



DEMOGRAPHIC RESEARCH

A peer-reviewed, open-access journal of population sciences

DEMOGRAPHIC RESEARCH

VOLUME 30, ARTICLE 68, PAGES 1849–1864

PUBLISHED 12 JUNE 2014

<http://www.demographic-research.org/Volumes/Vol30/68/>

DOI: 10.4054/DemRes.2014.30.68

Descriptive Finding

Spatial inequalities in infant survival at an early stage of the longevity revolution: A pan-European view across 5000+ regions and localities in 1910

Sebastian Klüsener

Isabelle Devos

Peter Ekamper

Ian N. Gregory

Siegfried Gruber

Jordi Martí-Henneberg

Frans van Poppel

Luís Espinha da Silveira

Arne Solli

© 2014 Sebastian Klüsener et al.

This open-access work is published under the terms of the Creative Commons Attribution NonCommercial License 2.0 Germany, which permits use, reproduction & distribution in any medium for non-commercial purposes, provided the original author(s) and source are given credit. See <http://creativecommons.org/licenses/by-nc/2.0/de/>

Table of Contents

1	Motivation	1850
2	Data and methods	1851
3	Spatial variation in infant mortality in 1910	1854
4	Discussion and conclusion	1857
5	Acknowledgments	1858
	References	1859
	Appendix 1: Overview of data sources	1861
	Appendix 2: Overview map – Administrative divisions considered in the analysis	1864

**Spatial inequalities in infant survival at an early stage
of the longevity revolution:
A pan-European view across 5000+ regions and localities in 1910**

Sebastian Klüsener¹

Isabelle Devos²

Peter Ekamper³

Ian N. Gregory⁴

Siegfried Gruber⁵

Jordi Martí-Henneberg⁶

Frans van Poppel⁷

Luís Espinha da Silveira⁸

Arne Solli⁹

Abstract

BACKGROUND

Spatial inequalities in human development are of great concern to international organisations and national governments. Demographic indicators like the infant mortality rate are important measures for determining these inequalities. Using demographic indicators over long time periods at relatively high levels of geographical detail, we can examine the long-term continuities and changes in spatial inequalities.

¹ Max Planck Institute for Demographic Research, Germany. E-Mail: kluesener@demogr.mpg.de.

² Ghent University, Belgium.

³ Netherlands Interdisciplinary Demographic Institute (NIDI-KNAW)/University of Groningen, The Netherlands.

⁴ Lancaster University, United Kingdom.

⁵ Max Planck Institute for Demographic Research, Germany.

⁶ University of Lleida, Spain.

⁷ Netherlands Interdisciplinary Demographic Institute (NIDI-KNAW)/University of Groningen, The Netherlands and Utrecht University, The Netherlands.

⁸ Universidade Nova de Lisboa, Portugal.

⁹ University of Bergen, Norway.

OBJECTIVE

This paper presents the initial outcomes of a larger project that aims to analyse spatial variation in infant survival across Europe over the last 100 years. In this paper, we focus on spatial disparities in infant survival in 1910. At that time, the longevity revolution was still at an early stage. We look at general spatial variation patterns within and across countries, and discuss some of the challenges related to the comparativeness of the data.

METHODS

We link official infant mortality data from more than 5,000 European regions and localities for the period around 1910 to a European historical GIS of administrative boundaries. The data are analysed using descriptive spatial analysis techniques.

RESULTS

In 1910, a number of countries in northern and western Europe led the longevity revolution in Europe, with the area of low infant mortality also extending into the north-western parts of the German Empire. Other areas with low infant mortality levels included the Belgian region of Wallonia, most parts of Switzerland, as well as central and south-western France. In eastern and southern Europe, we find significant variation within and across countries, which might stem in part from data quality problems.

1. Motivation

Spatial inequalities in human development at both the national and the subnational levels are of great concern to international organisations and national governments (UN System Task Team 2012, European Union 2010). Since at least the late 19th century, demographic indicators such as the infant mortality rate have been used to monitor how spatial inequalities increase or diminish over time (Armstrong 1986). In this paper, we present the initial results of a larger project that seeks to analyse the spatial inequalities in infant survival across Europe over the last 100 years, and at a relatively high level of spatial detail. In this comparative research project, we have two main aims. First, we wish to study the continuities and the changes in spatial human development inequalities across Europe over time. Second, we believe that an analysis of spatial aspects of the longevity revolution is likely to enrich our understanding of the mechanisms that led to the survival improvements. The analysis of within-country variation also allows us to go beyond national averages, such as those provided by the Human Mortality Database (2014); and to explore to what extent those averages may be misleading for countries with significant regional variations (see also Ryan Johansson

and Kasakoff 2000). For example, if a country exhibits high levels of infant mortality in the north and low levels in the south, the mean national levels will not be representative of either of the two regions.

