Social Differences in Maternal Mortality in Zeeland 1812–1913

By Ingrid K. van Dijk

To cite this article: Dijk, van, I. K. (2025). Social Differences in Maternal Mortality in Zeeland 1812–1913. *Historical Life Course Studies, 15*, 165-174. https://doi.org/10.51964/hlcs23091

HISTORICAL LIFE COURSE STUDIES

Histories of Health

VOLUME 15, SPECIAL ISSUE 7

GUEST EDITORS
Paul Puschmann
Sanne Muurling
Tim Riswick
Jan Kok

EHPS NETWORK

MISSION STATEMENT

HISTORICAL LIFE COURSE STUDIES

Historical Life Course Studies was established within *European Historical Population Samples Network* (EHPS-Net). The journal is the primary publishing outlet for research involved in the conversion of existing European and non-European large historical demographic databases into a common format, the Intermediate Data Structure, and for studies based on these databases. The journal publishes both methodological and substantive research articles.

Methodological Articles
This section includes methodological articles that describe all forms of data handling involving large historical databases, including extensive descriptions of new or existing databases, syntax, algorithms and extraction programs. Authors are encouraged to share their syntaxes, applications and other forms of software presented in their article, if pertinent.

Research articles
This section includes substantive articles reporting the results of comparative longitudinal studies that are demographic and historical in nature, and that are based on micro-data from large historical databases.

Historical Life Course Studies is a no-fee double-blind, peer-reviewed open-access journal supported by the European Science Foundation, the International Institute of Social History, the European Society of Historical Demography, Radboud University Press, Lund University and HiDO Scientific Research Network Historical Demography. Manuscripts are reviewed by the editors, members of the editorial and scientific boards, and by external reviewers. All journal content is freely available on the internet at hlcs.nl.

European Science Foundation
international institute of social history
ESHD European Society of Historical Demography
Radboud University Nijmegen, the Netherlands
open journals.nl
HiDo Network for Historical Demography
Lund University
KNAW

HISTORICAL LIFE COURSE STUDIES
VOLUME 15 (2025), 165-174, published 29-08-2025

Social Differences in Maternal Mortality in Zeeland 1812–1913

Ingrid K. van Dijk
Lund University

ABSTRACT

Using population reconstructions from linked civil certificates for the province of Zeeland, the Netherlands, for the period 1812–1913, I study the social gradient in maternal mortality. Maternal mortality is defined as deaths in the first 42 days after the birth of a child. Among the women — mother to at least one child and followed between age 20 and 45 — maternal mortality constitutes about one third of the total number of observed deaths. Maternal mortality is higher for upper class women in early 19th century Zeeland than for unskilled laborers. By the early 20th century, maternal mortality had become an uncommon event and social differences in its likelihood negligible. A comparison of the social gradient in maternal mortality to the social gradient in all mortality in the reproductive ages (age 20-45) in this period shows that the reverse social gradient in mortality is limited to maternal mortality — it is not found for all women's deaths in this period of life.

Keywords: Maternal mortality, Social differences in mortality, Mortality decline, Cause of death statistics, Social gradient

e-ISSN: 2352-6343
DOI article: https://doi.org/10.51964/hlcs23091

1 INTRODUCTION

In the mid-19th century Netherlands maternal mortality rates — mortality of mothers to causes related to childbirth — rapidly fell (Ory & van Poppel, 2013; Woods, 2009). Unhygienic practices around childbirth, and the absence of trained midwives contributed to high maternal mortality earlier in the 19th century (Woods, 2009). Moreover, high fertility and short interbirth intervals in combination with a low general standard of living and nutritional deficiencies increased the risk of maternal mortality (Janssens & van Dongen, 2018). In the mid-19th century, living conditions in the Netherlands started to improve. From the 1880s adult mortality started to fall (Wolleswinkel-van den Bosch et al., 2001), spearheaded by declining maternal mortality rates due to similar improvements that, around the same period, also started to benefit survival of infants and young children: better hygiene and a higher standard of living and fewer nutritional deficiencies (van Dijk et al., 2024). A higher overall standard of living could have contributed to women's general health before pregnancy and childbirth, making them less prone to infection and disease after giving birth.

