

# Maternal Life-Histories of Multiple Birth Mothers Compared to Singleton Only Mothers in 19th and Early 20th Century Netherlands

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# Maternal Life-Histories of Multiple Birth Mothers Compared to Singleton Only Mothers in 19th and Early 20th Century Netherlands

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## ABSTRACT

Research on mothers of twins suggests they have a more robust phenotype compared to singleton only mothers. Historical demographic microdata can be of additional value in studying differences in reproductive behaviour and survival of their offspring between multiple birth mothers and singleton only mothers. However, the number of such studies in historical populations is limited. This study aims to explore the possibilities to study maternal life-histories of multiple birth mothers compared to singleton only mothers using microdata on 19th and early 20th century Netherlands from the HSN/LINKS database. In line with studies on other historical populations, our results confirm multiple birth mothers on average had their first birth at younger ages, their last birth at older ages, longer reproductive lifespans, shorter inter-birth intervals, and higher lifetime fertility than singleton only mothers.

**Keywords:** Maternal life-history, Multiple births, Twins, Singletons, Fertility

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## 1 PRELUDE

In the mid-1990s Kees Mandemakers and Frans van Poppel regularly made trips to Middelburg to discuss the progress made in the collection of the Historical Sample of the Netherlands (HSN) data in the province of Zeeland. Finding information on the life course of the selected persons turned out to be a time-consuming job. For all births in the sample, death certificates in the municipality of birth and in neighbouring municipalities had to be checked to find out the dates of death of the research persons. How much more efficient would such a search process have been when use could be made of an index containing information on the name and age of the deceased and the names of parents and spouses for all deaths in the whole province over the entire period 1812–1970. Such an index would not only be an important instrument for the HSN community but could also be used for more general scientific studies in a variety of topics when additional information from the death certificates such as occupation and marital status was included in the index as well. And, last but not least, such an index would be extremely helpful for the thousands of genealogists studying the history of their family. The suggestion of Kees and Frans to construct such a database was very positively received by the staff of the Zeeland Archives (Rijksarchief Zeeland, nowadays Zeeuws Archief). Kees designed a special entry program (AKON), based on an existing HSN entry module for death certificates and in September 1996 the project could start as collaboration between HSN, the Zeeland Archives and Zeeland branch of the Dutch Genealogical Society. Data entry was done by about 25 volunteers, supervised by L.M. Hollestelle (Zeeland Archives). Around 2003 the project was completed. In the years that followed, comparable databases were developed in most of the other Dutch provinces and larger cities, identical databases were set up for marriages and births, and death, marriage, and birth databases have been interlinked. Due to the early start, the completeness and the high quality of the Zeeland database (nowadays called LINKS) Zeeland has evolved into the favorite Dutch study area of historians interested in the long-term processes of marriage, fertility, migration, mortality and longevity.

## 2 INTRODUCTION

Historical demographic microdata can be of great value in studying differences between twin (or multiple birth) mothers and singleton only mothers with respect to their reproductive behaviour and survival of their offspring. According to studies on Sami populations in the 18th and 19th century (Helle, Luma, & Jokela, 2004) and the population of Utah in the 19th and early 20th century (Chernenko, Hollinghaus, Robson, Hanson, & Smith, 2018; Robson & Smith, 2011), twin mothers were generally of higher phenotypic quality than singleton only mothers. Twin mothers were more likely to start reproduction at younger ages, had longer reproductive lifespans, shorter inter-birth intervals, and higher lifetime fertility than singleton only mothers (Chernenko et al., 2018; Helle et al., 2004; Robson & Smith, 2011). Although both mother and the twins often suffer complications during pregnancy and delivery (Hoekstra et al., 2007) and twins therefore face much higher early life mortality risks, Helle et al. (2004) found singleton offspring of twin mothers to have higher survival rates to adulthood than offspring of singleton only mothers. Chernenko et al. (2018) found a survival disadvantage in early life (below 5 years of age) for male and female singleton offspring of twin mothers and a survival advantage at older ages (age 50 years and over) of male singleton offspring of twin mothers. They observe elevated mortality risks in early life for male and female singleton offspring born after a twinset, but a higher survival advantage at older ages for male singleton offspring born after a twinset.

The number of such studies on fertility of twin birth mothers and on survival of their offspring compared to singleton only mothers in historical populations is limited and no such studies are available for the Netherlands yet. Our study aims to explore the possibilities to study maternal life-histories of multiple birth mothers compared to singleton only mothers using microdata on 19th and early 20th century Netherlands from the HSN/LINKS database developed by Kees Mandemakers and his team.