In this paper, we examine spatial variation in infant survival in 1910 within and across European countries, and discuss some of the challenges related to the comparativeness of the data. We have chosen to focus on 1910 for two reasons. First, at that point in time most European countries had experienced several decades characterised by little warfare, increasing economic prosperity, and improvements in education and healthcare. By 1910 some parts of Europe had seen substantial reductions in infant mortality, while other parts of the continent were lagging behind in this process (Masuy-Stroobant 1997). This relatively peaceful period would come to a dramatic end in 1914. Our second reason for choosing 1910 was based on data availability: it is the earliest period for which we were able to obtain sub-national infant mortality data for almost all European countries.

2. Data and methods

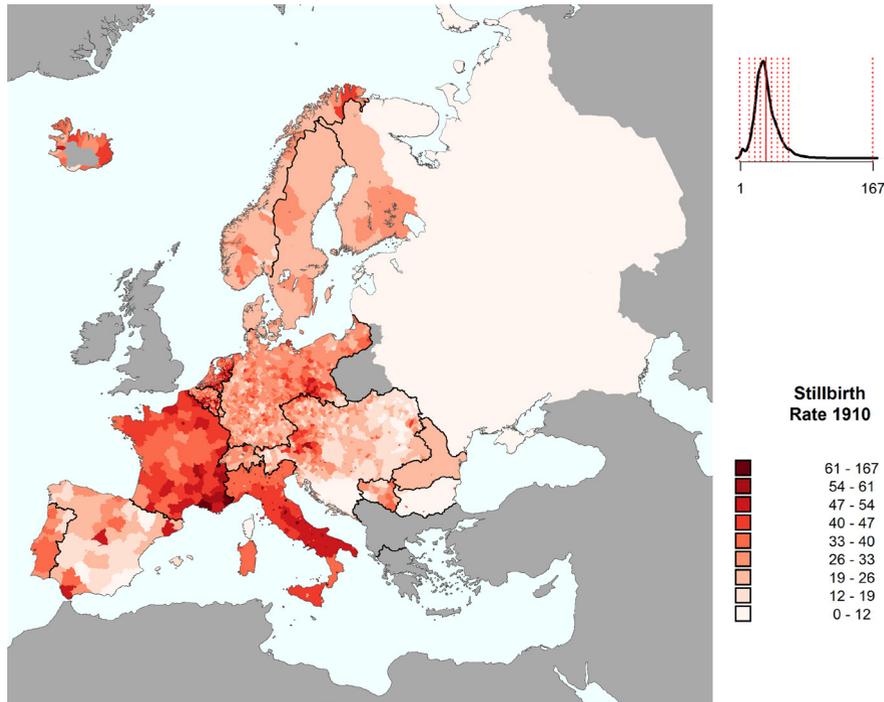
The demographic data are based on official statistics collected by statistical offices. In most cases, we were able to obtain the data from primary sources. For some countries, however, we used secondary sources (for an overview, see Appendix 1). Our goal was to collect data for the period around 1910, ideally using average values for several years in order to limit the influence of short-term fluctuations (e.g., due to hard winters) and small local populations at risk. The exact years and the levels of geographic detail for which we were able to obtain infant mortality data varied somewhat across countries (see Appendices 1 and 2). These data are linked to a European GIS file that provides information on the location and boundaries of the regions and municipalities for which infant mortality data are available. In this GIS file, we combined for the first time detailed national historical GIS datasets to create a single European-wide dataset. The results of the analysis are presented in maps and a plot showing regional/local variation by country. The latter is an adaptation of a plot used by Storeygard et al. (2008) in their paper on present-day global sub-national variation in infant mortality levels. In total, data on more than 5,000 regions and localities covering almost the entire European continent are available for the period around 1910. The only large area for which we were unable to derive information was for a part of south-eastern Europe comprising Greece and the European territories of the Ottoman Empire.

By around 1910, most European states had already established compulsory vital registration systems (see SGF 1907 and Edge 1928 for details). However, substantial variation in collection standards existed across Europe. Vital events registration was

still in the hands of church officials in a number of countries, including in all of the Scandinavian countries, the Austrian part of the Austro-Hungarian Empire, Serbia (Edge 1928), and the Russian Empire. In eastern European countries in particular, registration by the clergy was likely to have been far from perfect (SGF 1907; Edge 1928). The definition of a live birth varied. Some vital registration systems, such as those of England and Wales, Norway, and Sweden regarded all children as live-born if they were alive at birth. Meanwhile, countries such as the Netherlands, Belgium, and France counted children as stillborn if they died before the birth registration (Edge 1928). Some statistical offices, such as those of the United Kingdom, had not yet started to count stillbirths (Davis 2009). In addition to this variation in registration standards, differences in registration practices—especially in the registration of stillbirths or infant deaths shortly after birth—might have affected the statistics. For example, parents might have preferred for financial reasons to have an infant who died shortly after birth registered as a stillbirth. Alternatively, religious prescriptions might have encouraged parents to register a stillbirth as a live birth (SNOH 1930).