The possible contribution of resource-related factors suggests that social class differences may have existed in maternal mortality. Ory and Van Poppel (2013) show that in several regions of the Netherlands maternal mortality was higher for women from the class of skilled workers and even more so for farmers. In England, in the late 19th century and early 20th century, elite women had a higher risk of maternal mortality (Loudon, 1986), possibly because of medical care of a poor standard that was detrimental to women's health and survival after childbirth in the absence of proper hygienic practices. In the late 19th century, midwifery went through a transformation leading to increased professionalization and increased implementation of antiseptic techniques (Løkke, 2012; Woods, 2009) which greatly contributed to the survival of mothers and children. From a modern perspective, a social gradient could be expected in such mortality improvements, with the upper class benefiting most from such developments. Previous work (Ory & van Poppel, 2013) has shown a higher maternal mortality among skilled workers and farmers in the period 1846–1902, next to other risk factors, both biological and social.

However, little is known about changes over time in the contribution of social class to the maternal mortality risk. With time, risk factors for maternal mortality in the higher classes could have changed into a comparative advantage. For example, in the presence of improved hygienic measures of doctors and midwives their help at birth could have started to contribute more to survival chances of women giving birth (Loudon, 1986). Previous studies of maternal mortality have not accounted for such possible time trends in social differences in maternal mortality in the Netherlands. In this paper, I address long-term change in maternal mortality using family reconstructions, addressing the level and decline of maternal mortality and developments in social differences in maternal mortality in Zeeland, the Netherlands, 1812–1913.

2 MATERNAL MORTALITY IN ZEELAND AND THE NETHERLANDS IN THE RESEARCH PERIOD

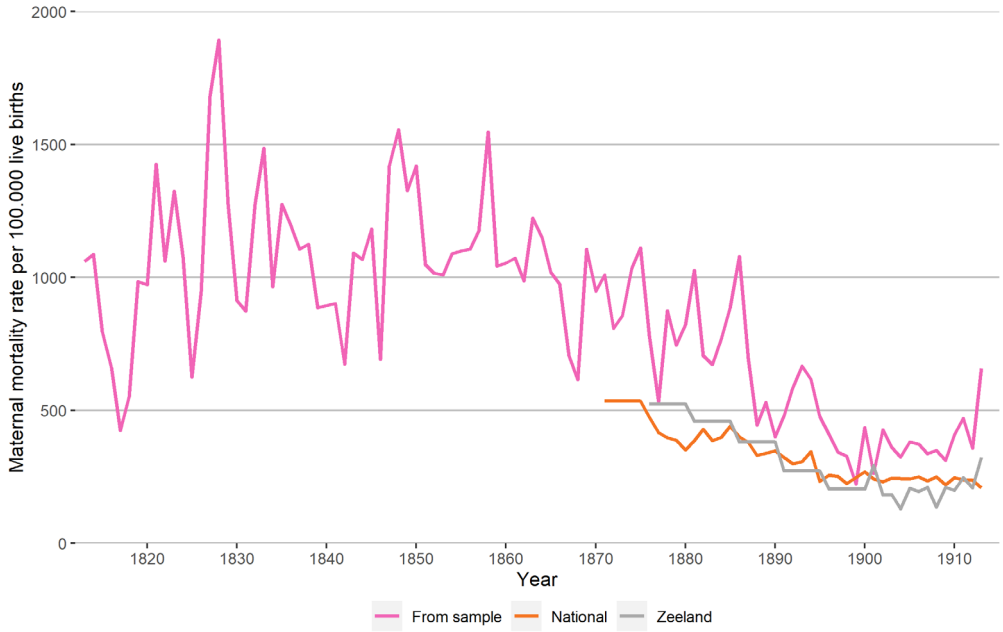
For the period 1875–1899, maternal mortality was reported in five-yearly cause of death statistics at the municipal, provincial and national level. Maternal mortality was reported in two categories: puerperal fever and other pregnancy and childbirth related causes of death. National cause of death registration was introduced in the Netherlands in 1865 by the introduction of the Public Health Inspectorate Act and the Medical Practitioners Act, resulting from efforts of the Dutch hygienist movement (van den Boomen & Ekamper, 2015; Walhout, 2010). Doctors were obliged to record the cause of death before burial. Slips on which causes of death were registered were send to the local administration and aggregated for country-wide statistics. Not all patients had been seen by a doctor and the cause of death was sometimes attributed after death or even burial (van den Boomen & Ekamper, 2015). These official statistics on puerperal fever and other pregnancy and childbirth related causes of death may therefore be incomplete for maternal mortality.

