was born in the town, in an industrialized parish or in an agricultural parish) and the social class of the mother. The dependent variable in the equation is a dummy variable indicating whether the child died as an infant or not. The full model produced the following results (Table 1).

If we first consider the effects of a parish's economic structure, we find that to be born in the town of Sundsvall increased the risk of dying by eight percent ($\text{Exp (B)}=1.0853$). The figure is slightly lower for industrialized parishes when all the other factors are kept constant. To be born in the same parish as the mother increased the risk of dying by 24 percent, confirming the results found in Figure 8. Increasing birth intervals decreased the risk of dying by 31 percent for each step. Mortality was slightly reduced as the mother grew older, but by less than one percent for each age group. The chances of survival were slightly better (3%) if the mother came from the working class rather than the middle class in Sundsvall. An increase in illegitimate parity also increased the risk of dying as an infant. Finally, to be born as a male was a slight disadvantage – approximately 12 percent. However, it turned out that only *birth interval* and *parity* were significant at the five percent level (boldface type) when the other factors were controlled for. Although giving birth in the home parish increased the risk of dying as an infant by as much as 24 percent, the figure is not statistically significant.

Our conclusion must be that "kin networks," as they are defined here, did not significantly contribute to the chances of surviving infancy for illegitimate children when other factors are controlled for. The same is true for such variables as the parish economy, sex and social class. Several of these factors might be important in explaining differences *between* illegitimate and legitimate children, but they con-

Figure 8. Survival function for illegitimate children in the Sundsvall region. Children born in the home parish of the mother and children born in other parishes. First 365 days after birth.



Source: The Demographic Data Base, Umeå University.

Table 1. Logistic regression analysis of the complete reproductive histories of women who gave birth to an illegitimate child in the Sundsvall region. Dependent variable=infant death. Reference group in parenthesis.

Variables in the Equation						
<i>Variable</i>	B	S.E.	Wald.	Df	Sig	Exp (B)
Economy (<i>agricultural</i>)			.3901	2	.8228	
<i>Town</i>	.0818	.1965	.17338	1	.6772	1.0853
<i>Industrial</i>	.0762	.1299	.3438	1	.5576	1.0792
Place (<i>home</i>)	.2181	.1366	2.5501	1	.1103	1.2437
Birth interval (<2 years)	-.3646	.1114	10.715	1	.0011	.6945
Social class (<i>middle</i>)	0.358	.1206	.0880	1	.7667	1.0364
Mothers age	-.0084	.0634	.0175	1	.8949	.9917
Parity (6+)			12.840	5	.0249	
1	-.9800	.3984	6.0495	1	.0139	.3753
2	-.1283	.3666	.1224	1	.7264	.8796
3	-.3881	.4027	.9288	1	.3352	.6784
4	-.6983	.4817	2.1021	1	.1471	.4974
5	-.1325	.5104	.0674	1	.7951	.8759
Sex (<i>boy</i>)	-.1279	.1182	1.1702	1	.2794	.8800
Constant	-5696	.4750	1.4385	1	.2304	

Source: The Demographic Data Base, Umeå University.

Note: B is the estimated coefficient, with standard error S.E. The ratio of B to S.E., squared, equals the Wald statistic. Exp(B) is the predicted change in odds for a unit increase in the predictor. When Exp(B) is less than 1, increasing values of the variable correspond to decreasing odds of the event's occurrence. When Exp(B) is greater than 1, increasing values of the variable correspond to increasing odds of the event's occurrence.

tribute little towards explaining differences in the chances of survival *among* illegitimate infants.²⁶ Instead, the most important explanatory variables are the number of illegitimate births that the mother experienced and whether or not these births came at short intervals.

To be born out of wedlock severely reduced the chances of survival for an infant, but the primary reason was not marginalization. Even if it is very difficult to separate poverty from marginalization, we would argue that poverty among single

²⁶ This topic was covered more extensively in Anders Brändström, "Life histories of single parents and illegitimate infants in nineteenth century Sweden," *The History of the Family*, 1:2 (1996), 205–226.

mothers played a more important role in Sundsvall. Generally, an illegitimate birth was an isolated phenomenon early in the life cycle of the woman. She suffered few consequences on the marriage market and a majority could expect to marry. However, as a single mother there was very little that she could do to improve the situation for her children. It did not make much difference where in the region she lived, unless she remained in the town, in which case her chances of marrying were more limited. Furthermore, it did not matter very much if her parents were nearby. Her children would only benefit if she managed to keep the number of illegitimate births to a minimum with long intervals between births. The only option available that would improve her children's chances of surviving infancy was to marry. Only through marriage could a woman change her life to such an extent that her children would have as good a chance of survival as other infants. Marriage had a positive effect, not only on legitimately born children, but also on illegitimate children when the marriage took place within a year after birth. In this case these children stood a much better chance of surviving infancy.

Concluding Remarks

The gradual decline of infant mortality in Sweden from the high and fluctuating rates of the latter half of the eighteenth century to the extremely low rates of today has made it difficult to isolate any specific explanatory factor or series of factors. On a superficial level nineteenth century Sweden appears fairly homogeneous with no large racial, religious or ethnic minorities. Geographical diversity is more apparent, ranging from fertile farmland in the south to mountainous areas in the north and a very long coastline. Although regional demographic differences were observed as early as the latter half of nineteenth century, research on infant mortality has mainly focused on either the entire country or specific localities.

An analysis of provincial level data on infant mortality revealed clear regional differences at the beginning of the nineteenth century. High rates of infant mortality are observable in the far north, in the vicinity of the capital, Stockholm, and in a u-shaped band of provinces stretching along the west coast through the southern part of the country to the east coast (Maps 1 and 2). There was no clear relationship with population density during the nineteenth and early twentieth centuries. Urban infant mortality rates were significantly higher than rural rates, but, because the country was so little urbanized during this period, that fact is not reflected in the figures for the provinces. As infant mortality levels dropped, regional patterns changed considerably (Maps 3 and 4). In the 1920s and 1930s a shift in urban-rural differentials took place with urban infant mortality becoming lower than rural infant mortality. After 1950 mortality levels and the difference between the highest

and lowest rates continued to diminish. The only consistent pattern over a longer period of time is that the northernmost provinces continually registered the highest rates.

The provinces in Sweden, however, are generally so large that highly divergent economic and social structures, as well as distinct cultural areas, are found in one and the same province. A further analysis of the regional differences in infant mortality using parish level data revealed a great deal of diversity. All of the provincial level regions, whether they had high, low, or moderate rates, included smaller areas (larger than a single parish) with divergent levels of infant mortality. In general, the mix of high, moderate, and low is apparent nearly everywhere, a fact missed by earlier research.

Studies of infant mortality in both historical and modern populations have shown that one of the most important factors affecting levels of infant mortality is the manner in which babies were fed. This, in turn, is often associated with economic, social and cultural factors that influenced the method chosen. Regions dominated by, for example, well-to-do peasants could have high, moderate or low levels of infant mortality depending on how local cultural factors such as traditional artificial feeding practices affected breast-feeding. Among the poorer segments of the population economic conditions, requiring the mother's participation in the workforce, could limit the possibility of breast-feeding. On the other hand, women in poverty stricken families may have been forced to breast-feed as alternative food sources were beyond their means. No straightforward association between regional differences in infant mortality and variations in breast-feeding was found, but the data on the prevalence of breast-feeding are limited and ambiguous.

Historically, illegitimate infant mortality has always been higher than legitimate infant mortality. Regional variations in illegitimacy, therefore, must be included in any regional analysis of infant mortality. Illegitimacy increased in Sweden as it did in most of Europe during the nineteenth century, although the reasons for this are still under debate. On a regional level illegitimate infant mortality varied considerably, with the highest rates in the provinces around Stockholm and in the south (Map 8). Illegitimacy was mainly an urban phenomenon in Sweden with rates in towns far exceeding those in the countryside. If we consider excess illegitimate infant mortality for rural Sweden, we find low levels in the north and high levels around Stockholm and sections of the west coast, indicating that illegitimacy may to a large degree have been culturally rooted (Maps 11a–b). Although it is reasonable to assume that in areas with few illegitimate births, illegitimate infant mortality would be high, as unwed mothers would receive little sympathy or help, as well as the converse, no such association was found (Maps 9a–b). The regional analysis on the provincial level indicates that patterns of illegitimacy were relatively stable over time. However, as in the case of the regional analysis of infant mortality,

provincial-level data appear to be too crude to allow any conclusions to be drawn on how illegitimacy and infant mortality interacted.

Using data on an individual level, certain aspects of the relationship between illegitimacy and infant mortality were analyzed. The reproductive life histories of a little more than eight thousand women who lived in the Sundsvall region (the town of Sundsvall and 16 nearby parishes) during the nineteenth century were extracted from the church records. Of these, approximately 2,500 gave birth to illegitimate children. An analysis of the significance of the presence of social networks, which could provide unwed mothers with support, indicates that the proximity of parents did not improve the chances of survival for children born out of wedlock. Indeed, it would appear that the reverse was true, even though statistically the negative effects were small (Figure 8 and Table 1). Although this suggests that marginalization, in this case ostracizing women with illegitimate children, was important, the various other analyses of the individual level data indicate that poverty among single mothers played a more important role in determining levels of infant mortality in the Sundsvall region (Figures 5–7). Unwed mothers generally were hard put to make ends meet. However, an illegitimate birth was often an isolated phenomenon early in the life cycle. As a single mother, there was little a woman could do to improve the situation for her children except to marry. Most unwed mothers in the region eventually did marry.

It becomes clear from the analyses undertaken in this paper that the systematic study of regional differences can provide new insights on how two of the major factors affecting levels of infant mortality, feeding practices and illegitimacy, interacted as infant mortality declined. Furthermore, it becomes clear that any deeper understanding of the mechanisms behind Sweden's gradual decline in infant mortality requires analysis of families and individuals.

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The Interpretation of Cause of Death Among Infants

Magdalena Bengtsson

Introduction

In this paper I will discuss the interpretation of cause of death in Swedish historical source material. A short introduction to the organisations and regulations concerning cause of death information in Sweden is followed by an examination of how previous Swedish researchers have interpreted and used this kind of information. Thereafter, cause of death patterns in infancy are analyzed for two birth cohorts in nineteenth century Linköping. My aim is also to discuss the interpretation of separate causes of death as well as the changes in mortality patterns in relation to the modification of regulations and praxis.

In 1738, the consistories were ordered by *Sundhetskommissionen* (the Health Commission) to report the number of births and deaths that occurred in the parishes and to give detailed information on contagious diseases. At this time information on cause of death was not reported. It was not until eight years later, in 1746, that the ambition to collect information on causes of mortality became apparent. That year the secretary of *Vetenskapsakademien* (the Academy of Science), Pehr Elvius, and the politician I. A. von Lantingshausen both presented reports addressed to a parliamentary committee with suggestions on how to improve population statistics. Elvius wanted to establish the size of the population and therefore stressed the need for national statistics, while von Lantingshausen demanded that the collection of data should be performed in the same way all over the country using special forms. Von Lantingshausen also argued that it was necessary to collect information on diseases with high mortality in order to keep the death rate down, especially among children. These reports led to intensive discussion on the need for further statistics, as well as on the clergy's competence in medical matters. This discussion

resulted in a proposal in 1748 for a national statistics department, and the following year *Tabellverket* (Swedish Population Statistics) was established.¹

It was stipulated that the clergy should fill in three tables every year and send them to *Tabellverket*. Table I contained the number of baptized, married and buried in the parish each month, and there were separate columns for men and women. Table II comprised the distribution of deaths in separate age groups and according to sex and cause of death, while Table III included information on population according to separate age groups, sex and social class.

Table II was revised four times between 1749 and 1830, after which the clergy was no longer required to send in cause of death information for all deaths.² The first version, used from 1749 to 1773, contained 33 cause of death categories.³ As the historian of ideas Eva Nyström has pointed out, this first Swedish list of causes of death was not complete. Her opinion is that it is likely that physicians and ordinary people had a more extensive “classification.”⁴ Some of the categories contained more than one diagnosis, and not all causes listed in one category were related to one other. Smallpox and measles were placed together in one category, as were chest disease and consumption. Many of the categories contained descriptions of symptoms such as fevers, pains in the chest, grippe and colic.⁵ For an observer of today, it is difficult to find any logical consistency in the classification.

The second version was introduced in 1774 and was valid until 1802. The number of causes had increased to 41 and one of the new causes was unspecified disease, a category that previously had been missing. Other changes included the separation

1 Concerning the establishment and early history of vital statistics in Sweden, see O. E. A. Hjelt, “Det svenska tabellverkets uppkomst, organisation och tidigare verksamhet. Några minnesblad ur den svensk-finska befolkningsstatistikens historia,” *Fennia*, 16 (1900), E. Arosenius, *Bidrag till det svenska Tabellverkets historia* (Stockholm, 1928), O. E. A. Hjelt, *Svenska och finska medicinalverkets historia 1663–1812* (Helsingfors, 1891–1892).

2 Only deaths in certain categories were to be reported, such as suicide, murder, child-birth and epidemic diseases. Arosenius (1928), 65.

3 Gustaf Sundbärg “Dödligheten av lungtuberkulos i Sverige åren 1751/1830,” *Statistisk Tidskrift* (1905), 196–197.

4 Eva Nyström “Den svenska dödsorsaksstatistikens framväxt och tidiga historia,” in *Hälsa, sjukdom, dödsorsak. Studier i begreppens teori och historia*, ed. L. Nordenfelt (Linköping, 1986), 120.

5 Nyström (1986), 118–120.

of smallpox and measles, and the assignment of consumption to its own category.⁶ Table II was further revised in 1802, 1811 and 1821.⁷

In 1831 *Tabellkommissionen* (the Swedish Population Commission) decided that the clergy would no longer be required to report death statistics unless the deaths were caused by miscarriage or delivery, by specific accidents or by smallpox. Deaths caused by infectious diseases such as measles, scarlet fever and dysentery were to be reported if there were extensive epidemics. As a result of this decision, Swedish cause of death statistics are incomplete for the period 1831 to 1860, and causes of death were not always reported in the death and burial records.⁸

Information on cause of death underwent further change in 1860, when death certificates issued by physicians were required for all deaths occurring in the cities and towns. In the case of women in confinement and newborns, a certificate issued by a certified midwife was sufficient. Death certificates were required in the countryside only if the deceased had been treated by a doctor for the final illness.⁹ The reason death certificates were not required for all deaths in Sweden was the lack of physicians in sparsely populated areas. In the same year, *Svenska Läkaresällskapet* (the Swedish Medical Society) compiled a bilingual nomenclature for reporting on causes of death. The list consisted of 115 recommended cause of death categories in Swedish and Latin. *Läkaresällskapet* wished to facilitate the reporting and hoped to attain uniform denominations.¹⁰

Previous Research

Several Swedish studies aimed at understanding and explaining changes in mortality during the eighteenth and nineteenth centuries have discussed the validity of cause of death information.¹¹ Important methodological questions have been raised con-

6 Nyström (1986), 120, 126–130.

7 B. Ingemar B. Lindahl, “Dödsorsaksstatistikens problem i modern tid,” in *Hälsa, sjukdom, dödsorsak. Studier i begreppens teori och historia*, ed. L. Nordenfelt (Linköping, 1986), 151–153.

8 Lindahl (1986), 136.

9 *Svensk Författningssamling* (SFS) 1859:64.

10 *SFS* 1860:13; Fr. Tholander, C. G. Grähs and K. F. Levin, “Den 26 April. Constitutio epidemica. Betänkande om mortalitetsstatistiken,” *Förhandlingar vid Svenska Läkare-sällskapets sammankomster från och med Okt. 1858 till och med Sept. 1859* (Stockholm, 1859), 136–153.

11 Arthur Imhof and Bengt I. Lindskog, “Dödsorsakerna i Sydsverige 1749–1773,” *Sydsvenska medicinhistoriska sällskapets årsskrift*, (1973), 120–143; Lars Widén “Mortality and causes of death in Sweden during the 18th century,” *Statistisk Tidskrift*, 13:2 (1975), 93–104;

cerning the *determination* of cause of death as well as the researcher's *interpretation* of them. The fact that the parish priests in Sweden were long responsible for the identification and reporting of causes of death has given rise to a discussion of the medical competence of the clergy. Did they have the capacity and ability to determine cause of death correctly? Other issues in this debate concern the level of accomplishment in medical science in the eighteenth and nineteenth centuries and the effects of instructions and regulations on cause of death registration. Variation in registration and mortality levels due to the practices of individual ministers have also been discussed.

In an early study on causes of death in southern Sweden 1749–1773, Arthur Imhof and Bengt Lindskog raised the question of the clergy's medical competence. They argued that one cannot assume that the medical standard of the clergy was good just because several medical volumes were published in Swedish in the eighteenth century and were widely spread throughout the country, or because the clergy was taught some rudiments of medicine. Even contemporaries did not think too highly of the medical education for the clergy. The scientists of repute at the time, Carl von Linné and Abraham Bäck, had many times proposed reforms of the clergy's medical education in order to improve reporting of mortality statistics. Furthermore, Imhof and Lindskog point out that, although the role of medical literature and education should be played down, the clergy did have some practical medical experience. They often acted as local doctors, as only about two dozen district medical officers were on duty in Sweden-Finland at the end of the eighteenth century. The clergy's ability to make a fairly correct diagnosis according to the prevailing medical theories should therefore not be underestimated, in Imhof's and Lindskog's view.¹²

The historian Britt-Inger Puranen has emphasized the clergy's central role for diagnosis and medical therapy. Puranen, who thoroughly discussed the validity of cause of death information in her study of tuberculosis in Sweden 1750–1980, expressed the opinion that their theoretical knowledge of medicine was limited and of uneven quality, a condition that characterized medical science in general. "The value of the medical education that the clergy received at *gymnasium* and university

Britt-Inger Puranen, *Tuberkulos. En sjukdoms förekomst och dess orsaker, Sverige 1750–1980* (Umeå, 1984), Nyström (1986), 107–133; Tommy Bengtsson, "Mortality and causes of death in Västanfors parish, Sweden, 1700–1925," in *Society, Health and Population during the Demographic Transition*, eds. A. Brändström and L-G. Tedebrand (Stockholm, 1988), 461–493; Jan Sundin, "Child mortality and causes of death in a Swedish city, 1750–1860," *Historical Methods*, 29:3 (1996), 93–106; John Rogers, "Reporting Causes of Death in Sweden, 1750–1950," *Journal of the History of Medicine*, 54:2 (1999), 190–209.

12 Imhof and Lindskog (1973), 140–141.

should not be thought of too highly, not even when the students attended seminars by Carl von Linné, [the pediatrician] Nils Rosén von Rosenstein or other as highly qualified scientists.”¹³ What Puranen stressed, as did Imhof and Lindskog, is the clergy’s valuable practical experience of medicine. She argued that the clergy’s responsibility for peoples’ health had old roots. In medieval society, diseases were considered as caused by a sinful life, and it was thence the clergy’s caring duties were derived. After the Reformation the parish members continued to turn to the parish priest for medical advice and treatment. He was also often the only educated person in the parish and knew the villagers well.¹⁴ This was a condition that the authorities wanted to make use of when the clergy became responsible for the collection of population statistics, and therefore medical literature specifically addressed to the clergy and other church authorities became available.¹⁵

Yet another researcher stressing the clergy’s practical experience of medicine is Eva Nyström, historian of ideas. In an article on the development of Swedish cause of death statistics she has argued that this practical experience of medicine made the clergy aware of the nature of various diseases and their change over time. They could thereby identify most lethal diseases and recognize significant symptoms, which would have made it easier to make a correct diagnosis.¹⁶ The significance of taking the disease panorama into account when discussing validity of cause of death information has also been advanced by Lars Widén. In an early article on cause of death specific mortality in late eighteenth century Sweden, he stated that, “even if it is true that the clergy was not formally competent for this work, it must have been possible for them to give the appropriate cause in many cases.”¹⁷ He sums up his line of argument with the conclusion that “the clergy was able to state the appropriate cause in the majority of deaths from infectious diseases which have a specific pathological picture.”¹⁸ Jan Sundin, who studied child mortality and causes of death

13 Puranen (1984), 71.

14 Puranen (1984), 54. See also Widén (1975) 94–95; Nyström (1986), 122.

15 Puranen (1984), 59–62.

16 Nyström (1986), 122. It is important to notice that the most lethal diseases in the 18th and 19th centuries were infectious diseases and many of them were relatively easy to identify. They had a characteristic course and some of them also appeared in epidemics. According to Imhof and Lindskog, plague, colic (*mage- och bukref*), feverish conditions and malaria would have been relatively easy for the clergy to diagnose. Imhof and Lindskog (1973), 141. See also Anders Brändström, “*De kärlekslösa mödrarna.*” *Spädbarnsdödligheten med särskild hänsyn till Nedertorneå* (Umeå, 1984), 96; Bodil Persson, *Pestens gåta. Farsoter i det tidiga 1700-talets Skåne* (Lund, 2001), 155–158.

17 Widén (1975), 94.

18 Widén (1975), 94–95.

in Linköping 1750–1860, has voiced a similar opinion: “we cannot always be certain that the diagnoses were correct, but we can get a crude picture of the symptoms.”¹⁹

Instructions and regulations were other prerequisites for the clergymen’s ability to fulfil their duty as registrars of mortality records. One interesting matter is the construction of cause of death categories by *Tabellverket*. As Jan Sundin has described them, some of the categories were “a mixture of names of specific diseases that are still used, groups of terms that by modern medical standards include rather related diseases, vague symptoms, and totally incomprehensible categories.”²⁰ He argued further that “the vicars could probably have recognized certain common diseases such as smallpox and whooping cough relatively easy, whereas other symptoms – diarrhea and other gastrointestinal troubles, for example – might not always have been registered under the same category.”²¹ Britt-Inger Puranen actually studied the occurrence of tuberculosis in different categories of causes of death. She could convincingly show that tuberculosis could be hidden in such categories as chest disease, chest fever, chest pain, etc.²² To make a correct diagnosis and then place it under the appropriate cause of death category in the mortality table seems to have been difficult enough. Changes in the regulations are likely to cause methodological problems for the researcher, just as they did for cause of death registration.²³

Britt-Inger Puranen and Tommy Bengtsson have both studied how the registration of causes of death on a parish level was affected by these changes. Puranen concluded that the nomenclature from *Tabellverket* to some degree influenced the terms in the death and burial register in the period 1750–1830, even though medical books had a stronger influence.²⁴ Bengtsson on the other hand, claims that the changes of nomenclature in 1774, 1802, 1811, and 1821 seemed not to have “any effect on what the priests in Västansfors registered in the parish registers. Thus, the problem with changes in the nomenclature when constructing continuous time series based on the population statistics does not exist when analysing the parish registers.”²⁵ An example from Linköping contradicts Bengtsson’s view. When the category “unknown childhood disease” in the first version of Table II was deleted in

19 Sundin (1996), 93.

20 Sundin (1996), 93. See also Imhof and Lindskog (1973), 140.

21 Sundin (1996), 94–95.

22 Puranen (1984), 65.

23 The instructions and regulations concerning mortality statistics changed several times. The mortality tables were revised six times between 1749 and 1859. A compilation of different versions of Table II is presented in an appendix in Sundbärg (1905), 196–197; Lindahl (1986), 151–153.

24 Puranen (1984), 64.

25 T. Bengtsson (1988), 467.

1774, it was replaced by “unspecified disease,” a diagnosis that no longer applied only to children.²⁶ In Linköping this change in terminology resulted in a shift from high infant mortality caused by unknown childhood diseases to an equally high level of mortality in the category *slag*.²⁷ The remarkable increase in infant mortality caused by *slag* was illusory, not real.²⁸

A change in regulations that affected mortality statistics, on the aggregate as well as the nominal level, was *Tabellkommissionens* 1831 decision that the clergy would no longer be required to report death statistics, unless the deaths were caused by miscarriage or delivery, by specific accidents or by smallpox. Deaths caused by infectious diseases such as measles, scarlet fever and dysentery were to be reported only if there were extensive epidemics. As a result of this decision, Swedish cause of death statistics are incomplete for the period 1831 to 1860, and causes of death were not always reported in the death and burial records.²⁹ Puranen found, for example, that the share of registered causes decreased in seven different parishes after 1830. The exception was parishes where the priests had been educated in the “era of pastoral medicine,” a period when the ambition was to train clergymen to become physicians and physicians to become clergymen. In spite of the changed regulations the medically educated clergy continued to report causes of death as long as they held office, but when a new parish priest arrived (after 1830) the share of reported causes of death decreased.³⁰

This conclusion can be illustrated by an example from Västansfors parish, studied by Tommy Bengtsson. The vicar since 1806, Eric Eggertz, was not affected by the 1830 change in regulations, but rather continued to register causes of death throughout his period of service. According to Bengtsson, his registration actually improved in the 1830s. When Eggertz successor, Georg Seseman took office in 1841, he adopted the new instructions and “about one quarter of the deaths were left without any notice of the causes.”³¹ In many parishes, however, the clergy continued to register this information. In Linköping, almost all deaths between the

26 Nyström (1986), 129.

27 The Swedish term *slag* would normally be translated as stroke, but in the case of infant and child deaths *slag* should be understood as sudden death.

28 Sundin (1996), 97.

29 Lindahl (1986), 136.

30 Puranen (1984), 64.

31 T. Bengtsson (1988), 468.

years 1831 and 1860 were given a cause of death.³² In the town of Sundsvall, the clergy also registered causes of death in the statistical tables after 1830.³³

As discussed above, the clergy's medical competence and instructions and regulations for mortality statistics influenced the registration of causes of death. Another equally important prerequisite was the individual parish priest's opportunities to collect information about the death. Had the clergyman visited the dying parish member or had he seen this person shortly after death? He may have based his entries on reports given by relatives.³⁴ This is difficult to ascertain but is important for the quality of mortality data. Widén argues concerning the clergy that "in their capacity as spiritual guides they may many a time [have] visited those taken seriously ill."³⁵ However, in the case of infants and children who had suddenly become ill, it is not certain that the parish priest arrived at the sickbed in time. Were there other factors related to the individual clergyman affecting cause of death information? As discussed above, the clergy's medical education and experience varied considerably. Another circumstance is that parish priests could have interpreted the instructions concerning reporting cause of death differently.³⁶ In her study of tuberculosis Britt-Inger Puranen found a connection between individual priests and the use of different classifications for chest and lung diseases. While one parish priest used the term consumption, another wrote chest disease for the same complaint. Puranen emphasizes therefore the importance of analyzing cause of death information specific to priests, as well as the use of local terminology for diseases over time.³⁷ Tommy Bengtsson is not convinced by Puranen's arguments. An observed under-registration of a certain category of causes of death (in comparison with mortality levels in the office of predecessors and successors) may incorrectly be explained as the effect of individual priests. The variation might, Bengtsson argues,

32 Sundin (1996), 95–96; Hans Nilsson, *Mot bättre hälsa. Dödlighet och hälsoarbete i Linköping 1860–1894* (Linköping, 1994), 36.

33 It is not known, however, if the information was registered in the death and burial records, as these were destroyed in the fire of 1888. Sören Edvinsson, *Den osunda staden. Sociala skillnader i dödlighet i 1800-talets Sundsvall* (Umeå, 1992), 27, 32.

34 Imhof and Lindskog (1973), 140.

35 Widén (1975), 94.

36 Some of the problems associated with cause of death statistics today are the discrepancies between diagnoses made before and after an autopsy and between diagnoses in the autopsy report and on the death certificate. Not all physicians follow the instructions for filling in a death certificate, and some errors also originate when statistics are registered. Lindahl (1986), 135–162.

37 Puranen (1984), 68.

just as well be explained by real changes in the disease panorama and in changes of the Church Law and the instructions.³⁸

Thus far, we have concentrated on the determination and registration of cause of death. Scholars have been rather optimistic in evaluating the clergy's ability to pinpoint cause of death. It was not so much the clergy's medical education as their practical experience. Thanks to their acquaintance with the parish members and their function as spiritual guides, they acquired knowledge on lethal diseases and significant symptoms. On the matter of how instructions and regulations influenced cause of death registration on the parish level, opinions were divided. Several authors emphasized methodological questions regarding *Tabellverket's* cause of death categories and agreed that the construction of categories is the heart of the matter. Individual factors influencing cause of death registration were also considered important, but difficult for the historian to detect.

When it comes to the researcher's possibility to interpret cause of death data and use the information in order to understand mortality changes over time, some authors are more pessimistic. Tommy Bengtsson argued for instance, that the clergy's ability to recognise deaths from infectious diseases did not facilitate the interpretation of mortality changes, as these diseases not were as frequent: for example, measles, whooping cough and thrush. The most frequently reported causes of death from the eighteenth and nineteenth centuries, such as stroke, unknown child disease and infirmities of old age, were vague and are therefore difficult to interpret.³⁹ "From the point of view of medical history, these [infectious] diseases are of course as interesting as the more common diseases, but from a social and economic historical point of view they are less important."⁴⁰

Imhof and Lindskog were also rather pessimistic concerning the interpretation of cause of death data. From their medical perspective there are a number of reasons why modern researchers should have difficulties in understanding a number of diseases and causes of death. First, medical terminology and medical science have experienced continuous change in history. Jaundice can serve as an example for a condition that was regarded as a disease in the eighteenth century and is nowadays considered a symptom. Secondly, our modern system of disease is based on pathological and anatomical changes, while eighteenth century physicians took symptoms as their starting-point.⁴¹ Thirdly, many diseases display a "pure historic variation and change throughout the centuries." Imhof and Lindskog therefore recommended care when translating diagnoses from the eighteenth century to diagnoses

38 T. Bengtsson (1988), 472.

39 T. Bengtsson (1988), 479–481.

40 T. Bengtsson (1988), 480.

41 See also T. Bengtsson (1988), 464.

of today. In the summary of their article their standpoint is even more pessimistic: “The eighteenth century diagnoses are discussed and found impossible to translate into the medical language of our days.”⁴²

Jan Sundin has expressed a more optimistic view than Bengtsson, Imhof and Lindskog, saying that “available statistical categories can provide a lot of insight into contemporary concepts of death, disease, and illness...”⁴³ A solution to the problem of uncertain and vague cause of death categories is, according to Sundin, to combine cause of death analyses with other indicators for cause of death, for example, seasonal analyses and biometric analyses of mortality.⁴⁴ One possibility, pointed out by Britt-Inger Puranen, is to analyse cause of death information specific to clergymen as well as local terminology over time.⁴⁵ Lars Widén also belongs to the more optimistic researchers: “It is obvious that the data do not meet modern requirements in regard to the reported causes of death. [...] However, it does not mean that these data cannot provide vital information, despite all their shortcomings, on the level and development of mortality during the latter half of the eighteenth century and the beginning of the nineteenth.”⁴⁶ There are almost as many opinions concerning the use of historical cause of death data as there are researchers, but it is obvious that the more optimistic authors are those who try to compensate for the short-comings in quality and validity.

A Local Example of Cause of Death Analyses

Findings from a study on infant and child mortality in Linköping will serve as a starting-point for a discussion of the interpretation of cause of death information and the changes it underwent during the nineteenth century.⁴⁷ Linköping was a rather small town that was dominated by administration, commerce and crafts. By 1800, Linköping had 2,680 inhabitants, and one hundred years later nearly 15,000

42 Imhof and Lindskog (1973), 141–142.

43 Sundin (1996), 93.

44 Sundin (1996), 106. See also Rogers (1999), 209.

45 Puranen (1994), 68.

46 Widén (1975), 93–94.

47 The analyses are based on results from my doctoral dissertation, where three birth cohorts were followed through childhood. Magdalena Bengtsson, *Det hotade barnet. Tre generationers spädbarns- och barnadödlighet i 1800-talets Linköping* (Linköping, 1996).

people lived in the city.⁴⁸ During the nineteenth century infant mortality decreased from around 280 to 120 deaths per thousand live births.⁴⁹

The source material consists of computerized parish records, initially registered at the Demographic Data Base at Umeå University. To accentuate the effects of changed regulations for stipulation of causes of death, I have chosen to present the results on infant mortality for two birth cohorts, 1797–1810 and 1870–75, a total of 2,521 individuals. Information on cause of death was given for 96 percent of the infant deaths in the period 1797–1810 and for 94 percent in the period 1870–1875.

The Early Period, 1797–1810

During this period the level of infant mortality was relatively high, with 242.2 deaths per thousand live births, but this was comparable to figures for Sweden for the period, 1811–1820.⁵⁰ The distribution of mortality for different cause of death categories is shown in Table 1.

Slag was the dominant cause of death in the early period and caused over fifty percent of all infant deaths. *Slag* is an old term for stroke, but here it should be interpreted as sudden death, as I will explain further on. The second most important cause of death was respiratory diseases. Around one fifth of all infant deaths were reported as having been caused by respiratory diseases, and the most common diagnosis was chest fever.⁵¹ Occasional deaths were caused by chest defects and chest disease.⁵²

In the early period, thrush caused nearly ten percent of the infant deaths in Linköping. Thrush (*Candida albicans*) is an infection in the mouth and throat caused by a yeast fungus. Infant deaths from thrush have been associated with lack of adequate hygiene.⁵³ The famous eighteenth century Swedish pediatrician Nils Rosén von Rosenstein was of the opinion that the infants who suffered most from

48 Folke Lindberg, *Linköpings historia, del 3. 1567–1862. Samhälls- och kulturliv* (Linköping, 1975), 12; Sven Hellström (ed), *Linköpings Historia Del 4. Tiden 1863–1910* (Linköping 1978), 13.

49 Lindberg (1975), 15; Parish statistics for Östergötland, Demographic Data Base, Umeå University.

50 *Historisk Statistik för Sverige. Del 1 Befolkningen* (Örebro, 1955), 60.

51 In the original: *bröstfeber*.

52 In the original: *bröstfel* and *bröstsjukdom*.

53 Ulla-Britt Lithell, *Kvinnoarbete och barntillsyn i 1700- och 1800-talets Österbotten* (Stockholm, 1988), 14.

Table 1. Mortality distribution for different causes of death during infancy. Linköping, 1797–1810 and 1870–1875.

	1797–1810		1870–1875	
Number of live births	1251		1270	
Cause of death	IMR	n	IMR	n
Atrophy	0.8	1	14.9	19
Childhood diseases	20.0	25	18.1	23
Congenital diseases		0	32.3	41
Gastro-intestinal infections		0	62.2	79
Other diseases	1.6	2	11.0	14
Respiratory diseases	49.6	62	29.9	38
<i>Slag</i>	134.3	168	3.9	5
Thrush	22.4	28	0.8	1
Tuberculosis		0	2.4	3
Unknown, illegible or unspecified	13.6	17	10.2	13
Total	242.2	303	172.4	219

Source: DDB, Umeå University.

thrush were those whose mouths were not properly cleaned and those who sucked old, thick or sour milk.⁵⁴

Smallpox was the most important childhood disease at this time and caused around five percent of all deaths, or 12.8 deaths per thousand. In Linköping, vaccination against smallpox began as early as 1802, which was fourteen years before vaccination became compulsory in Sweden. The town medical officer, Olof Noraeus, performed about 4,000 vaccinations in two years.⁵⁵ Other diagnoses in this category were whooping cough and measles. A small epidemic of whooping cough took place in this area between June and November 1806. Finally, there were two small categories, undefined fevers and atrophy. Atrophy contained diagnoses such as consumption and wasting disease.⁵⁶

A quick look at cause of death patterns in different age spans during the first year reveals that *slag* was the most common cause of death in the first month after birth (Tables 2–4). At ages 2–6 months, deaths from respiratory diseases had become more common, but *slag* was still a dominant cause of death. Deaths from childhood diseases became more common in the second half of the first year, whereas thrush had almost disappeared.

⁵⁴ Nils Rosén von Rosenstein, *Underrättelse om barns sjukdomar och deras bote-medel* (Stockholm, 1771), 42.

⁵⁵ Lindberg (1975), 41.

⁵⁶ In the original: *twinsot* and *tärande*.

Table 2. Mortality distribution for different causes of death, ages 0–30 days. Linköping, 1797–1810 and 1870–1875.

	1797–1810		1870–1875	
Number of live births	1251		1270	
Cause of death	IMR	n	IMR	n
Childhood diseases	-	0	1.6	2
Congenital defects	-	0	19.7	25
Gastro-intestinal infections	-	0	14.2	18
Respiratory diseases	2.4	3	6.3	8
<i>Slag</i>	37.6	47	1.6	2
Thrush	10.4	13	0.8	1
Total	61.6	77	54.3	69

Source: DDB, Umeå University.

Table 3. Mortality distribution for different causes of death, ages 2–6 months. Linköping, 1797–1810 and 1870–75.

	1797–1810		1870–1875	
Number of live births	1251		1270	
Cause of death	IMR	n	IMR	n
Childhood diseases	7.2	9	5.5	7
Congenital defects	-	0	7.1	9
Gastro-intestinal infections	-	0	29.1	37
Respiratory diseases	25.6	32	19.7	25
<i>Slag</i>	74.3	93	0.8	1
Thrush	9.6	12	-	0
Total	115.1	144	67.7	86

Source: DDB, Umeå University.

Table 4. Mortality distribution for different causes of death, ages 7–12 months. Linköping, 1797–1810 and 1870–1875.

	1797–1810		1870–1875	
Number of live births	1251		1270	
Cause of death	IMR	n	IMR	n
Childhood diseases	14.4	18	11.0	14
Congenital defects	-	0	3.1	4
Gastro-intestinal infections	-	0	18.1	23
Respiratory diseases	21.6	27	12.6	16
<i>Slag</i>	22.4	28	1.6	2
Thrush	2.4	3	-	0
Total	60.0	75	49.6	63

Source: DDB, Umeå University.

The Late Period, 1870–1875

The most important change in the period 1870–1875, when compared to the earlier period, was that *slag* had more or less disappeared as a cause of death (see Table 1). Instead, gastro-intestinal diseases had taken its place as the dominant cause of death, and responsible for 36 percent of all infant deaths.

Respiratory disease was still the second largest cause of death category and was reported to have caused 17 percent of the infant deaths. This category had also been enlarged by the addition of new diagnoses: chest catarrh, bronchial inflammation, lung catarrh and pneumonia.⁵⁷

Childhood diseases were reported as the cause of ten percent of all infant deaths during the late period. Smallpox, measles and whooping cough had appeared as causes of death in the earlier period, but scarlet fever and diphtheria were relatively new diagnoses. Smallpox caused the largest number of deaths in this category, and 17 out of 23 deaths were given this diagnosis. Mortality from smallpox had gradually decreased in the decades following the introduction of vaccination,⁵⁸ but mortality increased when serious epidemics struck the city in 1863 and 1874–1875.⁵⁹

Several causes of deaths can be categorized as congenital defects: prematurity, convulsions, congenital syphilis, deformities and weakness. These diagnoses are probably related more to conditions in the uterus and circumstances at birth and are less likely to be associated with exogenous factors.

The analyses of cause of death patterns in different age spans during the first year show that congenital defects together with gastro-intestinal diseases dominated mortality in the first month after birth (Tables 2–4). Mortality from respiratory infections became more prominent at the age of 2 to 6 months, even though gastro-intestinal diseases were still responsible for the highest mortality in that age group. During the second half of the first year mortality was more evenly distributed among the categories gastro-intestinal diseases, respiratory infections and childhood diseases.

Discussion

How should the information on cause of death given in the death and burial records be interpreted in this case? And how should the changes in cause of death patterns described above be understood?

57 In the original: *bröstkattarr, luftrörsinflammation, lungkattarr and lunginflammation*.

58 Sundin (1996), 97.

59 Nilsson (1994), 115–117.

Let me begin with the cause of death category *slag*. In the early period, infant mortality from *slag* was extremely high in Linköping, at the same time as no deaths from gastro-intestinal diseases were reported. This relationship was reversed in the later period, when physicians were required to issue death certificates. The fact that not a single infant born in Linköping between 1797 and 1810 died from a gastro-intestinal infection should not be interpreted to mean that the infants did not suffer from diarrhea.

We know from studies in the developing countries of today that diarrhea is one of the major causes of death among children. It is estimated that about one tenth of the children die from gastro-intestinal infections before five years of age.⁶⁰ Although conditions in seventeenth and eighteenth century Europe are not completely comparable with the situation in the developing countries of today, the chances these infants have for survival are believed to be similar, due to similar hygienic conditions in both environments. It is therefore likely that similarities can be found in the cause of death patterns. There is also evidence from historical studies of Swedish and Finnish parishes that gastro-intestinal diseases have been reported as the cause of death for infants.⁶¹ In Tanum, a coastal parish in southwestern Sweden, a third of the deceased infants who had been given a cause of death between 1780 and 1800 had died from gastro-intestinal diseases.⁶² Accordingly, there seem to have been local variations in the practice of using diarrhea and *slag* as the cause of death for infants.

I am inclined to think that at the beginning of the nineteenth century, infant deaths in Linköping that were caused by diarrhea were registered as another cause of death, such as *slag*, for example. That does not mean, however, that diarrhea was the cause of all infant deaths attributed to *slag*! There are a number of interpretations of the underlying cause of infant deaths noted in this category. In a study of cause of death patterns in Västansfors from 1700 to 1925, Tommy Bengtsson argued that *slag* contained all causes leading to sudden death.⁶³ It could naturally be argued that all infant deaths that could not be diagnosed as smallpox, measles, whooping cough, thrush or respiratory infections were given the diagnosis *slag*.

How did a contemporary physician reason about infant deaths caused by *slag*? The famous eighteenth century Swedish physician Nils Rosén von Rosenstein discussed convulsions and heart irregularity (*hjärtsprång*) in the third and enlarged

60 S. Martin Taylor et al., "Modelling the incidence of childhood diarrhea," *Social Science of Medicine*, 23:10 (1986), 995.

61 Brändström (1984); Ulla-Britt Lithell, *Breast-Feeding and Reproduction. Studies in Marital Fertility and Infant Mortality in 19th century Finland and Sweden* (Stockholm, 1981).

62 Brändström (1984), 199.

63 T. Bengtsson (1988), 481.

edition of his pediatric volume.⁶⁴ He believed that infants reported as dying from *slag* had in reality suffered from heart irregularity:

When one of their limbs twitches, we say that they have convulsions, but when the whole body twitches, and they are also blue in the face, we say that they suffer from heart irregularity ... A paroxysm of heart irregularity consists of two parts. The first is the twitches, and the other is the consequences, namely a deep sleep with a murmuring sound in the chest. It is during this [sleep], that they die, and since they are then lying there like one who is struck with *slag*, it is said that these children die from slag, which is in truth the case. Therefore we read in the weekly papers that so many infants are declared to have died from slag, although the real cause was heart irregularity.⁶⁵

The convulsions mentioned above could possibly be interpreted as symptoms of dehydration. Diarrhea may cause dehydration, which can lead to a life-threatening condition in a very short time. Today these children are given intravenous fluids and are sometimes treated in hospital.⁶⁶ Another possible explanation for the convulsions is a tetanus infection. Tetanus, caused by an infection at birth or via the navel as a result of inadequate hygienic measures, is a relatively common cause of death among infants in developing countries. It is a serious condition, as only half of the infected infants survive.⁶⁷

Some of the infant deaths caused by *slag* may, of course, have been what today is called sudden infant death syndrome, SIDS, a term for infant deaths where the cause of death cannot be explained by clinical circumstances, the situation at the time of death, or the autopsy. The reason some infants die suddenly, without any apparent cause, has not been completely elucidated, but several studies have shown that mortality was reduced when it was recommended that parents place babies on their backs rather than on their stomachs for sleep.⁶⁸

Several excerpts from Rosén von Rosenstein's book give advice on how to position the infant in bed:

64 Rosén von Rosenstein (1771).

65 Rosén von Rosenstein (1771), 46–48. Author's translation.

66 Taylor, et al. (1986), 995.

67 Melvin I. Marks, *Pediatric Infectious Diseases for the Practitioner* (New York, 1985), 636.

68 Torleiv Ole Rognum, ed. *Sudden Infant Death Syndrome – New Trends in the Nineties* (1995).

She [the wet-nurse] should never hold an infant straight up and down unless its head is supported by something. Likewise, an infant should always lie with its head a little higher than its body or it is prone to die of *slag*.

This reference to the importance of the position of the head suggests a similarity between *slag* and sudden infant death syndrome. It is difficult to trace any sign of sudden infant death syndrome in the death and burial records from Linköping during the nineteenth century, but successful attempts have been made in other parts of Sweden.⁶⁹

To sum up this discussion so far, there is strong evidence for an interpretation of *slag* as equivalent to diarrhoea. First, the diagnosis changed from *slag* to diarrhoea when death certificates issued by physicians were required, starting in 1860. Secondly, there is some similarity with developing countries of today in cause of death patterns, and thirdly, there is evidence from other historical studies. The transformation from *slag* to gastro-intestinal diseases may have been due to changes in practice (exemplified by local variations in the use of diarrhoea as the cause of death), and to the regulation about death certificates. An important effect of the regulation of 1860 is that medical expertise, together with the midwife, became responsible for establishing the cause of infant deaths in the cities, something that consequently should have made the information on cause of death more accurate than before.