Gourbin and Masuy-Stroobant (1995) also pointed out that most cases in which a birth event was registered incorrectly or not at all involved a stillbirth or an infant dying shortly after birth. To provide some insights into the distortions caused by differing registration standards and practises, we plot in Figure 1 the regional variation in the stillbirth rate for all of the European countries for which we could obtain data. The stillbirth rate is calculated by dividing the total number of stillbirths by the total number of births, including live and stillbirths. The colour scheme in the map of Figure 1 is based on a standard deviation categorisation centred on the mean. The density plot in the upper right corner of the map displays the density curve and the category breaks, with the mean being highlighted. We can immediately see that clear divides in stillbirth levels run along the borders of a number of western European countries. The Dutch and the French regions bordering Germany reported higher levels than the German regions on the other side of the border line. The Italian regions bordering Switzerland also had higher levels than the neighbouring Swiss regions. In the border zones, the differences in the stillbirth levels were as high as 20 per 1,000 births. In the Netherlands and France, these discrepancies might be related to the differing stillbirth registration standards outlined above.

Figure 1: Spatial variation in stillbirth rates 1910*



* The category breaks are based on a standard deviation categorisation centred on the mean. The density plot in the upper right corner displays the density curve and the category breaks with the mean highlighted. For Russia and Spain, the levels of geographic detail and the time periods of the data collection differ from the more detailed infant mortality data displayed in Figure 2 (see Appendix 1 for details).

Source: Statistical offices and secondary sources (see Appendix 1 for details); own calculations.

Base Maps: MPIDR Population History GIS Collection and national historical GIS (see Appendix 1 for details).

We can explore this issue in more detail using the example of Belgium, as our data for this country distinguish between stillbirths and false stillbirths. The former include infants born without any signs of life, a definition in line with registration standards in the United Kingdom, Scandinavia, and the German Empire. False stillbirths, by contrast, comprise in the Belgian statistics infants born alive who died before registration. These cases were in Belgium, France, and the Netherlands also counted as stillbirths (in all three countries registration had to occur within three days of birth). In the figures presented in this paper we count the Belgian false stillbirths as infant deaths. In Belgium in the period 1909-1911, false stillbirths accounted for about 18% of the total number of stillbirths (including false stillbirths), and 5% of the total number of

infant deaths (including false stillbirths). Thus, the distorting effects of cases of false stillbirth on the infant mortality rate were still rather small during this period. This would change in later periods, when the infant mortality reduction led to a higher share of infant deaths occurring in the first hours and days of life (Gourbin and Masuy-Stroobant 1995). In 1955, 22% of all infant deaths in Belgium were false stillbirths (Glei, Devos, and Poulain, 2014). It is, however, important to point out that not all spatial variation in stillbirth rates can be attributed to differences in registration standards, and that the rates also reflect real spatial variation in the incidence of such events. In a number of countries substantial regional differences in stillbirth rates can be observed, despite the relative consistency of registration standards within each country (e.g., Belgium, Germany).

Figure 1 also shows the stillbirth levels for a number of areas which, according to the literature, had poor registration standards, especially in the registration of births (e.g., eastern Europe; SGF 1907; Edge 1928). Gourbin and Masuy-Stroobant (1995) pointed out that under-registration mostly affected stillbirths or infant deaths shortly after birth; we would thus expect to find relatively low stillbirth rates in these areas. The data seem to support this view, as some eastern and southern European areas in particular had very low stillbirth rates (e.g., Russia, Hungary, Bulgaria, Spain, and the French island of Corsica). The relatively low stillbirth rates in western Austria (Tyrol) might have been influenced by religious prescriptions which encouraged parents to register a stillbirth as live birth (Bisig 1984). However, with the data we have available, we cannot rule out the possibility that a portion of the variation in stillbirths across Europe is attributable not only to differences in registration standards, but also to real variation in stillbirth rates.

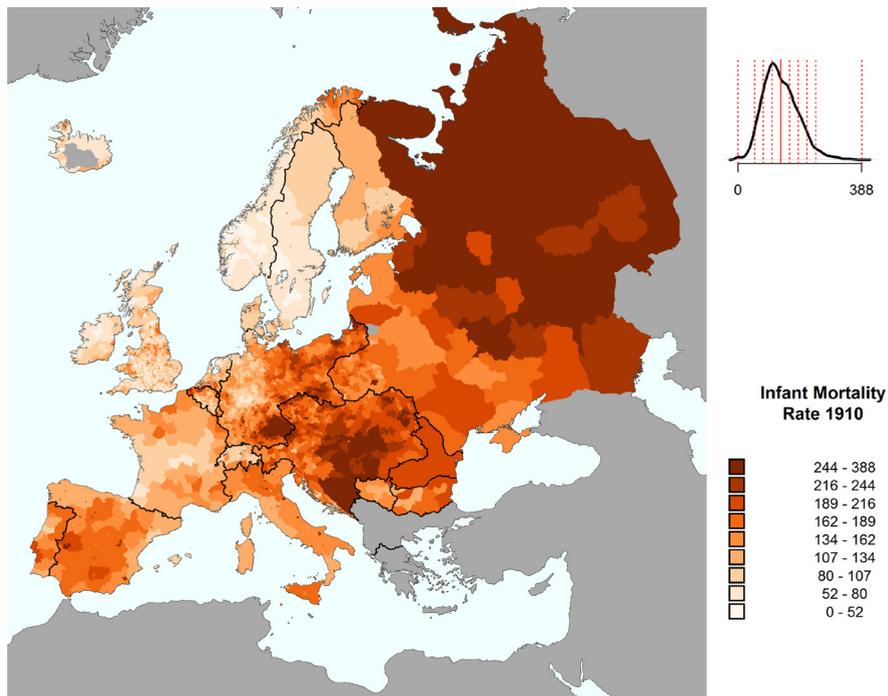
3. Spatial variation in infant mortality in 1910