Reconstructing the maternal mortality level for the 19th century is possible using population reconstitution data. Linked indexes of civil records can be used to estimate the level of maternal mortality, defined as deaths in the first 42 days after childbirth. A death in the postpartum period is the contemporary WHO definition of maternal mortality if a specific cause of death is unknown. The linked data used in this paper contain observations on women's marriages, death of their partner,

births of their own children, and the date of their own death, so that a mother's death in the first 42 days after childbirth can be identified. The maternal mortality rate based on linked civil records is significantly higher than the nationwide reports indicate. Compared to the number of births of these women, this results in an estimate of the maternal mortality rate — maternal deaths per 100,000 births — of over 1,000 per 100,000 childbirths in the early and mid-19th century. By 1875, the maternal mortality rate was rapidly falling, to around 750 mothers per 100,000 births. In this year, official national maternal mortality statistics were introduced. These result in estimations of the maternal mortality rate of slightly over 500 per 100,000 births for the province of Zeeland (526 over the years 1876–1880) and somewhat under 500 per 100,000 for all the Netherlands (476 in the year 1876).

Why do these estimates from official statistics and based on reconstituted family data for maternal mortality in Zeeland differ? Some maternal deaths after childbirth may incorrectly be included in maternal mortality estimates, and the degree to which that happens could differ between the two sources. The annual fluctuations observed in Figure 1 suggest that in some years part of the mortality attributed to obstetric causes may have had their primary cause in epidemic conditions. Yet, women could be more vulnerable to infectious disease in the postpartum period, so that this mortality is at least in part related to their status as new mothers. The same might be the case for mortality that is included with other causes of death in the official statistics: women may have been at greater risk because of their recent birth, and some mortality in relation to the childbirth may have incorrectly been included as due to another cause of death. Estimates of maternal mortality based on family reconstructions could therefore be more complete than official statistics. However, Ory and Van Poppel (2013) suggest that the true maternal mortality rate is probably lower than suggested by family reconstructions but also higher than what official statistics maintain, as official statistics may have omitted some maternal mortality by accident, to avoid culpability of doctors, or because deaths that would not have occurred without the pregnancy but that had a different primary reason (such as tuberculosis) were not included.

Figure 1 *Decline in maternal mortality in the research period*



Maternal mortality from the sample is based on mothers' deaths in the first 42 days after giving birth, divided by the number of births in the sampled group, based on population reconstitutions from linked civil certificates in LINKS, Zeeland. The national annual number of births nationwide and in Zeeland are from Statistics of Population Change in the Netherlands ("Statistiek van den loop der bevolking van Nederland"). Maternal mortality statistics are from 5-year reports on causes of death for regions and the nation "Vijfjarig overzicht van de sterfte naar den leeftijd en de oorzaken van den dood in elke gemeente van Nederland" for the years 1880 (1875–1879), 1885 (1880–1884), 1890 (1885–1889), 1895 (1890–1894), 1900 (1895–1899) (van den Boomen, 2021). Annual maternal deaths nationally 1875–1900 are taken from the "Statistics of Mortality by the causes of death over the year 1903" (Statistieken van den sterfte naar den oorzaken van den dood over het jaar 1903). Annual deaths after 1900 nationally and Zeeland from theS Statistics of Mortality by the causes of ddeath over the year...(Statistieken van den sterfte naar den oorzaken van den dood over het jaar…) 1901–1913. Data on maternal mortality and replication code is available from Zenodo: https://doi.org/10.5281/zenodo.15487217.

In this paper, I use maternal mortality rates estimated from family reconstructions. First, I estimate the share of maternal mortality in all mortality in the linked sample. A strikingly large number of deaths among Zeeland mothers aged 20–45 occurs in the first 42 days postpartum. In the period 1812–1839 around one in three deaths at this age range is in the postpartum period, falling to one in four in the period 1890–1913 (see Table 1).

3 DATA AND METHODOLOGICAL APPROACH

Analyses employ LINKS — LINKing System for historical family reconstruction — a large-scale historical demographic dataset for the province of Zeeland, Netherlands (Mourits et al., 2022). The data and code for this paper are available (https://doi.org/10.5281/zenodo.15487217). The province of Zeeland is situated in the southwestern corner of the Netherlands and consists largely of islands. The population had high fertility throughout the study period, with a mean number of children of around 8 for married couples (van den Berg et al., 2019). Infant and child mortality were high and life expectancy was low, with child mortality reaching 50% before the fifth birthday in some municipalities and years, with high levels of epidemic disease in particularly affected communities (Hoogerhuis, 2003; van Poppel & Mandemakers, 2002).