This shift in medical competence is also apparent with respect to the cause of death category congenital defects. At the beginning of the nineteenth century not a single death was reported among infants in Linköping as being caused by a congenital defect. By the mid-nineteenth century, the picture had changed somewhat: of the total of 225 infants who died during the period 1840–1849, approximately thirteen percent were given the diagnosis weakness. Two cases of hydrocephalus and one case of congenital syphilis were also reported. It is likely that a physician had examined the infants suffering from these latter two conditions, as they were of particular medical interest. For the infants dying of weakness, the clergyman probably established the cause of death himself after having talked with the parents.

In the period 1870–1875, two new diagnoses were added to the category congenital defects, namely prematurity and convulsions. Nearly one fifth of all infant deaths at this time were categorised as congenital defects, and the dominant diagnosis was weakness (13.4 deaths per thousand). Thereafter followed deformities (7.1 deaths per thousand) and prematurity (5.5 deaths per thousand).

The variety of deformities tells us something about the careful attempts of physicians to find the accurate cause of death: too much blood to the lungs, incomplete

69 Bodil E. B. Persson, "Barnkvävning och plötslig spädbarnsdöd (=SIDS)," *Scandia*, 62:2 (1996) 195–219.

lung development, dissociated spine and lung collapse.⁷⁰ Of course, the change in terminology reflects not only the entrance of the physician into the picture but also increased medical knowledge as well. Some causes of death in this category were not really causes, but were actually symptoms of disease, e.g. weakness and convulsions, but the various examples of deformities and the term prematurity are all examples of a cause of death terminology aimed at explaining what really caused the deaths.

Consequently, this shift can be characterized as the development from symptom-based to cause-based terminology. Symptoms are easier to recognize for a lay person, such as the clergyman, but extensive medical knowledge is required for the identification of causes. It is likely that the increased accuracy of the diagnoses over time can be explained, not only by the physician's entrance onto the stage, but also by the scientific developments within medicine during the nineteenth century.

In fact, the first systematic descriptions and classifications of disease were based on symptoms. The French botanist and medical professor François Boissier de la Croix de Sauvage (1706–1767) selected symptoms as the primary criteria for classifications of disease. De Sauvage dismissed causes of disease as criteria for classification, as all assumptions of causality were only vague suppositions. Carl von Linné (1707–1778) also developed a nosology based on symptoms, in which 11 classes were grouped as fevers or non-fevers. The non-fevers were divided into diseases of the nervous system, the body fluids and the firm parts of the body.⁷¹ The Scottish physician William Cullen (1710–1790) developed a new classification scheme based on his own experience as naval surgeon, private physician and university professor in charge of hospital patients. According to the medical historian Guenter B. Risse, “Cullen criticized his predecessors for attempting comprehensive arrangements not entirely based on personal observations, because lack of firsthand knowledge made them include virtually every symptom as a separate disease”.⁷² Although the system developed by Cullen was to a large degree also based on symptoms, he formulated the principle of physiological function as a criterion for the classification of nervous disorders. As important medical discoveries continued to take place in the nineteenth century, it became more and more obvious that the old nosology systems were of no use. The new medical disciplines of anatomy, physiology and cell biology demanded totally new categories, and it was not until 1893 that a classifica-

70 In the original: *blodträngsel till lungorna, ofullständig lungutveckling, kluven ryggrad, and lungkollaps*.

71 Lennart Nordenfelt and Eva Nyström “Sjukdomsklassifikation i historisk belysning,” in *Hälsa, sjukdom, dödsorsak. Studier i begreppens teori och historia*, ed. L. Nordenfelt (Linköping, 1986), 82–85.

72 Guenter B. Risse, *Hospital Life in Enlightenment Scotland. Care and Teaching at the Royal Infirmary of Edinburgh* (Cambridge, 1986), 116.

tion system founded on anatomy and topology was presented. Jaques Bertillon declared that diseases should be classified according to what part in the body had been affected.⁷³

A change in the cause of death pattern that was independent of regulations, practice or the state of medicine is exemplified by developments regarding mortality from diphtheria and scarlet fever in the nineteenth century. These infectious diseases were not reported as causes of death in Linköping in the beginning of the nineteenth century, but appeared in the period 1870–1875. In fact, diphtheria and scarlet fever appeared as new pandemics during the second half of the nineteenth century.⁷⁴ During the 1860s and 1870s mortality from diphtheria and scarlet fever was very high in Sweden and these diseases had increased in importance regarding child mortality.⁷⁵ Three major epidemics of scarlet fever struck Linköping in the latter part of the 19th century, namely in 1856–1857, 1877–1878 and 1892–1894. The majority of the deceased were children under six years of age.⁷⁶ In Sundsvall, there were large increases in mortality in children aged 1–4 years that were mainly due to epidemics of scarlet fever and diphtheria.⁷⁷ Consequently, a change in the epidemiological pattern not only influenced conditions in Linköping, but in all of Sweden.⁷⁸ The changes in mortality due to diphtheria and scarlet fever should thus be interpreted as a shift in the epidemiological regime.

73 Nordenfelt and Nyström (1986), 85–87, 96–97.

74 Alex Mercer, *Disease, Mortality and Population in Transition. Epidemiological-Demographic Change in England since the Eighteenth Century as part of a Global Phenomenon* (Leicester, 1990), 115, fig 5.5.

75 Rolf Bergman, “De epidemiska sjukdomarna och deras bekämpande,” in *Medicinalväsendet i Sverige 1813–1962*, ed. W. Kock (Stockholm, 1963), 334; Erland Hofsten and Hans Lundström, *Swedish Population History. Main Trends from 1750–1970* (Stockholm, 1976), 59; Marie C. Nelson, “Diphtheria in late-nineteenth-century Sweden: policy and practice,” *Continuity and Change*, 9:2 (1994), 222.

76 Annika Bergström, Dödlighet i scharlakansfeber i Linköping på 1800-talet, unpublished paper, Dept. of History (Linköping, 1995)

77 Edvinsson (1992), 181.

78 Marie C. Nelson and John Rogers, “The Epidemiological Transition in Sweden. Some Regional Implications,” paper presented at The 18th annual meeting of Social Science of History Association (New Orleans, 1993).

Final Comments

Is it possible to use information on cause of death from the eighteenth and nineteenth centuries in mortality analyses? How should we interpret and use causes of death in mortality analyses?

It has been argued that the clergy, who were responsible for designating cause of death up until 1830, had insufficient medical knowledge and that the information is therefore unreliable. It has also been argued that the science of medicine was rather underdeveloped during the eighteenth and nineteenth centuries, and death certificates issued by physicians were therefore not always reliable. While I agree that it can be difficult to use cause of death information for the purpose of identifying factors influencing infant and child mortality and explaining changes in mortality, to simply ignore this kind of information does not seem wise. The question is how it may be used.

Results from a study on infant mortality in Linköping have served as a starting-point for this discussion. In addition, different reasons for changes in cause of death patterns have been analyzed. The diagnosis *slag* was reported as having caused more than half of all infant deaths in the early nineteenth century, and I have pointed out several reasons why *slag*, in this particular context, should be interpreted primarily as diarrhea. Analyses of cause of death patterns revealed different types of change. Changes in practice, regulations and medical science are exemplified in the transformation of *slag* and congenital defects, whereas the appearance of diphtheria and scarlet fever in the mortality pattern was related to variations in the epidemiological regime.

In performing local studies where cause of death information is placed in its proper context, and analyses are combined with other kinds of mortality analyses, I believe that cause of death analyses are quite useful for understanding mortality and its changes. An awareness of 1) the conditions under which causes of death were rendered, 2) what regulations were in effect at the particular time, and 3) the environmental and epidemiological changes provides good prerequisites for successful use of cause of death information.

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Rural Infant Mortality in Nineteenth Century Norway¹

Gunnar Thorvaldsen

Much previous research on the Norwegian mortality decline has focused on specific localities, employing databases with linked microdata. One good choice is Rendalen, a parish on the Swedish border, representative of the world record low Norwegian mortality rates. The focus on the role of women, given their access to more abundant material resources towards the end of the eighteenth century, is a most interesting explanation for the declining level of infant mortality.² Another well-researched locality is the fjord-parish Etne, south of Bergen, where infant mortality was significantly higher – also an area where the role of women is highlighted. More recent studies have been done on Asker and Bærum, south of Oslo, with infant mortality levels closer to the national average.

The present article will not attempt to match these penetrating studies of well-researched rural localities, nor William Hubbard's insights into many aspects of urban mortality.³ Rather it broadens the scope to include the whole country. My study is limited primarily to Norway's sparsely populated rural areas, where 90 percent of the population lived in 1801, a figure that was declining towards 60 percent by 1900, when the national infant mortality rate (IMR) had fallen below ten percent.⁴ My basic aim is to track the development of infant mortality rates in Norway over time, and, where possible, to say something about regional differences in the proportion of children who died before they reached their first birthday. The

1 Another version of this article will also be published in *Studies in Mortality Decline*. Report from the Mortality Studies Group, ed. Sølvi Sögner. Centre for Advanced Study, (Oslo, 2002).

2 Sølvi Sögner, "A Case Study of Women's Role and Infant Mortality," in *Women's politics and women in politics: in honour of Ida Blom*, eds. Sølvi Sögner and Gro Hagemann (Oslo, 2000), 325. Kungliga Statistiska Centralbyrån, "Årstedernas inflytelse på dödligheten," *Statistisk tidskrift*, 55–57 (1879), 87–121.

3 William Hubbard, "The Urban Penalty: Towns and Mortality in Nineteenth Century Norway," *Continuity and Change* 15:2 (2000), 331–350.

4 Statistics Norway, *Historical statistics 1994*, table 3.1.

data is taken from a variety of sources: the printed official statistics available from 1855 onward, the computerized version of these statistics covering the period from 1876 to 1920, and from statistics compiled from church records either in original or digital formats. As will become evident, I am heavily indebted to many persons and institutions that have facilitated access to the primary data. Although the picture of infant mortality is complex, I shall try to discuss a couple of alternative explanations behind the data series.

My focus on the geographical dimension may need some defense. For an historian it seems more natural to study first and foremost the dramatic decline in infant and other types of mortality over time; in some places nineteenth century infant mortality rates decreased from around one third of all births to current levels below one percent. Since a similar trend toward decline can be found in most places in our part of the world, the study of spatial differentials may seem redundant. As early as 1855 the pioneering demographer and sociologist Eilert Sundt showed that the mortality curves of different localities did not develop similarly, nor were they at the same levels. For instance, while towns usually displayed the highest mortality rates in the nineteenth century, those in rural areas often were relatively higher during the twentieth. While such spatial differentials and their relative development may be comparably slight, they can shed much light on the causes behind the general level and trends of the corresponding mortality rate. In addition, the recent news about problems with increasing mortality among small children in northwestern Russia, shows the value of historical regional studies for understanding the current situation. However, when medical personnel *in locu* report the problems *they* have finding straightforward explanations for contemporary increases in mortality, it should cause historians to be a bit humble about gleaning universal causal factors from their often scanty source material.

Perhaps because of the vagueness and complexity inherent in the discussion about causes of mortality, a number of competing hypotheses have been put forward. Given the seasonal differences in mortality cycles when comparing northern and southern Europe, the effect of climate has become a strong candidate.⁵ The replacement of the miasmatic paradigm with the bacteriological shifted the focus of researchers to other factors, but climate is still a basic element in mortality differentials. From the 1960s the main debate has been between researchers favoring the nutritional argument⁶ and those stressing the importance of the epidemic climate. A more recent twist to this debate is to combine these two viewpoints, formulating more clearly than McKeown a theory of the synergistic effect of malnutrition and

5 Kungliga Statistiska Centralbyrån, "Årstidernas inflytelse på dödligheten," *Statistisk tidskrift*, 55–57 (1879), 87–121.

6 Thomas McKeown, *The modern rise of population* (London, 1976).

disease, in addition to putting forward a competing theory focussing on the importance of social dislocation in order to explain mortality.⁷ For the development of infant mortality rates in particular, however, it is still topical to highlight the role of nutrition, since it seems that differential infant mortality rates may be heavily correlated with the use or lack of breast-feeding in different localities.⁸ While the cyclical dispersion of breast-feeding was important,⁹ it can certainly not explain all geographic differences. The mothers' child care practices more generally and, from ca 1900, public measures to improve the health of infants must have been important.¹⁰

Some of the vagueness inherent in determining the causes behind shifts in infant mortality levels is also mirrored in the authoritative *Norwegian Health Atlas*.¹¹ Although it cannot be proven, the authors find every reason to believe that the work of the health stations was a major influence behind the relatively low infant mortality in Norway in the twentieth century. The first such station was started in Oslo in 1911, in order to "provide inexperienced mothers with guidance, encourage and reward mothers who wanted to breast-feed."

The National Level

Official infant mortality rates for Norway exist from 1836, but only for the national level.¹² Figures for earlier periods must either be modelled on the basis of other available statistics, such as the age distribution in the 1801 census and the crude death rate from 1735, or be compiled from the baptismal and burial registers in the church books. The latter approach is very laborious since only a fraction of the church registers preserved from the eighteenth and nineteenth centuries have been digitized. There is also evidence of under-registration, especially of infant deaths, in the period before 1820, when standardized forms were lacking and the clergy kept their records in their own fashion. (To some extent this is compensated for in relative terms by a corresponding under-registration of births.) There were 320 parishes

7 Kari J. Pitkänen, *Deprivation and disease: mortality during the great Finnish famine of the 1860s*. Suomen väestötieteen yhdistyksen julkaisuja (Helsinki, 1993).

8 Anders Brändström, "De kärlekslösa mödrarna:" spädbarnsdödligheten i Sverige under 1800-talet med särskilt hänsyn till Nedertorneå. Umeå Studies in the Humanities, vol. 62 (Umeå, 1984).

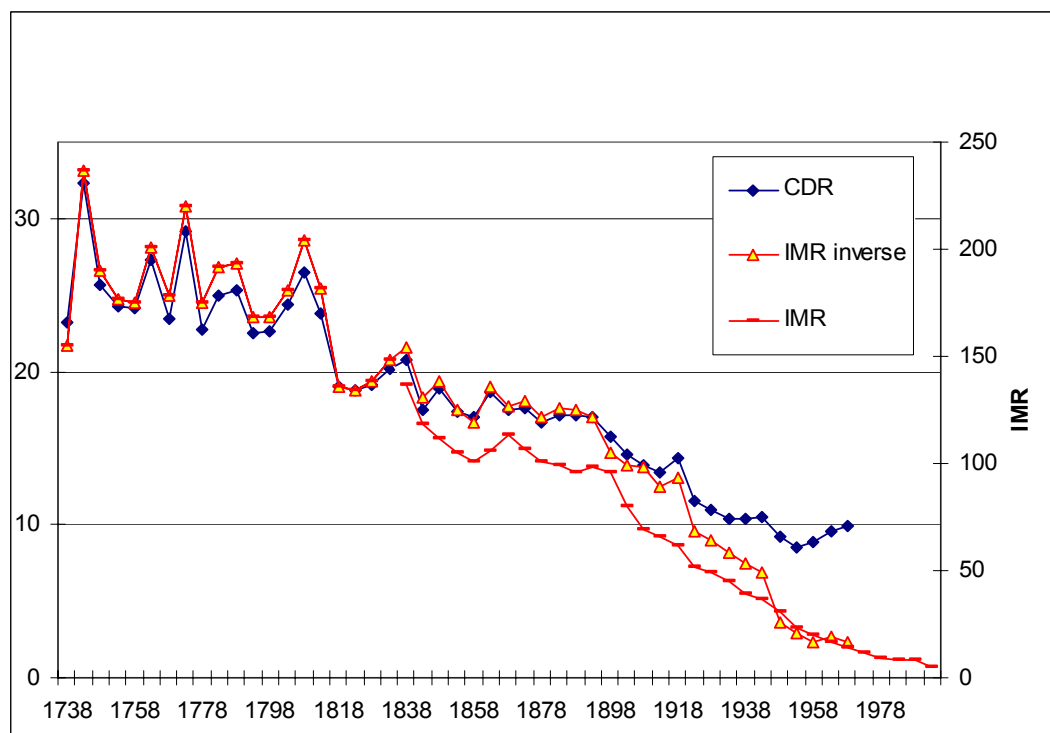
9 Marilyn Yalom, *A history of the breast* (New York, 1997).

10 Anne Løkke, *Døden i barndommen* (København, 1998).

11 Asbjørn Aase, *Nasjonatlas for Norge. Helse* (Hønefoss, 1996).

12 Statistics Norway, *Historisk statistikk 1994 = Historical statistics 1994* (Oslo, 1995).

Figure 1. Norwegian infant mortality rate (partly projected) 1735–1993.



Source: McCaa (1989) and Statistics Norway, Historical Statistic (1994).

in 1801, and the lack of standardization in the sources makes manual counting quite a challenge.

Figure 1 is an attempt to graph the development of the infant mortality rate and the crude death from 1735 to 1993. Before 1836 I have used a technique for backwards projection,¹³ and in order to test this, crude death rate the projection was also continued after that point in time. It can then be seen how the projection tends to overestimate IMR somewhat, which may be due to the disappearance of babies as emigrants.¹⁴ This was a less important factor before 1836, and it is also possible that the real IMR curve, especially during crisis years, could deviate more from the CDR curve, on which it is modelled. However, the general decline during the first part of the nineteenth century may be close to reality, since the local studies I refer to below also suggest a national rate of about 180 dead infants per thousand born around 1800. In addition, we may be confident about the disappearance of the

13 Robert McCaa, "Populate. A Microcomputer Projection Package for Aggregative Data Applied to Norway, 1736–1970," *Annales de démographie historique* (1989), 288–298.

14 Prior to 1866, emigration may be too small to support this hypothesis, although families with many children were an important part of early US emigration from Norway.

peaks after 1812 (with the exception of some localities) and the generally declining trend, especially after 1900. The 1860s and the two world war periods were exceptions with slightly increasing infant mortality levels.

How does this compare with data from other countries? In Sweden *Tabellverket* (Swedish Population Statistics) started compiling detailed aggregate data on the local level, as early as 1749.¹⁵ The Swedish IMR curve follows the Norwegian closely, although at a somewhat higher level, usually a couple of percentage points. When the Swedish series started, 1751–1755, 205.7 dead out of 1000 infants born were reported, while the projected figure for Norway is 177. Both series peaked in 1806–1810 with rates of 211.5 for Sweden and 204 for Norway. The first Norwegian empirical figure was 137 deaths per thousand for the mid-1830s compared to Sweden's 166.4. At the turn of the next century (1900) the figures were 100.5 per thousand for Sweden and 96 for Norway. Not until the Second World War did Sweden's infant mortality rate rank below Norway's (31 versus 37 deaths per thousand). These relative positions have since been maintained, with Norway now at a rate of one percent, while Sweden has declined to five deaths per thousand, reflecting the more centralized and urbanized Swedish society with easier access to medical information and services.

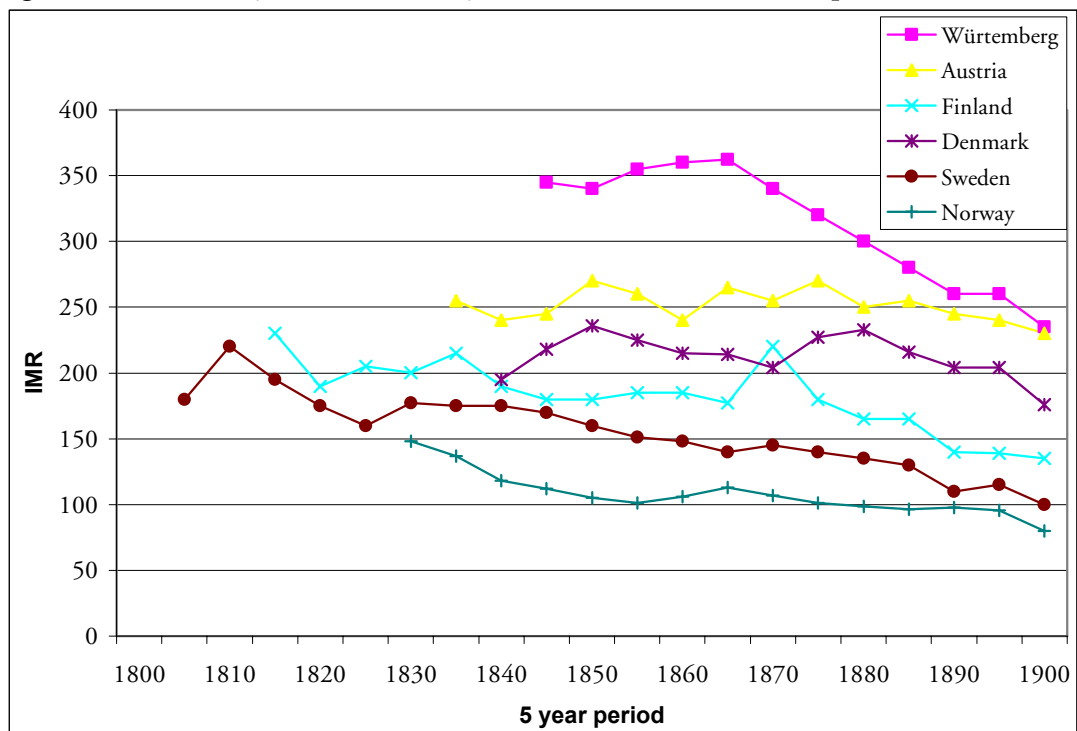
A comparison with several other countries undertaken around 1900¹⁶ shows that better conditions were generally provided for infants in the northern, Protestant countries than in the southern, Catholic areas. The chart from this report (Figure 2) shows how Norway was followed by Scotland, then Sweden and Denmark, and finally England during the second part of the nineteenth century. Austria, Italy and the southern German states can be found above the 25 percent line, while France had a rate only slightly above the best Protestant countries. The main exceptions from the described IMR divide through Europe are the rather inexplicably low level of Ireland and the high levels of Finland and Iceland (the latter not presented in the chart). This, as well as the high rates in Catholic countries, has been explained mainly by their relatively less frequent use of breast milk, and in the Finnish case, contagion from the east has been considered a factor.¹⁷ Among white immigrants to

15 The series 1749 to 1859 has been digitalized by the Demographic Data Base of Umeå University. Cf. <http://www.ddb.umu.se/index_eng.html>. Cf. also Statistics Sweden, *Befolkningens utvecklingen under 250 år. Historisk statistik för Sverige*, Demografiska rapporter, vol. 1999:2 (Stockholm, 1999).

16 Axel Johannessen, *Dødeligheden i Norge af børn under 1 aar* (Christiania, 1902).

17 Ólöf Garðarsdóttir, Loftur Guttormsson and Guðmundur Hálfðanarson, "Ungbarn og barnadaði á Íslandi 1771–1950. Nokkrar rannsóknarniðurstöður.," *Saga* (2001); Ulla-Britt Lithell, *Kvinnoarbete och barn tillsyn i 1700- och 1800-talets Österbotten*. (Uppsala, 1988). Kari J.

Figure 2. 19th century infant mortality rates for a number of European countries.



Source: Johannessen, *Dødeligheden I Norge af børn under 1 aar* (1903) og Løkke, *Døden I Barndommen* (1998).

the US, infant mortality rates were not much higher than in Norway around 1900, but probably significantly higher fifty years earlier, although early IMR figures for the US build on scanty evidence.¹⁸

The inadequate registration of vital events for most parts of the US renders detailed studies of age-specific mortality difficult, referring researchers to genealogies, retrospective census variables and church registers from selected congregations. England has better data from the 1860s making possible the mapping of the IMR on the county level.¹⁹ Throughout the nineteenth century, its variation among the regions was far from uniform, but the mean was quite constant, around 150 deaths per thousand, with a range from 70 to 250. For Germany one study uses regional

Pitkänen, "Infant Mortality Decline in a Changing Society," *Yearbook of Population Research in Finland* (1983), 46–74.

18 Rasmus Sunde, "Vikjer ved fjorden – vikjer på prærien. Ein demografisk-komparativ studie med utgangspunkt i Vik i Sogn" (Dr art, Universitetet i Bergen, 2001). Michael R. Haines and Samuel H. Preston, *Fatal years: child mortality in late nineteenth-century America* (Princeton, N. J., 1991).

19 Robert Woods and Nicola Shelton Woods, *An Atlas of Victorian Mortality* (Liverpool, 1997).

data from the last decades of the nineteenth and the first decades of the twentieth century to correlate CDR and IMR with various socio-economic and demographic background factors, the mean infant mortality declining from 250 to 70 deaths per thousand during the period.²⁰ The regression model shows that religion, urbanisation, population density and fertility were significantly related to mortality in the direction expected, while the effects of income were inconsistent. However, there was no correlation between population growth rates or the proportion of licensed doctors and mortality rates. A residual effect from the regional variable suggested that undocumented differences in nursing practices may have been important. Over time the regional mortality differentials became smaller.

In Denmark, a recent dissertation has established relatively stable IMR regions, with towns bringing up the infant mortality rates in their vicinity. Copenhagen pioneered the decline in IMR around 1900, although it had the highest rates earlier.²¹ Another study dealing with the decades around 1800 found higher rates, as well as more local and regional variations over time.²² Most notably in Sweden, the availability of series of local data from 1749 makes possible detailed study of the development of infant mortality for small areas. One group of experts has devised an ingenious special method to bring together similar localities in order to remedy the problem of small numbers from their tiniest geographical units.²³ When studied in this way, Gustav Sundbärg's authoritative division of Sweden into three ideal demographic units (1910) turns out to be misleading because of internal diversity. Even in the low mortality province of Jämtland on the border with Norway, some parishes displayed above average infant mortality. The discovery of contiguous high infant mortality parishes along the Swedish-Finnish border, where both sides were dominated by ethnic Finns,²⁴ points in the direction of the role of ethnicity as an interesting background factor there, as well as in multiethnic northern Norway.²⁵

20 Michael R. Haines and Hallie J. Kintner, "The Mortality Transition in Germany, 1860–1935: Evidence by Region," *Historical Methods* 33:2 (2000), 83–104.

21 Anne Løkke, *Døden i barndommen* (København, 1998).

22 Hans Chr. Johansen and Axel Skytthe, *Danish Infant Mortality*, (Odense, 2000), 13.

23 Anders Brändström, Sören Edvinsson and John Rogers, "Infant mortality in Sweden. Creating Regions from Nineteenth Century Parish Data," *Historical Methods* 33:2 (2000), 105–114.

24 Anders Brändström, "*De kärlekslösa mödrarna*": spädbarnsdödligheten i Sverige under 1800-talet med särskilt hänsyn till Nedertorneå, Umeå Studies in the Humanities, vol. 62 (Umeå, 1984); Kari J. Pitkänen, "Infant Mortality Decline in a Changing Society," *Yearbook of Population Research in Finland* (1983), 46–74.

25 Gunnar Thorvaldsen, "Infant Mortality in Northern Finland, Sweden and Norway," (Paper for the Social Science History Conference, Pittsburgh, 2000), 17.

Regional and Local Time Series

While the national series of published infant mortality rates for Norway extend back to 1836, the first on a more local or regional level were printed for the period 1856–1865 (NOS C No 1, *Folkemengdens bevegelse*) by *Tabellkontoret*, a forerunner of Statistics Norway. The administrative report unit chosen was probably a compromise between a table for all parishes, which proved too labor-intensive, and collapsing the information into a short table, listing each of the seventeen provinces.²⁶ Instead the country's 75 deaneries were chosen as the reporting level. Since IMR levels dropped significantly during the second half of the century, it is strange that the earliest regional data sets have never been exploited by researchers until recently. A possible explanation for this may be the incompatibility of the reporting level with modern tools, such as the Municipality Database, and the lack of computerized maps. These problems could, however, be overcome with OCR and cartographic software.²⁷

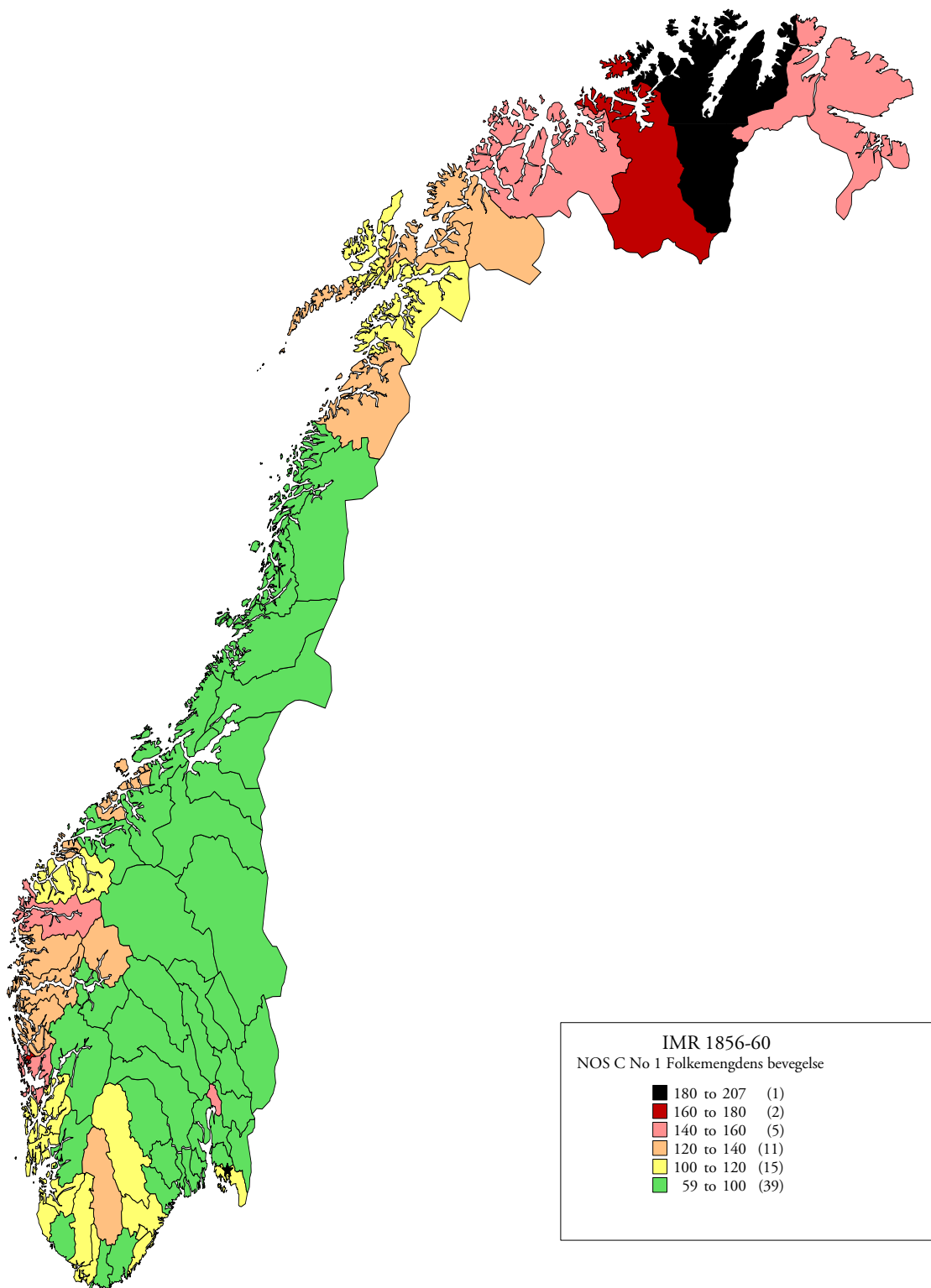
The resulting distribution of infant mortality rates for the last part of the 1850s across the Norwegian deaneries is shown on the map (Map 1).²⁸ Somewhat paradoxically, this map shows that the main explanation for the record low infant mortality rates in sea-oriented Norway can be found in the inland areas. While the national rate stayed above ten percent until the 1880s, the interior of the country is almost consistently below that threshold, and coastal deaneries often display higher figures. This is especially the case in the north where all deaneries reached the coast, and all deaneries lying north of the polar circle had rates higher than the average. The second high level area can be found along the coast and fjords of western Norway, especially in Nordfjord and around Bergen, whereas, in the Christiania area (Oslo), the high rate may have been due to urban influence. The third high level area is found in Setesdalen, a valley stretching northwards from Kristiansand. These landlocked deaneries form important exceptions from the coast-inland dichotomy, just as the coastal deaneries of the middle part of Norway consistently show below

26 *Province* is used for the Norwegian *amt* or *fylke* instead of *county* with its connotation of a much smaller area.

27 The tables were digitized with the OCR program Omnipage, and a modern municipality map was edited to show 1865 deanery boundaries derived from Harald Winge and Steinar Imsen, *Norsk historisk leksikon* (Oslo, 1999), using Mapinfo. Modern map coordinates from Mapinfo Corporation were chosen as a basis rather than historic municipality maps from the Norwegian Social Sciences Data Services, since the former use the same projection as Swedish and Finnish maps, making comparative regional studies across national borders more feasible.

28 The intervals and colors are the same as those used by Løkke (1998), giving a good impression of the higher proportion Norwegian parishes with IMR below 100, when compared to the Danish.

Map 1. Infant mortality rates, 1856-1860.



Source: Statistics Norway: Tablaux du mouvement de la population. I C No 1 1856-1865.

average levels. In the southern parts of Northern Norway, we find three deaneries with suspiciously low infant mortality rates, around 60 per thousand. This result necessitated a control against the church records, which confirmed the low number. No conspicuous lacunae in the burial registers could be found, for instance the parish of Alstahaug had as low an IMR as the whole Helgeland deanery, of which it is a part. Thus, both the highest and lowest infant mortality rates of pre-industrial Norway can be found inside the same region, Northern Norway, and in deaneries bordering on the sea.

The late 1850s was a period with relatively good harvests, a stable climate and few epidemics. In the early 1860s harder times struck, and harvest problems were reported by several administrative reports from the provinces (*Amtmannsberetningene* 1861–1865) due to bad weather. The epidemic climate also worsened with several waves of children's diseases, especially measles. This was followed by increased crude death rates and infant mortality rates, the latter rising from 101 to 106 deaths per thousand live births on the national level. A comparison of the maps for the two quinquenniums under scrutiny (last map not shown here), shows that the regional distribution of IMR levels had changed little. In southern Norway there was an even more pronounced inland-coastal pattern, and in the north we still see the contrast between areas north and south of the polar circle. The contrast between the western and eastern parts of the northernmost province, Finnmark, was more distinct, and in the southernmost deaneries the IMR increased markedly. On the other hand there was improvement in some of the deaneries of western Norway. A closer inspection of the deanery rates shows none below the seven percent mark, and in the southern parts of Northern Norway the level had increased above eight percent or by nearly three percentage points. The deteriorating conditions are shown by the 50 deaneries that experienced increased their infant mortality rates, while there was improvement in 23 deaneries. However, because increases as well as declines occurred in both high and low mortality areas, there was no correlation between the IMR level and its development from the late 1850s to the early 1860s. As expected, most deaneries kept their relative positions in terms of having high, medium or low infant mortality, but the changes that took place from one quinquennium to the next seem to be unrelated to the IMR level.

For the decade that followed, deanery data on burials by age also exist, but these statistics were reported for one year intervals, and in 1866 and 1867 all children below age six were grouped together. Rather than aggregating this cumbersome data set, I shall now move forward to 1876 from which time Statistics Norway reported

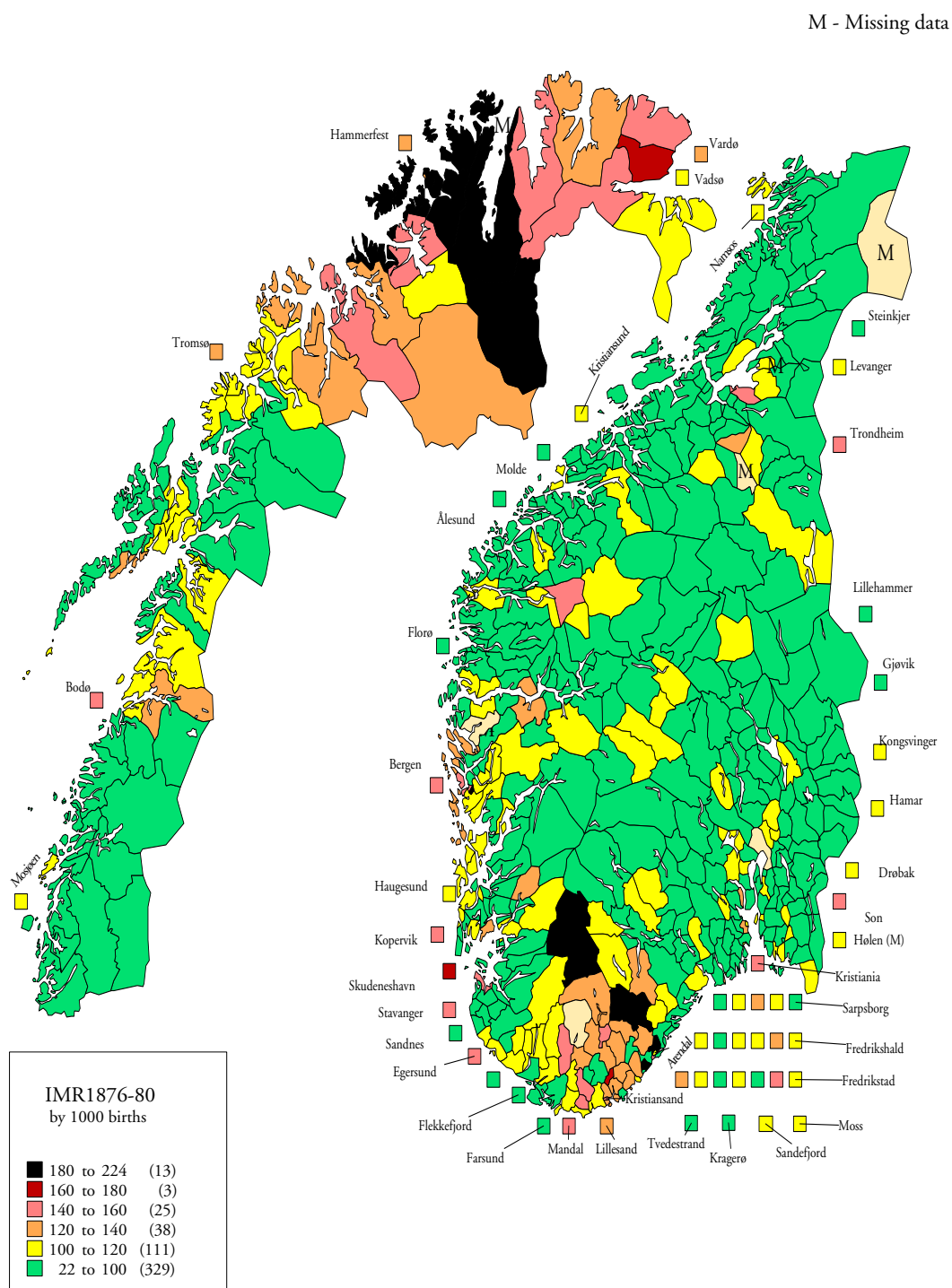
quinquennial data on infant mortality for each municipality.²⁹ Map 2 shows how the area expanded in which infant deaths per thousand fell below the 100 mark. This was not only due to declining mortality, but also to increasing geographic specificity. For instance, in the interior of Troms province two big “green” municipalities had previously been part of deaneries whose population predominantly lived along the coast. Thus the deanery and municipality maps are not readily comparable. Deaneries that contained population concentrations, often with the higher mortality found along the coast, also had thinly populated inland parishes which on the latter maps “turn green” just because they are singled out with additional borderlines. But in the western part of the country there can be little doubt that new low mortality areas emerged, even along the coast. Three types of high mortality locations remained, however. One was the valley of Setesdalen in the south, the second consisted of the northernmost province of Finnmark, including the northern parts of Troms, while the third included a number of towns, most of them lying along the coast.

Even though we have easy access to IMR figures for the following quinquenniums, for the sake of brevity we shall skip a couple of decades, when the long trend in the national rate was quite stable,³⁰ and examine the distribution of infant deaths over the Norwegian landscape right after the turn of the century, 1900 (cf. Map 3). This is the period when public measures for the improvement of infant health were being introduced and during which Professor of Medicine Axel Johannesen published his scientific findings on the phenomenon. With the advent of the new century, the average infant mortality rate for the country started to improve rapidly, having reached 80 deaths per thousand, a decline from 96 per thousand five years earlier. The general decline in most provinces necessitates the use of a new series of ranges on the map. The old ones are better for chronological comparison and for spotting “problem” areas, but they hide much of the regional variation. The green and yellow areas, denoting below average IMR, can be seen where low infant mortality was customarily found, but old high mortality areas in the south must now be included in this category. Something has obviously happened in Setesdal, and at the same time more towns have managed to creep below the average IMR level. Only seven municipalities fell into the “high” category, above 15 percent, and they are all found in Finnmark province and neighboring Kvenangen. North and east of Tromsø, nearly all municipalities stayed above the ten percent threshold,

29 Dead infants between one and two are also reported. From 1881 to 1920 such data are part of the Municipality Database of the Norwegian Social Sciences Data Service, cf. <<http://www.nsd.uib.no>>.

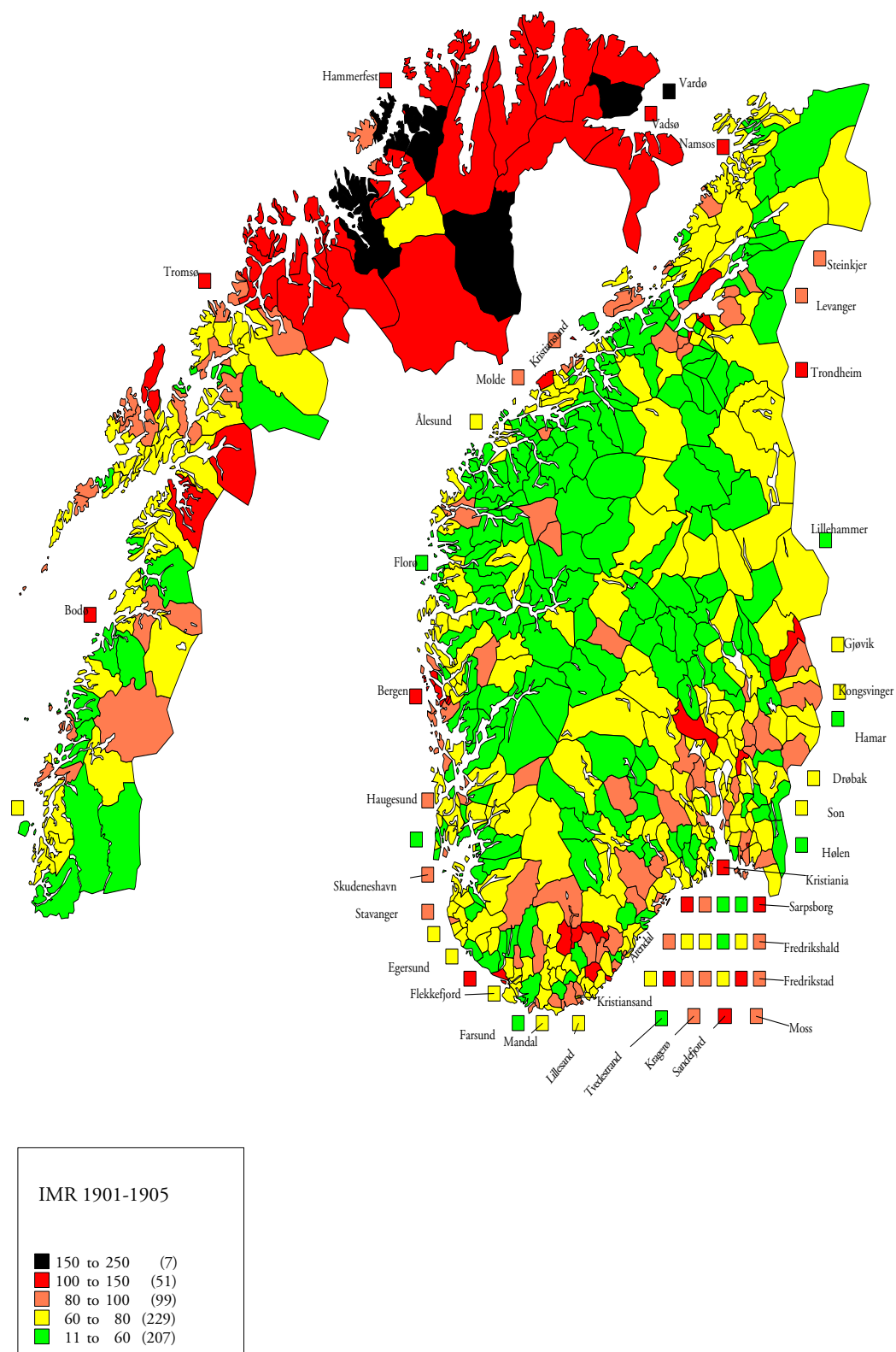
30 IMR increased by about one percentage point to 113 during the 1860s, and by the 1870s had declined to its previous level from the late 1850s (around 100).