The variation in registration standards and practises discussed above raises the question of whether we should present in this section the raw infant mortality data as recorded by the statistical offices, or whether we should try to adapt the data in order to correct for registration distortions. Ultimately, we decided that especially in areas where the under-registration of stillbirths was a problem, any attempt at correction would be based on unjustifiably bold assumptions. We have therefore chosen to present the raw data, and to address the limitations due to registration distortions in the text.

In Figure 2, we display a map with infant mortality levels for 1910 which shows the infant deaths per 1,000 live births. This map is also based on a standard deviation categorisation. The map indicates that around 1910 a number of northern and western European countries—such as Sweden, Norway, and the United Kingdom—not only

reported low average national infant mortality rates, but had comparatively low infant mortality rates across almost all of their sub-national regions. As these countries had quite reliable systems of registration at that time (Edge 1928), it is unlikely that the relatively low infant mortality rates they reported were just the result of registration problems. At the local level, however, hot spots of infant mortality could still be found in England and other countries of north-western Europe. The large-scale variation pattern across Europe exhibits clear spatial trends, with levels increasing from the northwest towards the east and south. The scale of this gradient is perhaps even more apparent in the variation plot of Figure 3. This plot shows by country the national infant mortality rate and the variation across regions and localities within each of the countries. However, the numbers presented for the southern and eastern European countries in particular have to be interpreted with caution.

Figure 2: Spatial variation in infant mortality rates 1910*

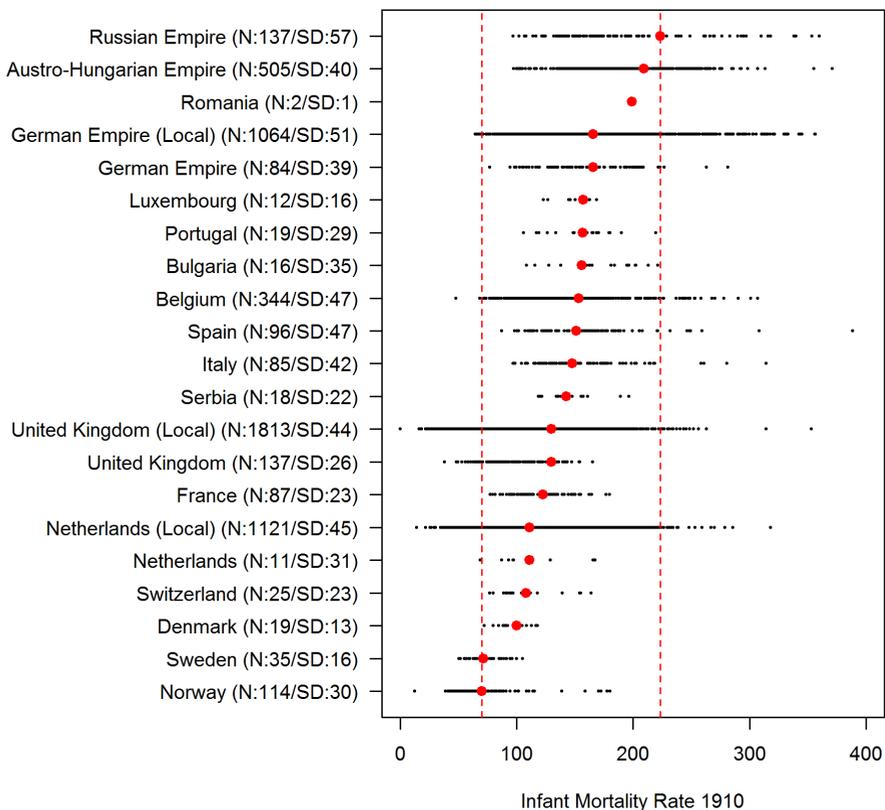


* The category breaks are based on a standard deviation categorisation centred on the mean. The density plot in the upper right corner displays the density curve and the category breaks with the mean highlighted.

Source: Statistical offices and secondary sources (see Appendix 1 for details); own calculations.