### 3 DATA AND METHODS

We use a unique LINKS database subset from the HSN/LINKS project with interlinked data from birth, death and marriage records for the Dutch provinces of Drenthe, Groningen and Zeeland (Mandemakers & Laan, 2017). The database consists of three base tables with births, marriages, and deaths. Birth records cover the period 1811–1913, death records cover the period 1811–1963, and marriage records cover the period 1812–1938. The predominantly rural provinces located in the northeast (Drenthe and Groningen) and the southwest (Zeeland) of the Netherlands cover around 13% of the Dutch population and 14% of the births in the 19th and early 20th century.

This LINKS database subset contains about 2.5 million records which are compiled from interlinked birth, marriage, and death records. However, not all records have a link of both a birth and a death record. 37% of all records are based on linked birth and death certificates, 33% based on birth certificates without linked death certificate, 4% based on death certificates of stillbirths (which required no separate birth certificate), and 26% based on other death certificates without a linked birth certificate. Almost all records (98.3%) are linked to a record of the mother. To select all records of persons born in the period 1812–1912 (the period for which the number of annual birth records is most complete) we estimated for all records without a linked birth certificate the date of birth based on date of death and age at death. Age of death was usually reported at the death certificate in whole years, or whole months or weeks for younger children (or in days for very young infants). We therefore calculated for adults and younger children a lower and upper limit of the date of birth and an average date of birth exactly in between. This gives almost 1.9 million records of persons born in the period 1812–1912. Since we are interested in key maternal life-history traits of mothers we calculated the age of the mother at birth directly from the date of birth of the mother or, if not available, estimated age at birth from the mother's age at death or age at marriage, if available. To reconstruct the maternal life histories of the mothers we ranked all children per mother by exact or estimated date of birth and calculated inter-birth intervals, which we, in the case of improbable short intervals, also used for checking and correcting for inconsistencies. This left us with a selection of 1,137,841 records of children born alive or stillborn in the period 1812–1912 with data on the age of the mother at birth (60.5% of all children alive and stillborn in the period 1812–1912 in the respective provinces). These children have been delivered by 239,166 mothers in 1,120,996 deliveries of which 16,450 twins (1.47%) and 197 triplets (0.02%). Since mother's age at birth appeared to be available for married women only our dataset includes no unmarried mothers.

To compare reproductive behaviour between multiple birth mothers and singleton only mothers, we calculated in line with Helle et al. (2004) and Robson and Smith (2011) several key maternal life-history traits: the average age at first and last birth, the average reproductive life span and average inter-birth interval, and the average numbers of deliveries, live births, and stillbirths. For multiple birth mothers we additionally calculated the average numbers of multiple birth deliveries, live births, and stillbirths. All calculations were done for each of the three provinces separately.

### 4 RESULTS

Multiple birth rates (number of multiple birth deliveries per 100 deliveries) in our study population vary from 1.2% in the province of Drenthe, 1.5% in Groningen to 1.6% in Zeeland. 5.0% of all mothers in Drenthe, 6.3% in Groningen, and 7.2% in Zeeland gave birth to at least one multiple birth. Overall fertility was highest in Zeeland (5.4 births per woman) and lowest in Drenthe (4.5) and Groningen (4.6). The outcomes of our analyses of the maternal life-history traits of our study population are shown in Table 1. Multiple birth mothers in the Dutch provinces of Groningen, Drenthe and Zeeland in the 19th and early 20th century did have on average 3 to 4 years longer reproductive life spans than singleton only mothers. They did have their first birth at younger ages and their last birth at older ages (on average about 0.5 years younger and around 3 years older).

Table 1 *Maternal life-history traits of married mothers with multiple birth and singleton only deliveries in the Dutch provinces of Groningen, Drenthe, and Zeeland, 1812–1912*