Map 2 . Infant mortality rates, 1876-1880.



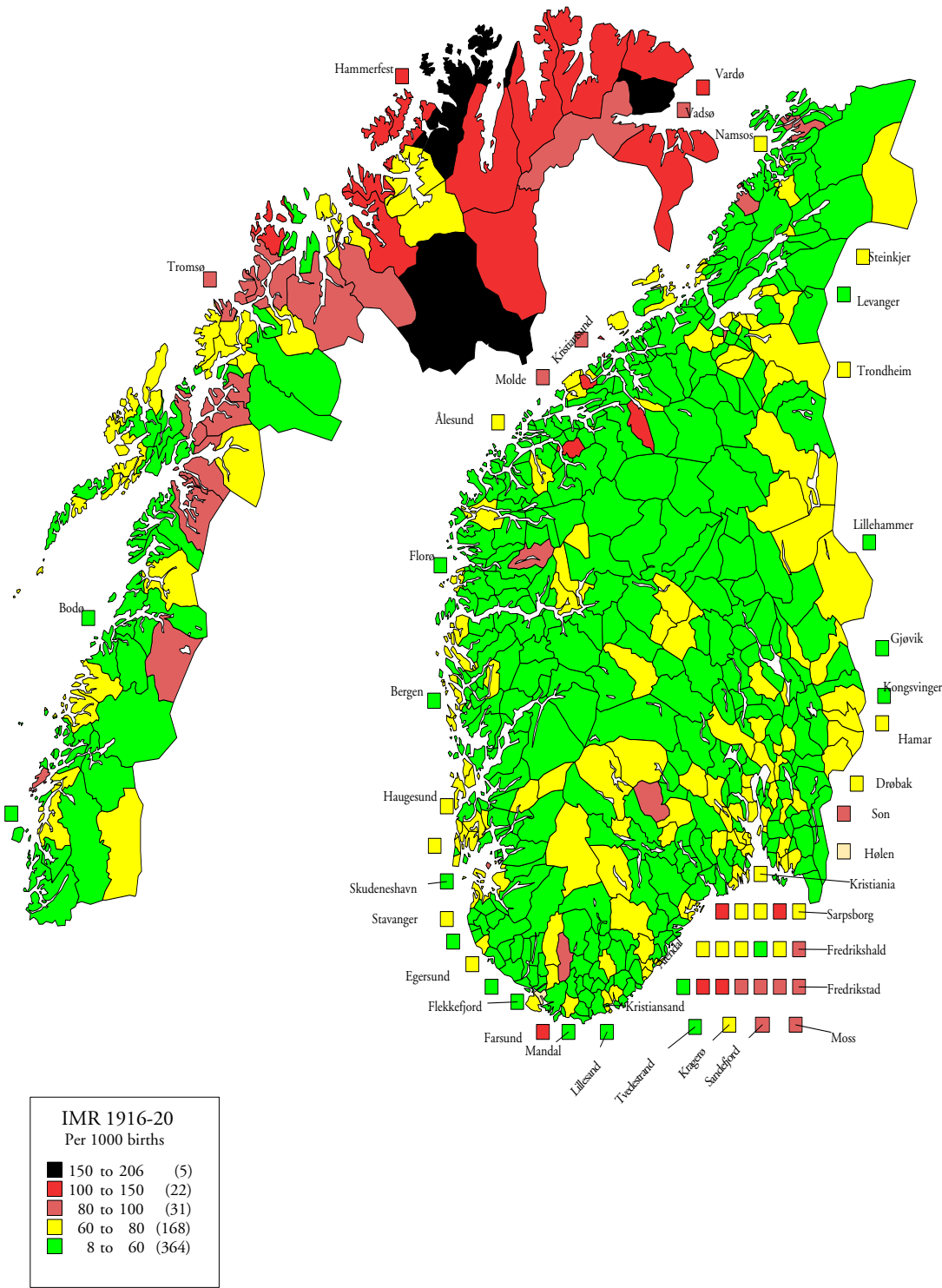
Source: Statistics Norway: Statistique du mouvement de la population. I C No 1 1876-18 80.

Map 3. Infant mortality rates, 1901-1905.



Source: Norwegian Social Sciences Data Service: The Municipality Database.

Map 4 . Infant mortality rates, 1916-1920.



Source: Norwegian Social Sciences Data Service: The Municipality Database.

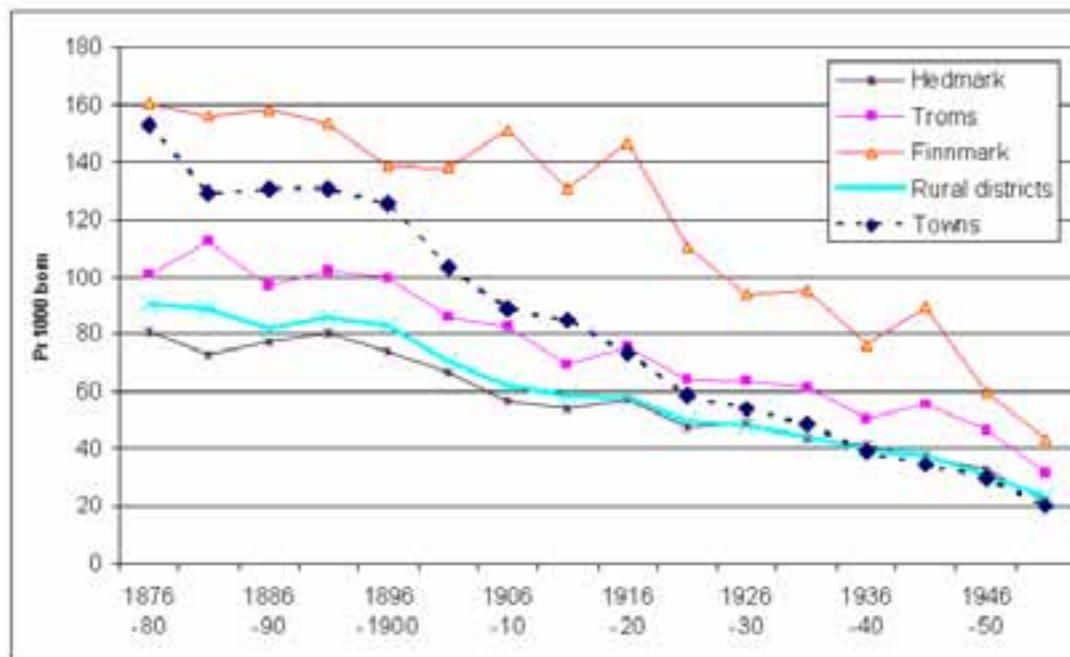
together with a number of towns in the south. A total of 99 municipalities had infant mortality rates one or two percentage points above average, but it is not easy to see any clustering in their distribution across the map, although there is a tendency for them to be found a bit inland.

The infant mortality rate continued its decline throughout much of the twentieth century. This overview of its development on the local and regional level will be concluded by examining the period from 1916 to 1920. This time span includes the second part of World War I, in which Norway was “the neutral ally”; the country did not participate directly, but in economic terms was part of the allied war effort with subsequent high costs of living and scarcity of some consumer items. In addition the great influenza pandemic, 1918–1919, hit Norway hard, creating the last spike in Norway’s crude death rate. Since this virus epidemic mostly struck young men, however, its effect on infants was probably rather insignificant. The national average IMR for this quinquennium was down to 62 deaths per thousand, continuing its secular decline.

Our 1916 to 1920 IMR municipality map (Map 4) uses the same ranges and colors as the map showing the situation just after the turn of the century. South of the polar circle there was a marked increase in the extent of the areas with green color, which indicates areas with infant mortality below the new national average. Furthermore, a large proportion of the towns fall into the categories below or just above the average IMR. North of the polar circle there were also several municipalities where infant mortality had improved. But most places in Finnmark and the northern part of Troms province still had high infant mortality rates, and, as in the period 1901–1905, all municipalities in the category above fifteen percent were part of (an extended) Finnmark. The line graph of selected provinces in Figure 3 clearly shows how the secular decline in Finnmark’s IMR was slow for a couple of decades after the towns, as a statistical category, started to rapidly improve their levels around the turn of the century. Before and during World War II the difference between Finnmark and the rest of the country became quite small, but there were still pockets of infant mortality well above average. Most notable is the predominantly Sami municipality of Kautokeino, where the IMR remained above five percent in the early 1950s.³¹ The district doctor found it difficult to establish the cause of death due to inadequate transportation during the long winter. By the 1980s most of the inter-provincial differences in infant mortality had disappeared, with

31 Knut Rein, “Spebarndødeligheten i Kautokeino 1946–1955,” *Tidsskrift for Den norske lægeforening*, 76 (1956), 815–816. For a study of ethnic mortality differentials in the US, see S. R. Johanson and S. H. Preston, “Tribal Demography: The Hopi and Navaho Populations as seen through the census manuscripts of the US Census of 1900,” *Social Science History*, 3:1 (1979), 1–33.

Figure 3. Infant Mortality Rates 1876–1950 for Selected Provinces and Rural/Urban.



Source: Becker, *Trend of mortality and causes of death in Norway 1856–1955* (1961).

Rogaland province remaining highest due to the relatively frequent instances of sudden infant deaths.³²

1800

As stated above, Norway does not have published infant mortality rates for the period before 1836, and no regional series of this kind before 1856. This is a serious lack of basic data, since both local Norwegian data and the national time series for Sweden show a substantial decline in IMR levels during the preceding decades.³³ An attempt has been made to model the IMR development for each of the four dioceses back to 1736 on the basis of crude death rates, census age distributions and

³² Asbjørn Aase, *Nasjonalatlas for Norge. Helse* (Hønefoss, 1996), 44f.

³³ Sølvi Sogner, “A Case Study of Women’s Role and Infant Mortality,” in *Women’s politics and women in politics: in honour of Ida Blom*, eds. Sølvi Sogner and Gro Hagemann (Oslo, 2000), 325; Anders Brändström, Sören Edvinsson and John Rogers, “Infant mortality in Sweden. Creating Regions from Nineteenth Century Parish Data,” *Historical Methods* 33:2 (2000), 105–114.

other predefined conditions.³⁴ However, as is evident, to the degree that infant mortality behaves differently from the mortality trend in general, which was probably the case during the several crisis years of the eighteenth century, IMR levels for different regions will not be truly comparable.

An obvious alternative is rather to work from the entries in the baptism and burial records of the church registers. These exist from 1623, but it is unfortunately not until the eighteenth century that they cover a substantial number of Norwegian parishes and report age of death. Before the second decade of the nineteenth century these sources had no predefined layout, so the variation in contents, style and handwriting is great. Some clergymen have provided us with neat tables of the number of dead and children born at the end of each year, increasing our confidence in the reliability of his information, while others kept their records in the form of a diary, noting weddings, burials and baptisms chronologically. It has been estimated that the proportion of missing cases may be as high as one third, but around the end of the eighteenth century, a more common estimate is eight or ten percent.³⁵ There may have been local variation in under-registration, or perhaps infant burials were not considered as important entries as other vital events.³⁶ As mentioned above, missing deaths may to some extent compensate for the missing baptismal entries.

Since the quality of some church registers prior to 1812 is inadequate, we shall never know the exact infant mortality rate for the period before and during the last Norwegian mortality crisis at the time of the Napoleonic Wars. But it is still possible to base reasonable estimates on local studies. Several such investigations have already been conducted and are primarily of two types. Classic family reconstitution has been most usual with its rich possibilities to combine several data types for source critical purposes. Especially when information from many sources can be utilized through a database system,³⁷ the estimated IMR level, is in all

34 Gunnar Thorvaldsen, "Infant mortality in Norway 1735–1900. An overview," (Conference paper, Umeå, 1999).

35 Gunnar Thorvaldsen, *Håndbok i registrering og bruk av historiske persondata* (Oslo, 1996).

36 Ragnhild Høgset, "Begravelsesskikker og trosforestillinger i det gamle bondesamfunnet. – en feilkilde når en bruker de gamle kirkebøkene til å studere dødelighet?" *Historisk tidskrift*, 68:2 (1990).

37 Ståle Dyrvik, "Spedbarndøden i Etne prestegjeld 1716–1900," in *Festskrift til Historisk institutts 40-års jubileum 1997*, eds. Edgar Hovland, Ståle Dyrvik and Geir Atle Ersland, (Bergen, 1997), 131–150. Sølvi Sogner and Gunnar Thorvaldsen, "Differential Infant Mortality in Rural Norway: A Comparison of a High and a Low Mortality Region," (Social Science History Association Conference, Fort Worth 1999), 26.

probability, correct for the local area in question. Even though migrants may be under-represented or some burial entries are missing, the IMR levels reported in most reconstitution studies should be comparable for different parishes and not much under the “true” number. The most recent overview of such studies can be found in a monograph by Margunn Skjei Knudtsen.³⁸

The other type of study has concentrated on several demographic phenomena, including mortality, analyzed on the basis of information about the population of 45 randomly chosen parishes in the 1801 census.³⁹ In addition this project used record linkage techniques to include data from the church registers for two to five years around 1801, combining the information at the individual level. Because record linkage usually skews the resulting sample of linked persons towards non-migrants and the more wealthy, this may have underestimated mortality among the propertyless, but it must still be safe to say that the farmers did not experience lower mortality than the cotters in early nineteenth century Norway. While Engelsen’s primary aim was to study social mortality differentials, he also presented results on infant mortality in the period from 1802 to 1803 for combined groups of parishes. Unfortunately the results are not comparable with other IMR rates, since he did not use the number of births as the denominator, but rather the number of children below age one in the 1801 census. Because infant mortality naturally affects the number of surviving infants counted in any census, both the numerator and the denominator in his calculations have been affected. Not only does this render his figures incompatible with other studies; the method also means the differences reported between parishes and regions in his study are unreliable. By using the number of births in the parishes as reported by Haavet, however, it has been possible to recalculate Engelsen’s figures into ordinary IMR estimates.⁴⁰

38 Margunn Skjei Knudtsen, *Fra frelse til helse: spedbarnsdødelighet og omsorgssyn i Norge ca 1700–1830 med særlig vekt på forholdene i Vår Frue sokn, Trondheim* (Trondheim, 1997), 83.

39 East Norway parishes: Borge, Onsøe, Aas, Sørums, Ullensager, Tryssild, Reendahlen, Aal, Sigdal, Eger, Lier, Hurum, Bolloug, Ramnæs, Sem, Thiølling, Hitterdal, Vinie; South Norway parishes: Gierrestad, *Sønneløv* (part of Øster Risør parish), Walle, Mandal; West Norway parishes: Lund, Egersund, Wigedahl, Quindherret, Fanøe, Lindaas, Leganger, Kind, Selløe, Vandelven, Stranden, Sundal; Middle Norway parishes: Ørkedal, Meldal, Hitteren, Frosten, Inderøe; North Norway parishes: Brønøe, Lødingen, Ofoten, Quædfjord, Carlsøe, Loppen.

40 Engelsen reports neither the number of dead infants in the parishes, nor the number of infants according to the 1801 census, presumably because a two year span is too short to report infant mortality rates on the parish level. I had to reconstruct his denominators from the 1801 census database in order to calculate IMR for the regional groups of parishes.

Table 1: Infant mortality rates for regional groups of parishes, 1802–1803, using the number of infants born or the number of infants in the 1801 census.

Parishes	Baptized 1802	Baptized 1803	Dead <1 1802–1803	Regional IMR	Engelsen
East	1403	1629	517	170.6	198
South	260	280	100	185.1	196
West	592	590	299	253.4	204
Middle	527	528	99	94.0	105
North	308	313	125	201.0	202
All	3090	3340	1141	180.9	177.4

Source: Rolf Engelsen, *Sosiale skilnader i mortalitet på landsbygda i Norge i åra 1802 og 1803*.

Elisabeth Haavet, *Avvik eller uhell? Ugifte foreldre omkring 1800. Hovedoppgaver*, Bergen, 1982.

Table 1 shows considerable differences in infant mortality between the five regions into which the 45 parishes were grouped. In the western part of the country about one fourth of the infants died, while the southern and eastern parishes had IMR levels somewhat below 20 percent. The IMR for central Norway of less than ten percent is suspiciously low, but before dismissing it on a source critical basis, it should be remembered that this was also a region with very low proportions of dead infants in the 1850s, at which time more trust can be placed in the primary material. As might be expected, the IMR figure reported for the parishes in northern Norway was higher than the average, but still significantly lower than the figure for the western part of the country. The years chosen by Engelsen may also have been special. In addition, considering the small number of parishes he has in a couple of regions, peripheral areas can affect the IMR decisively. For instance, in the northern parish of Ofoten, the IMR for 1802–1803 is close to Engelsen's average figure for his northern parishes, but the IMR the whole period 1799 to 1803 is significantly lower, only 122.2 deaths per thousand.

Ideally, IMR figures should be computed for as many parishes as possible in order to check the regional figures above and provide more detailed information on the local level. Moreover, this exercise should be done for a period as close to the 1801 census as possible, in order that its background variables may be used in multivariate analysis. This sizable task demands more time and resources than are presently available, but it is still possible to accumulate the information that is most readily at hand. In addition to results from the family reconstitution studies, I have exploited the microdata that have been digitized from the church registers for the period under examination and have also done some manual counting from the microfilmed versions of the original sources. In addition, I am indebted to colleagues who have provided information from private databases. While information about individual parishes from different sources may not be completely comparable,

it still provides a basis for evaluating the regional figures. In this way infant mortality rates around 1800 for a total of 56 parishes can be reported.⁴¹

These results are shown in Map 5. As might have been expected, the picture is rather heterogeneous, with church books for neighboring parishes reporting IMR figures at the opposite ends of the scale. These differences may have been caused by the under-reporting of infant deaths, local epidemics of children's diseases hitting at random just before or after the period investigated, and the general problem of small numbers in single parishes. The number of rural parishes showing the highest infant mortality in the west and the lack of such parishes in the eastern part of the country, however, lend additional support to the differences found between these two regions when Engelsen's numbers are recalculated. In the other regions too few parishes have yet been studied to draw any real conclusions, but I would like to point out the low-level parishes in the middle of the country and the heterogeneous, in-between results in the north. The results for individual parishes are given in Appendix 3.

While Engelsen's recalculated figures produce a national IMR of 177.4 pro mille, my own result is 180.9, which is quite close to the estimate of 190 made previously.⁴² Since the figure calculated for 1801–1805 with the projection technique described above was also 181, we should be able to say rather confidently that the infant mortality rate of Norway at the start of the nineteenth century was close to 18 percent. The Swedish figure for this quinquennium is 186.1 per thousand with females at 173.3 and males at 198.3; a similar sex difference could probably be found from the Norwegian individual level data. Between 1749 and 1815 the Swedish five-year IMR varied between 186 to 222 per thousand.⁴³ If the assumption is made that the relative variation in IMR in the two countries was proportional to the variation in their respective crude death rates, it may be estimated that the Norwegian IMR varied between 172 and 196 deaths per thousand during the period from 1749 to 1815.⁴⁴ (By plotting the IMR and CDR

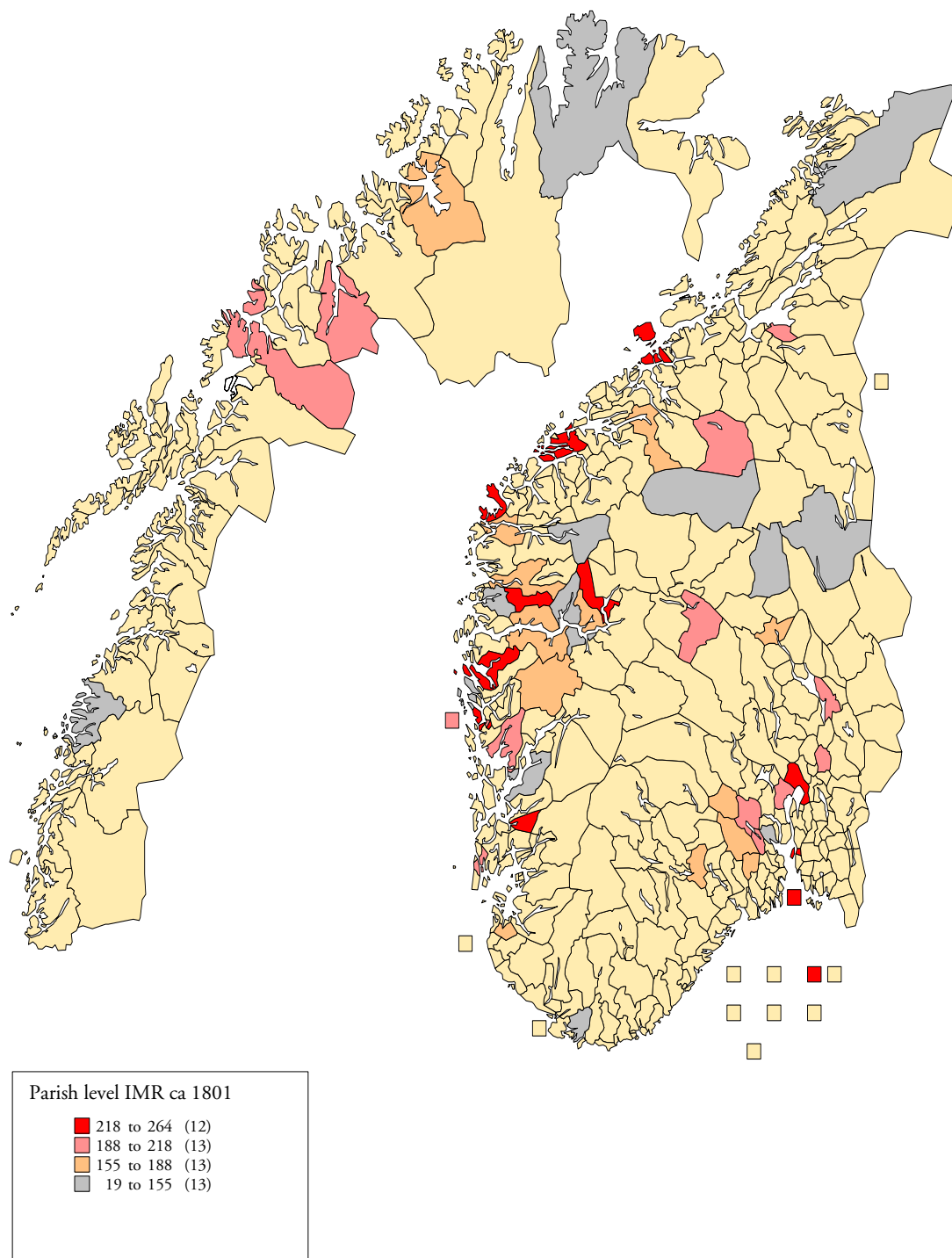
41 Six of these were also part of Engelsen's sample of 45 parishes. I am grateful for data from Arnfinn Kielland, Solfrid Fagertun, a number of theses, the Province Archive in Sogn and Fjordane, and the Digital Archive. Cf. the table in appendix 3. I am especially grateful to Eli Fure for providing both data for Asker/Bærum parish and for useful comments on a draft version of this article.

42 Ståle Dyrvik, "Poteta, dødsrata og demografien," *Historisk tidsskrift*, 57:3 (1978), 269–279.

43 Statistics Sweden, *Befolkningsutvecklingen under 250 år. Historisk statistik för Sverige*, Demografiska rapporter, vol. 1999:2 (Stockholm, 1999).

44 CDR varied for Sweden between 24.38 and 32.97, and for Norway from 22.5 to 29.1‰.

Map 5 . Infant mortality rates around 1800 for 56 out of 330 parishes.



Source: Appendix 3.

for Sweden in the same diagram, this assumption can be shown to be true except during the crises in the 1770s and around 1810, when the CDR increased relatively more than the IMR.) The projected Norwegian IMR varied between 168 and 220 per thousand, which is closer to the variation in Sweden. Until the church registers for more parishes have been studied for a longer period, we must be content to suppose that the quinquennial infant mortality rate probably stayed close to, or above, 17 percent from 1750 to 1815 and did not peak at much more than 20 percent. The annual or local IMR may, of course, have been lower or higher.

In summary, the infant mortality numbers above confirm the hypothesis that Norway recorded relatively low national infant mortality rates for much of the last two or three centuries. They also indicate a pattern of regional differentials, with the coastal areas reporting higher levels than the interior. For the first six or seven decades of the nineteenth century, the high coastal levels could be found especially in the western parishes north and south of Bergen. From the 1870s, however, the IMR declined in those areas, and a little later the high rates in Setesdalen disappeared, leaving the parishes north and east of Tromsø as Norway's high infant mortality area. The southern part of Northern Norway, on the other hand, consistently reported very low infant mortality rates. Until the first couple of decades of the twentieth century, many towns reported higher IMRs than the rural areas. Both "urban" and "coastal" may be seen as proxies for "densely populated," but from World War I there was a tendency for inland areas, rather than the coast, to report the highest infant mortality.

Discussion

We are fortunate to have source material enabling us to map the development of regional and even local levels of infant mortality in Norway from the second half of the nineteenth century. With much effort it is also possible to assemble data from the last part of the previous century, as I have done for the time around 1800. However, as stated previously, it is much more difficult to explain the regional IMR differences and their development over time. Even doctors present in Finnmark in the 1950s or in northern Russia today cannot find straightforward reasons for the above normal infant mortality figures. Even so, I shall attempt a discussion of possible background factors more with the intent to stimulate future data collection and research than to present an overall standard explanation.

First, there is synergy between food supply and infections, which has been the basis of so much controversy in the debates about historical mortality. The question of nursing is postponed here to concentrate on a discussion of the possibility that infant mortality was high because people did not have the resources necessary to

feed their families. The background is provided by the simultaneous introduction of the potato and the decline in mortality with the disappearance of crisis spikes. Even in a society where breast-feeding was usual, the nutritional conditions of the parents could be important for infants. But there is much counter-evidence. As shown in the maps, nineteenth century infant mortality was higher in most coastal areas where access to fish was better than in the low mortality inland areas mostly dependent on agricultural food production. Researchers have also found few signs that IMR differences were related to the social position of the children's families, except where the reduced levels among the lower social classes were extreme.⁴⁵ When the IMR fluctuated less than the CDR in Sweden during the crises of the 1770s and around 1810, this provides further evidence that the food supply was not the key factor behind infant mortality. Still, nutrition may have played a certain role for infants during the severe deprivation crises prior to 1815 and may have also had some effect in the growing urban centers later on. However, it is not likely to have had much importance as an explanatory factor for an IMR level of 18 percent around 1800 or 10 percent around 1900.

Thus it becomes more interesting to juxtapose the infection factor against different standards of child care, especially different ways of nursing children. Studies from the other Nordic countries have shown very convincingly how the practice or lack of breast-feeding may have had long lasting effects on IMR levels and how changes could be dramatic. In the Haparanda area in northern Sweden infant mortality declined from levels around one third of those born to levels below one fifth in connection with the midwife's breast-feeding campaign in the 1850s. The cause-effect relationship has been demonstrated convincingly in a number of ways.⁴⁶ Simultaneously, in northern Finland in Ylitorneå parish an ardent campaign by the vicar in favor of better child care, including nursing, brought the IMR down by similar proportions.⁴⁷ For Denmark a recent doctoral dissertation has shown the relationship between nursing practices and infant mortality figures on the parish level for many regions during the second half of the nineteenth century.⁴⁸ In Iceland

45 Eli Fure, "Spedbarndødelighet og sosiale forskjeller i Asker og Bærum 1814–1878. En metode for studier på individnivå," *Heimen* 37:4 (2000), 293–304; Rolf Engelsen, "Mortalitetsdebatten og sosiale skilnader i mortalitet," *Historisk tidsskrift* 62:2 (1983), 161–202.

46 Anders Brändström, "De kärlekslösa mödrarna." *Spädbarnsdödligheten i Sverige under 1800-talet med särskilt hänsyn till Nedertorneå*. Umeå Studies in the Humanities, vol. 62 (Umeå, 1984).

47 Kari J. Pitkänen, "Infant Mortality Decline in a Changing Society," *Yearbook of Population Research in Finland* (1983), 46–74.

48 Anne Løkke, *Døden i barndommen* (København, 1998).

the national IMR, between 25 and 30 percent prior to 1870, was consistently related to feeding practices that did not include using breast milk.⁴⁹

Seen against this background, the propensity for mothers in some areas or belonging to specific ethnic groups not to breast-feed during certain epochs has been called one of the biggest mysteries of historical demography. On the face of it, breast-feeding may seem to be the obvious one-and-only answer to all questions about infant nutrition. On closer examination, however, it turns out that the author of the standard popularized Norwegian reference book to promote breast-feeding has been able to fill almost 300 pages with detailed advice to mothers who want to breast-feed. The book was first published out of frustration, because so few women were able to give their own milk to their infants, even though they really wanted to. The need for guidance through the maze of complications is evidenced by the successful printing of four editions since 1970.⁵⁰ The book lists common myths about breast-feeding and why it has been believed to be more complicated than artificial nourishment: it ties down the mother; it creates a mess; the mother becomes listless and feels that special food, exercises or other precautions are necessary; the shape of the female body becomes distorted; breast-feeding is fattening; or breast-milk is too thin. The crucial factor in all this may be the self-confidence the mother needs to trust her own milk supply. This self-confidence will naturally be affected by the prevalent attitudes in her social environment and by whether she is given the opportunity and resources to spend enough time with her baby.

Cycles in the use of mother's milk are well-known from the twentieth century. Local studies from Norway indicate that in the first decades of the twentieth century more than 90 percent of the women breast-fed, a proportion that had declined to 20 percent by 1960, before breast-feeding once again became nearly universal.⁵¹ A recent study gives ample evidence of similar cycles in earlier centuries. The erotization of the breast during the Renaissance has been linked to a decline in breast-feeding by many mothers, especially those who could afford to employ wet nurses. By the beginning of the eighteenth century, the "high-culture ideal was still that of the 'unused' breast." More than half of the British women did not breast-feed their own children, and from Paris about half of the children were sent to wet nurses in the countryside by the middle of that century. By 1800, however, breast-feeding

49 Ólöf Garðarsdóttir, Loftur Guttormsson and Guðmundur Hálfðanarson, "Ungbarna- og barnadauði á Íslandi 1771–1950. Nokkrar rannsóknarniðurstöður," *Saga*, (2001).

50 Elisabeth Helsing, *Boken om amming*, 4 ed. (Oslo, 1995).

51 Ida Blom, "Ammerutiner – et stridsspørsmål mellom leger og mødre," in *Klokskap og kyndighet: Kari Martinsens innflytelse på norsk og dansk sykepleie*, eds. Marit Kirkevold, Finn Nortvedt and Herdis Alsvåg (Oslo, 1993), 114–124; K. Liestøl, M. Rosenberg and L. Walløe, "Breast-feeding practices in Norway 1860–1984," *Journal of Biosocial Science* (1988).

had been reintroduced on a large scale in both France and Britain. During the French Revolution the duty of loving mothers to breast-feed was contrasted with the tainted milk given to aristocrat children of the Ancien regime by wet nurses. Yalom gives a vivid description of commissioners drinking water splashing from the breasts of a goddess statue on the Place de la Bastille in 1793, urging the astonished onlookers to become breast-feeders. Both in France and Germany the ideal of the breast-feeding mother was portrayed in sentimental paintings and poems.⁵²

A plethora of printed information in favor of the practice was connected with the late eighteenth century nursing campaigns in many places. The first document arguing the benefits of breast-feeding may be a doctoral dissertation presented in 1729 and printed in London in 1748.⁵³ Such information was made more available through the publication of “An Essay upon Nursing and the Management of Children, from their Birth to Three Years of Age.”⁵⁴ This author thought that “this Business has been too long fatally left to the Management of Women” and strongly warned against giving infants cow’s milk or other surrogates. The main message was that “... no Child should ever be crammed with any unnatural Mixture, ‘till the Provision of Nature was ready for it; nor afterwards fed with any ungenial alien Diet whatever, the *first three Months*,”. Cadogan’s essay must have circulated widely, as it was printed eight times; a Swedish edition was printed in Stockholm in 1784.⁵⁵

As early as 1755 the Collegium Medicum had the Royal Printing Office publish a 16 page brochure in Swedish entitled “On the Health and Care of Infants,” strongly advocating the practice of breast-feeding. The authorities especially addressed the undesirable nursing practices in northern Finland, pinpointing “the un-Christian habit in several places in the provinces of Sweden, especially in Ostrobothnia among common people ... that the mothers, even if this is not caused by any inability, deny their infants the correct and natural nourishment of mother’s milk, only because it is convenient due to their work and activities outdoors,...” The brochure then goes on to describe the practice of using cow’s milk in a horn hung over the child’s cradle. I have, however, found no similar information printed in

52 Marilyn Yalom, *A history of the breast* (New York, 1997), 105 and 117.

53 Richard Conyers, *De Morbis Infantum*, Printed 1748 (London, 1729). Together with many other classic works on neonatology, this text was available on the Internet at <http://www.neonatology.org/classics/>.

54 William Cadogan, *An Essay upon Nursing and the Management of Children, from their Birth to Three Years of Age. By a Physician* (London, 1749).

55 According to the digitized Swedish National Library system, *Libris*.

Finnish until the Finnish State Medical Board in 1844 printed an 11-page pamphlet urging the benefits of breast-feeding.⁵⁶

In the meantime literature on child care was also published in Denmark-Norway, but somewhat later than in Sweden. Breast-feeding was recommended in a couple of medical books and a number of articles published in the 1770s and 1780s.⁵⁷ The literature also warned against the dangers involved in taking new-born children to church for baptism during the winter. After a pause during the first decades of the nineteenth century, a new wave of literature about infant care appeared in the 1840s,⁵⁸ for instance, a Danish textbook for midwives propagating rules about breast-feeding that are in accordance with late twentieth century advice.⁵⁹ It has been established that information about adequate child care was available, but the question is still how widely it was circulated throughout the Nordic countries. It is generally assumed that the eighteenth century was the time when people started to read not only for entertainment or for religious purposes, but also in order to find useful information. At least in Sweden, many children had learned to read by that era, as can be seen from the dean's inspection in the parish of Råneå in Norrbotten in 1720. Around 1850 a significant part of the Swedish and Finnish population could read, but most other European countries were less literate.⁶⁰ Thus, in most of Scandinavia, lack of access to information among the general public was in itself not the crucial factor for medical authorities wanting to reform nursing habits. More decisive was the resistance to reforming age-old feeding practices that were ingrained in the local culture, especially if the reformers were conceived as representing authorities whose general aim it was to get rid of "non-national" ethnic minority cultures. One author has singled out food habits as the last factor in an ethnic group's special culture to disappear in the acculturation process after

56 Oiva Turpeinen, "Infant mortality in Finland 1749–1865," *Scandinavian Economic History Review*, 27: 1 (1979), 1–21; Collegium Medicum, "Om Späda Barnens Ans och Hälsa," ed., G William Kammecker (Stockholm, 1755), 16.

57 Margunn Skjei Knudtsen, *Fra frelse til helse: spedbarnsdødelighet og omsorgssyn i Norge ca 1700–1830 med særlig vekt på forholdene i Vår Frue sokn, Trondheim* (Trondheim, 1997).

58 Gerda Bonderup, "Døden i barndommen. Melding av Anne Løkkes bok," *Historie* (1999), 136.

59 C. E. Levy, *Udtog af fødselsvidenskabens som lærebog for jordmødre* (København, 1843).

60 Robert Darnton, "History of Reading," in *New Perspectives on Historical Writing*, ed. Peter Burke (University Park, Pennsylvania, 1991), 140–167; Egil Johansson, *En studie med kvantitativa metoder av folkundervisningen i Bygdeå socken 1845–1873* (Umeå, 1972); Egil Johansson, *The history of literacy in Sweden: in comparison with some other countries* (Umeå, 1977).

migration.⁶¹ Another American study from the early twentieth century found that breast-fed infants increased their survival chances threefold.⁶²

It is thus apparent that the inclination of mothers to breast-feed has indeed varied over time and from place to place. Its potentially profound impact on infant mortality rates is also well-established. The velocity of such changes may be difficult to determine because of random short-term fluctuations and group differentials in small areas, but A. Brändström's research in Torneå suggests that much can happen in less than a decade. We have also seen that fashions and information connected with different nursing techniques did not stop at national borders – until 1814 Norway was part of the Danish Kingdom which also contained German states. The classic story about how prominent constitutional assembly member Peder Anker, squire on Bogstad estate outside Oslo, had his linen washed and starched in London, testifies to the importance of international style among the leading class in Norway. Or take the founder of the Figenschou dynasty in Troms, who was probably the cousin and Copenhagen neighbor of Niels Stensen, a frontal figure in seventeenth century European medicine.⁶³ The trade and migration routes between the Norwegian coast communities in the south and the rest of Europe were also channels of information.⁶⁴ The more than 24,000 people who had surnames of foreign origin according to the 1801 census, also suggest the free flow of cultural impulses from abroad.⁶⁵

Even though the relationship between breast-feeding and a lower IMR has been so convincingly demonstrated for Norway's neighboring countries, we cannot automatically jump to the conclusion that widespread breast-feeding explains the land's low infant mortality. As in most countries, source material about nursing practices is scarce. The best material originated in the obstetrics hospitals of Christiania, Bergen and Trondheim, where unwed mothers came to have their babies and were followed-up with detailed studies that show that breast-feeding was the usual

61 Milton Myron Gordon, *Assimilation in American life: the role of race, religion, and national origins* (New York, 1964).

62 Michael R. Haines and Samuel H. Preston, *Fatal years: child mortality in late nineteenth-century America* (Princeton, N.J., 1991).

63 Personal communication from Hans Kermit, Niels Stensen's biographer.

64 Sølvi Sogner, *Ung i Europa: norsk ungdom over Nordsjøen til Nederland i tidlig nytid* (Oslo, 1994).

65 Sølvi Sogner og Gunnar Thorvaldsen, "Surnames as proxies for place or origin in the 1801 census for Norway". In Jørgen Carling (ed) *Nordic Demography: Trends and differentials*. Scandinavian Population Studies vol 13. Unipub forlag, Oslo 2002.

practice.⁶⁶ Since, according to other investigations, illegitimate children were more unlikely to be breast-fed than other children, this is good evidence in support of breast-feeding. However, it is not necessarily representative for other regions or other periods. Nor can we rely on oral testimony. Even the most retentive memories of old midwives or mothers today naturally remember the situation when the new infant care measures of the early twentieth century were common, not the practice of earlier periods.

A. Brändström's dissertation has identified Swedish parishes where the cause and effect pattern between breast-feeding and infant mortality can be clearly demonstrated, and other areas where this is not possible. But since nursing remains a key factor to look into when IMR differentials are to be explained, it is natural to look for a Norwegian case. The Setesdalen physician's district, a valley stretching towards the southern tip of Norway, is an obvious selection. This is a well-defined area with a clear decline in infant mortality that occurs so late that it ought to be subject to comments by the district doctor. Fortunately, he printed a report in the journal of the Norwegian Medical Association telling how he fought the conservative attitudes of the grandmothers during the 1880s.⁶⁷ His vivid report blames the special culture in the valley. Even if his writing is colored by a lack of understanding for the way of life of ordinary people so common among civil servants, some of his observations seem relevant. His complaints about the very tight clothing of infants that hindered their breathing probably hints at a factor with an unknown effect on survival chances, but his observation that they were regularly fed foodstuffs such as potatoes and sour milk, in addition to breast milk, certainly is important. He states "they got other people's food." This mixing of artificial nourishment and breast-feeding can be used by the historian to explain nineteenth century infant mortality rates in between those found in areas with little breast-feeding (one third of all births) and levels found in places where mother's milk was widely used (one tenth of all births). Respiratory illnesses were frequent in all age groups, so he had a hard time convincing people that these maladies could kill children, since older children and grown-ups survived them. The doctor identified bronchitis and pneumonia as the biggest killers of infants. Secondly, there were frequent cases of diarrhea that took the lives of many infants, but that were erroneously classified as secondary symptoms, such as cramps. (The doctor may have been implicitly criticizing the clergyman's record keeping.) Relative to the illnesses mentioned above, the doctor was of the opinion that the ordinary children's diseases that appeared at regular

66 Margit Rosenberg, *On the relation between living conditions and variables linked to reproduction in Norway 1860–1984* (Oslo, 1991).

67 J G H Stang, "Aarsagerne til den store barnedødelighet i Sætersdalens lægedistrikt," *Tidsskrift for den norske Lægeforening* 18 (1898), 488–496.

intervals were only minor causes of child mortality, even if such diseases were much more feared by the population. Older children must also have been malnourished if they, as he suggests, were only fed sour milk until five years of age. He also complained about lack of cleanliness and the poor quality of housing. By the turn of the century (1900) infant mortality had declined substantially in the valley, probably as a result of Doctor Stang's campaign for better child care, including breast-feeding. Can this explanation be generalized to apply to other regional developments in infant mortality?

The other area where high infant mortality was found in the 1850s, as well as half a century earlier, was along the coast of western Norway. This is illuminated in a local study, utilizing a data set that is extraordinarily complete and reliable.⁶⁸ Peaking at even higher levels in the eighteenth century, the IMR fell from around 28 percent before 1785 to levels around eight percent during the last half of the nineteenth century. Although some of the high IMR levels in *Etne* in comparison with other parishes may be explained by the very complete data, we can still regard this study as representative of the high mortality area in the west. Some of the results, such as the IMR by month of the year, may build on numbers that are too small, but the finding that farmers' infants had higher IMR levels than cotters' and the dating of the initial decline of the IMR during the last two decades of the eighteenth century seem authoritative. Dyrvik relates the high IMR during the first weeks of life to artificial feeding, as in Brändström's study of Haparanda, especially when the women had to partake in the seasonal farm work. The most interesting hypothesis advanced by the author is that the IMR increased in years with harvest problems or bigger birth cohorts, because the women consciously sought to limit the size of their families by denying their children the protection of breast milk. A problem with this hypothesis is that most women presumably also knew that lactation prolonged the period between births, and such action would thus neutralize breast-feeding as a means of population control.⁶⁹ Therefore, I would rather suggest that during hard times women were forced to leave their children in

68 Ståle Dyrvik, "Spedbarndøden i Etne prestegjeld 1716–1900," in *Festskrift til Historisk institutt 40-års jubileum 1997*, eds. Edgar Hovland, Ståle Dyrvik, and Geir Atle Ersland. Skrifter/Historisk institutt. Universitetet i Bergen (Bergen, 1997), 131–150.

69 While longer inter-birth periods may neutralize the effect breast-feeding had on infant mortality, we should be open to the effect a change of feeding methods between siblings might have. If a mother breast-feeds one child and not the next, this will on average reduce family size by combining the postponing effect of lactation with the subsequently increased mortality risk of artificial food. This would make "sense" during a severe subsistence crisis. Reversely, changing from artificial food to breast milk between siblings would on average increase family size, and thus require economic opportunities only found in good times.

order to perform extensive work or were more willing to let others take care of them with artificial foodstuffs during a period when breast-feeding was out of fashion.

The district physician on the coast north of Bergen was astonished to find no educated midwife there upon his appointment in 1855. Even if we compensate for the general derogatory attitude of civil servants towards the populace, it is difficult to imagine that the doctor invented his description of how the lay midwives treated women who suffered difficult deliveries. Doctor Krohn fought a tough political battle for nearly two decades before convincing the local assembly in one of the parishes to pay for an educated midwife. This report says little about infant mortality or breast-feeding, but claims that the lack of expertise and of traditional midwifery increased the chances of stillbirths or dying in labor. The number of stillbirths was higher in this district than nationally and is correlated with the number of educated midwives over time. It is interesting that the high infant mortality areas on the western coast saw significant improvement, just as this district doctor fought to introduce midwives and improve obstetrics and child care. He was especially critical of the conservative population in Manger parish that obstinately continued to use magical folk remedies despite his inspired lectures on reform.⁷⁰ The report makes the important point that the doctors' fight to employ trained midwives was more beneficial than their own medical activities, especially since the midwives were key agents in the campaigns favoring breast milk.