Base Maps: MPIDR Population History GIS Collection and national historical GIS (see Appendices 1 and 2 for details).

Figure 3: Variation in infant mortality rates across and within countries 1910***



* In the graph, only the European territories of the states and empires are considered. "United Kingdom" includes Great Britain and Ireland, while "United Kingdom (Local)" just contains data for England and Wales. For the Russian Empire, we only cover the European part (including Finland and the Principality of Warsaw). Denmark excludes the Faroe Islands and Iceland; for Spain and Portugal the Atlantic islands are not included.

** N denotes the number of regions and SD the standard deviation of the regional/local infant mortality rate values. It is important to note that the within-country variation plots are influenced by cross-country differences in the level of regional detail at which we were able to obtain data. This can be seen in the variation plots for the German Empire, the United Kingdom, and the Netherlands, for which data at two different levels of spatial aggregation were available.

Source: Statistical offices and secondary sources (see Appendix 1 for details); own calculations.

If, for example, we focus on the Austro-Hungarian Empire, which we were able to divide in 505 regions, we find that none of these regions reported an infant mortality

rate below the national average registered in vanguard countries such as Norway or Sweden. The exceptional positions of Norway and Sweden as leaders of the longevity revolution are also remarkable. In Norway, for example, hardly any of the 114 identified sub-regions reported a value higher than the average national value of neighbouring Denmark, the European country with the third-lowest infant mortality rate at that time. The only Norwegian regions with relatively high infant mortality levels were situated in the far north along the border to Russia.

Substantial regional variation existed in the German Empire and the Russian Empire (see Fig. 2 and 3). The western German regions had lower infant mortality rates than the eastern and south-eastern German regions (see also Kintner 1988). The Russian Empire also exhibited stark east-west differences. The lowest levels were recorded in the Principality of Finland. The Principality of Warsaw, along with territories which today belong to the Baltic countries, Belarus, and Ukraine, also reported lower levels than the Russian core territories in the east. But these differences have to be interpreted with caution given the quality of the registration standards in eastern Europe (Edge 1928). There were also a number of smaller countries with high levels of internal variation, including the Netherlands, Belgium, and Switzerland. In the Netherlands the spatial pattern was partly determined by religious boundaries (Van Poppel 1992), while in the latter two countries, spatial dividing lines between areas with low and high infant mortality rates seem to have followed linguistic boundaries, at least in part.

In some rare cases, national borders appear to be relevant for understanding the variation in infant mortality rates. We can see, for example, a rather clear dividing line between Switzerland and the adjacent territories in southern Germany. The differences in the levels observed along the border between Serbia and the Austro-Hungarian Empire, and the border between western Bulgaria and Romania, are suspicious. The relatively low infant mortality levels in Serbia and parts of Bulgaria could be attributable to shortcomings in the vital registration systems in these countries.

4. Discussion and conclusion

In 1910, a number of countries in northern and western Europe led the longevity revolution in Europe, with the area of low infant mortality also extending into the north-western parts of the German Empire. Other areas with low infant mortality levels included the Belgian region of Wallonia, most parts of Switzerland, as well as central and south-western France. The levels of infant mortality attained in the vanguard countries differed sharply from the levels found in the Iberian Peninsula, Italy, and eastern Europe. In the latter group, the high degree of variation found within and across countries might stem in part from data quality problems.

The spatial clustering of areas in which populations had already achieved rather high infant survival rates might be an indication that at this early stage of the longevity revolution, best practises were emerging as a result of spatially constrained social interactions and diffusion processes (see Watkins 1991, Oeppen and Vaupel 2002, Edvinson, Garðarsdóttir, and Thorvaldsen 2008). But we cannot offer any firm conclusions on this question based on the evidence presented here. We will study this issue in more detail in future research, when we will apply spatial models to several cross-sections of data.

If we compare the historical infant mortality pattern in Europe in 1910 with current spatial variation in infant mortality (Storeygard et al. 2008, UN 2012), it is remarkable to see how much progress has been achieved over the last 100 years, not only in Europe, but globally. In 2005-2010, Europe reported an average infant mortality rate of seven, with national values ranging from two to 16. Worldwide, fewer than a dozen countries still report values above 100—a level which was comparatively low in Europe in 1910. However, some continuities in the spatial variation pattern persist. Most prominently, we can still detect an east-west gradient within Europe, as the countries with comparatively high infant mortality are concentrated in the east and the south-east. The east-west divide becomes even more pronounced when we look at other health indicators, such as life expectancy at birth (Leon 2011). By contrast, the infant mortality levels in southern European countries like Portugal, Spain, and Italy have caught up to the levels reported in northern and western Europe. Overcoming the health disadvantages in eastern Europe will remain an important task in the decades to come.

5. Acknowledgements

The authors would like to express gratitude to all persons and institutions who kindly provided access to national historical GIS files and demographic datasets (see Appendix 1 for details). We also would like to thank Heidi Harris for linking the national historical GIS to a European historical GIS, and the anonymous reviewers for their valuable comments and suggestions.