The LINKS database uses linked indexed civil certificates that originate from obligatory vital event registration, which was introduced in the Netherlands in 1812. The certificates include information on births, marriages and deaths, including the names of the individual and his or her parents, the municipality of the vital event, the individuals' place of birth, age and occupational titles of the index person and parents. Life course events of the same individuals have been linked together through name-based linkage of certificates pertaining to the same individuals, using first and last names of the ego and his or her parents, spouses, and children. The full database contains information on 1,930,189 individuals from Zeeland who experienced a vital event in that province between 1812–1913 for births, 1812–1938 for marriages, and 1812–1963 for deaths. LINKS has been used extensively for historical demographic research on the Netherlands and has been subject to thorough checks of quality and reliability (van den Berg et al., 2021). A unique advantage of the data for our purpose here is that also stillbirths were registered so that mortality in the postpartum period after any birth is included.

For the analysis, women in the reproductive ages 20–45 are included, if they married in Zeeland and at least one childbirth is observed. Descriptive statistics may be found in Table 1. Children are born between 1812 and 1913. 96,661 mothers are included, and 515,632 childbirths and the postpartum period are observed. For a full overview of selection criteria, see Figure A1. A full death date is available for 72,329 of the mothers (74,8%) included in the analyses. A death date or observation after age 45 (a civil record linked after age 45 which is not the death certificate, but for example a (re)marriage) is available for 73,171 women or 75.7% of all women. In our main analysis, it is presumed that women without follow-up survived to age 45 as mortality is generally low in this period of life and linkage between married women's life course observations with their own deaths are generally of high quality. However, some of the women for whom no death certificate was available may have out-migrated from the province of Zeeland. In a robustness check, women with no information about their death date are dropped from the analysis, and the differences between social classes in the period 1812–1839 are now smaller and only marginally significant (see Section 4).

It is important to note that contrary to previous studies, here, all women for whom at least one birth is observed are included in the analyses. In the analyses of maternal mortality, mothers' mortality in the 42 days postpartum is analyzed, the contemporary WHO definition of maternal mortality in absence of a clear cause of death (Ronsmans & Graham, 2006). The postpartum period after a stillbirth is also included. Stillbirths were registered separately in the Dutch municipal administration and to study maternal mortality these cases are of particular importance, as a difficult childbirth could result in the death of both mother and child.

Next to studying mothers' deaths in the 42-day postpartum window, the hazard ratio of all mortality of mothers between age 20 and 45 is also studied. All women for whom at least one childbirth is observed in the province of Zeeland, are included, i.e. the same sample of 96,661 mothers as used for the analysis of the first 42 days after childbirth. Here, follow up is from first observation of the woman in the research area (the year 1812, age 20 for Zeeland-born women, or her marriage or first observed childbirth in the province) to her death, age 45 or the year 1913 when the observations end. A fair

amount of mortality between age 20–45 occurs in the post-partum period, as mortality rates due to all causes generally bottom out in this age group. It should be noted that a significant downside of the approach taken here is that the reproductive histories of women cannot be included in the analysis, as I analyze *any* maternal death that happened in Zeeland in the period 1812–1913. The reason I choose this approach is that social differences in maternal mortality can be analyzed further back in time as no full record of mothers' marital and fertility history is necessary. Sociodemographic patterns can differ between socioeconomic groups so that not controlling for women's marital histories makes it impossible to pinpoint some of the mechanisms that contribute to social differences in maternal mortality.

The key predictor is the socioeconomic status (SES) of women's households. In the research period, men were usually the primary breadwinner. Female labor market participation was severely under registered (Janssens, 1997). In line with previous research on this region and period, analyses therefore rely on the occupation of the husband. SES was measured using the highest known occupational title with HISCLASS scores across all indexed civil certificates linked to one person. HISCLASS is a system that groups historical occupational titles into broad occupational classes. This broad status indicator is recoded into 5 occupational groups: elite (HISCLASS 1–2), lower middle class (HISCLASS 3–6), skilled workers (HISCLASS 7 and 9), unskilled workers (the reference group for the analysis, HISCLASS 10–13), farmers and fishermen (HISCLASS 8), and a separate, sixth category for missing observations (van Leeuwen & Maas, 2011). Occupational titles from the Netherlands have been standardized in previous work (Mandemakers et al., 2020).