As can be observed above, the region with high infant mortality north and east of Tromsø improved relatively little until the twentieth century. The municipalities with infant mortality reaching over one fifth of all births were found both furthest north and furthest east. While there is no direct proof that this was related to artificial feeding of infants, it is possible to establish a chain of circumstantial evidence. Finnmark and the northern parts of Troms province have been called "the meeting place of the three tribes." It must have been difficult for the Norwegian medical authorities to reach out to the Sami and Finnish ethnic groups that made up a majority of the population in Finnmark with information about child care, due to both cultural and linguistic barriers. It is part of the relative stability of the IMR level in the northernmost part of Norway that IMR levels there were reported as lower than in western Norway around 1800. While there is suspicion that this low level may have been caused by under-reporting of infant deaths, another explana-

70 Helge Sandvik, "Fødselsomsorgen i Ytre Nordhordland 1858–87. En sammenlikning med nasjonal statistikk," *Tidsskrift for Den Norske Lægeforening* 113:30 (1993), 3715–7; Helge Sandvik, "'Dei Vise forvidle Væræ.' En distriktsleges kamp mot overtro og trolldom på 1800-tallet," *Tidsskrift for Den Norske Lægeforening* 113: 29 (1993), 3572–4.

tion would be in line with Swedish findings about the Sami population.⁷¹ While their “natural,” as opposed to artificial, modes of child care were seen as an ideal in the eighteenth century, later on the practices of the majority population were favored by the medical authorities. Does this mirror a real shift in infant mortality levels connected with changed nursing practices?

The medical reports from Troms and Finnmark in the 1850s and 1860s say little about breast-feeding. Given the general propensity of civil servants to complain about the misdeeds of the common man, it seems reasonable to interpret this as a sign that many infants were breast-fed. This seems all the more likely in a region where cow’s milk was scarce during the winter season, and reindeer milk cannot be fed to infants because it thickens. In his report for 1853, the garrison doctor in Vardø complained about the dirty breast of a nursing mother. He was aware of the healthy effects of breast milk, but recommended more cleanliness.

Inconsistent nursing practices may explain why infant mortality rates in Finnmark were lower than in areas where women did not breast-feed. The rates are in between the high levels found in Iceland and the low infant mortality districts in Denmark or Norway, which may have been caused by either a proportion of the women not nursing, the early use of additional foodstuffs or a nursing period that was too short. Given the heavy workload of women along the coast, it may not always have been easy to find the opportunity for nursing infants. The extensive nature of the peasant fishing economy and the absence of men during the fisheries often left women of fertile age in charge of most of the production on land.⁷² Although women who participated in the seasonal fisheries were only occasionally found, they were widely employed in fish processing ashore or were out on the fjord to catch the day’s dinner. Letting younger or older family members care for the children while the mother did extensive farm work or other tasks must have been usual, with substitute foodstuffs for the infants being the logical consequence. Giving food containing starches or non-pasteurized cow’s milk to infants easily leads to diarrhea, which together with respiratory diseases, was the most common cause of death among infants. In contrast, the beneficial effect from mother’s milk on the immune system, especially from the initial colostrum, is well-known.

A. Brändström’s findings of high infant mortality due to lack of nursing among the Finns in Haparanda, Sweden make it natural to focus on the situation of this ethnic group in Finnmark. The Finns were clever farmers with more stable access to

71 Anders Brändström, “Från förebild till motbild. Spädbarnsvård och spädbarnsdödlighet i Jokkmokk,” in *Älvdal i norr*, ed. Sune Åkerman (Luleå, 1988), 307–352.

72 Governor’s report for Finnmark 1866–70, 23 and 28

cows' milk.⁷³ "In this respect the Finnish population set a good example; it is used to a rich consumption of milk from its homeland." The Medical Officer of Health in 1864 reported that the Finnish women in Vadsø would not employ the trained Norwegian midwife, most likely because of disagreement about birth procedures and child care. Brändström describes similar conflicts in Haparanda. We also know that areas of out-migration from Finland to Norway were characterized by extensive female farm work, lack of nursing and relatively high levels of infant mortality.⁷⁴ Lithell emphasizes the female workload as the main cause, while Brändström stresses a more cultural explanation. In my view these hypotheses may be combined in the argument that, although the economic situation improved during the first part of the nineteenth century, a reformed infant-feeding culture did not develop until the second half. Causal links between the relatively high levels of infant mortality and fertility may have worked in both directions and should be investigated using individual level data. While it has been proved that the high infant mortality among the Finns resulting from artificial feeding did not stop at the border with Sweden, there is less direct evidence in the case of their migration to northern Norway. In addition to the circumstantial evidence cited above, there is an interesting parallel in the exceptionally high mortality among infants born to French-Canadian mothers, while children of Scandinavian mothers did better than average in the US around 1900. "Apart from breast-feeding, however, there seems to be little that can be said quantitatively about the different modes of child-rearing as they might influence ethnic variation in child mortality."⁷⁵

In a letter from 1917 Margit Qvigstad described infant care among the Sami, giving a favorable picture where nursing was standard procedure.⁷⁶ Even if her impression may have been based more on the nomads than on the coastal Sami, this is further evidence that nursing was usual. Since nursing became more common in many places during the last part of the nineteenth century, however, we cannot base a notion of *consistent* nursing on this late source. Fortunately, a newly discovered ethnographic manuscript from 1896 gives a detailed account of Sami living conditions based on a teacher's study of two localities in Troms and Finnmark.⁷⁷ The

73 Ivar Bjørklund, *Fjordfolket i Kvenangen* (Tromsø, 1985); Medical report for Finnmark 1875.

74 Ulla-Britt Lithell, *Kvinnoarbete och barntillsyn i 1700- och 1800-talets Österbotten* (Uppsala, 1988).

75 Michael R. Haines and Samuel H. Preston, *Fatal years: child mortality in late nineteenth-century America* (Princeton, N.J., 1991), 42.

76 Appendix to letter for Katti Anker Møller, 1/9 1917, in the Manuscript Collection of the Norwegian National Library, Ms 4 0 2416 I D. I am grateful to Bjørg Evjen for the reference.

77 Ole Thomassen, *Lappenes forhold* (Gáivuona, 1999).

infants were said to be nursed until they were nearly one year-old. However, a rag with cream was introduced until the mother could nurse, and this was also used if she had insufficient breast milk. A. Løkke reports the use of similar rags in eastern Jutland in Denmark, an area that had high infant mortality.⁷⁸ Popular belief that the first, bluish milk was not nourishing was widespread, and this prevented many infants from receiving the valuable addition of colostrum to their immune system. While the extent and timing of giving additional foodstuffs to babies has still not been explored, there is every reason to pursue the nursing issue with individual level data. The Bourgeois-Pichat test, which is widely acclaimed as a good indicator of breast-feeding, has been applied to data from a number of parishes in the northernmost provinces during the nineteenth century. The timing of infant deaths graphed logarithmically using this method indicates that nursing was less consistent in Finnmark than in Troms.⁷⁹

Given that infant mortality remained high in Finnmark, why is there so little evidence of campaigning for better child care on the part of the authorities, in contrast to northern Sweden and Finland? The inaccessibility of some areas can form only part of the explanation. In addition, the slow decline in the infant mortality rate from the turn of the century (1900) may have convinced the authorities that their efforts to culturally integrate the Sami and Finns had the desired effect. The ethnic Finns in Sweden had dominated their territories for centuries, while much of the migration from Finland to Norway was a nineteenth century phenomenon, even though there were smaller groups of Finns who had been resident in Norway for generations. It is likely that second-generation Finnish immigrants breast-fed more extensively. The arguments in this case would find their parallel in the explanations as to why most groups of second-generation immigrants to the US had mortality patterns more like the native-born population.⁸⁰

Still, both infant and child mortality in the northernmost province of Norway remained high during the early decades of the twentieth century. Recent research has demonstrated fairly convincingly that the key factor in bringing down infant mortality figures during this period was the dissemination of information to medical personnel and, by means of them, to the parents.⁸¹ When this was not as suc-

78 Anne Løkke, *Døden i barndommen* (København, 1998), 175.

79 Gunnar Thorvaldsen, "Infant mortality in Northern Finland, Sweden and Norway," (Paper for the Social Science History Conference, Pittsburgh 2000), 17.

80 Samul H. Preston, et al., "Child mortality differences by ethnicity and race in the United States 1900–1910," in *After Ellis Island. Newcomers and Natives in the 1910 Census*, ed. Susan Cott Watkins (New York, 1994), 35–82.

81 Michael R. Haines and Samuel H. Preston, *Fatal years: child mortality in late nineteenth-century America* (Princeton, N.J., 1991).

cessful in Finnmark as in the rest of Norway, I would like to raise a warning flag against interpreting the long-lasting high mortality there as the downside of the struggle of the Sami and the Finns to keep their cultural identity intact. From the late nineteenth century the official policy of the Norwegian state was to “norwegianize” the ethnic minorities, for instance, by sending children to boarding schools and allowing them to speak only Norwegian. Pedagogical research shows, however, that successful education must take the pupils’ mother tongue as the starting point. The effort to get rid of the Sami and Finnish cultures fortunately failed, but the wasted resources hindered other vital educational projects for all ethnic groups. The failure to teach the population of Finnmark about better child care at the same pace as in the rest of the country should thus be seen as one of the worst consequences of Norway’s minority policy at the time.

The studies made of infant mortality in Asker and Bærum are particularly interesting, both because they build on a rich and linked data set from the censuses and church registers, and because the parish had the same IMR level as was the average for Norway around 1800.⁸² The parish lies directly southwest of Oslo, bordering on the Oslo Fjord, and had iron foundries in addition to agriculture. The infant mortality rate started to decline a couple of decades before 1800, but 1809 was still a year of crisis with many infant deaths, as were 1748 and 1761. It seems that infants were affected by these crises, but not to the extent of the population in general. The 1809 crisis affected infants and old people in particular and is therefore interpreted by the author as caused by an epidemic. Since the IMR is a valuable measure of a population’s general welfare, in an article referred to above E. Fure has interpreted the decrease in infant mortality as a sign of more abundant resources, giving children better chances of survival in the synergistic struggle with contagious diseases. She admits, however, that the lack of significant correlations between the IMR level and social class both in her studies and elsewhere weakens this line of reasoning.⁸³ In her conclusion Fure discusses the connection found in Trondheim between reduced infant mortality and medical information, particularly that favoring breast-feeding, but she finds this difficult to accept for Asker and Bærum since medical services, such as midwives and doctors, were practically absent in the

82 Eli Fure, “Spedbarndødelighet og sosiale forskjeller i Asker og Bærum 1814–1878. En metode for studier på individnivå,” *Heimen* 37:4 (2000), 293–304; Eli Fure, “Nedgangen i dødeligheten i Asker og Bærum 1733–1878,” *Heimen* 36:3 (1999), 177–186.

83 The rural character of the localities may explain this. It is interesting that infant mortality differences are bigger among occupational categories in the urban areas of the US and Britain, due both to the variations in living conditions and the reverse causal effect of women who lost children returning to work. Michael R. Haines and Samuel H. Preston, *Fatal years: child mortality in late nineteenth-century America* (Princeton, N. J., 1991).

parish. I would like to point out that information relayed from woman to woman could be more efficient than official propaganda – especially if it came from one’s equals or people with higher status.⁸⁴ The parish of Bærum borders on Lake Bogstad, where the squire lived who sent his linen to London to be cleaned. The 1801 census lists some twenty servants on his estate in addition to several associated households, suggesting widespread contacts with the surrounding community. I thus agree with Dyrvik’s view that the main change was one of attitudes in the collective of women.⁸⁵ Clergymen and doctors were not their only channels of communication with the outside world. And since the population in these parishes was ethnically homogeneous, the information channels were not blocked by cultural or linguistic barriers, and thus reforms might leave few traces in the source material. As indicated by the Brändström-Lithell debate, this does not rule out the possibility that more affluence and less work, allowing women to spend more time with their children, could help make a shift in feeding practices feasible. Recently, an authoritative study of the grain supply to Norway has concluded that the country’s population had already experienced an increased standard of living in the eighteenth century.⁸⁶ This is in line with the reasoning of the next local study.

Fortunately, a traditionally low infant mortality parish has been studied using the very complete and reliable nominative records. *Rendalen* is a rather isolated inland municipality on the Swedish border, midway between Lillehammer and Trondheim.⁸⁷ In this area the IMR fluctuated between ten and twenty percent in the eighteenth century, declining quite steadily from the 1770s until a level of five or six percent was reached a century later. The parish may thus be taken as representative for the inland areas of southeastern Norway. During the last half of the eighteenth century the cotters’ children had a somewhat higher IMR than did the farmers’ children, but there was little difference between the rates for legitimate and illegitimate births. Breast-feeding is assumed to have been more or less general, and factors such as cleanliness and a sparsely settled area also promoted low infant mortality. The author’s hypothesis is that the simultaneous decline in women’s mortality indicates better times for housewives due to increased family income from the region’s developing forest industry towards the end of the eighteenth century. Compulsory smallpox vaccination from 1810 onward and a health service with district physicians

84 Leonard and Philip Selznick Broom, *Sociology. A text with adapted readings*, 4 ed. (New York, 1968), 236ff.

85 Ståle Dyrvik, “Spedbarndøden i Etne prestegjeld 1716–1900,” in *Festskrift til Historisk institutts 40-års jubileum 1997*, eds. Edgar Hovland, Ståle Dyrvik and Geir Atle Ersland, Skrifter / Historisk institutt. Universitetet i Bergen (Bergen, 1997), 131–150.

86 John Herstad, *I helstatens grep: kornmonopolet 1735–88* (Oslo, 2000), 200.

87 Sølvi Sogner, *Folkevekst og flytting* (Oslo, 1979).

and midwives from the middle of the nineteenth century were other factors contributing to even lower infant mortality rates.

Regretably, we have no similar local study from the low mortality area in central Norway, since the one from Trondheim does not use linked nominative sources, and, as an urban study, it cannot be seen as representative for the region.⁸⁸ Even so, it is interesting how the author stresses medical knowledge and the promotion of breast milk as her main explanation for the lowered IMR levels. Further studies from the provinces of Trøndelag and Nordland are necessary in order to explain why Norway's lowest infant mortality in the first part of the nineteenth century, contrary to expectation, can be found along the coast. A likely set of explanatory factors is, however, that the population there lived more scattered than along the coast of western Norway, a region where it was easier to combine fishing with agriculture than north of the polar circle. In addition, as in Rendalen, the greater distance from the leading European countries may have lessened the impact of fashion cycles in breast-feeding. Thus far studies of the medical reports have given just a few clues, in addition to the usual reports of illnesses, occasional epidemics and harvest problems. One medical report states that in the province of Nordland it was unusual to have cows' milk during the winter, breast milk being the most likely alternative for infants.⁸⁹ Another indication of widespread breast-feeding is found in the report for Brønnøy parish in 1862. The doctor listed the age of the many children who died from a diphtheria epidemic that year, but very few were infants, indicating a strengthening of their immune systems with mother's milk.

Even though we have no decisive proof in the form of nursing statistics, there are a number of indications that more widespread breast-feeding connected with fashions in nursing and a more affluent population can explain at least parts of the decline in infant mortality from the late eighteenth century. We must, however, also confront the competing hypothesis about a milder epidemic climate. It is naturally possible that epidemic diseases came less frequently to Norway, or that the bacteria and viruses in question had become less virulent and dangerous. The difficulty inherent in this reasoning is that it is so difficult to test, and this to a greater extent than is the case with the nursing hypothesis. Even present-day illnesses and their relative strength are not easy to measure, and for historical illnesses there are no specimens.⁹⁰ That higher death rates in urban or densely populated areas are due

88 Margunn Skjei Knudtsen, *Fra frelse til helse: spedbarnsdødelighet og omsorgssyn i Norge ca 1700–1830 med særlig vekt på forholdene i Vår Frue sokn, Trondheim* (Trondheim, 1997).

89 Medical report for Alstahaug 1858. Norwegian National Archives Pakke 180, RA 3A0893/1.

90 The recent alleged excavation of virus from the Spanish flu has thus far brought no solution as to why the epidemic climate in 1918 was especially dangerous for young men.

to contagious illness is a commonplace, but a reduction in their illness frequency or death rate could still be due to improved immunity among the population.

If the high mortality areas are considered, people along the coastline would naturally be more exposed to disease, and there may have been more traffic along the western coast of Norway with its seasonal fisheries. But then the low mortality area in Nordland, where most of the population lived right on the coast and participated regularly in the Lofoten fisheries, would become a mystery. Further north, the high mortality rates in Finnmark might be explained by contagion coming in from the east, but, on the other hand, the long distances between settlements should have prevented the spread of diseases. The example of Finnmark also shows how difficult it can be to measure population density empirically. While the population per unit area was very small, most people lived in village-like places rather than on the single farms more usual in southern Norway. The scarcity of building material made people cram together into rather small houses, in contrast to the spacious homes in Rendalen. However, it is not easy to understand why the epidemic climate should be much tougher in Setesdalen than along the Swedish border. Recent research substantiates the likelihood of extended households being usual in Rendalen,⁹¹ so many people probably shared the same house during the long winter there, as well as in Finnmark. But with the relative lack of building material in the north, and the many fishermen who lived as boarders during peak seasons, the number of people per room or unit area was probably significantly larger there.⁹²

A multivariate study of the statistical correlation between mortality, population density and other factors along the lines described above for Germany awaits the on-going work of encoding the 1900 census.⁹³ Thus far, exploratory calculations for the period 1886–1890 show the municipal level correlation (Pearson's r) between IMR and proportion of illegitimate births to be close to zero. Johannesen found the illegitimate children of Christiania to be over-represented among diseased infants in the summer, while Sogner found no such effect for rural Rendalen. Thus, the reason may be that there were many more rural than urban municipalities in Norway. The correlation between the IMR and a fertility measure (children born

91 Hans Henrik Bull, "Hushold og genrasjonsskifter i Rendalen 1762–1900. Ættesamfunnets siste skanse?" (Universitetet i Oslo, 2000).

92 Gunnar Thorvaldsen, "Northern, Eastern or Urban Penalty? Aspects of Late 19th Mortality in the North of Norway," in *Papers from the Nordic Demographic Symposium in Umeå, August 1999 [In print]*, eds. Peter Sköld and Lars-Göran Tedebrand (Umeå: Umeå University, 2001).

93 For the rural areas the 1900 census only gives the number of inhabited buildings per dwelling unit, while the urban questionnaires asked for detailed information such as the number of rooms on each floor and the number of persons living there.

per married woman aged, 15–45) was also close to zero, while the correlation between the IMR and the proportion of dead children aged 1–2 was significant and as large as .42. I have interpreted this as an indicator that, towards the end of the nineteenth century, breast-feeding was quite universally distributed among most (rural) municipalities, no longer explaining child spacing differentials at this level. The remaining correlation between mortality rates in the first and second year of life might be explained by remaining geographical differences in hygienic conditions and child care practices other than nursing.⁹⁴

From the last decades of the nineteenth century, an increasing number of public health measures were enforced that also promoted the care of mothers and their infants. These measures ranged from clean water supply to health stations for mothers with newborn babies. Such measures have been described in detail for Denmark, but the development in Norway was parallel.⁹⁵ There can be no doubt that the information about better child care, including propaganda for breast-feeding, was the principal cause behind bringing the infant mortality rate below ten percent in all towns and all provinces but one before World War I. The exception was Finnmark, where communications and, to some degree, language problems made information work difficult even after World War II.⁹⁶ The importance of housing was highlighted when the infant mortality rate increased in Tromsø during the last year of the Second World War, as the population north of the city was evacuated southwards by the retreating Germans.⁹⁷

Very little evidence has been found that the general nutritional status of the population affected infant mortality historically, with the exception of some years of crisis. If parents did not know how to promote the health of their infants, the wealth of higher social class had little impact.⁹⁸ If wealthy parents tended to live in densely populated places, for instance along the coast where contagion spread more easily, it might more than offset their material advantage. A change in the epidemic climate cannot be entirely ruled out as having reduced the level of infant deaths in

94 The correlation between IMR and proportion of stillbirths is weaker, only .25, but significant, and could also indicate differences in the conditions surrounding new mothers, for instance, access to trained midwives. However, the correlation between stillbirths and the municipality identification number is equally strong. Does this indicate that the concept of stillbirth is not interpreted universally across Norway?

95 Axel Johannessen, *Dødeligheden i Norge af børn under 1 aar* (Christiania, 1902).

96 Knut Rein, "Spebarndødeligheten i Kautokeino 1946–1955," *Tidsskrift for Den norske Legeforening*, 76 (1956): 815–816.

97 Berit Nøkleby and Guri Hjeltne, *Barn under krigen* (Oslo, 2000).

98 Michael R. Haines and Samuel H. Preston, *Fatal years: child mortality in late nineteenth-century America* (Princeton, N. J., 1991).

previous centuries, but such a claim is in principle nearly impossible to substantiate. If general causes are sought that are valid over time throughout the country and that may also be applied outside Norway, breast-feeding and other elements of proper child care are the most likely candidates. The indications that breast-feeding became less fashionable in Europe from the seventeenth century are overwhelming, and there is also evidence that it became more usual for mothers to leave their infants in the care of older children or wet nurses. There is virtually no information about infant mortality in Norway before the eighteenth century, so the role of changing breast-feeding fashion in fluctuations in infant mortality cannot be established. But according to the center-periphery model of information flow, it is likely that the influence of fashions from the Continent and Britain had a greater impact on the west coast and in southern Setesdalen than further east and north. The low infant mortality in the middle part of the country must have been due to a combination of factors: easier living conditions than further north and a greater distance from European centers. As information about the beneficial effects of mother's milk spread from the last part of the eighteenth century and more affluence gave women better chances to practice breast-feeding, infant mortality rates dropped gradually. With the infant care measures introduced by the authorities from the late 1800s, this development accelerated until the early twentieth century.

It is my hope that this overview can stimulate further research into the causes of the mortality decline from qualitative and quantitative evidence on the local level. The low infant mortality zone in the province of Nordland and the high IMR areas in Finnmark and in Setesdalen are obvious candidates for such studies.

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Infant Mortality in Nineteenth Century Denmark

Regionality, Feeding Habits, Illegitimacy and Causes of Death

Anne Løkke

Nineteenth century Denmark experienced a growth in population more rapid than most other European countries. This growth was primarily based on a relative low infant and child mortality in the European context and an emigration rate lower than that of the other Scandinavian countries. Seen in this perspective, in a very concrete sense the future of the Danish nation was created in the nurseries.

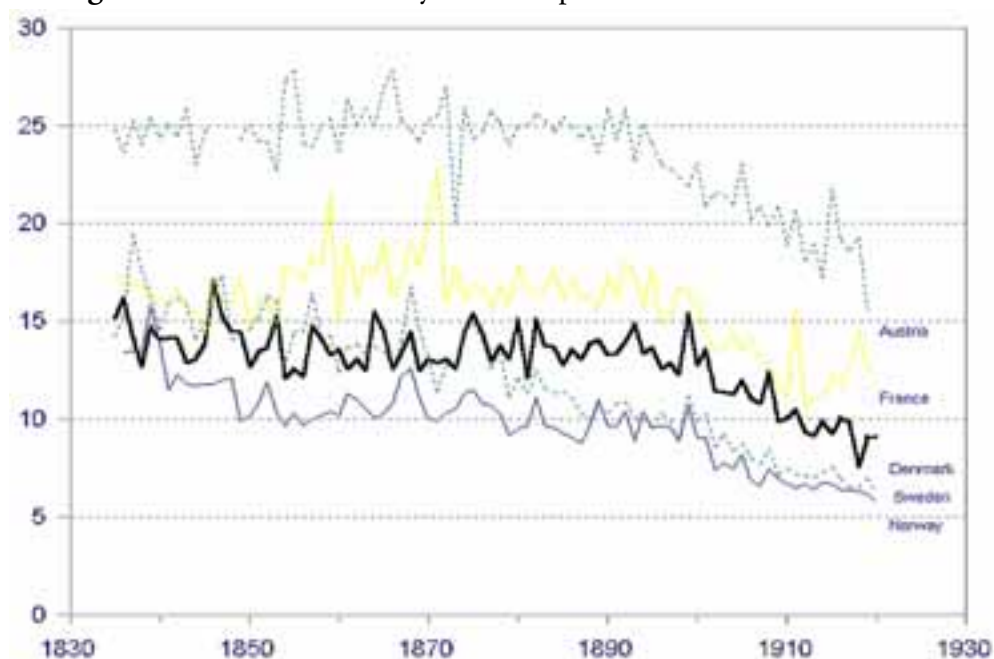
This study concentrates on mapping infant mortality in nineteenth century Denmark as an example of the composition of the infant mortality in a low mortality country: How homogeneous was infant mortality? Which groups bore the brunt of excess mortality and which groups got off with less? By what means was the low level maintained? First, however, a few words should be said on levels and trends.

Levels and Secular Trends, 1835–1920

The national average infant mortality rate (IMR), 1835 to 1900, was low in Denmark compared to most European countries, 13–15 percent (Figure 1), and the IMR remained relatively stable throughout the period, apart from the 15 percent peak in the late 1840s, when Denmark was struck both by war and the failure of potato and grain harvests (Figure 2).

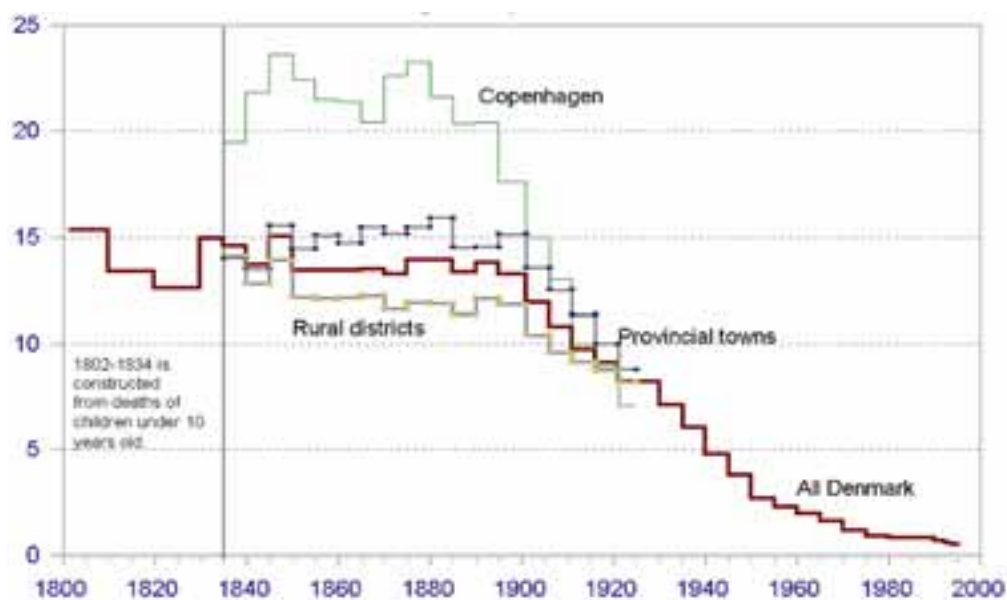
There was, however, a distinct difference between the capital and the rest of the country: the level in Copenhagen was 20–24 percent with marked peaks in the 1840s and 1870s. The average in the rural districts was 12–14 percent with the highest rates and the greatest fluctuations from 1835 to 1849, while from 1850 to 1900, the rate

Figure 1. Deaths in the first year of life per 100 live births, 1835–1920.



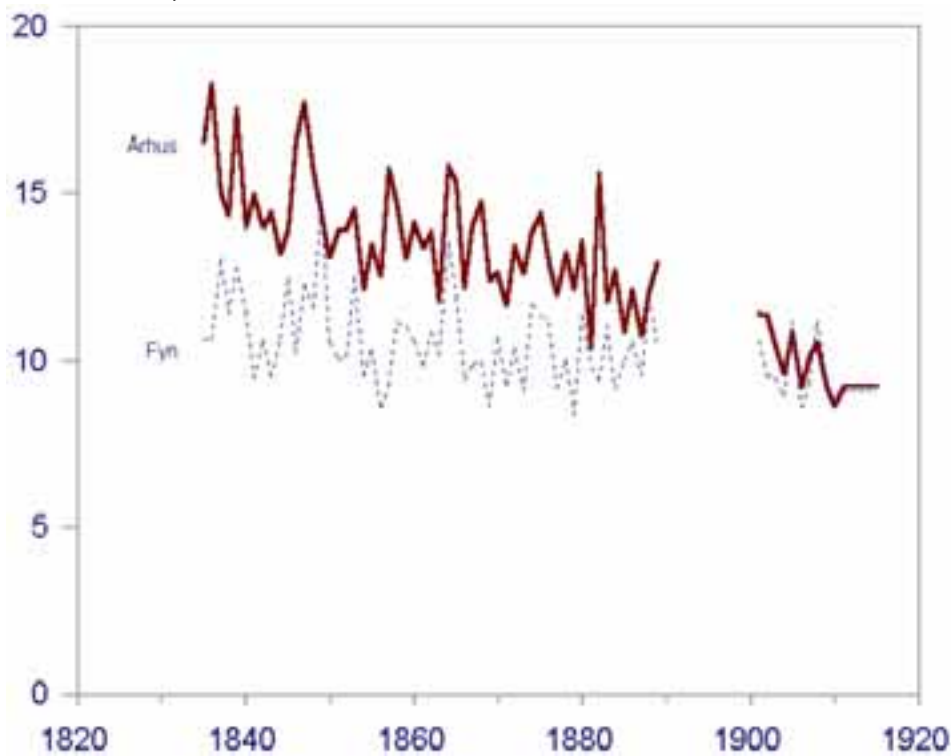
Source: Mitchell (1980), *European Historical Statistics* 137–141.

Figure 2. Deaths of infants in the first year of life per 100 live births, Denmark 1802–1995.



Source: For 1835–1996, see Løkke, *Døden i Barndommen*, 478. 1802–1834 is constructed for this paper from the number of deaths under age 10, based upon the assumption that the number of deaths under one year of age was the same proportion of all deaths under age 10 in the periods 1802–1809, 1810–1819, 1820–1829, and 1830–1834, as it was in 1835–1839.

Figure 3. Deaths in the first year of life per 100 live births, Århus and Fyn dioceses, rural districts, 1835–1915.



Source: Statistic Tabelværk concerning marriages, births, and deaths. Sources for 1890–1899 are missing. For 1911–1915, only the average exists.

was more stable, about 12–13 percent. The provincial towns had a level closer to that found in the rural districts, but with a tendency to rise during urbanization. In the 1830s, nine percent of the births in Denmark were in Copenhagen, ten in percent provincial towns and 81 percent in rural districts. Around 1900 the corresponding distribution was 19 percent, 20 percent and 61 percent.¹ This means that during the period an increasing number of infants were exposed to the higher mortality levels of the capital and towns. The great decline in IMR started in Copenhagen in the 1880s, followed by the provincial towns and the rural districts from 1900.

¹ “Befolkningsforholdene i Danmark i det 19. Aarhundrede,” *Statistisk Tabelværk*, 5. rk., litra A, nr. 5, (København., 1905), 106–107.

Regional Differentials in the Danish Countryside, 1835–1920

There were obvious regional variations in IMR in the rural districts aggregated at the diocese (*stift*) level (Figure 3).² Aggregated at district (*herred*) level, 1835 to 1874, the differences are even more marked (Maps 1, 2, and 3).³ There are districts with a stable IMR of six to ten percent, and there are districts that are equally stable with an IMR of 18–24 percent. But most districts showed a tendency to decline one or two levels between the 1830s and the 1850s, some of them going from the next highest (16–18%) to the lowest (6–10%) level.

It should be noted that the level in the Danish regions with the highest mortality (18–24%) was much lower than in the high level regions in Iceland, Sweden and Bavaria (30–50%). High mortality areas in Denmark would be called low mortality areas in an Icelandic context in the first half of the nineteenth century.

The minimum average level attainable for a parish for the period 1851 to 1868 was six to ten percent for the whole population and six to eight percent for legitimate infants. The same minimum level is found in aggregated figures at the parish level in Norway and among the royal families of Europe in the nineteenth century.⁴ This IMR, six to eight percent, seems to be the minimum level that a population selected by criteria other than infant mortality could reach before the great mortality decline around 1900.

Regional Differences in Provincial Towns, 1835–1920

The regional levels of the rural districts recur in the provincial towns located in the same region (Figure 4). Most distinctive in the early period was the very small town of Mariager, with its 564 inhabitants; located in a high mortality area, it had the second highest IMR after Copenhagen which had 120,819 inhabitants.

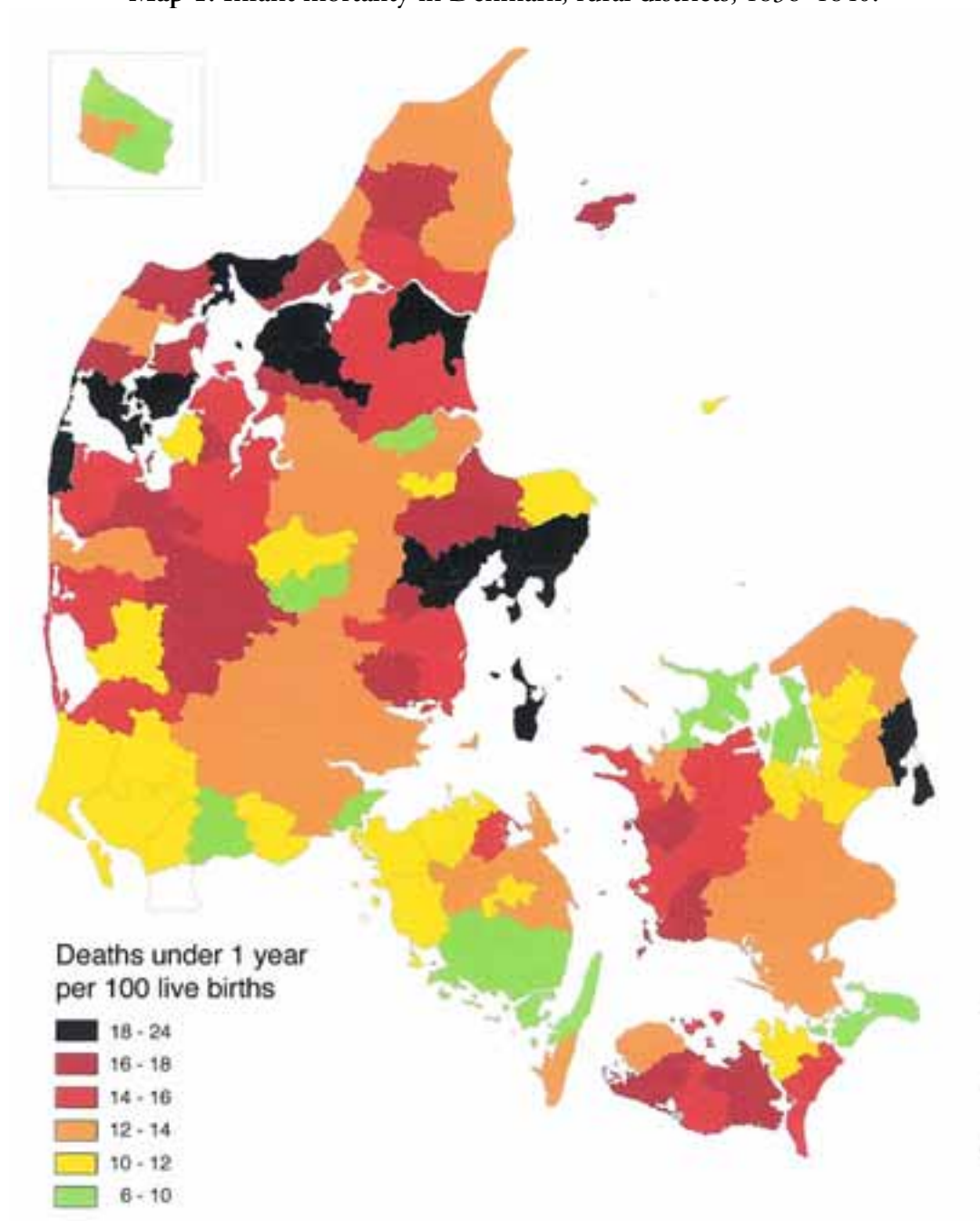
Urbanization did not have the same effect on all towns. Odense, found in a low mortality area, experienced considerable growth without an increase in IMR, while Randers, in a high mortality area, saw an increase from 15 percent in the 1830s to more than 20 percent in the 1870s.

2 *Statistisk Tabelværk* over ægteviede, fødte og døde, all volumes concerning 1835–1920.

3 The maps are derived from the clergymen's annual lists submitted to the central authorities. First published in Anne Løkke, *Døden i Barndommen – Spædbørnsdødelighed og moderniseringsprocesser i Danmark 1800 til 1920* (København, 1998), 144 I–III, where the tables can also be found, 482–493. It is possible to access my computerized lists from The Danish Data Archives <http://www.dda.dk/index.html>, study number DDA-4485 (Løkke).

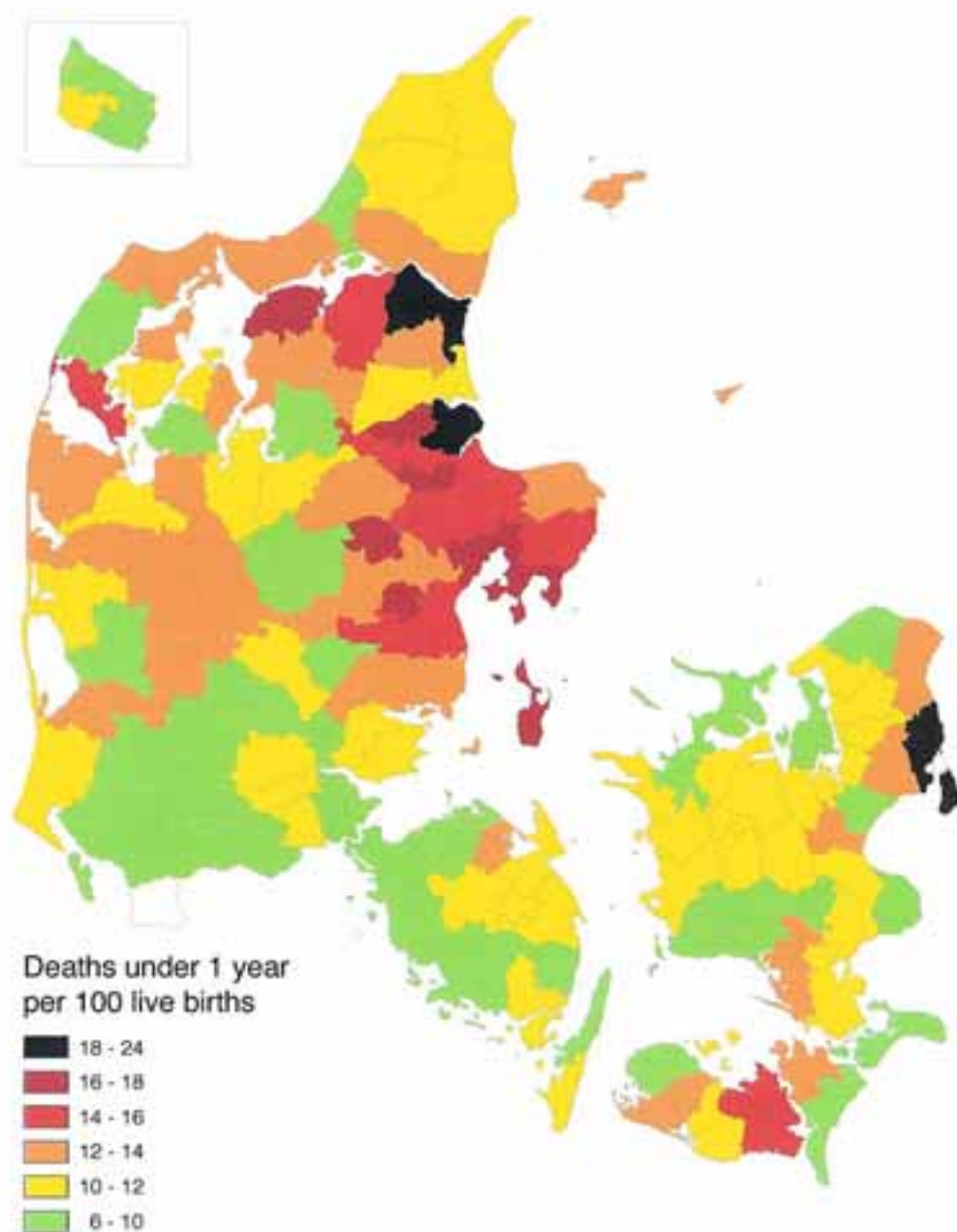
4 Harald Westergaard, *Die Lehre von der Mortalität und Morbilität* (Jena, 1901), 402.

Map 1. Infant mortality in Denmark, rural districts, 1836–1840.



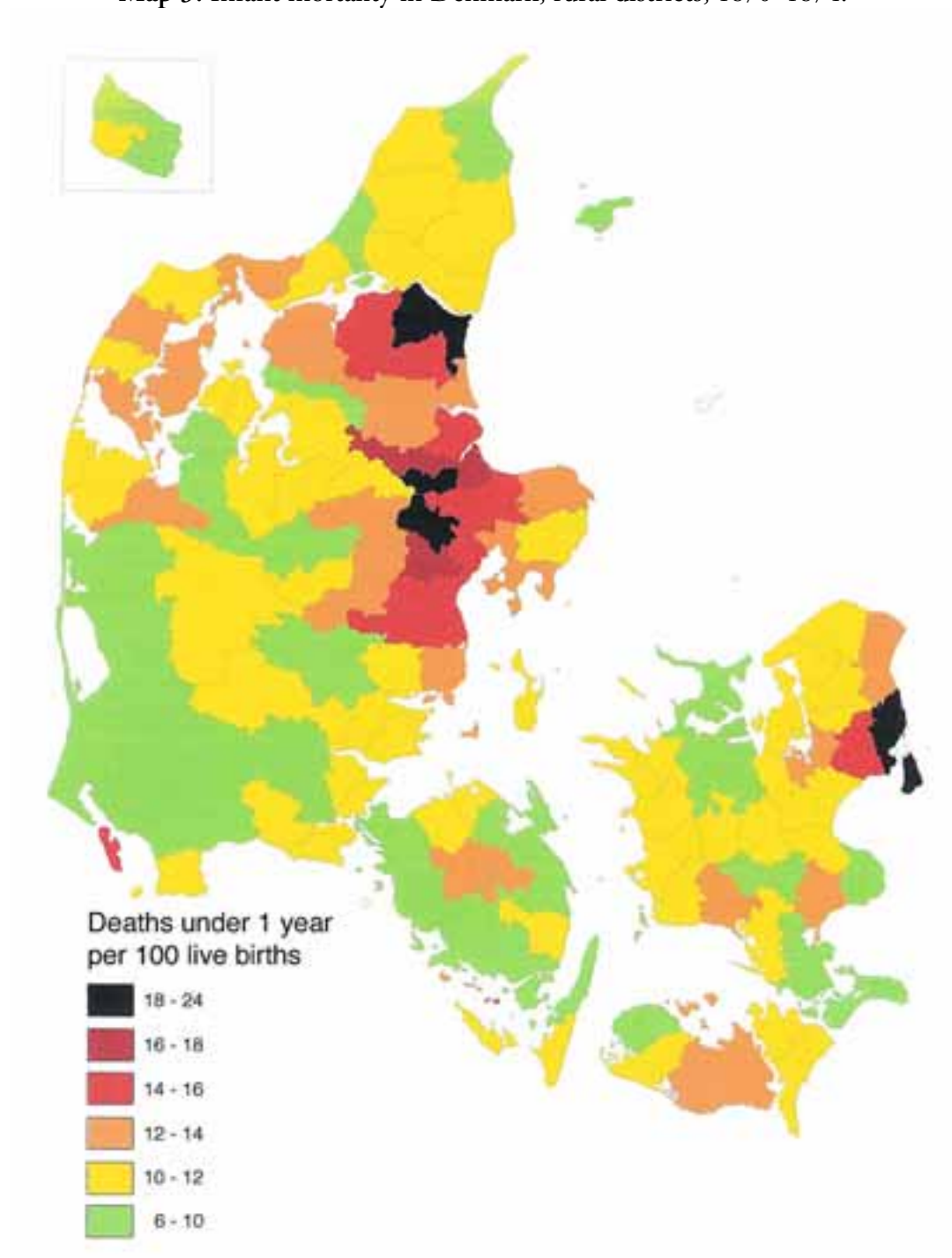
Source: *Døden i Barndommen – Spædbørnsdødelighed og moderniseringsprocesser i Danmark 1800 til 1920*, Bilag 2.3a.

Map 2. Infant mortality in Denmark, rural districts, 1850–1854.



Source: Løkke, *Døden i Barndommen – Spædbørnsdødelighed og moderniseringsprocesser i Danmark 1800 til 1920*, Bilag 2.3a.

Map 3. Infant mortality in Denmark, rural districts, 1870–1874.