References

- Armstrong, D. (1986). The invention of infant mortality. *Sociology of Health and Illness* 8(3): 211–232. doi:10.1111/j.1467-9566.1986.tb00298.x
- Bisig, B. (1984). Probleme der Definition und Vergleichbarkeit der perinatalen und Säuglingssterblichkeit. *Sozial- und Präventivmedizin* 29(6): 244–247. doi:10.1007/BF02078257.
- Davis, G. (2009). Stillbirth registration and perceptions of infant death, 1900–60: The Scottish case in national context. *The Economic History Review* 62(3): 629–654. doi:10.1111/j.1468-0289.2009.00478.x.
- Edge, P.G. (1928). Vital registration in Europe: The development of official statistics and some differences in practice. *Journal of the Royal Statistical Society* 91(3): 346–393. doi:10.2307/2341602.
- Edvinsson, S., Garðarsdóttir, Ö., and Thorvaldsen, G. (2008). Infant mortality in the Nordic countries, 1780–1930. *Continuity and Change* 23(3): 457–485. doi:10.1017/S0268416008006917.
- European Union. (2010). *Consolidated treaties: Charter of fundamental rights*. Luxembourg: Publications Office of the European Union. doi:10.2860/58644.
- Glei, D.A., Devos, I., and Poulain, M. (2014). About mortality data for Belgium. Background and documentation for the Human Mortality Database. Berkeley and Rostock: University of California, Max Planck Institute for Demographic Research.
- Gourbin, C. and Masuy-Stroobant, G. (1995). Registration of vital data: Are live births and stillbirths comparable all over Europe? *Bulletin of the World Health Organization* 73(4): 449–460.
- Human Mortality Database (2014). University of California, Berkeley (USA), and Max Planck Institute for Demographic Research (Germany) [electronic resource]. www.mortality.org or www.humanmortality.de
- Johansson, S.R. and Kasakoff, A.B. (2000). Mortality history and the misleading mean. *Historical Methods: A Journal of Quantitative and Interdisciplinary History* 33(2): 56–58. doi:10.1080/01615440009598949.
- Kintner, H.J. (1988). The impact of breastfeeding patterns on regional differences in infant mortality in Germany, 1910. *European Journal of Population* 3(2): 233–261. doi:10.1007/BF01796777.

- Leon, D.A. (2011). Trends in European life expectancy: A salutary view. *International Journal of Epidemiology* 40(2): 271–277. doi:10.1093/ije/dyr061.
- Masuy-Stroobant, G. (1997). Infant health and infant mortality in Europe: Lessons from the past and challenges for the future. Corsini, C.A. and Viazzo, P.P. (eds.). *The decline of infant and child mortality: The European experience: 1750–1990*. The Hague: Martinus Nijhoff Publishers/Kluwer Law International: 1–34.
- Oeppen, J. and Vaupel, J.W. (2002). Broken limits to life expectancy. *Science* 296(5570): 1029–1031. doi:10.1126/science.1069675.
- SGF (Statistique Générale de la France). (1907). *Statistique internationale du mouvement de la population d'après les registres d'état civil: Résumé rétrospectif depuis l'origine des statistiques de l'état civil jusqu'en 1905*. Paris: Imprimerie nationale.
- SNOH (Société des Nations Organisations d'Hygiène). (1930). *Memorandum relatif aux enquêtes sur les causes et la prévention de la mortalité et de la mortalité pendant la première année de vie: Allemagne, Autriche, France, Grande-Bretagne, Italie, Norvège, Pays Bas*. Genève: Société des Nations.
- Storeygard, A., Balk, D., Levy, M., and Deane, G. (2008). The global distribution of infant mortality: A subnational spatial view. *Population, Space and Place* 14(3): 209–229. doi:10.1002/psp.484.
- UN System Task Team on the Post-2015 UN Development Agenda. (2012). *Addressing inequalities: The heart of the post-2015 agenda and the future we want for all. Thematic Think Piece*. New York: United Nations.
- UN. (2012). *World population prospects: The 2012 revision*. New York: United Nations.
- Van Poppel, F. (1992). Religion and health: Catholicism and regional mortality differences in nineteenth-century Netherlands. *Social History of Medicine* 5(2): 229–253. doi:10.1093/shm/5.2.229.
- Watkins, S.C. (1991). *From provinces into nations: Demographic integration in western Europe, 1870–1960*. Princeton: Princeton University Press.