Table 1 *Descriptive statistics by period*

Sample of births	Any year	1812–1839 Birth cohort	1840–1869 Birth cohort	1870–1889 Birth cohort	1890–1913 Birth cohort
SES of the mothers (HISCLASS)					
Elite	6,7 (34,436)	10,9 (9,987)	8,0 (12,669)	5,1 (6,320)	3,9 (5,460)
Lower middle class	15,5 (80,109)	11,9 (10,904)	13,5 (21,429)	17,4 (21,696)	18,5 (26,080)
Skilled workers	18,6 (95,633)	17,0 (15,616)	18,5 (29,317)	17,7 (22,046)	20,4 (28,654)
Unskilled workers	28,6(147,346)	31,3 (28,816)	31,4 (49,772)	28,2 (35,177)	23,9 (33,581)
Farmers	14,8 (76,133)	13,4 (12,322)	13,3 (20,993)	15,3 (19,083)	16,9 (23,735)
Missing SES	15,9 (81,865)	15,5 (14,279)	15,2 (24,132)	16,3 (20,351)	16,4 (23,103)
Children/births	515,522	91,924	158,312	124,673	140,613
Maternal deaths (first 42 days)	4,139	992	1,612	976	559
Mothers	96,565	21,463	36,498	30,574	35,710
Sample of mothers	Any year	1812–1839 Period	1840–1869 Period	1870–1889 Period	1890–1913 Period
SES (HISCLASS)					
Elite	6.7	9,8	7,8	5,5	4,5
Lower middle class	15,2	11,7	13,3	16,5	18,5
Skilled workers	18,9	17,7	18,5	18,3	20,7
Unskilled workers	29,7	33,4	33,4	29,0	23,9
Farmers	13,4	11,5	11,5	14,5	15,8
Missing SES	16,1	16,0	15,5	16,3	16,6
Mothers	96,565	27,237	49,779	44,598	44,491
Maternal deaths (first 42 days)	4,139	992	1,612	976	559
Deaths age 20–45	13,408	2,779	5,443	3,020	2,166
Person-years	2,065,277	367,743	649,047	470,613	577,875
Children/births	515,522	91,924	158,312	124,673	140,613

Source: LINKS, Zeeland, 1812–1913 (Mourits et al., 2022).

Notes: Descriptive statistics for child sample refer to the percentage of children from a SES background based on father's occupation. Descriptive statistics for the mother sample are in person years and refer to SES associated with the husband's occupation.

4 RESULTS

Results are shown in Figure 2–4. Figure 2 presents the risk of mortality in the first 42 days after childbirth for every birth observed in the province of Zeeland, by social class and period. In Figure 3, the overall mortality risk of women between age 20 and 45, by social class and period, is reported. In the period 1812–1839, the risk of mortality in the first 42 days after the birth of a child is significantly higher for skilled workers and elite women and, marginally significantly, for the lower middle class. In the final period reported, 1890–1913, women in the farming class have a marginally significantly higher risk of mortality in the first 42 days postpartum than unskilled workers, but other social differences in mortality are no longer detected. Moreover, in the period in between no significant social differences in maternal mortality are found.

Over 30% of the mortality among women aged 20–45 with at least one child occurs in the first 42 days after a childbirth. The share of maternal mortality in all mortality declines from over 35% in the period 1812–1839 to about one quarter of observed deaths among women with at least one child in the period 1890–1913. Not only does the contribution of maternal mortality to all deaths decline, but the adult mortality rate also falls strongly in this period.

The results for women's mortality in the postpartum period contrast with overall mortality between age 20 and 45 for mothers (Figure 3). For all deaths among mothers, regardless of the timing of childbirth, mortality is only somewhat raised in elite groups and among skilled workers and the lower middle class in the period 1812–1839 — and these results are entirely driven by mortality in the postpartum period (Figure 4). Without maternal mortality, the hazard rate of mortality is significantly lower among the elite and middle class in the period 1840–1869 than among unskilled workers.

Figure 2 *Hazard Ratio of maternal mortality in the first 42 days after childbirth, Zeeland*

Figure 3 *Hazard Ratio of mothers' mortality age 20–45 by social class, Zeeland*

Figure 4 *Hazard Ratio of mothers' mortality age 20–45 excluding deaths in the postpartum period by social class, Zeeland*

Source: LINKS, Zeeland, 1812–1913.