Source: H. C. Sager, *Dødeligheden blandt de Nyfødte*, (Rudkjøbing, 1877).

Figure 4a. Deaths in the first year of life per 100 live births in some provincial towns, 1835–1844.

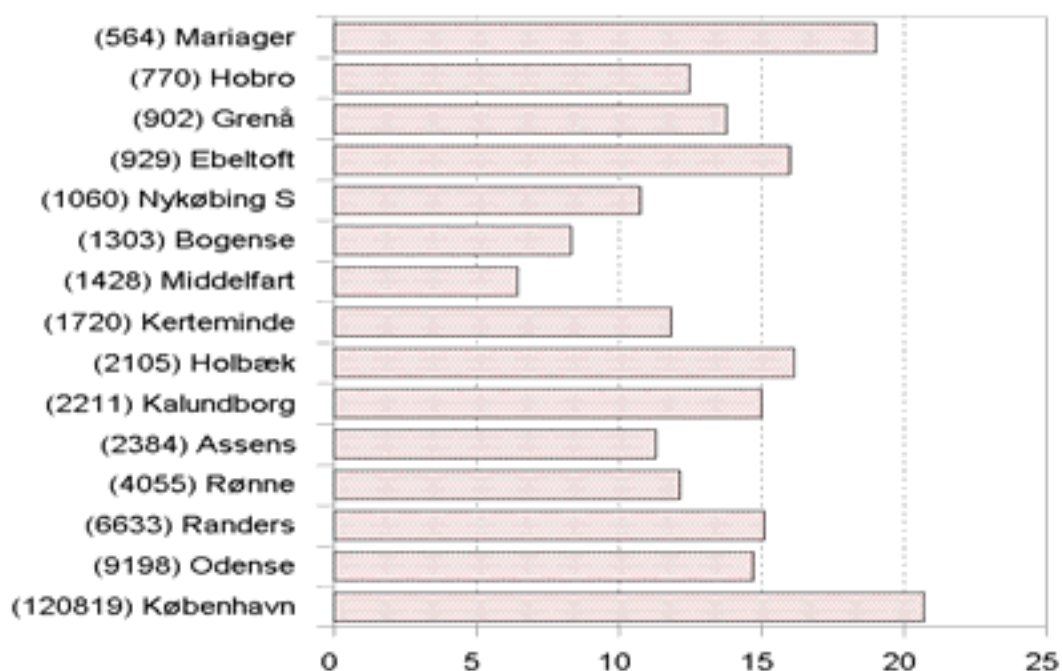
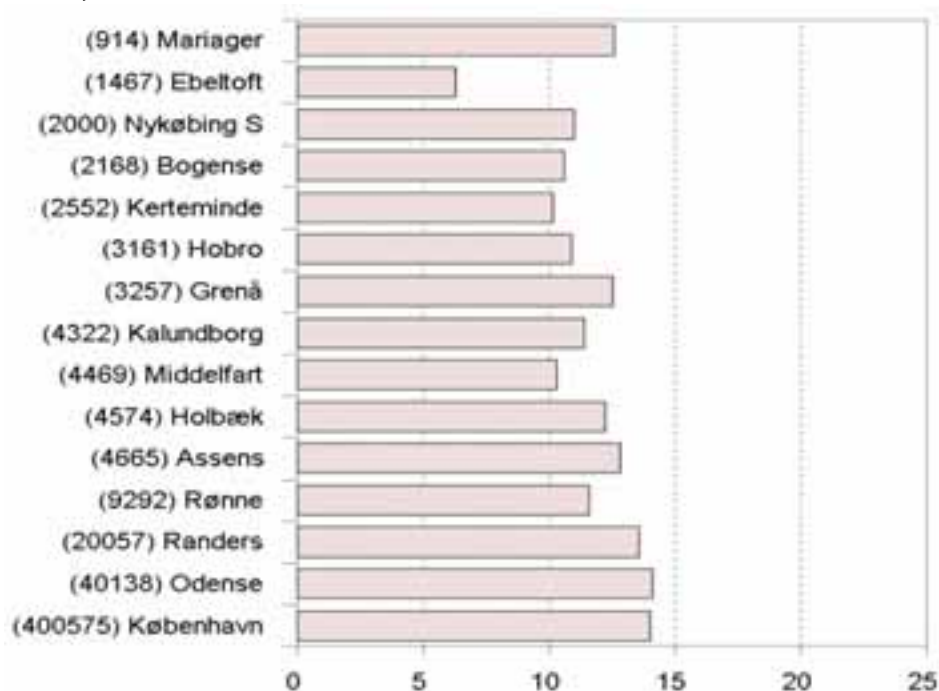


Figure 4b. Deaths in the first year of life per 100 live births in some provincial towns, 1860–1868.



Source: Løkke, *Døden i Barndommen*, bilag 2.9 and *Befolkningsforholdene* (1905), S.T. 5 rk. Litra A, nr, 5 s. 17. Number of inhabitants 1840 in parentheses.

Figure 4c. Deaths in the first year of life per 100 live births in some provincial towns, 1901–1910.



Source: Løkke, *Døden i Barndommen*, bilag 2.9 and *Befolkningsforholdene* (1905), S.T. 5 rk. Litra A, nr, 5 s. 17. Number of inhabitants 1840 in parentheses.

Regionality and Social Differences in Provincial Towns and Rural Districts, 1835–1920

In rural areas and small towns, 1820 to 1879, the IMR of the clergy, the officials and the great landowners was low (approximately 10 percent). Among the peasant population, however, region was as important a variable as wealth, and the relationship was not the same from region to region. In some regions quite wealthy farmers and poor farm workers had the same low IMR (10% for all births, 6–8% for the legitimate). In other regions the poorest part of the population had an excess IMR, especially before 1850. In some high mortality regions, however, wealthy farmers and poor farm hands both had high IMR levels (18–24%) before 1850. But after 1850 the levels split in a direction opposite to what might be expected: farm owners, a fairly well-off middle class accounting for half the rural population, still had a high IMR, while the rate declined among farm workers. In the areas where a high IMR was maintained into

the 1870s, the result was that the poor farmhands had a lower IMR than the economically well-off farm owners.⁵

From 1911 the official statistics provide the number of deaths and the number of mothers giving birth distributed by occupation of the head of the household. The mortality rate for infants calculated from this material is not completely comparable with the IMR in general, because twins count as one birth and still-born are counted as being born, but not as dead. With these reservations in mind, rates may be calculated for the legitimate infants of various occupational groups the years 1916–1920: workers in crafts and industries, 9.4 percent; rural workers, 8.3 percent; farmers, 6.9 percent; and higher social groups (high officials, doctors, etc.) five percent. For illegitimate births the rate in the provincial towns was 17.8 percent and in the rural districts, 15.5 percent.⁶ In the countryside and the provincial towns the great decline seems to have occurred first in the wealthiest and more educated part of the population.

Regionality Patterns?

No coast-inland pattern can be observed on any of the maps, and the maps do not give rise to hypotheses about any single cause which might determine similar infant mortality level all over the country. For example, the island of Bornholm (the square insert upper left on the maps) was characterized by isolated farmhouses. The western parts of Fyn (the big island in the middle of Denmark), on the other hand, had a high population density and many villages where small crofters lived very close to one another. Yet both were low mortality areas. The same goes for the quality of the farmland and the size of the farms. There are high and low mortality areas spread throughout regions uniform in these respects, while some very heterogeneous regions have similar rates of infant deaths. That does not mean that these factors are without influence on the IMR, but rather that they do not have such a strong effect that they overshadow other causes. In this current project I have refrained from examining these factors.

One pattern can be observed on the maps: rural districts in the immediate neighborhood of a larger town show a tendency to higher levels than other districts. For Copenhagen it is quite evident from others sources that the metropolis was surrounded by suburban slum areas recorded as rural districts. However, this is not the case for many of the smaller towns. The impact of the provincial towns on the

5 Th. Sørensen, *Børnedødeligheden i forskellige Samfundslag i Danmark* (København, 1883).

6 *Statistisk Tabelværk* 5. Rk. litra A No.15, 28–29 and 42–45.

surrounding area still needs to be examined in detail. From my study it is clear, however, that neither the size nor the growth of the town determines the exact level of IMR. But (in the nineteenth century) growth of a town meant a rise in infant mortality in the surrounding rural district, while the proximity of a larger town had a tendency to inhibit the attainment of the lowest level of infant mortality, six to ten percent.

A pattern linking IMR at the district level to the rate of still-births or the rate of illegitimacy does not emerge from my material (Figures 5a, 5b, 6a and 6b). There is no systematic correspondence between the distribution of IMR levels and districts with few or many still-births. The same goes for the distribution of districts according to the illegitimacy rates.

The most spectacular IMR pattern that can be observed from the maps is in the eastern part of the Jutland Peninsula. This area did not experience the same decline in the IMR as the rest of the rural districts from the 1830s to the 1850s and during the 1870s. On the contrary, in the 1870s this part of Denmark stands out as having an IMR rate distinctly higher than the rest of the rural districts. This has given rise to the question as to what the rural districts in the eastern part of Jutland had in common and what distinguished them from the rest of the country?

Resistance and Exposure

To work with this question it is necessary to decide which factors to examine and to develop a way of treating the interference of the broad range of factors which in other studies have proven to influence the level of IMR: for example, climate, population density, legitimacy, order of birth, confession, age of parents and feeding practices. Many attempts have been made to group these factors or to order them in a hierarchy, but they seem to elude this kind of order. It is always possible to discuss whether, for example, unsuccessful breast-feeding is a biological, social, economic or cultural factor.

To capture the interlinked nature of the factors influencing the level of IMR in a non-hierarchical way, I have developed a model that treats the level of IMR as an unstable balance between resistance and exposure.⁷ This model makes visible ways in which the same level of IMR in two populations may be caused by different factors, and how the same build-up of resistance may produce a different IMR, if exposure is changed.

7 The model is inspired by Jan Sundin, "Spädbarnsdödelighet och kulturelle faktorer i 1800-talets Sverige," *Bibliotek för Læger*, december (1993), 384–399, but differs from Sundin's model in the way it leaves room for any factor which in the future may be proven to affect the IMR.

Model 1 showing the level of infant mortality as a function of the balance between exposure and resistance. Many factors can increase or diminish exposure as well as resistance.

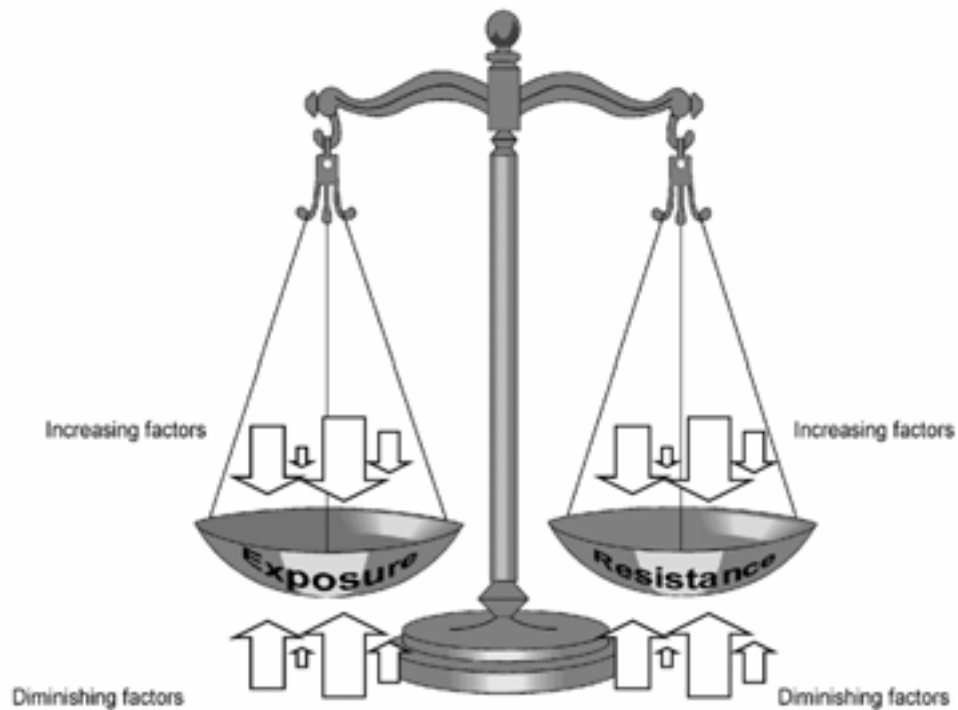
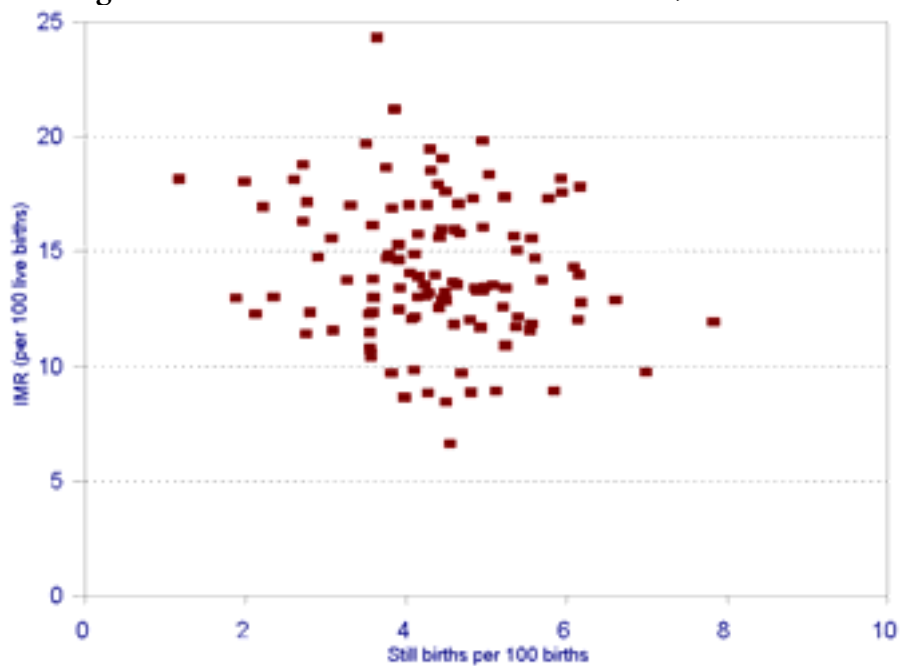
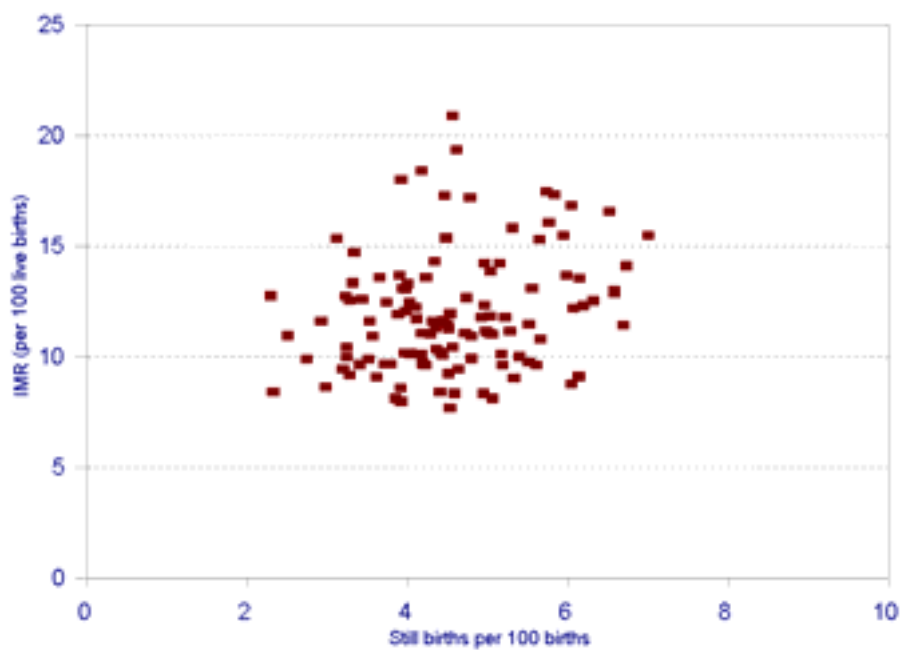


Figure 5a. Stillbirths and IMR in rural districts, 1836–1840.



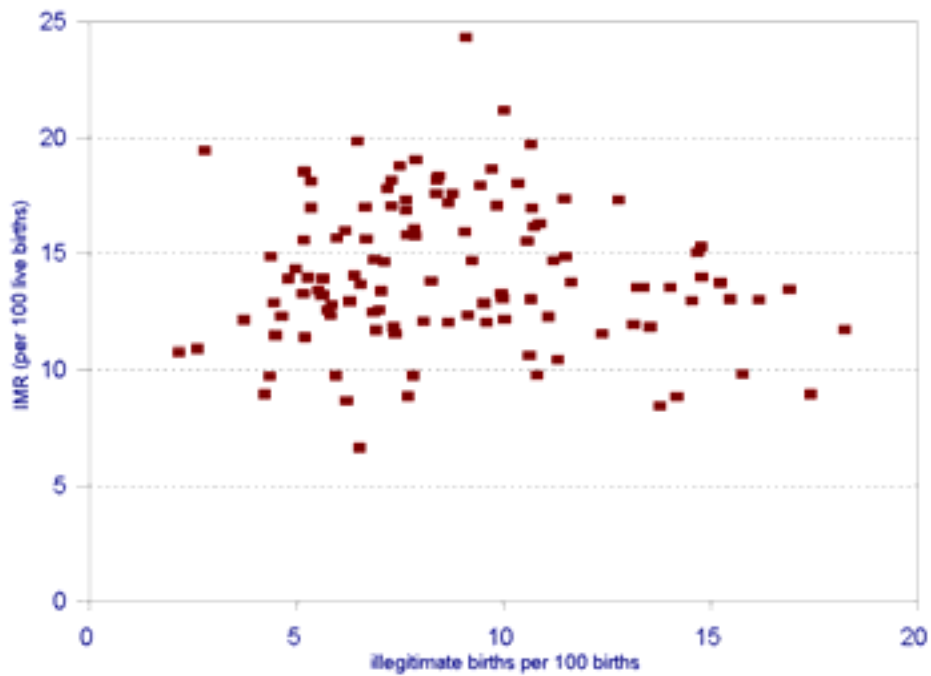
Source: Løkke, *Døden i Barndommen*, bilag 2.3a.

Figure 5b. Stillbirths and IMR in rural districts, 1850–1854.



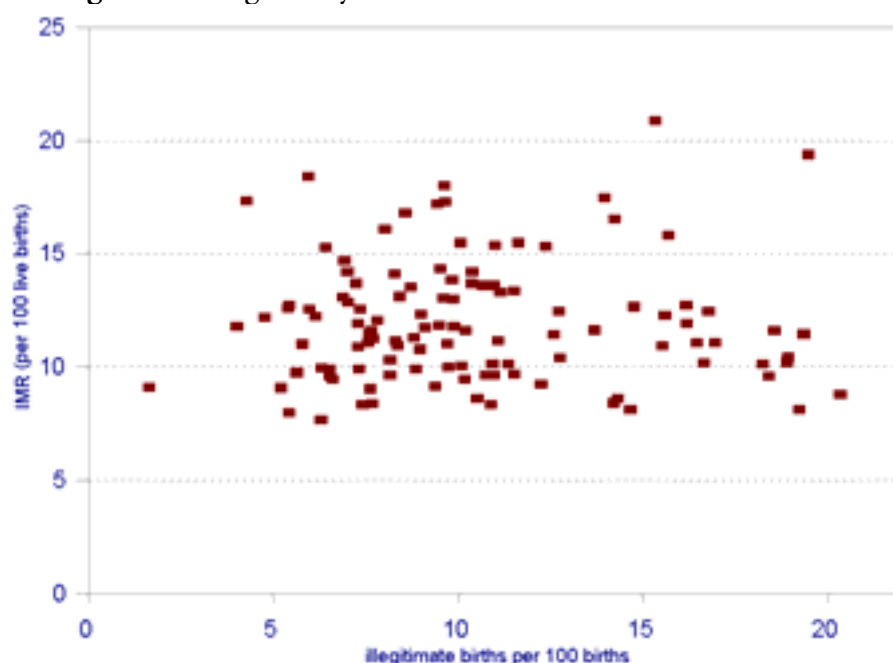
Source: Løkke, *Døden i Barndommen*, bilag 2.3a.

Figure 6a. Illegitimacy and IMR in rural districts, 1836–1840.



Source: Løkke, *Døden i Barndommen*, bilag 2.3a

Figure 6b. Illegitimacy and IMR in rural districts, 1850–1854.



Source: Løkke, *Døden i Barndommen*, bilag 2.3a

Breast-feeding

Among historical demographers there is agreement that breast-feeding is a key factor in determining the infant mortality level. A connection between regional differentials and lack of breast-feeding in high mortality areas has long been acknowledged for Iceland, Sweden and Germany. There IMR levels of around 30–50 percent of live births are not unusual in areas where breast-feeding was not in use in the nineteenth century.

In nineteenth century Denmark, however, breast-feeding was prevalent throughout the country. Although no regions or areas have been found where breast-feeding was not the normal way of nursing, there were still very marked regional differentials in the Danish nineteenth century infant mortality rates. The main argument in this article is that breast-feeding is not just breast-feeding. The way breast-feeding is administered can be very different and have very different effects measured in terms of infant mortality.

The massive reporting of breast-feeding in nineteenth century Denmark could encourage concentration on the exposure side of the model, a very relevant study which has still to be done in Denmark. However, I have chosen to start from the

resistance side of the model or, more precisely, the factors thought to increase resistance. While a lot of factors are known to reduce the resistance of infants, only a few can increase it, the most important of which is breast-feeding.⁸

In the demographic literature breast-feeding is often described as a one-zero variable: either breast-feeding exists or not. Breast-feeding results in low infant mortality, lack of breast-feeding in high mortality. Generally speaking, this reasoning is not false, but it is rather crude. My work with the infant care literature of two centuries has shown that there are very different ways of administering breast milk. The period of breast-feeding may be long or short, extra sustenance may or may not be administered, the infant may be fed by the mother or by a wet nurse, the infant may be allowed only a restricted number of occasions and/or limited time at the breast, or there may be no restrictions or unsystematic breast-feeding. The status of nutrition of the mother and her diet during breast-feeding also affect the composition of the milk. Likewise her ability to produce the increasing amount of milk demanded by the growing infant is affected by numerous factors.

All these differences must be assumed to affect the performance of breast-feeding as a resistance-building factor. The task to undertake is then to discover if different breast-feeding regimes existed in nineteenth century Denmark and to establish if they in some systematic way were related to the IMR level. To accomplish this, I have examined eight districts (*herreder*) that were chosen to cover both high mortality areas, low mortality areas and some in between.

Before examining breast-feeding in nineteenth century Denmark, however, it is necessary to discuss how to determine whether one practice is healthy and another unhealthy for infants, in other words to discuss the biological requirements of infants.

The Biological Requirements of Infants

Determining the biological requirements of infants is not straightforward. The infant cannot be seen as a piece of nature or a biological constant, the universal physical requirements of which can be discovered once and for all. The first problem is that the purely biological infant is not accessible as an object of research: a specific infant is always part of a specific environment and a specific culture which determine what effect a given treatment produces in an infant. The infant, however, is not infinitely plastic either, although its requirements can be met in many ways. The IMR varies more intensely than the mortality of older children and adults, a fact that shows that the biological limits for adapting to the cultural environments are more restricted for

8 Other known resistance-building factors are vaccination and good health of the mother while growing up, as well as during pregnancy.

infants. But even the bodies of adults have their biological limits. The biological requirements of bodies may be thought of as zones of response. In the center a limited zone of “best practices,” where the biological response is a minimal mortality. Around this zone there will be an area with an endless number of practices which do not fulfil the biological requirements and thereby increase mortality more or less.

The next problem is that the scientists who try to discover the biological functions of infants are always bound by the discourses of their time and culture. Here are a couple of examples. In 1971 research sponsored by FAO/WHO concluded that the breast milk of healthy mothers was insufficient to satisfy the energy requirements of normal infants beyond three months of age. The deductions were based on a few selected points of measure and linear thinking that regarded the energy requirements of infants (kcal/kg/day) as a linear function of age. In 1981, when trust in nature began to be in fashion again, other FAO/WHO experts proved that the required energy intake drops rapidly during the first months of life and begins to rise again after the tenth month. The resulting U-shaped curve led the experts to conclude that breast milk alone satisfies the energy requirements of the average infant for the first six months of life.⁹

About 1970, in an era fascinated by technology, an American pediatrician established that: “formula feeding has become so simple, safe, and uniformly successful that breast-feeding no longer seems worth the bother.”¹⁰ This statement expressed the twentieth century dream of dreams for pediatricians in America who had long advised mothers to give up breast-feeding for the visible and uniform bottle-feeding.¹¹ This effort bore fruit to such a considerable extent that at the time it was not possible to find a control group in the US that had been entirely breast-fed for six months.

In the 1990s the trend in the science of infant nutrition has been to admire the ingenuity of nature. More and more studies have been conducted that show the complex feed-back mechanisms between mother and infant. There are mechanisms that adjust the amount and composition of breast milk to various circumstances, such as premature birth, the age of the infant, varies micro-floras, twins, etc. Another line of research finds still more advantages in breast milk as compared to formula-feeding: for example, immunological qualities and superiority of breast-feed infants in growth and development of eyesight and intelligence.

How can historians use the knowledge of pediatricians to discuss infant feeding in the past, when this scientific knowledge varies so much over time? The scientific research of our era is, of course, subjugated to the same conditions as earlier research.

9 WHO, *Infant Feeding, The Physiological Basis* (Geneva, 1990), 61–62.

10 L. F. Hill, “A salute to La Leche League International,” *The Journal of Pediatrics*, 73 (1968), 161–62.

11 Rima D. Apple, *Mothers and Medicine. A Social History of Infant Feeding, 1890–1950* (Wisconsin, 1987).

Many of today's results will be revised. But scientific research is not useless for pediatricians or for historians because it is socially constructed. However, it is the indispensable duty of both to reflect over the conditions under which the knowledge is produced. This demand has been increasingly easy to meet during recent decades, because the development of international co-operation has resulted in a profound awareness of the cultural and environmental conditions for scientific observations. This produces knowledge that does not claim to be universal. Precisely because the limitations of this knowledge in time and space are known, it can make a contribution to the discovery of the biological response given different cultural and environmental conditions.

When an historian examines nutritional habits of the past to get an idea of their importance for the level of mortality, the answer is neither to take the newest scientific knowledge at face value nor to reject it. The examination must be carried out as a comparison over time, as well as space, using the pediatric research of today, not as an eternal truth, but as a known yardstick positioned squarely in these elements.

Breast-feeding according to Pediatrics

Today pediatricians explain the better survival of infants who are entirely breast-fed as opposed to those fed entirely artificially, all other things being equal, with four points:

- Breast milk is not handled and not so exposed to contamination on the way to the baby. Every other food for babies is exposed to contamination because it has to be handled.
- Breast milk automatically meets the nutritional needs of young infants, both needs that have been discovered, as well as the ones science has not yet uncovered.
- The breast-fed infant does not receive harmful or useless substances.
- Through breast milk the infant gains access to the immune system of the mother, and the development of the infant's own immune system is stimulated.¹²

The excess mortality of artificially fed infants is highest where the hygienic conditions are worst, where knowledge of suitable substitution is poor, and where poverty places obstacles in the way of obtaining suitable substances.

12 WHO, *Infant Feeding* (1990), 31.

In the western industrialized world of today the differences in mortality between breast-fed and formula-fed infants are so very small that pediatricians disagree as to whether there is any at all. As far as morbidity is concerned, however, breast-feeding still seems to favor infants in the industrialized world. Breast-feeding contributes to prevention of allergies,¹³ otitis media, coeliac diseases and bronchial infections.¹⁴

Breast and Complementary Feeding – a Question of Timing

Nutritional science of today leaves no doubt that, for young infants all over the world, it is an advantage to be entirely breast-fed. But to what age does it remain an advantage? Or, in other words, what is the optimal age for introducing complementary feeding and for final weaning? And how does complementary feeding affect the infant when introduced at a non-optimal age?

The last question will be considered first. In a WHO review that brings together scientific information concerning the physiological development of infants, it is argued that in the first four months of life complementary food can harm the infant in at least four ways:

- the infant may ingest harmful micro-organisms.
- the food may contain too few nutrients in forms the infant is able to use.
- the food may contain nutrients in forms or concentrations which cause indigestion or other illnesses, both short- and long-term.
- any other sustenance will reduce breast milk production because the infant's demand, expressed in suckling, guides the production of the milk supply. An infant satisfied by something else will not suckle sufficiently to ensure the proper amount of milk.¹⁵

The effects of complementary feeding depend naturally on its content. Although the infant is well-equipped to digest proteins and fat from breast milk, the size of the molecules in other proteins, as well as other types of fat, can cause allergy problems and indigestion.¹⁶

At the age of three months infants start to produce the enzyme that adults use to digest starches. So, from this age, infants tolerate starches fairly well, and from the age of four months they can make some use of the nutrients in starches, although they do

13 WHO, *Infant Feeding* (1990), 65.

14 WHO, *Infant Feeding* (1990), 31.

15 WHO, *Infant Feeding* (1990), 55, 62.

16 WHO, *Infant Feeding* (1990), 56.

not yet need them. By the age of six months starches can be digested well. However, infants who are fed foods containing starch before the age of three months have been observed to develop frequent gastrointestinal disturbances, particularly diarrhea. Some researchers have observed that infants given starches before the age of three months are able to digest them before other infants, but it takes a while before the acute diarrhea settles down. The undigested starches may also interfere with the absorption of other nutrients.¹⁷

Nutritional science agrees that breast-feeding without any complementary feeding before the age of four to six months is optimal for all infants, regardless of which culture or under which circumstances the infant is brought up.¹⁸ Under good sanitary conditions and when it is possible to purchase safe food, this may be the optimal age to start complementary feeding. The mouth, tongue, intestinal canal and reflexes are then developed to process such food, and older infants thus gain access to nutrients that are not available in optimal quantities in the breast milk to meet the increasing demand from the growing infant. On the contrary, under bad sanitary conditions it may be safer to extend the period during which the infant is entirely breast-fed to around 12 months of age, because it is first at this age that extra nutrients are absolutely necessary. Prolonged breast-feeding without complementary feeding before the age of 12 months will spare the infant from combating a harmful micro-bacterial flora until the immune system is more mature.

The optimal timing for final weaning, i.e. the transition from breast and complementary feeding to a diet devoid of breast milk, depends on the cultural and sanitary conditions. In western industrialized countries it has not yet been possible to demonstrate positive effects of breast-feeding beyond the second half of the first year of life. In Bangladesh, Rwanda and Egypt, however, the survival of the child is dependent on breast milk from the mother until the age of three years.¹⁹

In summary, the level of infant mortality is most fruitfully seen as a balance between exposure and resistance. A major part of building resistance is determined by nutrition, and the best nutrition for infants under the age of six months is obtained from breast-feeding. However, the optimal nutritional situation for infants and

17 WHO, *Infant Feeding* (1990), 56.

18 There are a few exceptions: HIV infection in the mother and not in the infant and some very rare congenital and hereditary metabolic disorders in the infant are the most important. WHO, *Infant Feeding* (1990), 41–51.

19 Kim F. Michaelsen e.a., "Weight, length, head circumference, and growth velocity in a longitudinal study of Danish infants," *Danish Medical Bulletin. Journal of the Health Sciences*, 41 (1994), 577–85; Kim F. Michaelsen, "Nutrition and Growth During Infancy. The Copenhagen Cohort Study," *Acta Paediatrica*, 86:Supplement 420 (1997), Allan S. Cunningham, Derrick B. Jelliffe and E. F. Patrice Jelliffe, "Breast-feeding and health in the 1980s: A global epidemiologic review," *The Journal of Pediatrics*, 118:5 (1991), 659–66.

children over the age of six months is in part determined by exposure. In infectious environments with poor sanitary conditions safety must take priority, which may make it necessary to postpone the introduction of complementary food until the very latest moment from the point of view of nutrients. Good sanitary conditions and a well-functioning health sector provide the latitude for giving high priority to an optimal vitamin and mineral content in food, thus making complementary feeding the best choice.

Infant Feeding in Nineteenth Century Denmark

How can knowledge be obtained about infant feeding before 1900? In Denmark it is impossible to establish exact breast-feeding rates that early. The first scientific examination of breast-feeding rates in Denmark is from 1915. It is a marvelous study that examined working class infants born in Copenhagen from the mid-1890s to 1912.²⁰ However, some information may be obtained about nineteenth century infant feeding. Three main groups of sources have proven useful:

- 1) Medical reports: Since 1803 all Danish doctors, both medical officers and private practitioners, have been required to send a yearly medical report to the Royal Board of Health (*Det Kongelige Sundhedskollegium*). One of the subjects which had to be taken up was the condition of infants and of mothers who had newly given birth.²¹
- 2) Folklore collections of popular culture: There has been a quite intensive collection of folklore in Denmark. Much material has been published and more is found in the handwritten manuscripts in the National Museum and other museums.²²

20 For the examination of breast-feeding rates in Denmark, see Løkke, *Døden i Barndommen*, 151 and 207; Susanne Houd, *Ammefrekvens og Ammemønstre i Danmark 1938–1988*. Rapport til "Fællesforum vedr. amning og spædbørns kost i Danmark," nedsat af Indenrigsministeriet 26.4.1986. Undersøgelsen gennemført ved midler fra Sundhedsstyrelsens Sundhedspulje, (København, Unpublished photocopy, c. 1989); and Michaelsen, "Nutrition".

21 The medical reports are preserved and kept in the National Archives (*Rigsarkivet*). A summary from the Royal Board of Health has been published every year since 1838. See Løkke, *Døden i Barndommen*, 511.

22 A survey over published and unpublished folklore narratives about infants, infant care and motherhood is published in J. S. Møller, *Moder og Barn i Dansk Folkeoverlevering. Fra Svangerskab til Daab og Kirkegang*, (København, 1940).

- 3) Handbooks in childcare: Many handbooks in infant care describe traditions they found harmful, in order to combat them.

There are great weaknesses associated with all three source groups. The medical reports tend to condemn what they report. Often doctors think of peasants as *dirty beasts*, regardless of whether they report from a high mortality or a low mortality area. They also constantly complain that infants are breast-fed too little, too much or incorrectly. The same goes for many of the handbooks.

The problem with the folklore collections is the nostalgic perception of the fading traditional culture of the peasants. The old peasants were more natural than the increasing urban population, or so the argument goes. It is natural to breast-feed, and thus the infants of the peasants were breast-fed for years. This argument is not disturbed by parallel stories about bottle-feeding and pre-chewing food. To use these sources it is necessary to combine them at a strict regional and local level and be very aware of the chronology.²³

However, when I abandoned all the sources that gave no concrete description of ways of feeding infants at various ages and became aware of the chronology, a pattern began to emerge.²⁴ This pattern grew more distinct, when I realized that the career of the doctor influenced how he perceived infant care. Doctors who had been both in a high mortality area and in a low mortality area were capable of seeing the differences, whereas doctors who spent their whole lives in one area tended to describe popular practice in the normal medical clichés without regard to the actual infant care.

Conditions on Fyn

All the concrete reports from Fyn tell about a very deeply rooted tradition of breast-feeding. No special infant food was prepared. The infants were nursed for at least a year, more often for two or three. In the second half of their first year, when the infants were able to sit on their mother's knee and take food from the table, they were allowed to eat what they could manage and liked from the adult menu.

The famous Danish composer Carl Nielsen (1865–1931), who came from an old Fyn family of peasants, rural workers and village fiddlers, described the following in his autobiography (He was number seven of twelve children.):

We children were allowed to nurse until we were a couple of years of age. I remember still the sensation of my mother's skin. When my mother sat suckling the

23 See the analyses and further discussions in Løkke, *Døden i Barndommen*, 151–172 and 204–207.

24 See further discussions in Løkke, *Døden i Barndommen*, 151–172 and 204–207.

youngest of us, she was often glad - almost delighted. So it happened, she took the small one away, played a little with the breast and then put it to the mouth of one of the older children, saying, "Do you want a bit too, ducky?" I have stood in my wooden shoes before my mum and had my part of the feast.²⁵

The medical reports tell the same story. Nearly all the infants from Fyn were breast-fed, complementary food was introduced late in the first year of life, and nursing was prolonged well into the second or third year of life. If mothers of young infants had to go somewhere, they left their offspring with a lactating neighbor, who then suckled both her own infant and the one left in her care until the mother returned. (The disadvantage of this habit was that small epidemics of syphilis appeared now and again among mothers and infants, if some unfortunate sailor husband had brought home the disease.)

Eastern Jutland

In this part of the country it was part of the normal procedure during birth that a neighbor chewed a *sut teat* for the newborn while the mother was giving birth to the placenta. A *sut* is a rag with chewed bread and sugar.

The *sut* is known from all over Denmark, but it is only from this area that I have seen it mentioned as part of the normal treatment during birth. In many other places it seems to have been used by poor mothers to soothe the baby if she was forced to leave it alone. The medical reports provide a closer look. To quote one from 1874:

I think the cause of the many gastric diseases is to be found in the very inexpedient nourishment the parents offer the infants. Certainly the baby is often breast-fed, but nearly always it has also - and that right from birth - "food". And this food consists for most infants of exactly the same food as the grown-ups eat. People believe firmly that infants who eat all kinds of food from birth will be the strongest. Think about a baby eating kale and split peas (which is the main menu in winter), sour rye bread and salted pork; and you would nearly have to agree that people are right: Infants who can stand that menu must indeed be strong.²⁶

The doctor continued by describing how the more lucky infants had pap made for them, instead of the diet mentioned above, but nearly none escaped very early solid sustenance alongside the mother's milk.

25 Nielsen, Carl, *Min fynske barndom*, (København, 1927), 14-15.

26 Rigsarkivet Medicinalberetning for 1873 ved J.C. Neergaard.

Infant Feeding in Denmark

With just a cursory examination it is difficult to see much difference between Fyn and East Jutland. In both cases the infants had mother's milk and adult food. But the very important difference is the timing. In East Jutland complementary feeding was started at birth or very soon after, while such extra sustenance was delayed until the second half of the first year of life on Fyn. What is excellent for one year-olds can kill a newborn.

Of the eighth districts (*herreder*) I have examined, the infant feeding on Fyn and in East Jutland are two extremities of a broad spectrum. The districts in Sjælland and Bornholm also combine breast-feeding and complementary feeding, but not as extremely as on Fyn and in East Jutland.

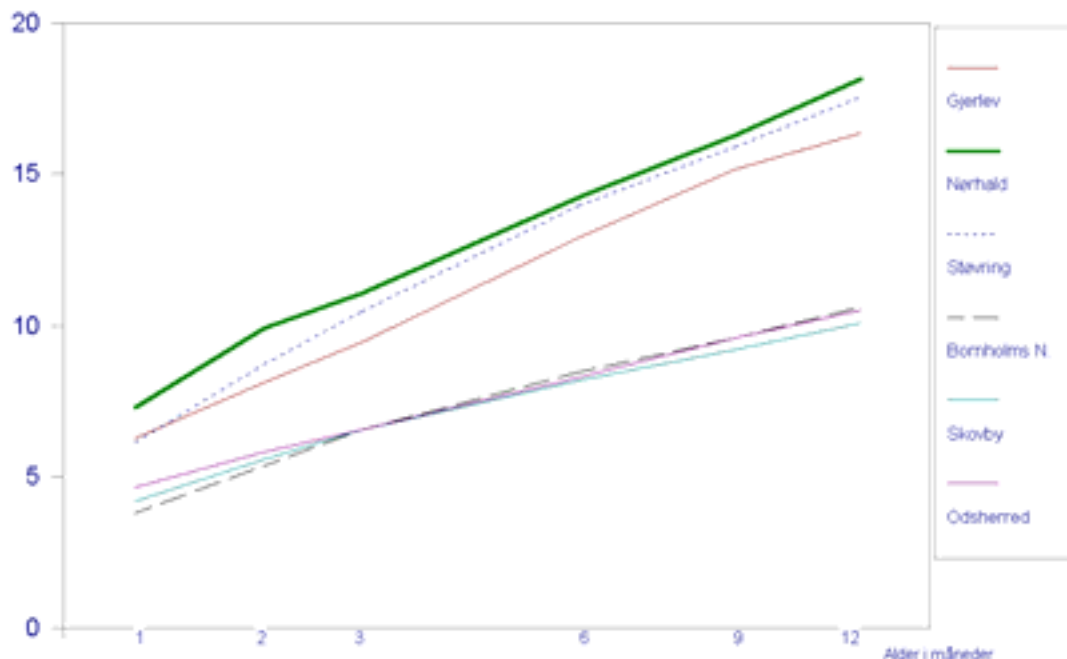
The most extreme practices formulated as ideal types are as follows:

- type 1: The infant was breast-fed completely without other sources of nutrition until the child was able to sit at the table and eat. This point in time could arrive between the infant's sixth and twelfth months of life. The child continued to be breast-fed parallel until finally weaned at an age between eighteen months and three years. Women's milk was seen as fully sufficient to fulfill requirements of infants up to one year of age.
- type 2: The infant was breast-fed, but was very soon also given other means of sustenance. This extra food was varied from place to place and over time. For example, the *sut* was sometimes used, the meals of the family might be chewed by an adult, or pap might be made from rye, oat, wheat, barley or crackers, with or without butter, cows' milk or cream, and, after about 1830, potatoes. Breast milk was seen as necessary but not adequate for the infant, and mothers often worried if they had milk enough or if the milk was good.

I have not formulated bottle-feeding or any artificial feeding as a third type, because I have not found any regions in Denmark where the ideal was not to breast-feed at all. This does not mean that there have not been infants who were fed artificially; nor does it mean that bottle-feeding has not been more common in some regions than in others. But it does mean that I have not discovered entire regions with non-breast-feeding cultures such as were found in Island, Sweden and Bavaria. This observation fits well with the lower average level of infant mortality in Denmark, and it could explain why the Danish high mortality areas do not reach the extremely high levels of IMR found in regions known to avoid breast-feeding altogether.

The spectrum running from type 1 to type 2 is also a continuum from a kind of infant feeding that creates a maximum of resistance over a resistance-neutral method, to the worst kind of type 2 feeding that reduces resistance both by causing stress to the infant's digestion with indigestible sustenance and by increasing exposure through

Figure 7. Accumulated IMR per 100 live born in six districts in rural areas, 1851–1868.



Source: Løkke, *Døden i Barndommen*, bilag 2.3.

direct contact with food and tools that may bear germs. The results of a given method of infant feeding in terms of the IMR level depends, however, on all the other factors known to influence infant mortality. In places with extreme exposure, for example, due to high population density or with traditions of poor hygiene, type 2 would prove more fatal than in sparsely populated areas. The same level of infant mortality may be achieved by many combinations of breast-feeding, different kinds of sustenance and various exposures.

The bulk of the local infant feeding traditions was found to be somewhere in between the two ideal types. However, traditions very close to type 1 are found in the areas with the very lowest IMR (7–10%), and traditions very close to type 2 and with very early introduction of extra sustenance were found in the areas with the highest mortality.

In the type 2 areas of eastern Jutland, the required extra sustenance was rather expensive: butter, cream and fine wheat among the most prestigious classes. This could explain why the more wealthy social groups in this area had a higher IMR than the poorer rural laborers. Because the infants were breast-fed anyway, it gave them a better chance when the parents could not afford extra sustenance such as butter, cream and pap from fine wheat.

When analyzed in biometrical terms, it is seen that mortality was higher in the high mortality areas already after the first month of life, and it remained higher

throughout the first year of life (Figure 7). In the low mortality areas no weaning crisis is seen.

Judged by modern pediatric knowledge, the infant feeding practices in type 1 areas were very close to what is now regarded as the best practice in an infectious environment.²⁷ Type 2 is considered today to be dangerous for young infants in at least four ways: by inducing harmful micro-organisms, by not providing the nutrients the infant needs, by including nutrients in a form or concentration that harms the digestion of an infant, and by reducing the mother's production of breast milk because the infant nurses less when it is satisfied by other means of sustenance.²⁸

To summarize, although breast-feeding was prevalent in nineteenth century Denmark, there were distinct regional differences in infant feeding practices. These differences are so important in the infant mortality context that they may be responsible for a major part of the regional differentials in IMR.