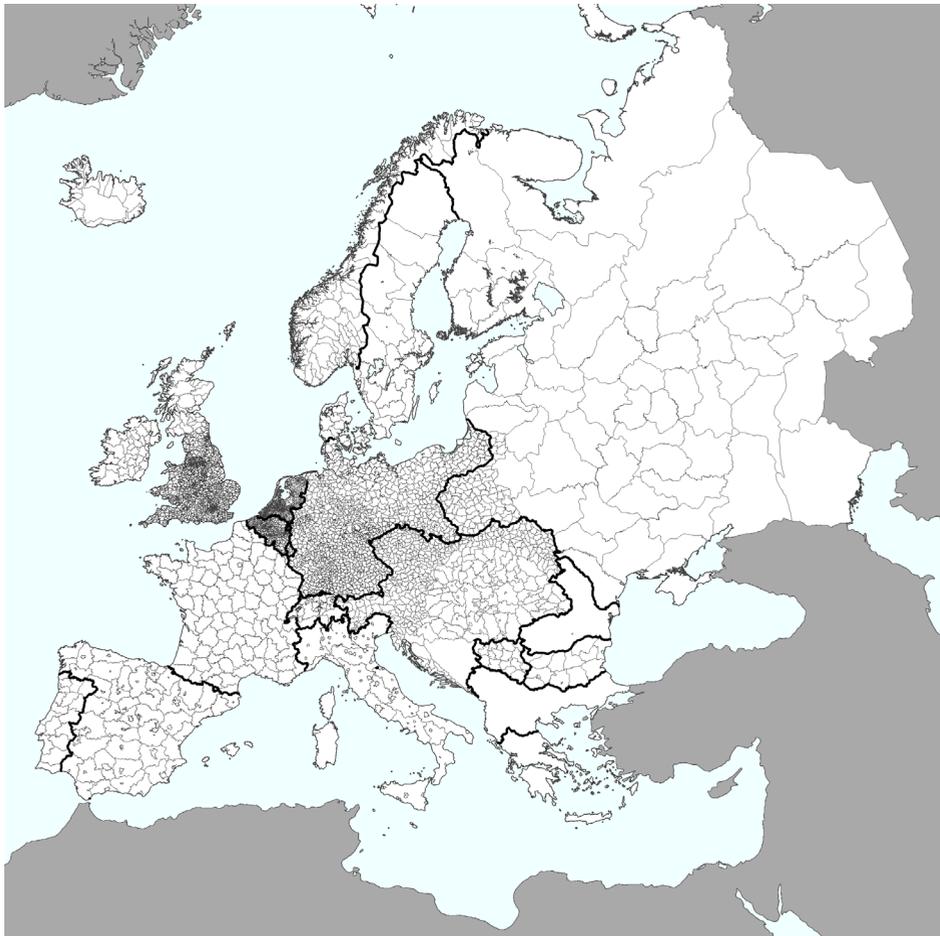
Appendix 1: Overview of data sources

Country/ Territory	Demographic Data Year/Source	Historical GIS Source	Regions/Locations with Infant Mortality Data (in Brackets: Stillbirth Data)
Austria	1910 Bureau der K. K. Statistischen Zentralkommission. (1912). <i>Bewegung der Bevölkerung der im Reichsrate vertretenen Königreiche und Länder im Jahre 1910</i> . Wien.	MPIDR Population History GIS Collection (based on a file by Rumpler, H. and Seger, M. (2010). <i>Die Habsburgermonarchie 1848– 1918, Band IX, Soziale Strukturen, 2. Teilband</i> . Wien.)	404
Belgium	1909-1911 Data collection by Isabelle Devos (HISSTER- Database); Ministère de l'Intérieur. <i>Mouvement de la population et de l'état civil</i> .	Belgian Historical GIS Obtained from: Historical Database of Local Statistics – LOKSTAT, Ghent University, History Department supervised by E. Vanhaute and S. Vrielinck.	344
Bosnia- Herzegovina	1909/1910 Statistische Mitteilungen IV 17, p. 77 & V 18, p. 89.	MPIDR Population History GIS Collection (see Austria)	1
Bulgaria	1910 Statistics Bulgaria (Historical Online Library)	MPIDR Population History GIS Collection	16
Denmark	1909/1910 Statens Statistiske Bureau. (1913). <i>Ægteskaber, Fødtte of Døde i Aarene 1906-1910</i> . København, pp. 82.	MPIDR Population History GIS Collection	19
England and Wales	1911 General Register Office. (1913). 47th annual report of the Registrar-General of births, deaths, and marriages in England and Wales (1911). London.	Great Britain Historical GIS (co- ordinated by H. Southall)	1813 (locations with no population or births were excluded)
Finland	1909/1910 Keisarillisen Senaatin Kirjapainossa. (1913). <i>Katsaus väestönmuutoksiin Suomessa vuosina 1909 ja 1910 ynnä jälkikatsaus lähinnä edellisiin vuosikymmeniin</i> . Helsingborg.	MPIDR Population History GIS Collection	8
France	1908/1909 Statistique Générale de la France. (1912). <i>Statistique du mouvement de la population – Nouvelles série – Tome 1. Années 1907, 1908, 1909 et 1910</i> . Paris.	MPIDR Population History GIS Collection	87
Germany	1909/1910 Kaiserliches Statistisches Amt (ed.). (1913). <i>Statistik des Deutschen Reiches (Band 246): Bewegung der Bevölkerung im Jahr 1910</i> . Berlin, pp. 123.	MPIDR Population History GIS Collection	1064