	Groningen		Drenthe		Zeeland	
	Multiple birth mothers	Singleton only mothers	Multiple birth mothers	Singleton only mothers	Multiple birth mothers	Singleton only mothers
	Mean	SE	Mean	SE	Mean	SE
Age at first birth (years)	26.60 ± 0.11	27.04 ± 0.03	26.27 ± 0.18	26.79 ± 0.05	25.81 ± 0.10	26.42 ± 0.03
Age at last birth (years)	38.49 ± 0.12	35.64 ± 0.04	38.27 ± 0.23	35.59 ± 0.07	38.53 ± 0.12	35.25 ± 0.05
Reproductive life span (years)	11.89 ± 0.14	8.60 ± 0.04	12.01 ± 0.26	8.80 ± 0.07	12.72 ± 0.14	8.83 ± 0.05
Inter-birth interval (months)	30.29 ± 0.46	32.43 ± 0.14	32.23 ± 0.95	33.86 ± 0.20	25.36 ± 0.53	28.86 ± 0.16
Number of deliveries	6.09 ± 0.07	4.45 ± 0.02	5.83 ± 0.12	4.36 ± 0.03	7.62 ± 0.09	5.15 ± 0.02
Number of live births	6.78 ± 0.07	4.28 ± 0.02	6.48 ± 0.12	4.17 ± 0.03	8.30 ± 0.09	4.94 ± 0.02
Number of stillbirths	0.40 ± 0.02	0.17 ± 0.00	0.42 ± 0.03	0.19 ± 0.01	0.44 ± 0.02	0.22 ± 0.00
Number of multiple birth deliveries	1.08 ± 0.28		1.06 ± 0.24		1.10 ± 0.34	
Number of multiple birth live births	1.97 ± 0.02		1.93 ± 0.03		2.04 ± 0.02	
Number of multiple birth stillbirths	0.19 ± 0.45		0.20 ± 0.45		0.18 ± 0.45	
Number of mothers	6,618	99,099	2,063	39,032	6,690	85,664

Source: Own calculations based on LINKS data (Mandemakers & Laan, 2017).

Differences in Zeeland were slightly larger than in the other two provinces. Multiple birth mothers also did have shorter inter-birth intervals than singleton only mothers, ranging from an average 1.6 months shorter in Drenthe to 3.5 months shorter in Zeeland. Due to the longer reproductive life spans combined with the shorter inter-birth intervals multiple birth mothers had on average around 1.5 deliveries more in the northern provinces and 2.5 more in Zeeland than singleton only mothers. These results are in line with findings from Helle et al. (2004) and Robson and Smith (2011) on differences in reproductive behaviour between twinning and singleton only mothers in 18th and 19th century Sami populations in northern Scandinavia and in the 19th and early 20th century population of Utah.

## 5 DISCUSSION

The aim of our study was to explore the possibilities to study maternal life-histories of multiple birth mothers compared to singleton only mothers using an interlinked dataset from the HSN/LINKS project. We used the dataset to reconstruct the maternal life-histories by first ranking all live births and stillbirths per mother by date of birth. However, since not all records in the dataset included data from a birth certificate, in those cases no exact date of birth was available and birth dates had to be estimated with a margin of error. However, in research specifically focusing on multiple births, dates of birth are crucial in determining whether children belong to a multiple birth or not. Inaccurate birth dates or incorrectly unlinked birth and death certificates may lead to incorrectly identified twins or other multiple births. We tried to correct for incorrectly identified multiple births. The finally calculated twinning rates for all three provinces fall within ranges found in other studies (Helle et al., 2004; Robson & Smith, 2011). However, errors in the data may still exist and additional checking of the multiple birth records against the original birth certificates still could improve the dataset.

Previous research has indicated twinning mothers were generally of higher phenotypic quality than singleton only mothers (Chernenko et al., 2018; Helle et al., 2004; Robson & Smith, 2011). These studies focus on three aspects of twinning in human populations: maternal lifetime reproduction, maternal survival, and survival of their offspring. Our explorative study focuses on maternal lifetime reproduction only, but can be extended in the future to analyse survival of multiple birth mothers and survival of their multiple birth and

singleton offspring. However, not all records in our dataset include data from death certificates and thus no date of death is available in these cases: for 82% of the mothers date of death is available and for the remainder of the mothers survival data is truncated to the date of their last birth; 62% of the records of the children include their date of death and an additional 17% include survival truncated to their date of marriage. This would allow us to analyse survival of the offspring to at least adulthood for around 80% of the children in our dataset. The dataset would not only allow for analysing differences between singleton offspring from multiple birth mothers and singleton only mothers in line with Helle et al. (2004), but also in line with Chernenko et al. (2018) for differences between singleton offspring of multiple birth mothers born before or after a multiple birth. Other variables available in the LINKS database, like sex of the child, birth period, socio-economic position of the parents, or rural or urban municipality could be included in future extensions of our analyses as well.

The results of our explorative analysis of maternal life-histories of multiple birth mothers compared to singleton only mothers in 19th and early 20th century Netherlands are in line with findings for other historical populations. Despite some shortcomings, the unique LINKS database subset with interlinked birth, death and marriage records from the HSN/LINKS project that we used for our analyses seems reasonably well suited for extending our analysis to survival of multiple birth mothers and their offspring. Research based on this dataset can have a valuable contribution to research on twinning in the Netherlands.

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