Note: Reference group: Unskilled workers. Analyses are separately by period.

In a robustness check, only women for whom there is an observation after age 45 or whose death is observed are included. That is, survival is not assumed for women whose death is not observed before age 45, but they are removed from the sample, dropping about one quarter of the women (see Section 3). Results are shown in Appendix Figure 2. In this version of the analyses some of the previously shown differences between social groups are less pronounced for the period 1812–1839, indicating a possible underestimation of mortality among women from the reference group, the class of unskilled workers, in the primary models. The higher mortality of women from the class of skilled workers and lower-middle-class workers than in the reference group of unskilled workers is here marginally significant ($p < .10$) instead of significant at the more common $p < .05$ level in the first period. The largest change is that there are no significant differences found between elite women and unskilled workers. Finally, in the 1840 to 1869 and 1870 to 1889 periods, farmers have significantly lower mortality than unskilled workers. These findings make clear that the results presented in Figure 3 should be interpreted with caution. At the same time, as out-migration should be less of an issue shortly after the birth of a child than over the entire life course of women, results in the models presented in Figure 2 should be less affected by the absence of follow-up observation than those over the entire 20–45 age window.

5 CONCLUDING DISCUSION

Using population reconstructions from linked civil certificates for the province of Zeeland for the period 1812–1913, I compared social differences in maternal mortality with social differences in women's overall survival between age 20–45. I showed that in the province of Zeeland, maternal mortality was higher among elite, lower middle class and skilled worker class-women in the early 19th century, compared to unskilled workers. Their comparative disadvantage disappeared by the middle of the 19th century. By the early 20th century maternal mortality had become an uncommon event and social differences in its likelihood negligible. In comparison to all women's mortality between age 20–45, substantially larger socioeconomic differences in maternal mortality are found. The differences in mortality between social groups for women aged 20–45 in the period 1812–1839 are driven by mortality in the postpartum period and when maternal mortality is excluded, lower mortality for women from elite and lower middle-class households than for women from unskilled worker's households is found.

Higher mortality among elite women has been found previously, for example, for England for the late 19th and early 20th century (Loudon, 1986). In this paper, evidence for such a phenomenon is only found for the early 20th century. It has previously been hypothesized that increased mortality for the elite groups may have been related to dangerous medical help in the absence of good antiseptic and aseptic procedures. Although elite women in Zeeland may have had access to medical care more than women from unskilled laborer's households, it is unclear if that may also have been true for skilled workers' households. Other explanations for the patterns found here may relate to, for example, fertility differences between social groups. With the chosen approach, addressing any death in the first 42 days following a (linked) childbirth, social inequalities in maternal mortality can be addressed somewhat further back in time than in previous work (Ory & van Poppel, 2013), using data from LINKS Zeeland from 1812 to 1913. However, by not addressing women's fertility histories nor following them through their marital life and reproductive career, it was not possible to address fertility differences as a mechanism linking class and maternal mortality. The exact mechanisms related to these social differences therefore remain elusive. In the future, more comprehensive data sources for the period preceding the nationwide implementation of civil records would help illuminate the mechanisms contributing to higher maternal mortality among the upper class in the first part of the 20th century, and the later disappearance of such social class differences in maternal mortality.

To investigate social differences in maternal mortality, the socioeconomic status of the household was used, based on the occupation of women's husbands. In historical data, women's work is under-registered, even if most women worked, at home, in the family business, and in paid labor (Janssens, 1997). Differences by women's own social status to the extent that it related to their own occupation were not included in this work. Neither does it account for social inequalities that may exist beyond socioeconomic status alone. Spatial or familial clustering of particularly poor conditions, putting women at risk of infection and death after childbirth, or a local shortage of medical help and help for women in labor, may have resulted in familial and spatial concentration of maternal mortality. Finally, the death of

a mother had a large, negative effect on her children — reducing the survival chances and health of her children in historical Netherlands (Quanjer et al., 2023). The decline of maternal mortality therefore likely contributed to the increasingly good standards of living in which children in the Netherlands grew up, and played a crucial role in the transition to longer lives in better health witnessed over the 19th and 20th century.