Country/ Territory	Demographic Data Year/Source	Historical GIS Source	Regions/Locations with Infant Mortality Data (in Brackets: Stillbirth Data)
Hungary	1905 Magyar Kir. Központi Statisztikai Hivatal. (1907). A Magyar Szent Korona Országainak 1903., 1904. és 1905. évi népmozgalma. Budapest.	MPIDR Population History GIS Collection (see Austria)	100
Iceland	1911-1915 Data collection by L. Guttormsson and O. Garðarsdóttir	Historical Iceland GIS provided by L. Guttormsson and O. Garðarsdóttir	20
Ireland	1911 General Register Office. (1912). Annual report of the Registrar-General for Ireland containing a general abstract of the numbers of marriages, births and deaths registered in Ireland during the year 1911. London, p. 94.	I.N. Gregory	35
Italy	1908 Regions: Istituto Centrale di Statistica. (1975). Tendenze evolutive della mortalità infantile in Italia. Roma, pp. 237. Cities: Unione Statistica delle Città Italiane. (1910). Annuario Statistico della Città Italiane Anno III – 1909-1910. Firenze, p. 229.	MPIDR Population History GIS Collection	85
Luxembourg	1908-1912 Office de la Statistique Générale. (1962). Annuaire Statistique 1960. Luxembourg, pp. 122.	MPIDR Population History GIS Collection	12
Netherlands	1908-1912 Ekamper, P. and Van Poppel, F. (2008). Infant mortality by municipality in the Netherlands, 1841-1939. Dataset deposited with DANS - Easy Archiving System. [Dataset Persistent Identifier: urn:nbn:nl:ui:13-d9x-vke]	Netherlands Geographic Information System (NLGis) (Boonstra, O.W.A. (2007). NLGis shapefiles. Dataset deposited with DANS – Easy Archiving System. [Dataset Persistent Identifier: urn:nbn:nl:ui:13-wsh-vv7])	1121
Norway	1906-1910 Statistics Norway (SSB), digitized by the Norwegian Social Science Data Services (NSD)	Norwegian Historical GIS Norwegian Social Science Data Services (NSD)	114
Poland	1913 Główny Urząd Statystyczny Rzeczypospolitej Polskiej. (1921). Ruch naturalny ludności wyznań chrześcijańskich w.b. Królestwie Kongresowem w latach 1909-1918. Warszawa.	MPIDR Population History GIS Collection	79
Portugal	1913 Archivos do Instituto Central de Higiene. (1920). Estatística do Movimento Fisiológico da População de Portugal. Coimbra, pp. 49 and 62.	Regions: MPIDR Population History GIS Collection Cities: L.E. da Silveira	19

Country/ Territory	Demographic Data Year/Source	Historical GIS Source	Regions/Locations with Infant Mortality Data (in Brackets: Stillbirth Data)
Romania	1910 Biuroul Statistic. (1912). Anuarul Statistic al României. București. Primăria Comunei București. (1913). Anuarul Statistic al Orașului București pe 1910 și 1911. București.	MPIDR Population History GIS Collection	2
Russia (European part without Finland and Poland)	1910 Data collection by A.J. Coale (Princeton Fertility Project Data Archive). Stillbirths 1901: SGF. (1907).	MPIDR Population History GIS Collection	50 (1)
Scotland	1909 General Register Office. (1911). 55th detailed annual report of the Registrar-General of births, deaths, and marriages in Scotland. Glasgow, p. XXI.	MPIDR Population History GIS Collection	34
Serbia	1906 Uprava Državne Statistike. (1908). Statistički godišnjak kraljevine Srbije. Beograd.	Gruber, S.: MPIDR Population History GIS Collection	18
Spain	1909/1910 Infant Deaths: Salvador, E.N. (1922). La mortalidad infantil y la demografía general en España. Años 1859 a 1921. Madrid. Births/Stillbirths 1907: Dirección General Del Instituto Geográfico y Estadístico. (1913). Anuario Estadístico de España 1912. Madrid.	Regions: MPIDR Population History GIS Collection, Cities: J. Martí- Henneberg	96 (48)
Sweden	1911/1912 Kungl. Statistiska Centralbyrån. (1914). Befolkningsrörelsen år 1911. Stockholm. Kungl. Statistiska Centralbyrån (1915). Befolkningsrörelsen år 1912. Stockholm.	Riksarkivet: Historical GIS of Sweden	35
Switzerland	1910 Data Collection by E. van de Walle (Princeton Fertility Project Data Archive) Stillbirths: Statistisches Bureau des eidg. Departements des Innern. (1913). Statistisches Jahrbuch der Schweiz 1912. Bern, p. 23.	MPIDR Population History GIS Collection	25
Total			5601

Appendix 2: Overview map – Administrative divisions considered in the analysis



Base Maps: MPIDR Population History GIS Collection and national historical GIS (see Appendix 1 for details).