Infant Feeding and Doctors

Preston and Haines found that in the USA doctor's infants did not exhibit mortality below the national average. They argue that it must be because proper knowledge was lacking from society before the twentieth century.²⁹ This conclusion may be qualified when looking at the Danish example: knowledge was not lacking in general, but it was certainly lacking in the case of the doctors. Where the mothers in low mortality regions were very close to practicing what today is thought to be the best form of nursing, doctors in their advice books were recommending practices now thought to be harmful.³⁰ Furthermore, the doctor's knowledge was becoming more dangerous for the infant's lives throughout the nineteenth century. While physicians in the Age of Enlightenment and the early nineteenth century encouraged all mothers, of high rank or low, to provide their infants with their own milk in a type 1 manner, breast-feeding gradually became unfashionable in the Victorian Era. By mid-century the doctors writing books on infant care accepted both types 1 and 2. They only had reservations concerning the type of extra sustenance to be given. It should be liquid

27 Cunningham (e.a.), "Breastfeeding," 664; Michaelsen, "Nutrition," 31; WHO, *Infant Feeding* (1990), 41–64.

28 WHO, *Infant Feeding* (1990), 62.

29 Samuel H. Preston and Michael R. Haines, *Fatal Years. Child Mortality in Late Nineteenth Century America* (Princeton, 1991), 188–89 and 209.

30 Carl Edv. Levy, *Kortfattet Anviisning for unge Mødre til Sundhedsmæssig Forpleining af deres spæde Børn* (København, 1845); Aug. Thornam, *Den første Barnepleie* (København, 1869).

pap, made from bread without extra fat and given with a spoon.³¹ This meant that parents seeking the doctor's advice on how to keep their infants alive received little help, as the doctors recommended a practice that today has proven rather dangerous.

From the 1860s onward matters worsened. While the leading obstetricians and pediatricians still recommended both types 1 and 2, they were under increasing attack from their less specialized colleagues, who worried about the problems upper-middle and upper class mothers encountered who wanted to nurse their babies.

In a generally positive review of a book on child care from 1876 the reviewers severely disagreed with the author on one point – the superior effects of mother's milk in keeping children healthy and alive, compared with bottle feeding:

I see here a relic of sentimentality ... In these social classes, who most often seek the doctor's advice in these matters, the nutrition the mother can provide to her baby is indeed truly often poor. And in her attempts to fulfill a "mother's first duty" often by the great pains, tensions, excitement and the loss of body materia, lay the foundations for serious complaints, often nervous, but now and then even worse. Of course, I think of the delicate lady, not of the sturdy wet nurse. In my opinion it is more often than not the task of the doctor to prevent the mothers' instinctive or learned sense of obligation to breast-feed their infants themselves.³²

Instead, he advised the mothers to take a wet nurse if the family could afford it or to use Biedert's cream compound or Nestle's Farine Lactée. The last advice was rather dangerous. The commercial artificial food not only deprived the infant of the resistance that could be built up from breast milk; it contained a large amount of carbohydrates indigestible for newborns, and knowledge about sterilization processes was lacking. Ten years were to pass before the German chemist Soxhlet invented a device for safe sterilization of milk in feeding bottles according to Pasteurian principles.

A biometrical analysis of the increasing IMR among the off-spring of doctors, lawyers and their equals in a large parish in Copenhagen, 1820–1879, indicates that this fashion did have an impact on the infant feeding habits. While the 1820–39 curve fits well with breast-feeding and the introduction of new food, e.g. extra substance at the age of six months, the later curves suggest an increase in artificial feeding immediately after the birth.³³

31 Løkke, *Døden i Barndommen*, 249–51.

32 Hospitalstidende (1876), 240.

33 Løkke, *Døden i Barndommen*, Figure 2.43.

Infant Feeding in the Twentieth Century

This state of affairs was changed with the breakthrough of the “medical infant care program” in the infant care books.³⁴ This program was discussed among doctors from 1876 onward, but it was only from 1890 that the program of tranquility, cleanliness and regularity reigned supreme in Danish books on infant care. This program prescribed six months of breast-feeding without extra sustenance and then weaning over two to six months, until breast-feeding ceased after the age of twelve months. For infants who could not be breast-fed, the program offered recipes for scientifically prepared bottles in accordance with the bacteriological principles of Pasteur and the chemical analysis of women’s milk.

When considering whether rigorous pursuit of the “medical infant care program” could possibly have been instrumental in reducing infant mortality, there is no doubt that the understanding of bacteriological processes improved artificial feeding and that increased cleanliness reduced the exposure of children to risk. On the other hand, the insistence on regularity may have delayed the fall in infant mortality, since suspending the interaction between mother and infant prevented the regulation of the mother’s milk supply to the baby’s needs. The result of this is what is called secondary milk shortage, that is, the mother is unable to produce sufficient milk after the first two or three months of the infant’s life.

The rate of breast-feeding did decline during the twentieth century, but the decline did not really accelerate before 1940. Among workers in Copenhagen in the years before 1912 approximately 55 percent of all infants were breast-fed for at least six months.³⁵ Among infants born in wedlock the percentage who were breast-fed at least four months declined from 62 percent in 1940 to 17 percent in 1969.³⁶

34 The concept of the “medical infant care program” is mine, and was introduced in *Døden i Barndommen*.

35 G. Riemann, “Om Diegivningens Udbredelse og Betydning,” *Maanedsskrift for Sundhedspleje* (1915), 249f.

36 F. Biering-Sørensen, J. Hilden and K. Biering-Sørensen, “Breast-feeding in Copenhagen 1938–1977. Data on more than 365.000 infants,” *Danish Medical Bulletin*, 27:1 (1980), 44. The percentages from Riemann can not be compared directly with Biering-Sørensen, as Riemann measures breast-feeding without any sustenance and Biering-Sørensen measures any breast-feeding, even if extra sustenance was given.

Illegitimacy

Children born out of wedlock were not as unusual in nineteenth century Denmark as later myths of the Biedermeier and the Victorian eras let us presume. In the entire country roughly ten percent of all births were outside the bonds of marriage during the whole century.³⁷ But the national average conceals very distinct differentials. While in Copenhagen 20–26 percent of all births were illegitimate, the level in the rural districts on average was seven to ten percent and in the provincial towns on average eight to thirteen percent, declining from the mid- to late century. There were also large differentials among rural districts aggregated at district level (*herred*), from two percent in a few districts to 16–17 percent, a rate found in the first half of the century in the districts of Fyn.

There is no easy correlation between IMR and the rate of illegitimacy. Figures 6a and 6b show that all combinations were at work at the district level. Both districts with a very low and with a very high IMR could have high rates of illegitimacy.

While the official statistics readily provide the number of illegitimate infants born, there was a reluctance to calculate and publish the IMR for these infants. It was first after several battles with the central administration that the Statistical Bureau received permission to collect this information. From 1860 on, however, the Bureau was able to categorize infants who died during their first month of life as legitimate or illegitimate. From 1895 this distinction was also made for the first year of life.

Examinations of parish registers show, as expected, that the IMR among illegitimate infants was higher than among legitimate children born in nineteenth century Denmark. But in most parts of the country, the rate were not excessive. For the period 1820–1879 the average calculated for 46 rural parishes produced an IMR of 16.4 percent for the illegitimate infants. This was roughly the proportion 1.4:1 in comparison with the legitimate children.³⁸ This goes for Copenhagen as well until 1840, when an unfortunate development for the illegitimate infants began, which will be discussed below.

The combination of a relatively high rate of illegitimacy and a relatively low excess mortality for these infants could be due to a very high proportion of children who received legitimacy during the infant's first year of life. In many places in the Danish countryside it was not unusual for couples to marry after the birth of the first child. For 1870–1879 an average of 24 percent of the illegitimate infants born in ten rural parishes were legitimized by marriage between their parents during the child's first year of life. In addition, some infants were legitimized by the marriage of the mother

37 Rising from 7.4 percent in 1801–1809 to 11.5 percent 1840–1849, thereafter slowly declining to 9.6 percent in 1890–1900; "Befolkningsforholdene," *Statistisk Tabelværk*, 5. rk, Litra A, nr. 5, 109.

38 Sørensen, *Børnedødeligheden i forskellige samfundslag*, (1883), 80.

to someone other than the father of the infant. As much as 37 percent of those born to unwed mothers were legitimated either by the father or another bridegroom in the few parishes where this has been examined.³⁹

Legitimation poses a rather complicated methodological question because it affected both the composition of the population at risk and the number of reported deaths. Considerable differentials should be expected between the mortality of the two groups of infants, both recorded as illegitimate in the parish registers: that is – those who were only juridically illegitimate and the infants who were really social illegitimate and left alone with their mother. The mortality of infants born to couples not yet married must be assumed to be close to that of infants born in wedlock. This means that the mortality of the socially illegitimate infants must be assumed to be higher than the mortality for the whole group of “registered illegitimate.”

Another problem is that in the parish registers, infants whose mothers married between the child's birth and death tend to be registered in the burial register as legitimate. This means that the number of deaths among the legitimate infants is systematically too large in relation to the registered number of live births and too small for the illegitimate. Thereby, the IMR of the legitimate infants appears to be higher, and of the illegitimate, lower, than the social reality. The whole question of illegitimacy and IMR in the countryside still waits for a thorough investigation which accounts for the different cultural settings and the behavior of the family toward the unwed mother.

Illegitimacy in Copenhagen

The proportion of infants born out of wedlock in Copenhagen was high: 26 percent of all births, 1801–1809, a rate that slowly declined to 20 percent for the years 1880–1889. Not all of the mothers were inhabitants of Copenhagen. The city had plenty of facilities suitable to attract unsupported expectant mothers. Most important was the Royal Lying-in Hospital, founded in the eighteenth century, whose explicit aim was to provide pregnant unmarried women with free and anonymous birth assistance to prevent clandestine childbirths and infanticide. For women able to pay there were many private possibilities as well, small maternity homes and midwives who received pregnant women as boarders.⁴⁰

As for the rest of the country, a thorough study is still waiting to be done, but there is more knowledge for Copenhagen. From 1877 the city medical officer (*stadslægen*)

39 Sørensen, *Børnedødeligheden*, 89, note 1; Sørensen, “Fejlkilder ved Beregning af Dødeligheden hos uægte Født,” *Hospitalstidende*, (1889), 629–42.

40 “Befolkningsforholdene,” *Statistisk Tabelværk*, 5. Rk., Litra A, nr. 5, 109.

kept statistics based on the death certificates, which distinguish between legitimate and illegitimate births. For 1820–1879 only one parish has yet been studied, but it is a rather large and fairly representative one, Christianshavn.

The illegitimacy rate of Christianshavn showed increasing excess mortality during the century, rising from an IMR level at 25 percent in the 1820s to close to 50 percent in the 1870s. The rate for legitimate births remained at a stable level, about 20 percent during the same period. In the 1820s the IMR level of working-class infants was similar for both illegitimate and legitimate births, but during the century the rate of the latter decreased, while the former increased.⁴¹

In the late 1870s, when the statistics for all of Copenhagen include the IMR for illegitimate births, the level was just under 40 percent. From the 1880s a rapid decline started, so that the level had been reduced to about ten percent in 1920, a rate that was still excessive, because the IMR for legitimate births had declined as well.

The IMR of illegitimate infants placed in foster homes by the Royal Lying-in Hospital is known for some periods: 1850–1854, it was 38 percent and 1870–1878, 42 percent.⁴² Since 1888 law requires the supervision of all foster children by the municipal health authorities. The IMR among these infants was 40 percent when the inspection started. Even though most foster homes with excessive fatalities were sorted out by the Royal Lying-in Hospital and completely disappeared as a result of compulsory inspection, these figures render probable the assumption that at 50 percent, the IMR among illegitimate infants in Christianshavn is a bit too high. But there is no doubt that the rate was increasing in the 1860s and 1870s and had reached a level of about 40 percent or more before the decline began.

Cause of Death Registration

The registration of causes of death in Denmark followed other paths than the population statistics. In Copenhagen some initiatives were taken in the sixteenth century based on information given to the sexton by relatives. After 1749 statistics were based on this information.⁴³

The modern cause of death registration derived from death certificates started in 1829/1832. Then the law prescribed that death certificates should always be issued by a doctor when death occurred in places where a doctor could be found. In practice,

41 Sørensen, *Børnedødeligheden i forskellige samfundslag*, (Kbh., 1883), 102–109.

42 *Den hygiejniske kongres* (1858), 140–41; Fritz Levy "Om Plejebørnene med særligt Hensyn til Forholdene i Kjøbenhavn," *Ugeskrift for Læger*, (1884) 274.

43 Løkke, *Døden i Barndommen*, 55.

this meant Copenhagen and the provincial towns.⁴⁴ From 1832 onward the doctor issuing the certificate was obligated to indicate a cause of death. The information from these certificates in Copenhagen was collected and published from the start in 1832 and in the provincial towns from 1860. Cause of death registration for the rural districts, however, has existed only since 1920.⁴⁵

The Causes of Death, 1835–1960

When causes of death for infants in Copenhagen 1836–1920 are divided into main groups (Figures 8a, 8b, and 9), they reflect changes in the way causes of death were categorized as well as a changing cause of death pattern. Three main developments can be distinguished.

- The proportion of infant deaths with no registered cause of death declined.
- The proportion registered with a symptom (cramps, atrophía) and/or age (newborn), rather than a disease, as cause of death also declined. This means, of course, that the importance of diseases as cause of death increased.
- Digestive maladies as cause of death experienced sudden popularity. Before the mid-1860s this cause was seldom used; then it increased to be the most commonly used single cause of death in the 1890s. This development started before any proper prevention or treatment had established itself in the medical world: a sterilizing procedure for bottle feeding was established by Soxhlet in 1886.⁴⁶ The general advice on breast-feeding without extra sustenance the first six months of life as the best way of feeding infants dominated from about 1890. Finally, the treatment of infants that were already ill improved in the beginning of the twentieth century. At the same time prevention of digestive disorders among infants began to be used as an argument for investments in better public hygiene. The recategorization of a large part of the infant deaths to digestive illnesses was part of the process which caused the IMR to decline.⁴⁷

44 In places with no doctor, two civil men appointed by the chief constable of the local police were supposed to inspect the body and complete the certificate.

45 Løkke, *Døden i Barndommen*, 55–56.

46 “Sterilisering af Komælk, der bruges til Opfødnings af Børn.” Efter F. Soxhlet XXXIII: 15–16 *Munch. med. Wochens.* (1886); *Ugeskrift for Læger*, 4:15 (1887), 215.

47 Løkke, *Døden i Barndommen*, 62–64.

In the twentieth century all infant deaths tended to have a disease as cause of death except the feared “cot death” (listed as sudden death without known cause). During the period 1930–1960 the defeat of infectious diseases was rather successful, leaving the bulk of the remaining infant mortality to conditions related to the development of the fetus and the transition from fetus to infant.⁴⁸ In the 1930s infectious diseases, including pneumonia, were a more common cause of death than prematurity, congenital malformations, injuries from birth and other maladies. Later, the latter group far outnumbered infectious diseases as causes of death. In 1931 the numbers were as follows: prematurity, congenital malformations, injuries from birth and other affections of newborns (2.8% of the live births), pneumonia (2.3%), and infectious diseases (1.6%). In 1950 the corresponding values were 2.0 percent, 0.5 percent and 0.2 percent.⁴⁹

Discussions and Conclusions

The IMR in nineteenth century Denmark was much more heterogeneous than the stable average indicates. This heterogeneity can be seen in almost every possible variable, and the great mortality transition that took place from the turn of the century was as much a process of homogenization as a fall.

The IMR levels in nineteenth century Denmark show distinct regional patterns, most marked in the rural districts, but they also dictate the IMR in the provincial towns. One exception is that, for the top social layer in the towns, the regional patterns apparently exercised less influence, while fashion seems to have had a certain importance.

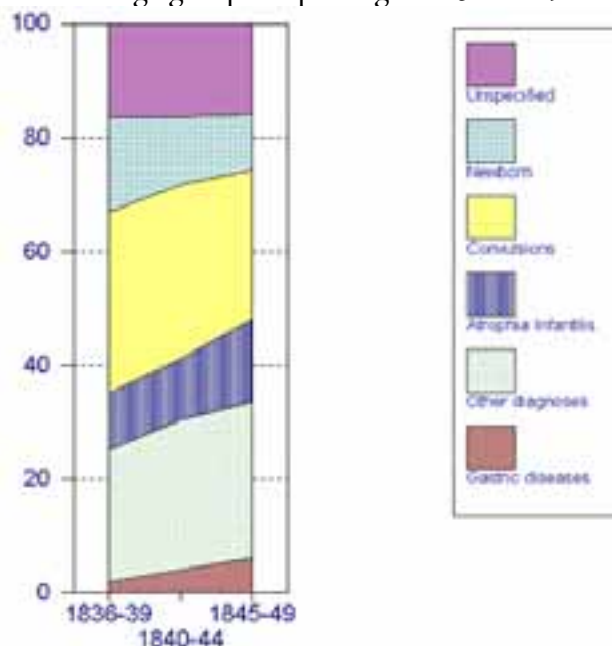
The regional pattern, however, is not sufficient to describe the secular trends. Supplied with two more patterns overlapping each other, however, it is possible to make out the most important developments, that is a socio-economic pattern and an urbanisation pattern.

The socio-economic pattern affected mainly those who were worst off. Among laborers in the countryside and in the towns, a falling curve of infant mortality is apparent throughout the century and is most readily explicable in the light of economic improvements. The lower classes lived under such harsh conditions that the mothers were forced to leave their children earlier and breast-feed them less than their own ideal of mothering demanded. Quite small economic improvements resulted in better care and breast-feeding of children in the first months of fragility and

48 Anne Løkke, “Infancy and Old Age,” 70.

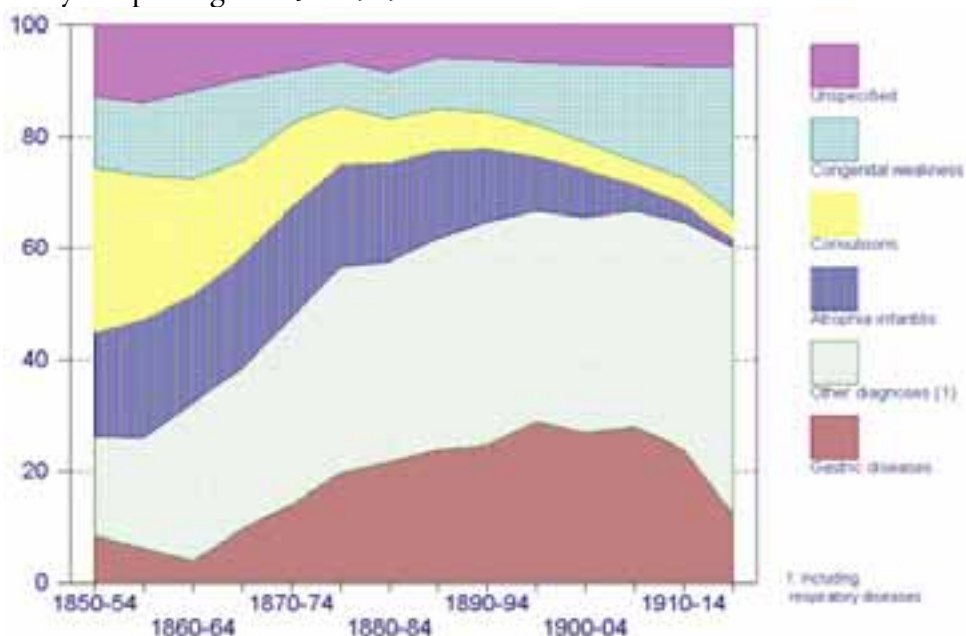
49 P. C. Matthiessen, “Spædbørnsdødeligheden i Danmark 1931–1960,” in *Statistiske Undersøgelser* 11, ed. Det statistiske Departement (1964), 9, table 2.

Figure 8a. Deaths during the first two years of life distributed as causes of death in percent of all deaths in the age group. Copenhagen 1836–1849.



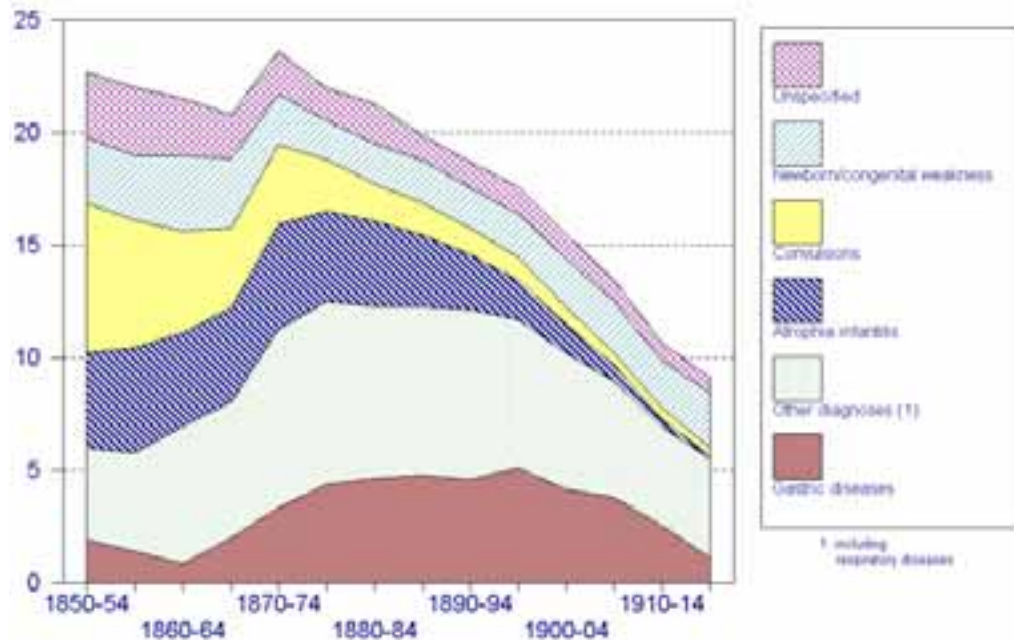
Source: Anne Løkke, *Døden I Barndommen. Spædbørnsdødlighed og moderniseringsprocesser i Danmark 1800–1920*. København, Gyldendal 1998, Bilag 2.3.

Figure 8b. Deaths in infancy distributed as causes of death in percent of all deaths in infancy. Copenhagen 1850–1919.



Source: Anne Løkke, *Døden I Barndommen. Spædbørnsdødlighed og moderniseringsprocesser i Danmark 1800–1920*. København, Gyldendal 1998, Bilag 2.3.

Figure 9. Deaths in infancy per 100 live born distributed according to the causes of death. Copenhagen 1850–1919.



Source: Anne Løkke, *Døden I Barndommen. Spædbørnsdødlighed og moderniseringsprocesser i Danmark 1800–1920*. (København, 1998), Bilag 2.3.

dependence. Easing the economic burdens of those living under the harshest conditions did not automatically lead to a fall in infant mortality, however. As was shown in the case of the farmers, prosperity was not sufficient to ensure a high level of survival. In addition, it was necessary for the infant to be cared for and fed in a way that was within the relatively limited biological spectrum, ensuring that the nutrition received built up resistance to infection and that exposure to risk factors was reduced. The drop in infant mortality among agricultural laborers as an automatic consequence of economic improvements resulted from the fact that breast-feeding was the universal norm, while the use of “dummies” and a farinaceous diet by the poor was a matter of necessity. A slight improvement in the economic situation made it possible and attractive to breast-feed more, as they were unable to afford dietary supplements of butter, milk and cream which gave prestige among farmers in high mortality areas.

In the countryside it is quite clearly possible to observe the decline in infant mortality among agricultural laborers. On the other hand, the fall in the rate among workers in Copenhagen is only visible in a decline during the first month of life, because after 1850 rapid urbanization provoked a hygienic crisis, which becomes apparent in the mortality increase in the second half of the first year of life. The urbanization crisis reached its peak in Copenhagen in the 1870s. Over a period of time investment in public hygiene reduced the environmental risks to which children

were exposed in the major cities. This solution of one of the problems associated with the urbanization crisis had the effect of turning the long-term gentle decline into an accelerated fall from the 1890s onward.

Urbanization crises can be registered in the larger provincial towns as well, while the courses they ran appear also to have been influenced by the regional levels. Thus infant mortality did not rise as dramatically in Odense in its period of growth as it did in Randers. In the case of Odense infant mortality was low in the surrounding countryside, while Randers was situated in an area of high mortality.

In the period 1820–1860 there were marked social differences in the IMR levels in Copenhagen, the better off having the lowest levels. At the peak of the urbanization crisis in the 1870s, however, the social differences disappeared. From the end of the 1880s a decrease for all groups became apparent, but the fall was most rapid in the upper classes. Thus, important social differences in infant mortality re-emerged in the years between 1900 and 1920. The rapid decrease in infant mortality in the upper social echelons suggests that new knowledge enabled them to use prosperity to ensure the survival of their children.

The minimum IMR was ten percent for a regional population as a whole, while the percentage for legitimate infants in these areas was about six to eight percent. The maximum nutritional build-up of resistance to infection and the least exposure to risk were the prerequisites determining these low figures. This minimal infant mortality was not to be found in the vicinity of middle-sized and large towns. The fact that country districts with such low mortality rate were to be found indicates that, in nineteenth century Denmark, tradition, norms and knowledge existed that kept infant mortality at a low level without the intervention of doctors and modern scientific knowledge. In the country districts, where exposure to risk was low, a very high infant mortality rate was accordingly neither biologically, socially nor economically inevitable. However, general public or scientific awareness of this knowledge did not exist, despite the fact that there are indications that knowledge of the protective nature of breast-feeding was becoming more general and had an effect in certain regions. Other regions were apparently quite insensible to changes that could have reduced infant mortality in the nineteenth century. The regional levels show this quite well. No channels or institutions existed to work systematically for greater homogeneity at the lowest level. And when the battle against infant mortality commenced, nobody asked the peasant women in the low mortality areas what they did. Instead, the “medical infant care program” was adopted. This program won the day and ousted all the old regional infant feeding cultures without considering whether they were more or less successful in keeping infants alive.

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The Development of Infant Mortality in Iceland, 1800–1920

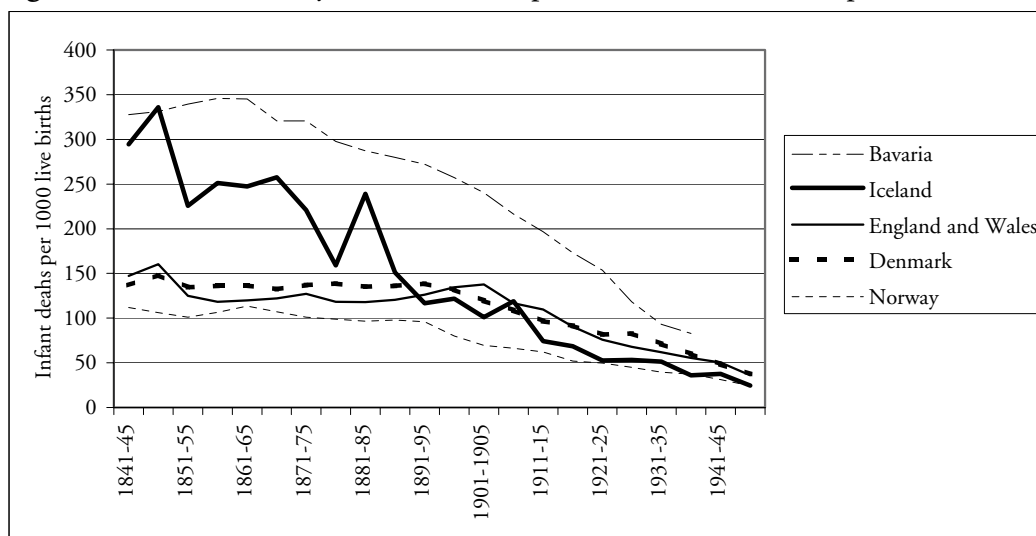
Loftur Guttormsson and Ólöf Garðarsdóttir

Introduction

By European standards infant mortality in pre-industrial Iceland was extremely high. Until 1918 the country was part of Denmark, and during the nineteenth century Danish medical authorities on several occasions expressed their concern about the high mortality rates among young children in Iceland. It was generally acknowledged that high infant mortality rates in Iceland were mainly to be explained by the prevailing practice of the artificial feeding of newborns. In Denmark infants were, as a rule, breast-fed, and there infant mortality remained at an average level of ca 140 per 1000 live births during the period 1840–1890 (Figure 1). In Iceland, on the other hand, infant mortality rates in the mid-nineteenth century were almost twice as high as in Denmark. Iceland then experienced an average of 250–300 deaths per 1000 live births, and during years of severe epidemics infant mortality rates were even higher. This was the case in 1846, when infant mortality at the national level exceeded 600 per 1000 live births.

Compared to the other Nordic countries, Icelandic infant mortality rates were exceptionally high and can best be compared to the high levels of German-speaking areas in central Europe, in particular Bavaria. Like Iceland, Bavaria was known for a tradition of artificially feeding newborns. Figure 1 shows that infant mortality rates in Bavaria and Iceland were relatively similar during the pre-transitional period. In its transition toward low mortality rates, however, Iceland deviated remarkably from Bavaria. After 1870 there was a sharp decline in infant mortality and shortly after the turn of the twentieth century, Iceland had dropped to low levels of slightly more than 100 deaths per 1000 live births, a level comparable to the other Nordic countries. At that point in time Bavaria still displayed infant mortality levels above 200 per 1000.

Figure 1. Infant mortality in Iceland compared to four other European societies.



Sources: *Hagskinna. Icelandic Historical Statistics*, Guðmundur Jónsson and Magnús S. Magnússon eds. (Reykjavík, 1997), 56–61; B.R. Mitchell, *European Historical Statistics*, 39–41. Information for Bavaria is based on different types of official statistics. Data was obtained from Michael Haines, Colgate University, Hamilton, New York.

Behind aggregate national levels of infant mortality there is a wide range of regional variations in infants' survival chances, variations that were generally acknowledged by Icelandic contemporaries during the Enlightenment. These variations mirrored important differences in ecology, socio-economic conditions, health policies and cultural practices. The main objective of this paper is to analyze regional differences in infant mortality in Iceland with particular emphasis on infant feeding and causes of death. By investigating infant mortality and the timing of change in regions with different socio-economic structures, we intend to shed light on some of the crucial factors behind the infant mortality decline in Iceland.

In the first part of this paper, however, we analyze differences in infant mortality between legitimate and illegitimate children. This part of the analysis focuses mainly on infant mortality in the fishing area of Garðar and Bessastaðir in south-western Iceland, a district where the proportion of infants born out of wedlock was extremely high.

Infant Mortality and Legitimacy

There is an evident paradox in the infant mortality decline in Iceland, a paradox often discussed in infant mortality research on other European countries. Urban areas were known to be unhealthy for young children, and infant mortality was generally much higher in towns and cities than in rural areas. Therefore it appears

contradictory that the decline in infant mortality in Iceland took place during a period of rapid urbanization and proletarianization by the turn of the twentieth century. In Iceland the 1870s and 1880s have been described as periods of increasing poverty and overpopulation. The remarkable increase in illegitimate births during the last third of the nineteenth century has been regarded as one sign of overpopulation.

During the last decades of the eighteenth century and the beginning of the nineteenth century the illegitimacy ratio remained constant, slightly below the level of ten percent. Figure 2 shows that there was an increase in the illegitimacy ratio after 1810, and in 1830, 15 percent of all children were born out of wedlock. After 1860, the illegitimacy ratio increased again and culminated during the 1870s, when more than one fifth of all infants in Iceland were born out of wedlock. However, contrary to findings in other European societies, there appears to have been a relatively modest difference in infant mortality rates for legitimate and illegitimate infants.¹

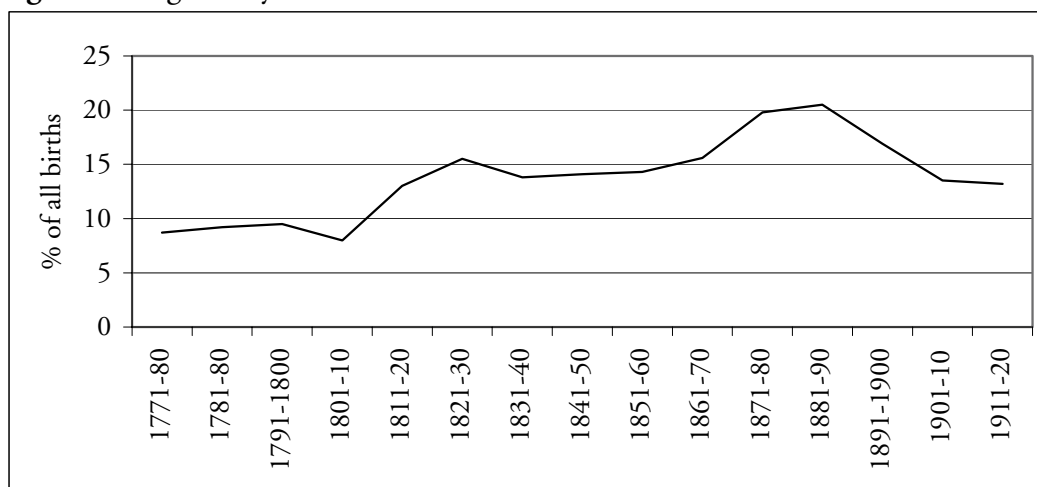
Unfortunately, published statistics for Iceland do not contain information on legitimacy and infant deaths until 1863. After that year neonatal deaths were recorded according to legal status at birth, but no information is available for the post-neonatal period. Initially differences in neonatal mortality rates between legitimate and illegitimate neonates were around 15 percent. Differences in mortality increased somewhat toward the end of the century; thus, in the beginning of the twentieth century, illegitimate infants had 30 percent higher death risks in the first month of life than their legitimate counterparts.²

Recent research has suggested that a more detailed analysis of the social and economic situation of unmarried mothers is needed to explain differences in infant

1 See, for example, Michael Mitterauer, *Ledige Mütter. Zur Geschichte der unehelicher Geburten in Europa* (München, 1983); Carlo Corsini and Pier Paolo Viazzo, "Introduction. Recent Advances and Some Open Questions in the Long-term Study of Infant and Child Mortality," in *The Decline of Infant and Child Mortality. The European Experience: 1750–1950*, eds. Carlo Corsini and Pier Paolo Viazzo (Haag, 1997), xiii–xxxi; Anders Brändström, "Life Histories of Parents and Illegitimate Children in Nineteenth-Century Sweden," in *The Decline in Infant and Child Mortality*, eds. Corsini and Viazzo.

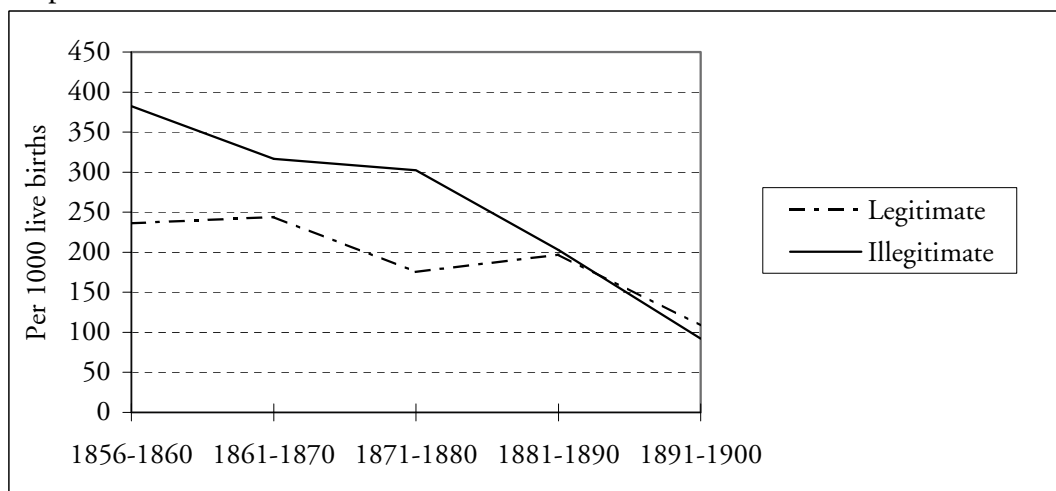
2 *Skýrslur um landshagi fyrir Ísland*, vols. 3–5. (Copenhagen, 1866–1875); *Landshagsskýrslur fyrir Ísland 1899–1912* (Reykjavík, 1899–1913).

Figure 2. Illegitimacy ratio in Iceland.



Source: *Hagskinna*, pp.50–51.

Figure 3. Trends in infant mortality rates of legitimate and of illegitimate infants in the parish of Garðar and Bessastaðir, 1856–1900.



Sources: NAI (National Archives of Iceland, Reykjavík). Prestsþjónustubækur og sóknarmannatöl VII.4, Garðar á Álfanesi (og Bessastaðir), 1816–1862 and 1863–1910.

Table 1. Death risks for illegitimate infants according to their mother's household position at their birth in Garðar and Bessastaðir 1851–1893.

Household position	Children alive after one year (N)	Children dead after one year (N)	Not known if child is alive (N)	IMR (per 1000 live births)
Mother heads a household (alone or with father)	101	34	1	252
Mother lives in her parental home	29	9	0	237
Mother servant or pauper in the household of a non-relative	26	26	6	448
Household position unknown	2	1	1	
Total (illegitimate)	158	70	8	285
Legitimate infant mortality in Garðar 1856–80				217

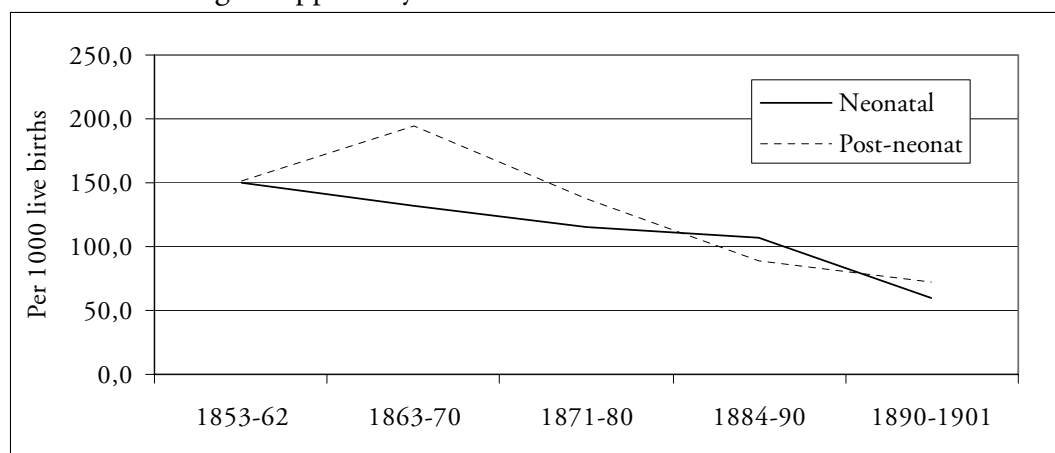
Sources: NAI (National Archives of Iceland, Reykjavík). Prestsþjónustubækur og sóknarmannatöl VII.4, Garðar á Álftanesi (og Bessastaðir), 1816–1862 and 1863–1910.

mortality for legitimate and illegitimate infants.³ A life-cycle analysis of the reproductive histories of mothers of illegitimate babies born in the parish of Garðar and Bessastaðir during the period 1851–1893 shows that the family situation of children born out of wedlock had important implications for their survival chances.⁴ Garðar and Bessastaðir is a coastal parish situated on the southwestern coast of Iceland in

3 See, for example, Anders Brändström, “Kinship and Mortality: Illegitimate Children in Sundsvall, Sweden, 1808–1900”. Paper presented at the 22nd meeting of the Social Science History Association in Washington, DC, 16–19 October 1997; Frans van Poppel, “Children in One-Parent Families: Survival as an Indicator of the Role of Parents,” *Journal of Family History* 25:3 (2000), 269–90.

4 Ólöf Garðarsdóttir, “The implications of illegitimacy in late nineteenth-century Iceland: the relationship between infant mortality and the household position of mothers giving birth to illegitimate children,” *Continuity and Change*, 15:3 (2000), 435–461.

Figure 4. The development of neonatal and post-neonatal mortality in the county of Snæfellsnes- og Hnappadalssýsla.



Sources: NAI. Biskupsskjalasafn, Skýrslur um fædda, gifta og dána C, VI, 14E (1838–1856), C, VI, 15A og 15B (1857–1870); NAI. Skjalasafn landshöfðingja. Séröskjur. Yfirlit yfir gifta, fædda, dána, aldur kvenna er börn fæddu, svo og yfir fermda, 1872–1901.

the vicinity of Reykjavík. The inhabitants were heavily dependent upon fishing, and by Icelandic standards the parish was densely populated. The proportion of children born out of wedlock was extremely high in the area. In 1870, the illegitimacy ratio mounted to around 33 percent compared to slightly more than 20 percent at the national level. During the period 1851–1880, infant mortality in the parish of Garðar and Bessastaðir was approximately 30 percent higher for illegitimate babies than was the case with children of married couples (Figure 3). When the proportion of infants born out of wedlock peaked during the late 1870s, the survival chances for legitimate infants remained at a constant level, whereas there was a steep decline in mortality among illegitimate children. Between 1881 and 1900 survival chances for the two groups were identical.

Women giving birth to illegitimate children in Garðar and Bessastaðir were by no means a uniform group. A detailed analysis of the household position and kin relations of women giving birth to illegitimate children in Garðar and Bessastaðir shows that more than 55 percent of all these mothers giving birth to an illegitimate child lived in a free consensual relationship together with the child's father and thus *de facto* had the same social position as married women. Fifteen percent of the women lived in their parental home (or in the parental home of the father), whereas 25 percent were in the vulnerable position of servant or pauper in the household of non-relatives. An analysis of differences in infant mortality between these groups shows that babies of mothers that were either in a superior household position (head of household/spouse) or were supported by strong kinship networks (lived in their parental household) had survival chances almost identical to legitimate children. Table 1 shows that mortality rates among these children were between 237

and 252 per 1000 live births, slightly higher than for their counterparts born within wedlock, who exhibited an infant mortality rate of 217 per 1000. On the other hand, the minority of infants born to unmarried women who occupied an inferior household position, that is were noted as servant or pauper, displayed infant mortality rates that were much higher, 448 deaths per 1000 live births. These results are in line with previous studies that confirm the importance of kinship networks in pre-industrial Iceland in particular during periods of need.⁵

Regional Differences in Infant Mortality

Even if no published statistics on regional differences in infant mortality were available, contemporaries in eighteenth and nineteenth century Iceland were well aware of the existence of important differences in mortality levels among districts. It was generally believed that infant mortality was relatively low in the rural areas in the northeastern part of the country and high in the southwestern part, especially in the relatively densely populated fishing districts.⁶

A number of recent studies focusing on regional differences in infant mortality in Iceland have unveiled higher mortality in densely populated coastal areas than in the rural districts. In the coastal parish of Hvalsnes in southwest Iceland infant mortality was above 300 per 1000 during the period 1766-1810. At the same time infant mortality was 210 and 268 deaths per 1000 in two inland parishes situated in western and southern Iceland.⁷ Similar results were revealed in a study of infant mortality in coastal areas in the post-transitional period. At the end of the nineteenth century infant mortality had dropped to levels around 120 per 1000 at the national level. Two expanding fishing towns in eastern and northern Iceland

5 Gísli Ágúst Gunnlaugsson and Loftur Guttormsson, "Transition into old age. Poverty and retirement possibilities in late eighteenth and nineteenth century Iceland," in *Poor Women and Children in the European Past*, eds. John Henderson and Richard Wall (London, 1994), 250–268; Gísli Ágúst Gunnlaugsson and Ólöf Garðarsdóttir, "Transition into widowhood: a life-course perspective on the household position of Icelandic widows at the beginning of the twentieth century", *Continuity and Change*, 11:3 (1996), 435–458.

6 See Eggert Ólafsson and Bjarni Pálsson, *Ferðabók*, vol. 1 (Reykjavík, 1943), 229–230 and 313–315, and vol. 2, 50; Hannes Finnsson, "Um Barna-Dauda á Íslandi," *Rit þess Íslenska Lærdóms-lista Félags* 5 (1784), 121.

7 Loftur Guttormsson, "Family, household and fisheries in south-western Iceland 1750–1850" (unpublished paper).

(Seyðisfjörður and Siglufjörður) revealed much higher death rates during this period, 150–160 deaths per 1000 live births. Both towns experienced accelerated population growth with extremely intensive in-migration during the late nineteenth and early twentieth centuries. Overcrowding, hard work, the lack of health services and insecure communications are among the factors that may have produced this situation of excess mortality.⁸

Map 1 (1840–52), Map 2 (1870–80) and Map 3 (1911–21) are based on tabulations carried out by the ecclesiastic authorities on the basis of parish register data.⁹ Important regional variations are unveiled both as regards patterns and development of infant mortality for the period 1841–1921. In the beginning there was a great range of mortality rates at the county level. As a rule, counties in the northeast had relatively low mortality rates, whereas the south and west displayed high infant mortality. During the period 1840–1852, the county with the lowest rate (Suður-Pingeyjarsýsla in northern Iceland) revealed an infant mortality rate of 213 per 1000, while the highest (Rangárvallasýsla in southern Iceland) was 400 deaths per 1000 live births. At the parish level the differences were even more apparent: the lowest rate was a parish that experienced only 87 deaths per 1000 births during this thirteen year period, while the highest rate of infant mortality was above 600 per 1000. In the 1870s infant mortality had decreased in all counties, although the rate of decrease varied considerably. As a rule, areas that started out with high mortality

the low mortality areas. As in earlier periods, the county of Suður-Pingeyjarsýsla exhibited the lowest rates in Iceland (123‰), whereas the county of Snæfells- og Hnappadalssýsla had the highest rates (253‰).