ACKNOWLEDGEMENTS AND FUNDING

The linked indexes of the civil records are available from the Institute of Social History, Amsterdam, Netherlands: https://hdl.handle.net/10622/QUJNCD. Data on maternal mortality and replication code is available from Zenodo (https://doi.org/10.5281/zenodo.15487217. Code for replication of figures and tables is also available at ingridvandijk.com/papers/maternal-mortality. This research was supported by the ERC StG "Relative Health: Long-Run Inequalities in Health and Survival Between Families and Across Generations" (grant agreement 101163144). I thank Nynke van den Boomen and Evelien Walhout for assistance with the data sources on maternal mortality levels in the Netherlands. All mistakes are, of course, mine. A final acknowledgement is for Angelique Janssens. As my PhD supervisor, she has been a source of inspiration and support, and I am indebted to her curiosity and broad scientific interest. Her passion for historical demography and the history of women's work, of households, improvements in mortality and health has been a great source of inspiration. Angelique, thank you for your guidance, encouragement and support over the years.

REFERENCES

Hoogerhuis, O. W. (2003). *Baren op Beveland. Vruchtbaarheid en zuigelingensterfte in Goes en omliggende dorpen gedurende de 19e eeuw* [Childbearing on Beveland. Fertility and infant mortality in Goes and neighbouring villages in the nineteenth century]. [Doctoral dissertation, Wageningen University]. https://doi.org/10.18174/164903

Janssens, A. (1997). The rise and decline of the male breadwinner family? An overview of the debate. *International Review of Social History*, *42*(S5), 1–23. https://doi.org/10.1017/S0020859000114774

Janssens, A., & van Dongen, E. (2018). A natural female disadvantage? Maternal mortality and the role of nutrition related causes of death in the netherlands, 1875–1899. *TSEG - The Low Countries Journal of Social and Economic History*, *14*(4), 84–115. https://doi.org/10.18352/tseg.988

Løkke, A. (2012). The antibiotic transformation of Danish obstetrics. The hidden links between the decline in perinatal mortality and maternal mortality in the mid-twentieth century. *Annales de Demographie Historique*, *123*(1), 205–224. https://doi.org/10.3917/adh.123.0205

Loudon, I. (1986). Deaths in childbed from the eighteenth century to 1935. *Medical History*, *30*(1), 1–41. https://doi.org/10.1017/s0025727300045014

Mandemakers, K., Hornix, J., Mourits, R., Muurling, S., Boter, C., van Dijk, I. K., Maas, I., Van de Putte, B., Zijdeman, R. L., Lambert, P., van Leeuwen, M. H. D., van Poppel, F. W. A., & Miles, A. (2020). *Standardized, HISCO-coded and classified occupational titles* (Release 2020.02, V1). [Data set]. IISH Data Collection. https://hdl.handle.net/10622/88ZXD8

Mourits, R. J., Mandemakers, K., Laan, F., & Zijdeman, R. L. (2022). *Linked civil registry, Zeeland,* (Release 2017_01, V2). [Data set]. IISH Data Collection. https://hdl.handle.net/10622/QUJNCD

Ory, B. E., & van Poppel, F. W. (2013). Trends and risk factors of maternal mortality in late-nineteenth-century Netherlands. *The History of the Family*, *18*(4), 481–509. https://doi.org/10.1080/1081602X.2013.836457

Quanjer, B., van Dijk, I. K., & Rosenbaum-Feldbrügge, M. (2023). Short lives: The impact of parental death on early-life mortality and height in the Netherlands, 1850–1940. *Demography*, *60*(1), 255–279. https://doi.org/10.1215/00703370-10421550

Ronsmans, C., & Graham, W. J. (2006). Maternal mortality: Who, when, where, and why. *The Lancet*, *368*(9542), 1189–1200. https://doi.org/10.1016/S0140-6736(06)69380-X

van den Berg, N., Rodríguez-Girondo, M., van Dijk, I. K., Mourits, R. J., Mandemakers, K., Janssens, A. A. P. O., Beekman, M., Smith, K. R., & Slagboom, P. E. (2019). Longevity defined as top 10% survivors and beyond is transmitted as a quantitative genetic trait. *Nature Communications, 10*, Article 35. https://doi.org/10.1038/s41467-018-07925-0

van den Berg, N., van Dijk, I. K., Mourits, R. J., Slagboom, P. E., Janssens, A. A. P. O., & Mandemakers, K. (2021). Families in comparison: An individual-level comparison of life-course and family reconstructions between population and vital event registers. *Population Studies*, *75*(1), 91–110. https://doi.org/10.1080/00324728.2020.1718186