The last three decades of the nineteenth century and the initial years of the twentieth century were characterized by a steep decline in infant mortality, and shortly after the turn of the century levels of infant mortality in Iceland had dropped to levels on par with the other Nordic countries. During this period the gap in mortality levels between the areas diminished remarkably; thus in the second decade of the twentieth century (see Map 3, 1911–21) most counties displayed

8 Gísli Á. Gunnlaugsson, and Loftur Guttormsson, “Household Structure and Urbanization in Three Icelandic Fishing Districts, 1880–1930.” *Journal of Family History*, 18: 4 (1993), 334–335; Ólöf Garðarsdóttir, “Á faraldsfæti. Fólksflutningar og félagsgerð á Seyðisfirði 1885–1905” (Unpublished thesis, University of Iceland, Institute of History, 1993).

9 NAI. Biskupsskjalasafn. Skýrslur um fædda, gifta og dána C, VI, 14E (1838–56), C, VI, 15A og 15B (1857–1870); NAI. Skjalasafn landshöfðingja. Séröskjur. Yfirlit yfir gifta, fædda, dána, aldur kvenna er börn fæddu, svo og yfir fermda, 1872–1901.

infant mortality levels close to the national level (64‰). Only one county stands out with exceptionally high infant mortality rates, the county of Norður-Ísafjarðarsýsla in the northwestern part of the country. During this period infant mortality rates in this county were above 100 per 1000 live births or around 50 percent higher than the national average.

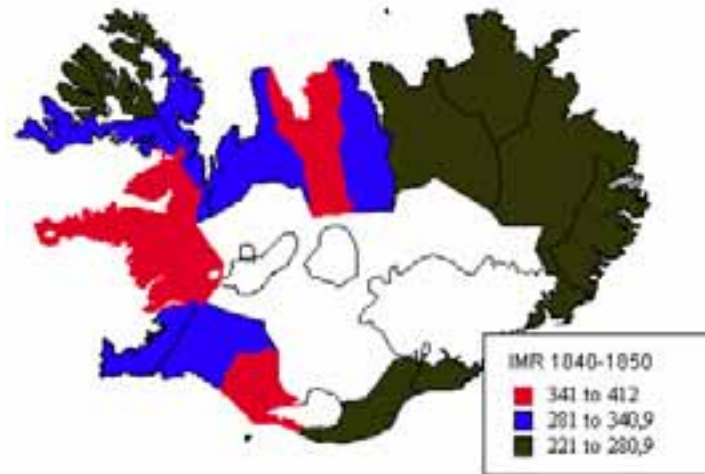
As regards mortality patterns in the mid-nineteenth century, recent research on regional differences in infant mortality has more or less confirmed the ideas put forward by Enlightenment authors. The sparsely populated counties in the northeast were characterized by comparatively low infant mortality rates, whereas infant mortality was highest in the western and southern parts. However, no obvious correlation between population density and infant mortality can be established. Although the sparsely populated northeastern areas had low infant mortality rates, there are also examples of sparsely populated rural areas with very high mortality rates. This is notably the case with the two counties (Rangárvallasýsla and Dalasýsla) where infant mortality rates ranged above other districts during most of the nineteenth century. Frequently, however, densely populated areas with high population turnover displayed high infant mortality rates. This was above all the case with fishing districts in the west and southwest.

Thus the western county of Snæfellsnes- and Hnappadalssýsla, that was dominated by fishing, had very high infant mortality throughout the nineteenth century. The county of Gullbringu- and Kjósarsýsla (where the capital Reykjavík is located) is another district with a high population turnover and high population density along the coastline. However, this county showed a much more favorable mortality development than was the case with Snæfellsnes- and Hnappadalssýsla. In the beginning of the period the county as a whole was close to the national average, and at the turn of the nineteenth century the situation had become even more favorable.

At that point in time, infant mortality rates in Gullbringu- and Kjósarsýsla were among the lowest in Iceland. In this connection it is important to note that the county of Gullbringu- and Kjósarsýsla was much more diversified in economic, demographic and social terms than was the case with Snæfellsnes- and Hnappadalssýsla. Not unexpectedly, infant mortality rates in individual parishes in Gullbringu- and Kjósarsýsla exhibited important variations. The capital of Reykjavík had relatively low infant mortality rates, while, on the other fishing communities located on the peninsula of Reykjanes exhibited high infant mortality. In these communities infant mortality was extremely high around 1850, but notable improvements occurred during the last three decades of the nineteenth century. (see the discussion below.)

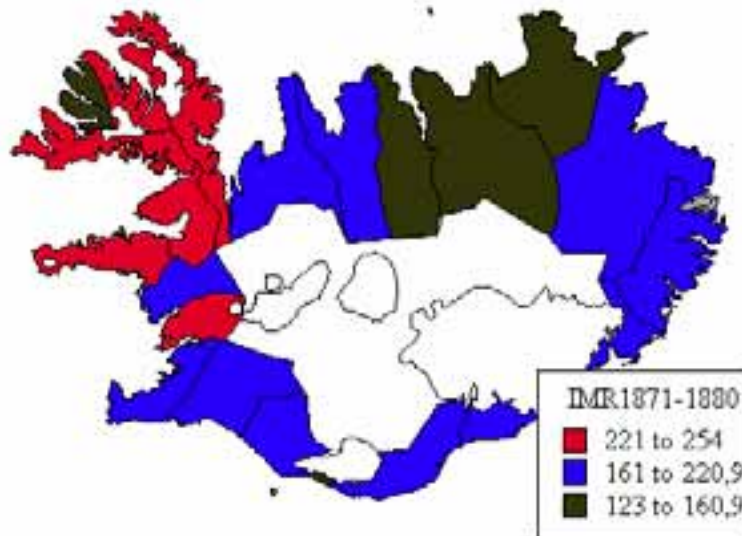
There are interesting variations in the relative share of neonatal and post-neonatal mortality between sparsely populated agrarian areas and areas with high population density. Agrarian areas with extremely high infant mortality rates tended

Map 1. Infant Mortality Rates in Iceland by counties, 1840–1852.



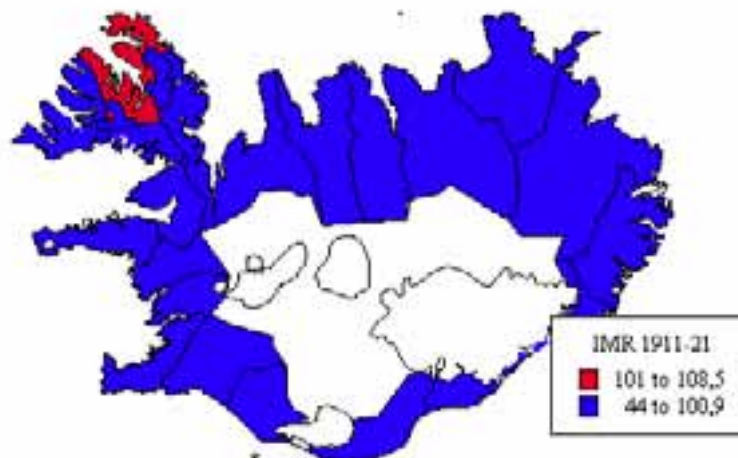
Source: NAI (National Archive Island). Bps. C. VI. Skýrslur um fædda, gifta og dána 1838–1871 (The maps were created by Ólöf Garðarsdóttir on the basis of a map by Björn Gunnlaugsson (1846)).

Map 2. Infant Mortality Rates in Iceland by counties, 1871–1880.



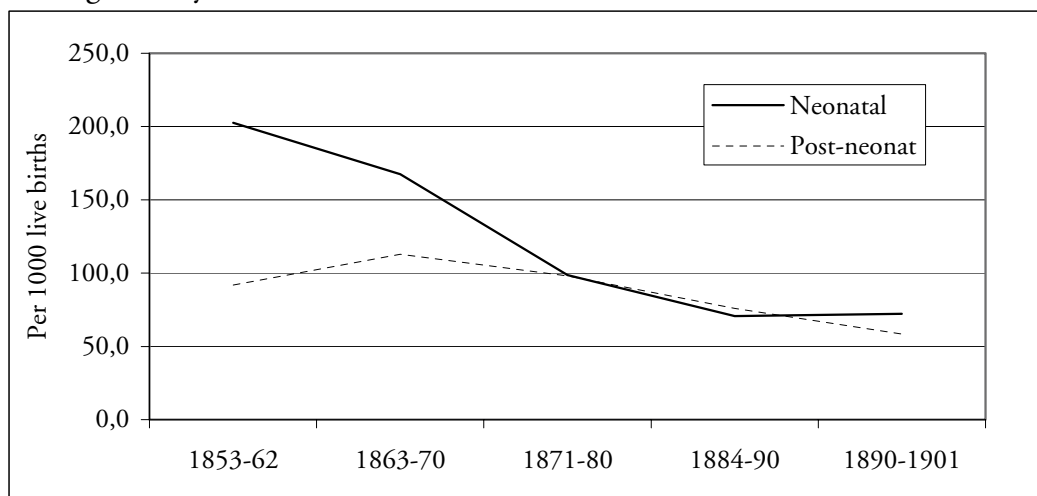
Source: NAI Skýrslur um fædda, gifta og dána, aldur kvenna er börn fæddu, svo og yfir fermda 1838–1871 and NAI. Skjalasafn landshöfðingja. Yfirlit yfir gifta, fædda og dána, aldur kvenna er börn fæddu, svo og yfir fermda 1872–1901.

Map 3. Infant Mortality Rates in Iceland by counties, 1911–1921.



Source: Statistique de l'Islande 24, 56 and 57. État et mouvement de la population 1911–1915, 1916–1920 and 1921–1925 and Statistics Iceland. Reports on deaths 1916–1921.

Figure 5. The development of neonatal and post-neonatal mortality in the province of Rangárvallasýsla.



Sources: NAI. Biskupsskjalasafn, Skýrslur um fædda, gifta og dána C, VI, 14E (1838–56), C, VI, 15A og 15B (1857–1870). NAI. Skjalasafn landshöfðingja. Séröskjur. Yfirlit yfir gifta, fædda, dána, aldur kvenna er börn fæddu, svo og yfir fermda, 1872–1901.

to have neonatal mortality rates that were much higher than was the case with post-neonatal mortality. On the other hand, densely populated fishing districts are more likely to display post-neonatal mortality rates that are higher than neonatal mortality. These two trends appear in Figures 4 and 5 showing the development of neonatal and post-neonatal mortality in two high mortality areas, the agrarian district of Rangárvallasýsla and the fishing district of Snæfellsnes- og Hnappadalssýsla. In

the 1850s more than two thirds of all infant deaths in Rangárvallasýsla occurred during the first month. Post-neonatal mortality, on the other hand, was not higher than in the neighboring agrarian districts with comparatively low overall infant mortality rates. In Snæfellnes- og Hnappadalssýsla, on the other hand, neonatal mortality was much lower than in Rangárvallasýsla: slightly less than 50 percent of all infant deaths occurred during the neonatal period.¹⁰ Comparatively high post-neonatal mortality in densely populated fishing areas suggests that infants in those regions were more likely to die from infectious diseases than their counterparts in high-mortality rural areas. Conversely, infants in rural areas with high infant mortality rates were more likely to suffer from complications connected with artificial feeding among newborns.

Several studies have demonstrated that neonatal mortality tends to be extremely high in areas where infants are not breast-fed. This was the case in several parts of Germany (in particular Bavaria and the Würtemberg area),¹¹ Austria and districts around the Baltic Sea (western Finland and northern Sweden).¹² Absence of breast-feeding is the most likely reason for the extremely high neonatal mortality prevailing in pre-industrial Iceland. During the pre-statistical period around 50 percent of all infant deaths occurred during the first month of life. It is worth noting that the proportion of neonatal deaths in Iceland was higher than in other rural areas in northern Scandinavia and Bavaria where breast-feeding was uncommon.

10 Ólöf Garðarsdóttir and Loftur Guttormsson, "Regional aspects of the development of health reforms and the decline in infant mortality in 19th century Iceland", *Nordic Demography in History and Present-Day Society*, eds. Lars-Göran Tedebrand and Peter Sköld (Umeå, 2002).

11 John Knodel, *Demographic behavior in the past. A study of fourteen German village populations* (Cambridge, 1988), 46–53; John Knodel and E. van de Walle, "Breast Feeding, Fertility and Mortality: an Analysis of some Early German Data," *Population Studies* 21 (1967), 400–402.

12 Anders Brändström, "De kärlekslösa mödrarna". *Spädbarnsdödligheten i Sverige under 1800-talet med särskild hänsyn till Nedertårneå*. Umeå Studies in the Humanities, vol 62 (Umeå, 1984), 103–106; Ulla-Brit Lithell, "Child-care. A mirror of womens' living conditions. A Community Study Representing 18th and 19th Century Ostrobothnia in Finland," in *Society, Health and Populations During the Demographic Transition*, eds. Anders Brändström and Lars-Göran Tedebrand (Umeå, 1988), 91–108.

Infant Feeding

Iceland is well-known for a tradition of artificial infant feeding, at least during the eighteenth and early nineteenth centuries.¹³ Contemporary evidence attests to the fact that during the eighteenth and early nineteenth centuries breast-feeding was extremely rare in Iceland. Apparently, only very poor women living in cottages in fishing areas occasionally breast-fed their children due to extreme poverty; they had no access to milk products.¹⁴ In these cases breast-feeding seems to have been the last resort when cow-milk could not be procured. Other kinds of social and geographical differences in infant feeding practices can also be noted. Thus infants in northern Iceland were rarely given solid food before they had reached the age of three months. In the southern and western parts of the country, on the other hand, it was common to give infants solid food already in the first month of life. The diet consisted of meat, fish or butter that had been pre-chewed by adults, the so-called *dúsa*.¹⁵

During the second half of the nineteenth century and in the beginning of the twentieth medical authorities and professional midwives exercised strong pressure on the common people to replace the traditional artificial feeding with maternal milk. This is reflected clearly in the annual medical reports and in many periodicals intended for the public.¹⁶ Results of international investigations were published in order to highlight the advantages of breast-feeding for the survival chances of babies in comparison with bottle-feeding. Empirical evidence furnished the district physicians with eloquent instances of the beneficial effects of breast-feeding.¹⁷

There is indirect evidence showing that breast-feeding progressed very unevenly from one part of the country to another. A biometric analysis of infant mortality as it develops across the first year of life, furnished by John Knodel and Hallie Kintner, has demonstrated that infant mortality in societies with artificial feeding generally deviated from the traditional linear model developed by Bourgeois-

13 Loftur Guttormsson and Ólöf Garðarsdóttir, "Aspects of infant mortality in Iceland," in *A Matter of Survival*, eds. Michael Haines and Marie C. Nelson, (forthcoming).

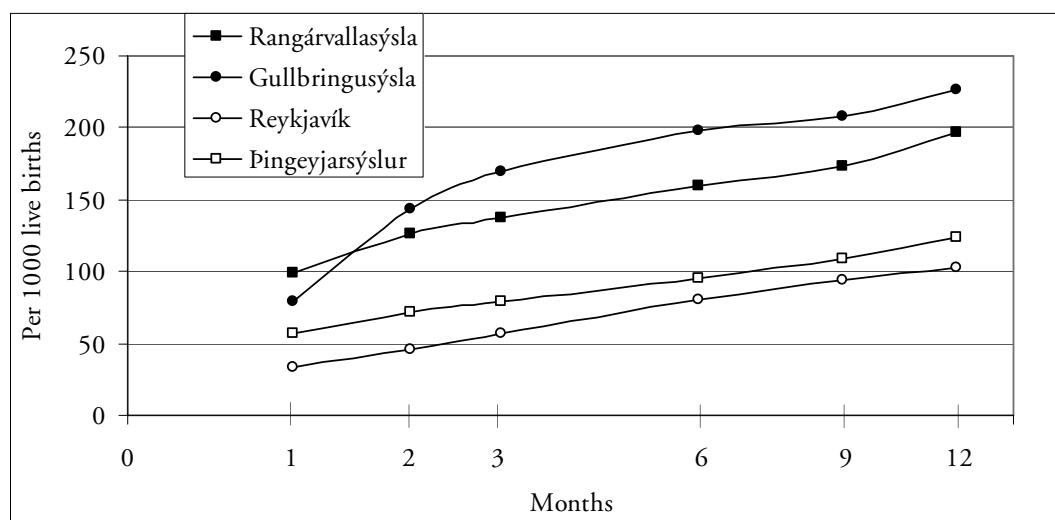
14 Guttormsson, "Barnaeldi, ungbarnadauði," 138–140.

15 Árni Björnsson, *Merkisdagar á mannsevinni. Gamlar venjur, siðareglur og sagnir* (Reykjavík, 1996), 91–94.

16 See, e.g., *Eir. Mánaðarrit handa alþýðu um heilbrigðismál* (Reykjavík, 1900).

17 See, e.g., National Archives (=NA), Skjalasafn landlæknis. Ársskýrslur lækna DI and DII. Bíldudalshérað 1907.

Figure 6. Biometric cumulative infant mortality in Rangárvallasýsla, Píngeyjarsýslur, Gullbringu- og Kjósarsýsla (with the exception of Reykjavík) and Reykjavík, 1872–1880.



Source: NAI. Skjalasafn landshöfðingja. Séröskjur. Yfirlit yfir gifta, fædda, dána, aldur kvenna er börn fæddu, svo og yfir fermda, 1872–1901. Pichat,¹⁸ a model that assumes that infant mortality after the first month post-partum is linear according to age.

Figure 6 shows the extent to which infant mortality in four Icelandic areas during the period 1872–1880 deviated in this respect from a linear development. According to this evidence, breast-feeding was widespread in Reykjavík at this time, as well as in the county of Píngeyjarsýsla in northern Iceland. In both cases infant mortality rates were far below the national average (about 180‰). On the other hand, the county of Rangárvallasýsla and the county of Gullbringu- og Kjósarsýsla in southern and southwest Iceland had low breast-feeding rates (with infant mortality rates considerably higher than the national average). In Gullbringu- og Kjósarsýsla the increase in mortality is most dramatic during the second and third month. Furthermore, both these areas exhibit high neonatal mortality rates, which means that a large number of infants died from diarrhea during the first weeks of life.

Evidence from medical health reports from the nineteenth and early twentieth centuries suggests that infant feeding practices changed relatively slowly in most areas. For the later period relevant source material becomes more abundant; district

18 John Knodel and Hallie Kintner, “The Impact of Breast Feeding Patterns on the Biometric Analysis of Infant Mortality,” *Demography*, 14:4 (1977), 391–409.

physicians wrote lengthy reports on infant feeding,¹⁹ and, after 1912, midwives were required to provide detailed information on all women they helped in delivery.²⁰ Moreover, in early twentieth century Iceland several national surveys were carried out to assess the extension of breast-feeding versus artificial feeding in different parts of the country. As a rule, in these surveys feeding methods were divided into three categories: exclusively breast-fed, mixed feeding and exclusively artificially fed. The most detailed survey on feeding practices is a study carried out in connection with the 1920 census. All households with a child below the age of one were asked about feeding practices. The queries were whether the infant was breast-fed when the census was taken and, in the case of weaned infants, whether the child had previously been breast-fed and for how long.

Information on breast-feeding for the entire country, based on the 1920 census, is included in Figure 7. It shows that breast-feeding was much more common in the urban settings than in rural areas. Breast-feeding rates were highest in the capital Reykjavík; 70 percent of all children aged one and to two months were put to the breast. The same was true for only 40 percent in rural areas and for 58 percent in towns other than Reykjavík. At the same time it is clear that, even if breast-feeding was initiated, few infants were nursed for extended periods. In agrarian settlements weaning was common after the second month, whereas most breast-fed infants in Reykjavík were nursed for at least three or four months. The short duration of breast-feeding definitely points toward early introduction of supplementary diet for infants.²¹

The information in Figure 8a–8c is based on medical reports (for the period 1911–1920) from district physicians who, in turn, received reports from individual midwives. These reports do not contain material on the duration of breast-feeding. Presumably the information is mainly based on feeding relatively shortly after birth, since midwives were not supposed to carry out any health control after two weeks post-partum. Figure 8a shows that 90 percent of all infants in Reykjavík were put to the breast, a rate higher than that derived from the census material (cf. Figure 7). As midwives were principally in favor of breast-feeding, the discrepancy between the two sources may indicate that mothers normally breast-fed their newborns upon

19 A summary of these reports has been published under the auspices of the Director of Public Health, *Skýrslur um heilbrigði manna á Íslandi* and *Heilbrigðisskýrslur 1911–1920*.

20 *Stjórnartíðindi* 1914, B, 12–20.

21 On the impact of supplementary food on breast-feeding rates, see Victoria Cesar Gomes et. al., “Pacifier Use and Short Breast-feeding Duration: Cause, Consequence, and Coincidence,” *Pediatrics*, 99:3 (1997), 445–53.

advice of the midwives. Very likely, however, some stopped breast-feeding shortly after the midwife ceased visiting them, i.e. approximately two weeks post-partum.

Towns and villages in the vicinity of Reykjavík display diverse patterns: in Hafnarfjörður only 50 percent of all infants were exclusively breast-fed, whereas infants in Keflavík were breast-fed to the same extent as their counterparts in Reykjavík. The rural areas also reveal two distinct patterns: in the northeast breast-feeding appears to be the rule (Figure 8b), whereas in the south slightly more than 50 percent of all infants were put to the breast (Figure 8c). At the turn of the twentieth century, one district physician in the area complained that it was uncommon for mothers to breast-feed: “Furthermore, it is still a common belief among many peasants that milk diluted with water is unhealthy for infants.”²² An additional complaint from district physicians in southern Iceland was that infants were given solid food too early and that gastro-intestinal diseases were common among young children.²³

It took many generations for the majority of Icelandic mothers to turn their backs on the traditional practice of artificial feeding. Most of the localities which by 1920 showed the lowest level of breast-feeding belonged to the counties which had the highest infant mortality rates at the turn of the twentieth century, in particular the county of Norður-Ísafjarðarsýsla in the northwest (Map 3). It can be noted at the same time that this county was among the most isolated from the main lines of land communication. Moreover, Norður-Ísafjarðarsýsla is an interesting case in point when one looks at the problem of causes of death among infants and young children in Iceland.

Causes of Death

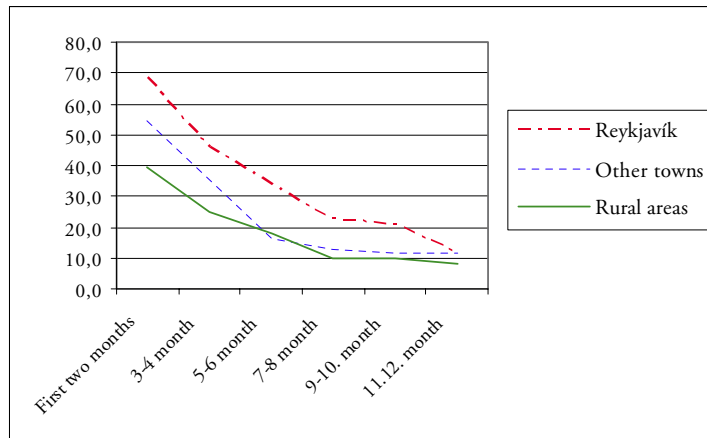
As far as the period before 1900 is concerned, our knowledge of causes of death in Iceland is primarily based on parish registers. In fact, it was not until 1911 – about eighty years later than in Denmark – that death certificates were required from physicians (medical doctors), and then exclusively in urban areas.²⁴

22 NAI. Skjalasafn landlæknis. Ársskýrslur héraðslækna, 17. læknishérað. Skaftártunga, Mýrdalur (Bjarni Jensson).

23 NAI. Skjalasafn landlæknis. Ársskýrslur lækna. Eyrarbakkaþé (1911 and 1918), Mýrdalshérað and Grímsnes (1911, 1912 and 1913).

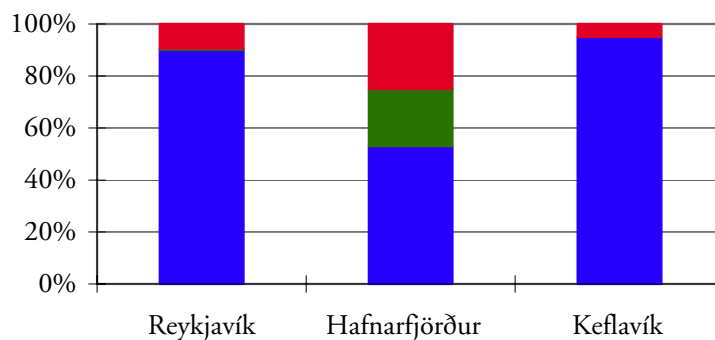
24 *Stjórnartíðindi fyrir Ísland 1911*, A, 192–195. Parish ministers continued to be responsible for the notation of causes of death in rural areas and were required to send certificates

Figure 7. Length of breast-feeding rates in Reykjavík, in other towns and in rural areas 1920.



Source: NAI. Manntal á Íslandi (frumgögn).

Figure 8a. Feeding practices 1911–1920. South-west. Urban/fishing. Breast-feeding traditionally relatively frequent, especially in Reykjavík. Early provision of educated midwives in Reykjavík.



to district physicians. For Denmark, see Anne Løkke, *Døden i barndommen. Spædbørnsdødelighed og moderniseringsprocesser i Danmark 1800 til 1929*. (Copenhagen, 1998), 55–56.

Figure 8b. Feeding practices 1911–20. North and north-east. Rural area and small fishing towns. Breast-feeding relatively frequent already in 1860. Early provision of educated midwives.

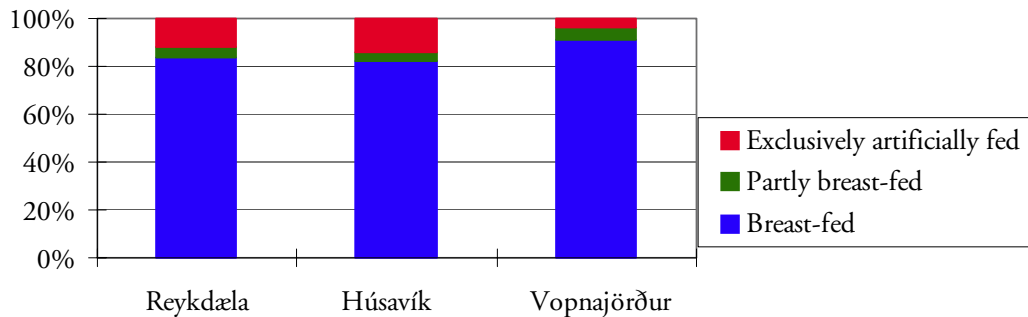


Figure 8c. Feeding practices 1911–20. South. Sparsely populated rural areas. Breast-feeding traditionally rare. Few midwives.



Source: Heilbrigðisskýrslur 1911–1920 (Reykjavík, 1922), pp. xcix.

Parish registration was introduced in Iceland in 1746. For the decades that follow burial registers do not contain any information on the cause of death of the deceased. In 1784 parish ministers were enjoined to add information on the date and cause of death of the deceased.²⁵ However, this information is very incomplete because parish ministers were not given any guidelines concerning the nomenclature and classification of mortal diseases. Neither were they provided with pre-printed forms similar to those produced by the Swedish National Health Board in

²⁵ *Skrár um skjöl og bækur í Landsskjalasafninu* II. Skjalasafn klerkdómsins. (Reykjavík, 1905).

the mid-eighteenth century.²⁶ Consequently, most causes of death as noted in the parish registers are not specific. This is true, in particular, for infants and young children. With the exception of well-known infectious diseases, such as smallpox and measles, children in the burial registers are frequently reported as dying from “child weakness” or “(common) child disease”.

From 1804 onward, district physicians were enjoined to give the Director of Public Health in Reykjavík annual reports on the general state of health and sanitary conditions. They were to pay particular attention to the most common diseases as well as to infant mortality.²⁷ With the gradual increase in the number of district physicians in the course of the nineteenth century, the reports yield more reliable and useful information, especially as regards the incidence of epidemics and infectious diseases in different parts of the country.²⁸ However, owing to the large size of individual medical districts, physicians continued until late in the nineteenth century to rely heavily on the kind of information contained in the parish registers. In addition to parish registers and medical reports, mention should be made of a number of treatises and articles written by medical doctors on the nature of the most common infant and childhood diseases and the most appropriate ways of dealing with them. However, in many respects this source material is more relevant for the study of medical and sanitary conditions than for the analysis of the actual disease panorama in the country.²⁹

Given the nature and state of available evidence, there is no way of analyzing quantitatively the importance of individual causes of death among infants and young children in nineteenth century Iceland.³⁰ *Faute de mieux*, an attempt will be made here to assess major changes during this period that seem to have affected the ecology of infant and child diseases.³¹ In this perspective it is useful to highlight the relative importance of such broad categories of diseases as “endemic/epidemic dis-

26 See Eva Nyström, “De svenska dödsorsaksstatistikens framväxt och tidiga historia,” in *Hälsa, sjukdom, dödsorsak. Studier i begreppens teori och historie*, ed. Lennart Nordenfelt (Malmö, 1986), 110–120.

27 See *Lovsamling for Island*, vol. 6 (Copenhagen, 1856), 661–663.

28 *Heilbrigðisskýrslur 1911–1920* (Reykjavík, 1922), xcii–xciv.

29 See, e.g., Jón Sveinsson, “Tilraun til að upptelia Siúkdóma þá, er til bana verða, og orðid gæta, fólki á Íslandi,” *Rit þess Íslenszka Lærdómslistafélags* 14 (1794), 1–150.

30 Cf. Løkke, *Døden i barndommen*, 57–65; Jan Sundin, “Child Mortality and Causes of Death in a Swedish City, 1750–1860,” *Historical Methods*, 29:3 (1996), 94–106.

31 See Günther B. Risse, “Cause of death as a historical problem,” *Continuity and Change*, 12:2 (1997), 175–176.

eases" as well as the relative importance of intestinal and lung diseases from the late eighteenth century to the beginning of the twentieth century. In this connection, in many cases it will be necessary to distinguish between infants and young children (one to four years old).

Medical doctors writing on infant health around 1800 agreed that colic (*colica meconii*) was the most important cause of death among Icelandic infants; it was attributed mainly to the prevailing practice of artificial feeding which caused intestinal obstruction and inflation of the belly (*upphemba*),³² and, finally, diarrhoea resulting in dehydration.³³ In this respect artificial feeding had similar consequences in Iceland as in other parts of Europe where breast-feeding was either uncommon or absent.³⁴ Furthermore, Iceland shared with these regions extremely high neonatal mortality rates (see discussion above).

In some parts of the country, particularly on the small islands off the Icelandic coast, Vestmannaeyjar in the south and Grímsey in the north, neonatal tetanus caused neonatal mortality rates to rise to exceptionally high levels, 500–700 deaths per 1000 live births. It is probable that the dependence of the insular population on sea-bird products contributed largely to such calamities. As far as Vestmannaeyjar is concerned, public authorities took an initiative in the 1840s, founding a birth clinic where newborns were isolated from the unhealthy environment and cared for during the two first critical weeks of life. In this manner neonatal mortality rates in Vestmannaeyjar were reduced to "normal" Icelandic standards within a very short time.³⁵ Recently it has been argued that neonatal tetanus represented a much more wide-ranging cause of neonatal deaths in early nineteenth-century Iceland than is

32 Jón Sveinsson, "Tilraun til að upptelia Siúkdóma," 133–135; Jón Pétursson, *Lækninga-Bók handa almúga* (Copenhagen, 1834), 8–9.

33 Helgi Skúli Kjartansson, "Ungbörn þjáð af þorsta. Stutt athugasemd um ungbarnadauða og viðurværi," *Sagnir* 10 (1989), 98–100.

34 See, in particular, Knodel, *Demographic behavior in the past*, 46–53; Brändström, "De kärlekslösa mödrarna," 94–100.

35 Loftur Guttormsson and Ólöf Garðarsdóttir, "Public intervention to diminish infant mortality from neonatal tetanus in the island of Vestmannaeyjar (Iceland) during the first half of the nineteenth century." Paper presented at the nineteenth International Congress of Historical Sciences. Oslo, August 6–13 2000. The International Commission for Historical Demography, Session I on Mortality.

commonly acknowledged, but, apparently, the argumentation does not rest on firm empirical foundations.³⁶

From the late 1820s onwards, the disease panorama among infants and young children in Iceland underwent radical change, leading to a rise in infant and early childhood mortality. As many countries on the European continent,³⁷ between 1820 and 1850 Iceland experienced an important rise in the frequency and virulence of epidemic diseases. During this period there were, among other diseases, outbreaks of scarlet fever, measles and diphtheria. In Iceland the insular condition of the country caused characteristic behavioral patterns for these diseases. Intermittently they arrived as "mortal visitors" from continental Europe and raged as epidemics throughout the country for a limited period of time, entailing catastrophic mortality, whereafter they disappeared for several decades. Thus, a smallpox epidemic raged in Iceland between 1785 and 1787. The next time the country was visited by smallpox in 1839; thanks to the preventive effects of inoculation, the disease did not spread beyond the southwestern part of the country and killed relatively few children.³⁸ Similarly, scarlet fever, which raged in 1797–98, visited the country the next time in 1827. As for whooping cough, it came in 1825, after having been absent for more than 40 years.³⁹ In both cases the sudden incidence of these two diseases is reflected in exceptionally high annual mortality rates.

It is not clear what caused Iceland during the first quarter of the nineteenth century to be more or less sheltered from infectious diseases such as those mentioned above. Possibly the important reduction in naval communication between Iceland and Continental Europe which took place as a result of the Napoleonic Wars

36 Daniel E. Vaisey, "An Estimate of Neonatal Tetanus Mortality in Iceland, 1790–1839," *European Journal of Population* 13 (1997), 62, 67; Guttormsson and Garðarsdóttir, "Public intervention to diminish infant mortality."

37 See, e.g., Robert Woods, Naomi Williams and Chris Galley, "Differential Mortality Patterns among Infants and Other Young Children: The Experience of England and Wales in the Nineteenth Century," in *The Decline of Infant and Child Mortality. The European Experience: 1750–1950*, eds. Carlo Corsini and Pier Paolo Viazzo (Den Haag, 1997), 57–72; Marie C. Nelson, "Diphtheria in late-nineteenth-century Sweden: policy and practice," *Continuity and Change* 9:2 (1994), 213–42.

38 Jón Steffensen, "Bólusótt á Íslandi," *Menning og meinsemdir* (Reykjavík, 1975), 311–314.

39 Peder A. Schleisner, *Island undersøgt fra et lægevidenskabeligt Synspunkt* (Copenhagen, 1849), 62–69; Sigurjón Jónsson, *Sóttarfar og sjúkdómar á Íslandi* (Reykjavík, 1944), 58–60.

explains the low mortality rates, at least in part.⁴⁰ So much is certain that the second quarter of the nineteenth century was marked by a wave of noxious diseases that killed infants and young children alike. It culminated with the measles epidemic of 1846 when infant mortality rose to the level of 611 deaths per thousand live births.⁴¹ The last mortality peak (infant mortality rates of 439‰) typical of the old demographic regime, in 1882, was caused by a measles epidemic. During these two epidemic waves, occurring at an interval of thirty-five years, measles proved to be a huge killer of infants and children in Iceland.⁴²

One of the diseases which raged during this period was significantly more noxious to children than infants, namely diphtheria. Until the late nineteenth century, diphtheria was not clearly distinguished from croup and even some forms of scarlet fever.⁴³ The two forms of throat distemper, diphtheria and croup, continued to be subsumed under one term in Icelandic, *barnaveiki*. In the source material *barnaveiki* appears for the first time as an epidemic disease in the 1820s; as such, it peaked around 1860 and continued to rage intermittently until the early 1880s.⁴⁴ During the second half of the century diphtheria had undoubtedly become endemic in Iceland; but thanks to the introduction of anti-diphtheria serum at the turn of the century, child deaths caused by this malady were greatly reduced.⁴⁵

Around the turn of the twentieth century, the great infant and child mortality peaks that had characterized the preceding century had disappeared. Even if diseases such as measles and whooping cough continued to behave as epidemics, only occurring at shorter and shorter intervals, their virulence was greatly reduced as well as

40 Loftur Guttormsson, Ólöf Garðarsdóttir and Guðmundur Hálfðanarson, "Ungbarna- og barnadauði á Íslandi 1771–1950," *Saga. Tímarit Sögufélags* 39 (2001), 88–89.

41 Schleisner, *Island undersögt*, 50–54; *Hagskinna. Icelandic Historical Statistics* (Reykjavík, Hagstofa Íslands, 1997), 56–59.

42 As for the effect of crowding on measles mortality, see Robert Woods and Nicola Shelton, "Disease Environments in Victorian England and Wales," *Historical Methods* 33:2 (2000), 75.

43 In Icelandic medical treatises the distinction between diphtheria and croup appears clearly for the first time in Jón Hjaltalín, *Barnaveikin og taugaveikin* (Akureyri, 1866). For comparison see Nelson, "Diphtheria in late-nineteenth-century Sweden," 220.

44 Steingrímur Matthíasson, "Barnadauði á Íslandi," *Eimreiðin* 10 (1904), 84–87. Diphtheria attained its climax in Sweden in much the same period, see Nelson, "Diphtheria," 221–223.

45 Matthíasson, "Barnadauði á Íslandi," 84–85; *Heilbrigðisskýrslur 1911–1920*: (Reykjavík, 1925), xxxiii–xxxvi.

the mortality caused by them.⁴⁶ Epidemics were increasingly met with quarantine measures while certain diseases, for example scarlet fever, tended to become endemic.⁴⁷

As a result of the progress of bacteriological knowledge at the end of the nineteenth century, the attention of medical and political authorities was increasingly drawn towards certain hygienic-related diseases, especially those that were water- and food-borne, such as typhoid fever. The early phases of urbanization entailed a growing risk of polluted drinking water as long as sewerage and water pipelines had not been installed. For those families who stuck to the practice of artificial feeding, polluted water represented a real threat. Probably these circumstances can partly account for the excessive infant mortality experienced by some fishing towns in early twentieth century Iceland.⁴⁸ Consequently, in this period much emphasis was laid on the installation of sewage and water systems. These initiatives made the urban environment much less fatal to the survival chances of infants than was the case at the end of the nineteenth century.⁴⁹

Medical health reports from individual physicians indicate that intestinal diseases were less frequent during the second decade of the twentieth century than they had been earlier.⁵⁰ This probably relates to the fact that campaigns in favor of breast-feeding launched during the initial years of the century had been more successful in

46 This was in line with developments in the neighboring countries, see Thomas McKeown, *The Modern Rise of Populations* (New York, 1976), 95–100. Probably the reduced mortality in Iceland was due to the combined effects of a more varied diet, more widespread breast-feeding and successful quarantine measures, see Guttormsson, Garðarsdóttir and Hálfðanarson, “Ungbarna- og barnadauði,” 88–91.

47 *Heilbrigðisskýrslur 1911–1920*, (Reykjavík, 1922), xx–xxiii.

48 See Gunnlaugsson and Guttormsson, “Household Structure and Urbanization,” 326–328. See also medical reports from individual physicians, e.g., NAI. Skjalasafn landlæknis. Ársskýrslur lækna, Reykjavík 1897 (Guðmundur Björnsson).

49 Concerning the installation of water and sewage systems in urban areas in the beginning of the twentieth century, see Guðjón Friðriksson, *Saga Reykjavíkur. Bæinn vaknar 1870–1940*. Vol 1 (Reykjavík, 1991), 249–269; Lúðvík Kristjánsson, *Úr bæ í borg. Nokkrar endurminningar Knud Zimsens fyrrverandi borgarstjóra um þróun Reykjavíkur* (Reykjavík, 1952), 84–112.

50 NAI. Skjalasafn landlæknis. Ársskýrslur lækna. See, for example, Reykjavík 1910 and 1913 (Guðmundur Hannesson and Jón Hj. Sigurðsson) and Hafnarfjörður 1909, 1910 and 1911 (Þórður Edilónsson).

urban areas than was the case in sparsely populated rural districts. This further improved the survival chances of young infants and children.

From 1916 onward, information on causes of death on the individual level is available in Iceland. At this point in time infant and childhood mortality had dropped to levels below most other western societies. Infant mortality figured at a level slightly below 65 per 1000 live births during the period 1916-21. Early childhood mortality was below 10 per 1000. Table 2 shows that intestinal diseases were no longer a frequent cause of death among infants and other young children. At the national level, death rates from intestinal diseases were 520 per 100,000 for infants and only 55 per 100,000 for one to four year old children. Mortality from lung diseases was much higher: 1,802 deaths per 100,000 for infants and 294 in early childhood. It is worth noting, however, that cause of death is often unspecified in the case of infants. Moreover, cause of death for infants was often listed as "childhood convulsions" (*barnakrampi*). Without a doubt, this category includes children who died of convulsions in connection with diarrhea and dehydration. At this point in time, the great killers of the nineteenth century appear to have had relatively little effect on levels of infant and childhood mortality. Mortality from "childhood diseases" (measles, scarlet fever, diphtheria and whooping cough) had dropped to relatively low levels, 810 per 100,000 for infants and 294 per 100,000 for one to four years old children (Table 2). During the period in question epidemics were reported in 1916 in all medical districts in Iceland and, similarly, in 1920 a severe epidemic of whooping cough was noted in all districts. Even though mortality from epidemic diseases like measles was scarcely comparable to nineteenth century levels, it is worth stressing that in individual districts and individual families the harm done by these diseases was considerable. In 1916, measles swept through the country between May and November, and even if it was possible to some extent, by means of quarantine measures, to prevent children from catching the disease, infant mortality from measles alone in the year 1916 was 1,430 per 100,000 and early childhood mortality 350 per 100,000. The disease was most fatal during the last three months of the first year and the second and third years of life. The whooping cough epidemic of 1920 had even higher levels of fatality; in that year infant mortality in whooping cough was 2,512 per 100,000 and early childhood mortality 770 per 100,000.

An analysis of the information on causes of death in different regions shows that the disease panorama was quite different from one place to another. As noted earlier, differences between regions had now become small compared to earlier periods. However, the analysis of causes of death in different regions of the country reveals that intestinal diseases were more fatal in areas with previously high levels of infant mortality and a prevailing tradition of artificial feeding. This is the case with Rangárvallasýsla that had an infant mortality rate of 1,077 per 100,000 from intestinal disease, whereas the average rate for Iceland was 520. In general it can be noted

Table 2. Infant and early childhood mortality from different diseases (per 100,000) in Iceland, 1916–21.

	IMR	ECMR
Congenital diseases	1181.2	3.9
Childhood diseases	810.0	293.8
Lung diseases	1802.2	293.8
Intestinal diseases	519.7	54.5
Childhood convulsions ("barnakrampi")	641.2	17.5
Other infectious diseases	330.7	165.4
Other diseases/ accidents	384.7	70.1
Cause of death not specified	816.7	75.9
Mortality rates / 1000	64.9	9.7

Source: Statistics Iceland. Dánarskýrslur 1916–21.

that fishing towns situated in areas with prevailing traditions of artificial feeding were characterized by high infant mortality rates and in particular by high mortality rates from intestinal diseases. Thus the village of Vestmannaeyjar (in Rangárvallasýsla) exhibited a mortality from intestinal diseases of 1,757 per 100,000 and the town Ísafjörður in Norður-Ísafjarðarsýsla – the county with overall highest mortality rates during this period (see Map 3) – had infant mortality rates from intestinal diseases of almost 2,500 per 100,000.

Concluding Remarks

Within the Danish kingdom, mid-nineteenth century Iceland distinguished itself by excessively high levels of infant mortality. At the same time infant mortality exhibited huge regional variations from one county to another (ranging 210–250 from 355–399 deaths per 1000 live births). Basically, the high-level regions covered the western and southern parts of the country, while the low-level regions were located in its northern and eastern parts. However, generally speaking, the transition from high-level to low-level infant mortality took place within an exceptionally short period of time, mainly between 1870 and 1915. By 1915 infant mortality rates in Iceland were on par with the lowest rates in Europe. This rapid decline in infant mortality coincided with the initial phases of Icelandic industrialization and urbanization.

In pre-transitional Iceland infant mortality did not vary significantly by social class. Furthermore differences according to the matrimonial status of the mother (legitimate/illegitimate births) were less important than in most other societies. As

far as illegitimate births are concerned, kinship networks had strong impact on the survival chances of infants. On the whole, however, it is geographical location in combination with different cultural norms, that accounts for the most important variations in infant mortality. The analysis of regional differences in infant mortality suggests that changes in infant feeding practices played a crucial role in reducing infant mortality during the transition period.

By 1800 artificial feeding was generally practiced in Iceland. During the latter half of the nineteenth century, however, many parts of the country witnessed important progress in breast-feeding. An analysis of infant mortality levels by counties shows, *grosso modo*, that levels of infant mortality were positively related to the extent of breast-feeding. In addition, a biometric analysis illustrates the impact of feeding practices on the survival chances of infants in different areas. In the 1870s they were almost twice as high in the north-east and the capital (Reykjavík) where breast-feeding had become widespread, as compared to the northwestern counties. After the turn of the twentieth century, medical health reports provide further evidence of the strong inverse correlation between infant mortality levels and breast-feeding. In many places successful breast-feeding campaigns among the common people were the outcome of a close collaboration between district physicians and midwives. On the other hand, as many babies were not nursed at all or breast-fed for only a few weeks, pressures for increasing popular awareness of the importance of cleanliness, in particular as regards the treatment of artificial milk and ways of bottle feeding, constituted a critical factor of change.

Not unexpectedly, available information on causes of death reflect the important changes which affected infant feeding practices during the transitional period. As long as artificial feeding practices prevailed, intestinal diseases had been the most important cause of infant deaths. In the 1910s, when information on causes of death at the individual level became available for the first time, intestinal ailments had been replaced by lung diseases as the most important cause of death among infants and young children. However, intestinal diseases continued to weigh heavily in areas where breast-feeding was not yet practiced on a large scale. By this time the great epidemic infant and child killers of the nineteenth century, such as measles and whooping cough, had lost much of their virulence. Occasionally, they were even successfully coped with in individual places with quarantine measures. By 1920 Iceland had become relatively safe for infants and young children in comparison with the dreadful situation prevailing around the mid-nineteenth century.

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Social Differences in Infant Mortality in the Norwegian Parish Asker and Bærum 1814–1878¹

Eli Fure

By the turn of the century 1700/1800 less than one in five Norwegian children died before their first birthday. The average hides variations among regions and over time.² Infant mortality had, at least in some areas, started its secular decline from the end of the 18th century.³ Neither in Norway nor in other countries have the causes of decline been definitively identified. One hypothesis has been that the decline in mortality was associated with an increase in prosperity. One would, therefore, expect that infant mortality was higher in the poorer classes, at least during the initial stage of the decline in infant mortality.

Researchers have published data on infant mortality according to social groups in some Norwegian family reconstitution studies from different parishes. Usually there are two groups: one consists of farmers, whereas the other is a mixed group of cotters, crofters, laborers, workers, fishermen and sailors. Family reconstitution is very time-consuming work. The results for individual parishes often do not consist of a large number of cases, and the differences found have not been subjected to statistical testing. This makes it difficult to interpret the results, and the researchers are usually reluctant to make substantial conclusions. One exception is a study not based on study of a single parish, but rather on linkage between records from church registers from 45 randomly chosen parishes for two to five years around

1 E. Fure, "Spedbarnsdødelighet og sosiale forskjeller i Asker og Bærum 1814–1878. En metode for studier på individnivå," *Heimen*, 37 (2000). A Norwegian version of this paper was first published here.

2 G. Thorvaldsen, "Rural Infant Mortality in Nineteenth Century Norway" *in this volume*.

3 E. Fure, "Nedgangen i dødeligheten i Asker og Bærum 1733–1878," *Heimen*, 36 (1999).

1800 and the 1801 census. The results of this study indicate that infant mortality was highest in the most affluent social group.⁴

Method

Family Reconstitution and Life Tables

In order to analyze historical mortality at the individual level, the data set has to consist of some kind of linked records. Information about a person must be retrieved from at least two different sources. The usual procedure, family reconstitution, was developed by French demographers almost 50 years ago. The method consists in linking entries in marriage registers to those in the baptism and burial registers, thus reconstituting families onto “family sheets”. The information on these sheets is subsequently used for demographic analyses.⁵ For mortality studies, life tables are constructed; the number of births, deaths and the number remaining alive at increasing ages are tabulated and then analyzed.

The data set from Asker and Bærum is not a family reconstitution. An interactive record linking system was used in order to link computerized individual event records from church records, censuses and land registers into life courses. The units are persons, not families, but there are connections between parents and children, so that it is possible to use information about the parents in the analysis of infant mortality.

An efficient way of exploiting the information in life tables is to combine it with regression analysis, which makes it easier to assess the effect of different variables on mortality. This type of regression technique is used for many purposes in different types of research and is known under several names, such as event history analysis or survival analysis, which is the term that will be used here.

4 R. Engelsen, “Mortalitetsdebatten og sosiale skilnader i mortalitet,” *Historisk tidsskrift* 2 (1983), 161–202.

5 M. Fleury, and L. Henry, *Des registres paroissiaux à l'histoire de la population. Manuel de dépouillement et d'exploitation de l'état civil ancien* (Paris, 1956).

Survival Analysis

Survival analysis was designed for longitudinal data on the occurrence of events, that is a qualitative change that can be constituted in time, a transition from one discrete stage to another. In this case the events are deaths. The death rate resembles the death probability, which is the probability of dying at a particular age interval, but they are not the same. The death rate has the form *number of events per interval of time*: it is a conditional probability, and only the individuals who have survived to the beginning of the interval are considered. For computing the death rate, we need not only the number of deaths, but also the time until the deaths occur. The shorter the time, the higher the death rate.

The main advantage of survival analysis is that it allows for *censoring*. If a person does not die during the age of interest, he or she is censored. All the children who survive their first birthday are censored in studies of infant mortality. Not all types of censoring are acceptable in survival analysis, as some may give biased results. It is important to know how the persons enter into and leave the analysis. Censoring is not a concept in family reconstitution, but there are rules about how to use the data for different types of demographic analyses.

Censoring and Family Reconstitution

It is always easier to know the number of deaths in a population, than to know the exact size of the population. Migration disturbs mortality analyses because it makes it difficult to know the size of the population at risk. In order to cope with this problem, the creators of the family reconstitution method assume that children stay with their families until they are 10 or 15 years old. If it is clear that the family lived within the parish at a given point in time, it is assumed that the children also lived in the parish at that time. The basic rule is not to use the same type of event that is studied, to decide whether the family still lived in the parish. In studies of infant mortality one does not use the dates for infant deaths as final points of observation of families.

Proof for the presence of a family can be that the parents are found in a census or in a church register as parents for a baptized or buried child (if it is not an infant). Figure 1 shows how different types of events can be used to decide which children should be included in the analysis of infant mortality. Solid lines show the periods where the different persons A-F can be used for mortality analysis according to family reconstitution; dotted lines show periods that cannot be used. Persons A through C survived their first birthdays, while person D died. They can all be used, as we know that their families were present in the parish thereafter. The persons E and F cannot be used. We know the births of E and F, and the death of E, but nothing

about their families. If E is included in the analysis, but not F, infant mortality will be overestimated.

It has been maintained that the problem of migration in infant mortality studies is negligible because we can control migration through information about the presence of other members of the family, but the data from traditional family reconstitution studies are not exploited as efficiently as possible. There are important differences in the number of births and the number entered in the life tables which usually include ages up to 15. In her Ph.D. thesis, Sølvi Sogner shows that 3,851 children were baptized during the period 1734–1828. Less than 65% of these enter the life table.⁶ In another study, only 52% of the baptized children are used in the life table.⁷ The possible effect this had on selection should be discussed.

This method meant that only births that occurred up to 15 years before the cut-off date of the study are used. For example, if the final year chosen was 1800, children born in 1786 or later are not included. This choice was probably justified in order to save labor as the life tables were created manually. This effect is, however, selection over time. If time is not crucial in the study, this selection is not critical.

Another problem is that children born out of wedlock are often excluded from family reconstitution studies. Since children have higher mortality, this exclusion means that the total mortality rates will be downward biased. Further characteristics of those who do not enter the life tables are unknown, and therefore, it is difficult to discuss how the mortality rates might be affected.

The traditional method leads to a loss of information, both because family reconstitution is a manual method, where each different sorting of the cards is time consuming, and because traditional life tables, and not survival analysis, are used. In survival analysis the individuals are present until the death occurs or until the time when the individual no longer takes part in the analysis. In life table analysis the individuals are used until they die or until they pass certain predefined age intervals. If we know the date of birth for a person and know that he or she was alive at the time of a census some months later and then disappears, he or she is not used in life tables based on family reconstitution. In survival analysis the person can be used up to the last time we know that he or she was alive. With the help of the computer, we can compare mortality rates based on different assumptions of survival times.

6 S. Sogner, *Folkevekst og flytting* (Oslo, 1979), 306, 387.

7 H. B. Randsborg, *Befolkningsutviklingen i Bø i Telemark 1727–1815*. Cand. philol. thesis, (University of Oslo, 1979).

Figure 1. Conservative censoring. Solid lines show examples of life courses to be included, dotted lines shows life courses to be excluded, according to the family reconstruction method

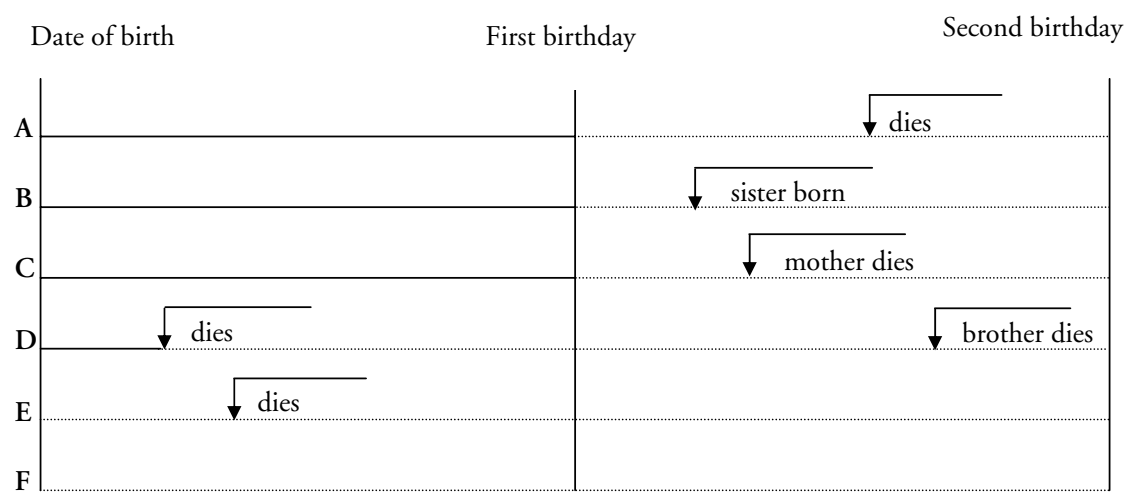
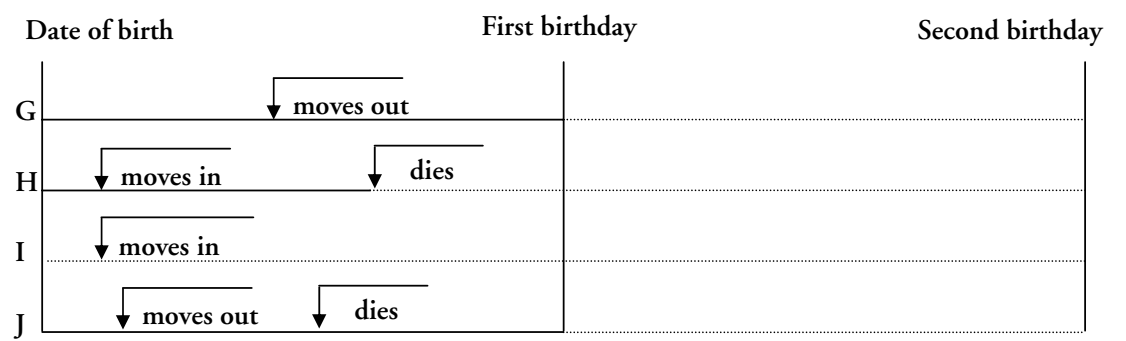


Figure 2. Radical censoring. Solid lines show examples of life courses to be included, dotted lines show life courses to be excluded, according to the assumption that children survive infancy unless a death record is found.



Censoring Individually Linked Life Courses

In my data set, where the basic units are individuals and not families, the question of survival times must also be solved.⁸ First of all, the baptized children, just under 15,000, were selected. To these were added about 400 children found only in the burial lists. Most of these 400 were born in Asker and Bærum, but died so shortly after their birth that they missed baptism in church. The main problem is that we do not know if, or when, the children moved out of the parish. Two different assumptions will be tested and the results will be compared. The most radical solution is to assume that everybody survived infancy, whether they moved out of the parish or not, unless we have a death record before their first birthday. Some possible cases are shown in Figure 2. Solid lines show accepted life courses with the most radical assumption; dotted lines show life courses that cannot be used. The persons G and J are possible types of out-migrants, as was F in Figure 1, that is, persons for whom we have only information on baptism. Both G and J move out, whereas J dies in infancy after out-migration. With the radical assumption, both G and J are considered to be alive on their birthdays.

The persons H and I are in-migrants after baptism, that is a type of person not included in Figure 1. The person H is included in the analysis until his or her death, while the person I is not included in the analysis at all. The possible loss of survival time for I is assumed to be compensated by the excess survival time of J. The radical assumption will make the best use of the data and should be chosen if it can be proven to be reasonable.

One year is a short period, and families with small children were less likely to move than unmarried young people. If the families moved, it is highly improbable that the migration was related to the health condition or mortality risk of the child.

The 400 infants who were registered in the burial records only include children who were not born in Asker and Bærum, but who moved in shortly after their birth. A sample where the families of these infants were studied in detail suggests that about 25% of them were born outside the parish. These are included in the analysis because they were probably subject to the same causes of death as the children who were born in the parish.

The radical assumption is thus that the number of deaths among the out-migrants was about the same as the number of deaths among the in-migrants, or, in other words, that the out- and in-migration rates were equal and that the mortality rates were equal for out- and in-migrants.

⁸ The data set consists of linked individual event record from the censuses in 1801, 1815, 1825, 1835 and 1865, all of which are nominative in Asker and Bærum; baptismal, marriage and burial records from the church registers for the period 1814–1878, as well as records from land registers from 1802, 1826, 1838, 1866 and 1888.

A more conservative approach is to follow the principles of family reconstitution as far as possible. If it can be documented that the family still lived in the parish, we can safely assume that their infants lived with them. This is fairly obvious for children born in wedlock, but cannot be assumed for children born out of wedlock. An unmarried mother could leave her child with a wet nurse, and thus we cannot be sure that the child lived in the same parish as the mother.

For each mother and father the final individual event record was located, and, if the record was for an event other than the death of the infant, then the date of the event was chosen as the end of the observation of the parent. Since the final registration is from 1878, there was little time for parents of children born in the late 1870s to have other records as proof of their existence in the parish. This procedure leads to a selective loss of these late-born infants, whether they died or not. The types of life courses included in the analysis are those of the persons A-D in Figure 1.

Explanatory Variables – Hypotheses and Coding

Sex, Year of Birth, Marital Status of Parents and Residence

Information on sex, birth year, whether the birth was within or out of wedlock and residence are variables with values for almost all the children. The place of birth or the place of death for the 400 who were not in the baptism lists is interpreted as residence. Sex is either given explicitly in the church records, or may be deduced from the first names.

Boys normally have higher mortality than girls, so I expect this also to be true for the children in Asker and Bærum. In an earlier article where the data was based on aggregate figures from the church registers, I have found a decline in infant mortality,⁹ so I assume that the method of survival analysis will show a decline as well.

The baptismal records always state whether a child was born within or out of wedlock. Altogether seven percent of the children were born out of wedlock. Among the 400 from the burial lists, 14% were born outside marriage. The total number of illegitimate children born was 1,100. It is well-known that children born out of wedlock have higher mortality than those born within marriage, but the difference varies in historical studies.

9 E. Fure, "Nedgangen i dødeligheten i Asker og Bærum 1733–1878," *Heimen*, 36 (1999).

The economy in Asker and Bærum was based primarily on agriculture, but there were also families who earned their living from an iron foundry. It would be interesting to see if children who lived on the foundry premises had a higher or lower mortality than those who lived elsewhere. Slightly more than 1,000 children were born in the foundry areas.

Epidemic diseases might spread more easily in the more densely populated foundry areas, and this would lead to higher mortality. On the other hand, infant mortality was lower among workers in the foundry industry in Sweden. This has been explained by the paternalistic spirit of the foundry owners who supplied the workers families with medical care. Breast-feeding was reported to have been more common in iron foundry communities than in adjacent rural communities.¹⁰

In Asker and Bærum there is no evidence of better health care for the foundry workers than for the other inhabitants in the parish. The low rate of infant mortality in the parish cannot be explained otherwise than with the existence of a widespread practice of breast-feeding before the outset of the decline in infant mortality.

In addition to the foundries there was also a village, Sandvika, inhabited by fishermen and workers. Sandvika was more densely populated than the rural districts. Infant mortality was at the time higher in urban than in rural areas, but Sandvika was quite small. Only 300 children were born in the village. If the numbers are not too small, I will expect higher mortality in Sandvika.

Social Groups

When the question about the relationship between infant mortality and social class is raised in historical studies, the underlying hypothesis has often been inspired by the present world situation where poorer countries have higher death rates. The hypothesis presupposes that there is knowledge about factors that increase the survival chances of infants, and that these factors, such as cleanliness, proper nourishment, and adequate housing and clothing, are correlated with prosperity.

The best nourishment for an infant is mother's milk. It is important to start the breast-feeding as early as possible and to avoid supplementary food the first months. Breast-feeding strengthens the immune system of the child. Supplementary food may be difficult for the child to digest, or even worse, it may be contaminated. Both the intensity of the breast-feeding and the length of the breast-feeding period are important for child survival. Breast-feeding practice is perhaps more a question of culture than of prosperity. A Swedish study has shown that infant mortality was

10 J. Sundin, "Culture, Class, and Infant Mortality during the Swedish Mortality Transition, 1750–1850," *Social Science History*, 19 (1995), 120–121.

higher in farmers' families than in the families of landless agricultural workers, because breast-feeding was more widespread among the latter.

Housing conditions were better for farmers than for the lower social class. For the adult population respiratory diseases were a major cause of death in Asker and Bærum, and this was probably also the case for infants. Cause of death was often not stated for children, but the mortality was much higher during the winter than in summer.¹¹ All other things being equal, this should imply that the farmers' children were better protected and had lower mortality. Greater exposure to infectious diseases could counter this effect. It is not certain that farmers' households with many members were more favorable environments than the smaller households of the landless class. In his analysis of the 45 parishes around 1800, Engelsen found higher infant mortality among the more prosperous. He attributes this to their larger households.

Cleanliness and, in particular, clean water are important to avoid gastro-intestinal diseases. In historical populations, however, there is always the question as to whether people realized the importance of clean water. The significance of this factor is difficult to assess in Asker and Bærum. The fact that mortality was higher during winter than during summer for infants indicates that respiratory diseases were more important than diseases related to cleanliness.

Thus, it is not obvious that infant mortality is related to prosperity or social class. As if this was not enough, it is also difficult to interpret information about social position. The sources do not give consistent types of data about the father; occupation, trade, or social class may be given, or nothing at all. There will often, but not always, be a correlation between these pieces of information, but here. I assume there is a correlation between high social position and prosperity.

The coding was done in two steps. First, a fairly detailed coding of occupations was completed which resembles the codes in the machine-readable version of the 1801-census for the whole country.¹² Each source was coded separately. Thus different codes could be given to the same occupation if found in two different sources. This was useful because some occupations had higher status at the beginning than at the end of the period. In some sources there was an abundance of occupations or trades; in other sources, the paucity was just as remarkable. Altogether 240 codes were employed, which is an amount that is impossible to use in any analysis. The level of detail was chosen in order to get an overview of the content in the data set.

The next step was to group these codes into three main categories for social class: an upper, a middle and a lower class. The idea was to group farmers in the upper

11 E. Fure, "Dødsårsaker i Asker and Bærum på 1800-tallet. En kildekritisk undersøkelse," *Heimen*, 36 (1998).

12 J. Oldervoll, *1801-prosjektet, Databehandling av ei folketeljing*, (Historisk institutt, University of Bergen, 1978), 14–22.

class; craftsmen, shipmasters and innkeepers in the middle class; and landless laborers, craftsmen, sailors, fishermen and servants in the lower class. Separating the middle from the lower class was not easy. The craftsmen were the most difficult group to handle. Therefore, the lower and the middle class were grouped together.

The coding in itself is complicated. Additional problems included choosing which of several codes a person should be assigned during a lifetime and how to treat those cases where there was no information. The best choice would be to use information given in connection with the baptism of the child, but this is impossible, since 30% of the baptisms lacked information about social class. I had to use information about the social position of the father from all the sources where such information was given, before, at or after the baptism. The advantage is that more fathers can be classified socially; the disadvantage is that social mobility is not considered. Sometimes there is real social mobility, but sometimes it is only apparent, as for the servant category. Farmers' children were often servants in their youth, which meant nothing for their later social classification.

Analytically it may be a problem to use information after the birth or death of the child as an explanatory variable. This is so if the information is dependent upon the preceding event. In this case it is not likely that the death or survival of a child had an effect upon the social classification of the father.

I tried to make a general code for the whole lifespan of a person in two ways. The first was to make some kind of a personal profile for each person. For some persons, there were many codes; for others few or none. The result was not very encouraging. Many had an unsystematic mixture of codes for high and low class during their lifetime. Some had, of course, been socially mobile, but the overall impression was that the social coding, laborious as it had been, nevertheless contained errors. It is difficult to assess the amount of errors, the probability of getting a wrong code for each person increases for each time there is a piece of information to be coded during the life-course.

Another method was, therefore, chosen. To solve the problem that a person was designated as a farmer, regardless of how much land he owned or controlled, information from the land registers was useful. If the size of the farm was greater than 500 *ares* (12.5 acres), or the taxation of the farm exceeded one *daler* in the land register, the social classification of the owner was high. In other countries and in Norway today 500 ares is a small farm, but this size has been used as the dividing line between large and small farms in earlier Norwegian social history studies.¹³

In the final coding all codes for each person were registered so that a high social code gave one plus point, while a low social code gave one minus point.

13 T. Pryser, *Thranittene i Ullensaker: En sosialhistorisk analyse* (Cand. philol thesis, University of Oslo, 1974).

Information from the land registers was given double weight, because it was less ambiguous than the information from censuses and church records and because land ownership was very important in an agricultural society. Finally, the number of points were added. Those who had a positive number of points were categorized as the high social class, where a negative sum meant inclusion in the lower group. Cases where there was no information about social class, or where the points canceled out each other, resulting in a sum of zero, were not coded at all. In all 20% were excluded, while of those who were coded, 20% went to the higher class, and 80% to the lower. This process was completed for all the persons in the data set; for the fathers the proportion coded was higher, more than 95%.

Control of Data Quality – the Stillborn Children

In the family reconstitution method a family context is created for each individual. This context enables the researcher to assess the quality of the data, i.e. under-registration or errors in the sources and to make corrections so that the finally reconstituted families are as complete as possible. My data set underwent a quality control with several types of testing during the record linkage process.¹⁴

The definition of stillbirths changed during the 19th century, and the church records reveal inconsistent registration practices. Altogether 462 cases were stated as stillbirths and are thus omitted from the analysis, but there is also a problem with the children who were reported as dying on the day of birth or the day after. These children are not evenly distributed in the church records. Does this mean that some of the stillbirths really were live births? The stillbirths and the infants who died before they were two days old were added for each year. The new distribution was not smoother than for the stillbirths alone.

In order to get comparable data, another solution was chosen. All stillbirths and all children who died before they were two days old, about 150 infants, were excluded from the analysis.

14 E. Fure, "Interactive Record Linkage: The Cumulative Construction of Life Courses," *Demographic Research*, <http://www.demographic-research.org/Volumes/Vol3/11>.

Table 1. The relative risk of infant mortality in Asker and Bærum 1814–1878 according to alternative methods of censoring. Summary table of four different outputs. The complete tables are in the appendix.

Method for censoring of data						
	Radical			Conservative		
Variable	Risk ratio	P-value	N	Risk ratio	P-value	N
Male	1.17	0.0040	14793	1.15	0.0200	12896
Out of wedlock	1.94	0.0001	14793	1.46	0.0004	12896
Year of birth	0.99	0.0001	14793	0.99	0.0001	12896
Foundry	0.93	0.5098	14793	0.94	0.6302	12896
Sandvika	1.23	0.2370	14793	1.10	0.6244	12896
High social class	0.94	0.3630	14087	0.97	0.6905	12501

Sources: See note 8.

The Results

Within survival analysis there are several different statistical models. My choice was a Cox regression model which is a combination of the proportional hazard model and the estimation method of maximum partial likelihood. I used the statistical package *SAS*[®] System for the analysis.¹⁵ One of the important advantages of Cox regression is that it is not necessary to choose a particular probability distribution to represent survival times, therefore it is quite robust.

For indicator (dummy) variables with values of 1 and 0, the risk ratio can be interpreted as the ratio of the estimated risk for those with a value of 1 to the estimated rate for those with a value of 0 (controlling for other variables). The p-value refers to Wald chi-square tests for the null hypothesis that each coefficient is equal to 0.

Table 1 shows the results for the two alternative ways of censoring the data. The first is the radical, where all the infants not registered as buried before their first birthday are treated as surviving, and thus are censored at their first birthday. The second is the conservative, where the surviving children must have one of the parents living in the parish after their first birthday. Table 1 is an abbreviated combination of four different analyses: two ways of censoring, one with and one without social group as a variable. The reason for doing separate analyses when the social group is used as a variable is that *SAS*[®] omits observations without a complete set of values in the analysis. Social group is the only variable where several

15 D. Cox, "Regression Models and Life Tables," *Journal of the Royal Statistical Society, Series B* (1972). The method is also described in Paul D. Allison, *Survival Analysis Using the SAS® System, A Practical Guide* (Cary, NC, 1995).

observations do not have a value. When this variable is used, the number of observations is reduced. The results for each analysis are shown in detail in the appendix.

With the radical censoring, 700 observations lack information on social status; with the conservative the loss is less, 400 observations. Children born out of wedlock often lack information about their fathers, and many of these children are already excluded with the conservative censoring.

Radical Censoring

The results obtained by radical censoring are shown in the left part of Table 1. Males had, as expected, a higher mortality rate than females: the estimate is 17% higher. For each year infant mortality declined one percent, and the death risk was almost twice as high for children born out of wedlock as those born within. The two variables for residence do not show significant results.

If the social group is taken into the analysis, the estimate for the increased mortality risk for illegitimate children is reduced to 1.7. There is a positive correlation between belonging to the lower social class and being born outside marriage, but many of the children born out of wedlock lack information on social class and are lost from the analysis. The variable itself, social group, does not seem to have an effect upon infant mortality.

Conservative Censoring

The number of observations are reduced with conservative censoring, particularly the number of deaths. Except for children born out of wedlock, whose surplus mortality was reduced to 1.5, the effects of the other variables are almost the same as with radical censoring. With conservative censoring the estimate of the surplus mortality of the illegitimate children changes little when social group is added to the variables, because so many of these children are missing from the analysis even before the social class variable is added. Illegitimate children are probably underrepresented in life tables based on family reconstitutions, which means that the mortality figures from these studies may be too low. The size of this gap is difficult to determine.

If we compare the results obtained by radical and conservative censoring, we find that, except for the effects of being born out of wedlock, other variables are quite similar, but the p-values are better with the radical censoring. If the analysis is lim-

ited to children born within marriage, it is definitely an advantage to choose radical censoring.

Another Test of the Effect of Social Class on Infant Mortality

Having chosen radical censoring, I wanted to pursue the issue of a possible relationship between social class and infant mortality. Infant mortality for two groups of legitimate children born at the beginning of the nineteenth century was studied. This was the time when infant mortality was highest, and if a difference existed between social groups, it should have appeared during this period. The wealthy group consisted of farmers who had large farms in the land register of 1838. The limit was set at four times as much as for the first classification (Four *daler* in tax). A higher limit would have reduced the number of observations too much. The other group was children of fathers with the lowest social code in the census of 1825, i.e., excluding those who were originally coded as belonging to the middle class. The reason to choose this census rather than the 1835 census was that the land register refers to the situation many years before it was printed. It is important for the sake of comparison that the children in the two groups were born at about the same time.

The birth years turned out to be very evenly distributed among the two groups. The median birth year for the children of the wealthy farmers was 1827, while for the other group the median year of birth was 1825. Only the children born before 1840 were included in the analysis. There were a total of 384 children in the wealthy group, and 1,920 in the other group. The results of the analysis show no significant relationship between social group and infant mortality.

Concluding Remarks

Examination of the data set showed that the problems of stillbirths needed to be dealt with. My choice was not to include the stillbirths, but to exclude the children who lived less than two days.

It is bold to assume that all the children who were not registered as dead in the burial lists survived their first birthday, but the comparison between the results of this assumption and a more conservative assumption based on the principles of family reconstitution justifies the radical assumption, at least for the majority of children, that is those who were born within wedlock. The advantage of such an assumption is the more efficient use of laboriously collected data. In family reconstitution children born out of wedlock often disappear in the analysis.

The higher mortality of illegitimate children was hardly surprising. More unpredictable was the outcome of the social class variable. Thus far earlier studies of individual Norwegian parishes have not shown clearcut patterns of social differences, but the data sets have been small and the method of analysis has not been the most efficient. Nor did the present study, utilizing a large data set and a more refined method of analysis, result in a correlation between social group and mortality. It is possible that there are weaknesses in the coding of social class, but if an important correlation existed, there should have been some signs of it. The conclusion must be that, if there was such a correlation, it must have been very weak.

The only Norwegian analysis based upon a large data set is the study of infant mortality in the randomly chosen 45 parishes around 1800, and it shows that mortality was positively correlated with high social class. The author points out that wealthier persons had larger households and indicates that the risk of infection might have been higher in these households.

Conventional wisdom relates the mortality decline to improved welfare and living conditions. An improvement in welfare is difficult to measure, but even if the landless classes increased during the nineteenth century, it is commonly believed that there was an improvement in living conditions at the same time, at least in the countryside. In Asker and Bærum no difference in infant mortality between the two social classes was found. This may mean that there was no relationship between improved living conditions and infant mortality, or that the positive effects of the improvement were marginal compared to all the perils to which an infant was exposed. Another plausible explanation is that the improvement was so general that both social classes benefited from it.

In recent research there has been a focus on cultural causes for the decline in infant mortality, for example, changes in the care of young children. In her doctoral dissertation from 1997, Margunn Skjei Knutsen has made a valuable contribution by bringing to light literature on child care around the end of the eighteenth century.¹⁶ The weak point in the analysis is the connection between the possible new ideas among the small numbers of the literate elite of Trondheim and the practice of the common people in the town. The time elapsed between the arrival of the literature in Norway and the improvement in child mortality seems to be too short to argue for a causal effect. In Asker and Bærum, where there were practically no doctors or midwives to promote new ideas on child care, as opposed to the situation in Trondheim, infant mortality also declined.

There is probably not one single cause for the decline in infant mortality during the nineteenth century in Norway, nor in Scandinavia for that matter, but if we

16 Margunn Skjei Knudtsen, *Fra frelse til helse. Spedbarnsdødelighet og omsorgssyn i Norge ca. 1700–1830 med særlig vekt på forholdene i Vår Frue sokn, Trondheim* (Ph. D. thesis, NTNU, Historisk institutt, 1997).

find an almost simultaneous decline in many local communities, care must be shown not to select particular explanations for each community, unless there are quite specific local circumstances warranting such an explanation. We have not yet found the primary cause, or the combination of causes of the decline in infant mortality during the nineteenth century.

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Appendix 1

Map of Swedish Provinces (*län*)



Appendix 2. Socio-economic differences in infant mortality in a number of Swedish historical studies.

Source	Place	Time period	Type of area	Relatively higher infant mortality*	Other comments
Bengtsson, T	Västanfors Västmanland	1750-1849	Rural industrial	Same	Ca 4.000 children
Sundin/Tedebrand	Lögdö foundry Västernorrland	1774-1793	Rural industrial	Lower	374 children
Winberg	Dala Västergötland	1776-1830	Rural	Upper	2.414 children
Ahlberger/Winberg	Örby Västergötland	1792-1850	Rural	Same	
Martinius	Cohort from 17 parishes Skaraborg	1810-12	Rural	Lower	552 children.
Brändström	Svinnegarn Uppsala	1803-44	Rural	Lower	1.422 children
Brändström	Tanum Bohuslän	1800-1870	Rural	Lower	4.139 children
Brändström	Fleninge Malmöhus	1820-1889	Rural	Upper	2.019 children
Brändström	Trosa Stockholm	1820-94	Rural	Varying	1.870 children
Brändström	Nedertorneå Norrbotten	1820-94	Rural (small urban part)	Upper	7.850 children.
Edvinsson	Nora, Skog, Bjärträ Västernorrland	1812-21, 1845-54	Rural	Varying	2.350 children
Edvinsson	Revsund, Sundsjö, Bodsjö, Bräcke Jämtland	1810-19, 1845-54	Rural	Lower	1.350 children
Sundin/Tedebrand	Foundries Västernorrland	1830-35	Rural industrial	Varying	409 children

Source	Place	Time period	Type of area	Relatively higher infant mortality*	Other comments
Sundin/Tedebrand	Nordingrå Västernorrland	1830-35 1810-49	Rural	Varying	810 children (1830-35) Ca 3000 children (1810-49)
Eriksson/Rogers	Åsunda Uppland	1825-1845?	Rural	Lower	805 children
Eriksson/Rogers	Åsunda Uppland	1855-1905	Rural	Upper	902 children
Fridlitzius	40 parishes Malmöhus and Kristianstad	1821-1860	Rural	Same	
Lynch/Greenhouse	14 parishes Västernorrland	19 th century	Rural and rural industrial	Varying, farmers higher	20,626 children
Norberg	Alnö Västernorrland	1840-1909	Rural industrial	Varying	8,175 children
Brändström	Västervik Kalmar	1781-1861	Urban	Lower	4,990 children
Hörsell	Eskilstuna Södermanland	1811-15	Urban	Lower	339 children
Bengtsson, M	Linköping Östergötland	1797-1810	Urban	Lower	1,251 children.
Bengtsson, M	Linköping Östergötland	1840-49	Urban	Lower	1,432 children
Bengtsson, M	Linköping Östergötland	1870-75	Urban	Lower	1,270 children,
Edvinsson	Sundsvall Västernorrland	1803-92	Urban	Lower	9,694 children
Nilsson	Linköping Östergötland	1860-94	Urban	Lower	8,263 children.
Burström/Bernhardt	Maria, Stockholm	1885-1910	Urban	Lower	36,718 children <15 years
Bernhardt	Stockholm	1895-1920	Urban	Same, craftsmen higher	4,123 children <5 years.

- * Upper = infant mortality is higher among the higher social strata
- Lower = infant mortality is higher among the lower strata
- Same = the differences in infant mortality are small or non-existent
- Varying = there is no clear relationship between the social hierarchy and different levels of infant mortality.

Sources:

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- Katherine A. Lynch and Joel B. Greenhouse, "Risk Factors for Infant Mortality in Nineteenth-Century Sweden", in *Population Studies* 1994:48, p 123f.
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- Hans Nilsson, *Mot bättre hälsa. Dödlighet och hälsoarbete i Linköping 1860-1894*, (Linköping 1994), p 165-173.
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Jan Sundin and Lars-Göran Tedebrand, “Mortality and morbidity in Swedish iron foundries 1750–1875”, in Anders Brändström and Jan Sundin (eds), *Tradition and Transition. Studies in microdemography and social change*, (Umeå 1981), p 118–131.

Christer Winberg, *Folkökning och proletarisering. Kring den sociala strukturmövandlingen på Sveriges landsbygd under den agrara revolutionen* (Göteborg 1975), p 242ff.

Note: The table summarizes the results from various historical studies that provide information on social class differences in infant mortality. It should be kept in mind that the studies vary considerably in their aims as well as their methodology. Some treat social inequality directly while others only consider differences in socio-economic status as background variables. Factors such as the size of the populations under study, the techniques used for measuring infant mortality, and differing social classification schemes all limit direct comparisons. Although the table only provides a rough overview of social class differences in infant mortality, it does reveal that there is a great deal of variation.

Appendix 3: Infant mortality in selected Norwegian parishes, ca. 1801, with some data on number of baptisms and burials.

Parish number	Province	Parish	Born 1799-1803	Dead 1799-1803	Dead <1 1799-1803	IMR	Period and sources
0120	Smaalehnene	Mosse				220,0	1800-1825 Jannecke Lahn
0201	Aggershuus	Agger				264,0	1791-1800 Sølvi Sogner
0203	Aggershuus	Ascher	686	657	140	204,1	Eli Fure
0204	Aggershuus	Næsodden	103	81	16	155,3	Bente Nordbø
0216	Aggershuus	Ullensager	609	596		207,1	1790-1809 Halvorsen / Indseth
0221	Christiania	Christiania				242,0	1791-1800 (Vår Frelser) Sølvi Sogner
0301	Hedemarken	Stange	499	503	94	188,4	DA
0314	Hedemarken	Reendahlen				126,0	1781-1828 Sølvi Sogner
0404	Christians	Faaberg	539	384	98	181,8	DA
0407	Christians	Ringboe	415	304	60	144,6	
0411	Christians	Lessøe	563	305	57	101,2	Arnfinn Kielland
0416	Christians	Slidre	513	396	109	212,5	DA
0507	Buskerud	Eger				211,0	1791-1801 Dag Kristoffersen
0512	Buskerud	Sandsvær				179,0	1791-1801 Dag Kristoffersen
0513	Buskerud	Flesberg				165,0	1791-1801 Dag Kristoffersen
0517	Buskerud	Kongsberg				219,0	1791-1801 Dag Kristoffersen
0604	Jarlsberg Og Larvik	Sande	237	201	23	97,0	DA
0605	Jarlsberg Og Larvik	Hoff				213,0	1791-1801
0606	Jarlsberg Og Larvik	Laurdahl		70	19	181,0	1791-1801 Dag Kristoffersen
0614	Jarlsberg Og Larvik	Anneboe	205	145	23	112,2	
0615	Jarlsberg Og Larvik	Sandeherred	416	303	78	187,5	
0708	Bratsberg	Bøe				183,6	1770-89 Hege Brit Randsborg
0909	Listers Og Mandahl	Lyngdahl	1192	900	226	189,6	1790-1800 Oddleif Lian
1012	Stavanger	Augvaldsnæs	1261	1047	272	215,9	1791-1800 Sven Gabrielsen Øygarden
1015	Savanger	Høyland	89		15	169,0	Sandnes 1801-11 Olav Tysdal
1101	Søndre Bergenhuus	Etne				220,0	1795-1804 Ståle Dyrvik
1107	Søndre Bergenhuus	Ous				205,0	1770-1801 Jan Oldervoll
1108	Søndre Bergenhuus	Quindherred	372	260	38	102,2	DA
1117	Søndre Bergenhuus	Manger	537	282	58	108,0	DA

Parish number	Province	Parish	Born 1799-1803	Dead 1799-1803	Dead <1 1799-1803	IMR	Period and sources
1118	Søndre Bergenhuus	Lindaas				229,0	1790-99 Erik Thomassen
1120	Søndre Bergenhuus	Voss				155,0	1790-99 c/o Ståle Dyrvik (1978)
1121	Bergen		2743	2633	521	189,9	DA
1247	Søndre Bergenhuus	Askøy	257	215	60	233,5	DA
1204	Nordre Bergenhuus	Hafslo	291	313	76	261,2	DA FASF only to 1799
1205	Nordre Bergenhuus	Sogndahl	400	268	65	162,5	FASF
1207	Nordre Bergenhuus	Leganger	486	374	70	144,0	FASF
1208	Nordre Bergenhuus	Wiig	437	372	74	169,3	FASF
1211	Nordre Bergenhuus	Yttre Holmedahl (Fjaler)	461	256	71	154,0	FASF
1212	Nordre Bergenhuus	Indre Holmedahl (Gaular)	343	254	80	233,2	FASF
1213	Nordre Bergenhuus	Førde	477	331	76	159,3	DA
1217	Nordre Bergenhuus	Indvig	566	313	80	141,3	DA
1219	Nordre Bergenhuus	Davig	253	195	44	173,9	FASF
1220	Nordre Bergenhuus	Sellø	296	223	72	243,2	FASF
1309	Romsdal	Borgen	441	543	102	231,3	Arnfinn Kielland
1312	Romsdal	Nesset				186,0	1791-1800 Bjarne Skorgen
1323	Romsdal	Edø	284	290	62	218,3	
1401	Trondhjem	Strinden	150	109	30	200,0	
1402	Trondhjem	Klæbo	148	85	24	162,2	
1411	Trondhjem	Opdahl	368	340	78	212,0	DA
1512	Nordre Trondhjem	Overhallen				145,0	1790-99 Torkel Christiansen
1607	Nordland	Rødø	120	134	12	100,0	
1616	Nordland	Ofoten	221	204	27	122,2	Solfrid Fagertun, RHD
1708	Finmarken	Lenvigs	222	210	44	198,2	
1711	Finmarken	Lyngens				205,0	1791-1800 Asbjørn Lanes
1713	Finmarken	Altens Talvig	309			174,0	1791-1800 Henry Minde
1718	Finmarken	Kjøllefjord	126	135	16	127,0	

Sources: Abbreviations: DA: The Digital Archive; FASF: The Province Archive of Sogn and Fjordane; No source listed: The Norwegian Historical Data Archive. All figures are based on microdata counted by the persons listed, or by myself from digital or manual registers. The period is 1799-1803 except where explicitly mentioned. I am grateful to all who have provided me with data for this list.

Appendix 4

Complete output of the four analyses of infant mortality (tables A-D). Survival analysis with Cox regression method.

Table A. Radical censoring, the social class variable excluded. N=14,793: 13,386 censored and 1,407 dead.

Name of variable	Parameter estimate	Standard error	Wald Chi-Square	P-value > Chi-Square	Risk Ratio
Male	0.1542	0.0536	8.2873	0.0040	1.17
Out of wedlock	0.6631	0.0801	68.4935	0.0001	1.94
Year of birth	-0.0090	0.0014	39.8812	0.0001	0.99
Foundry	-0.0595	0.1087	0.2994	0.5843	0.94
Sandvika	0.2026	0.1714	1.3987	0.2370	1.23

Table B. Radical censoring, the social class variable included. N=14,087: 12,846 censored, and 1,241 dead

Name of variable	Parameter estimate	Standard error	Wald Chi-Square	P-value > Chi-Square	Risk Ratio
Male	0.1450	0.0570	6.4723	0.0110	1.16
Out of wedlock	0.5296	0.1015	27.2493	0.0001	1.70
Year of birth	-0.0102	0.0015	44.8234	0.0001	0.99
Foundry	-0.1149	0.1167	0.9700	0.3247	0.89
Sandvika	0.1010	0.1917	0.2779	0.5981	1.11
High soc. class	-0.0632	0.0695	0.8275	0.3630	0.94

Table C. Conservative censoring, the social class variable excluded. N=12,896: 11,749 censored, 1,147 dead.

Name of variable	Parameter estimate	Standard error	Wald Chi-Square	P-value > Chi-Square	Risk Ratio
Male	0.1378	0.0593	5.4078	0.0200	1.15
Out of wedlock	0.3803	0.1078	12.4532	0.0004	1.46
Year of birth	-0.0090	0.0017	29.5054	0.0001	0.99
Foundry	-0.0573	0.1190	0.2319	0.6302	0.94
Sandvika	0.0990	0.2024	0.2397	0.6244	1.10

Table D. Conservative censoring, the social class variable included. N=12,501: 11,385 censored, 1,116 dead.

Name of variable	Parameter estimate	Standard error	Wald Chi-Square	P-value > Chi-Square	Risk Ratio
Male	0.1467	0.0601	5.9555	0.0147	1.16
Out of wedlock	0.4582	0.1185	14.9624	0.0001	1.58
Year of birth	-0.0089	0.0017	27.9575	0.0001	0.99
Foundry	-0.0828	0.1215	0.4642	0.4957	0.92
Sandvika	0.1291	0.2029	0.4049	0.5246	1.14
High soc. class	-0.0287	0.0720	0.1585	0.6905	0.97

Sources: See note 8.

Appendix 5

Publications within the Framework of the NOS-H project

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