van den Boomen, N. (2021). *Born close to death. Region, Roman Catholicism and infant mortality in the Netherlands, 1875–1899* [Unpublished doctoral dissertation]. Radboud University Nijmegen. https://repository.ubn.ru.nl/handle/2066/240453

van den Boomen, N., & Ekamper, P. (2015). Denied their 'natural nourishment': Religion, causes of death and infant mortality in the Netherlands, 1875–1899. *The History of the Family*, *20*(3), 391–419. https://doi.org/10.1080/1081602X.2015.1022199

van Dijk, I. K., Lazuka, V., & Quaranta, L. (2024). Maternal and infant health: Understanding the role of institutions and medical innovations. In M. Dribe, T. Nilsson & A. Tegunimataka (Eds.), *Urban lives: An industrial city and its people during the twentieth century* (pp. 243–280). Oxford University Press.

van Leeuwen, M. H. D., & Maas, I. (2011). *HISCLASS: A Historical Social Class Scheme*. Leuven University Press.

van Poppel, F., & Mandemakers, K. (2002). Sociaal-economische verschillen in zuigelingen- en kindersterfte in Nederland, 1812–1912 [Differential infant and child mortality in the Netherlands, 1812-1912]. *Bevolking & Gezin*, *31*(2), 5–40. https://iisg.nl/hsn/documents/81-mandemakpoppel.pdf

Walhout, E. C. (2010). Is breast best? Evaluating breastfeeding patterns and causes of infant death in a Dutch province in the period 1875–1900. *The History of the Family*, *15*(1), 76–90. https://doi.org/10.1016/j.hisfam.2009.12.001

Wolleswinkel-van den Bosch, J. H., van Poppel, F. W. A., Looman, C. W. N., & Mackenbach, J. P. (2001). The role of cultural and economic determinants in mortality decline in the Netherlands, 1875/1879–1920/1924: A regional analysis. *Social Science & Medicine*, *53*(11), 1439–1453. https://doi.org/10.1016/S0277-9536(00)00417-2

Woods, R. (2009). *Death before birth: Fetal health and mortality in historical perspective*. Oxford University Press.

APPENDIX

Figure A1 *Data selection*

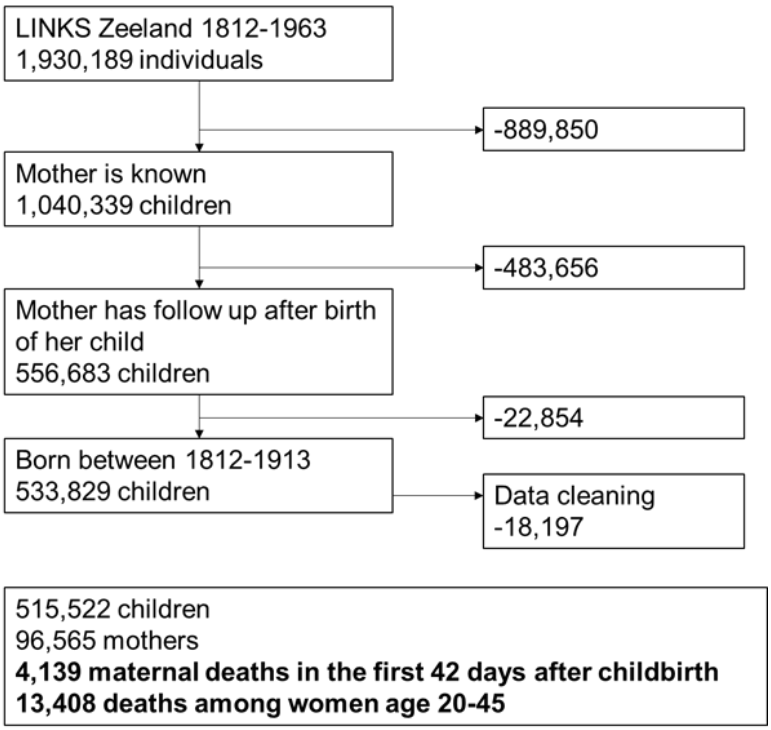


Figure A2 *Women's mortality between age 20 and 45, women with follow up observation, Zeeland*

Source: LINKS Zeeland. Reference group: Unskilled workers. Analyses are separately by period.