

## Survival analysis of individual data from historical parish registers: Analysis of population born from the end of the 18<sup>th</sup> century to 1830s in Jablonec, Czech lands

Ludmila Fialová<sup>1</sup>, Klára Hulíková<sup>2</sup>, Barbora Kuprová<sup>3</sup>

---

Czech historical data have been studied only through the traditional methods of historical demography (e.g. family reconstitution method according to Henry, 1980) so far (e.g. Fialová, 1994, 1998, 2004). However, the data (individual records from parish registers) offer many possibilities of application of other methods, which are actually used in demographic analysis of contemporary data, e.g. the survival analysis (Alter, 1998). The most important advantage of the historical data is its detail and many possibilities of classification according to many different variables (reflecting different aims of study).

The aim of the paper is to describe the reproductive behavior of people born from the end of the 18<sup>th</sup> century to 1830s. Data are individual records from parish registers from Jablonec, city in the northern part of the Czech lands.

Jablonec was a village typical for the manufacture of glass products in the second half of the 18<sup>th</sup> century. It was promoted to the township on the 21<sup>th</sup> April 1808. The title meant for Jablonec that it received the right to hold markets. It meant that Jablonec received the place where its products could be sold. Manufacture of textile products developed in Jablonec in the first half of the 19<sup>th</sup> century. So Jablonec was one of the industrial townships in that time. In 1830 the number of inhabitants reached 3 thousands, in 1850 almost 4 thousands.

The studied period was very special thanks to the significant economic growth of the area and improvements of financial and social situation of the families or society in general. The historical data could be used for illustration of the influence of all these historical facts to the demographic behavior during the demographic transition. In accordance to the aim of the paper, demographic events and their timing will be studied separately for groups of cohorts and changes in timing can be described not only from period point of view (comparison in time) but also from the cohort one (comparison of cohorts and differences among them). We focused on birth cohorts as well as on marriage cohorts.

For the analysis the dataset of individual records from parish registers was used. All records for a man, a woman and their children contained the date of birth, death and marriage if available. We included only records about first marriages to the analysis and we selected only those cohorts, where (with only some exceptions) at least 10 events occurred. Selected cohorts are included in the Table 1.

*Table 1: Cohorts (birth and marriage cohorts) included to the analysis*

	Cohorts included to the analytical part	Total number of events
Births – Males	1777–1831	1048
Births – Females	1776–1835	1067
Marriages	1800–1861	1173

---

<sup>1</sup> Charles University in Prague, Faculty of Science, Department of Demography and Geodemography (ludmila.fialova@natur.cuni.cz)

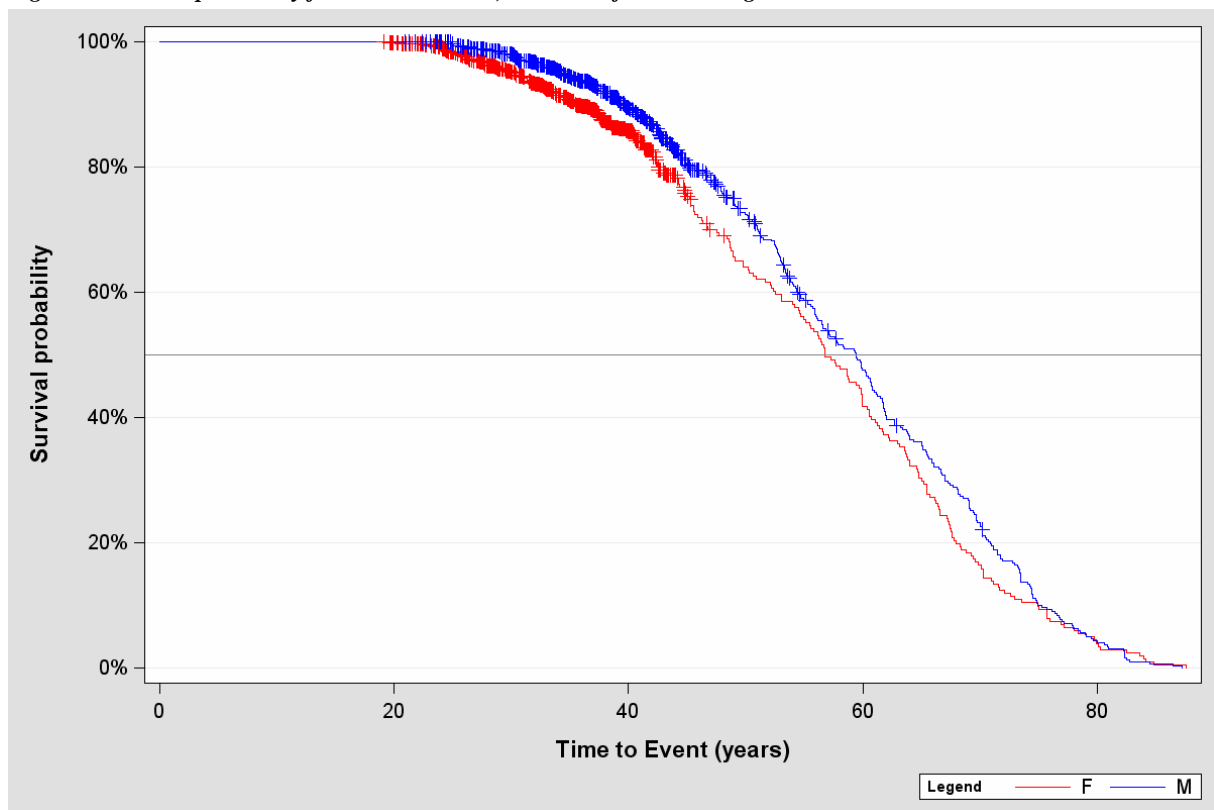
<sup>2</sup> Charles University in Prague, Faculty of Science, Department of Demography and Geodemography (klara.hulikova@natur.cuni.cz)

<sup>3</sup> Charles University in Prague, Faculty of Science, Department of Demography and Geodemography (bara.kuprova@gmail.com)

In the paper, the main analytical method is the survival analysis. Survival analysis is an analytical tool contemporary used and very popular everywhere, where the time durations are the subject of study, especially in epidemiology, medicine, biology, demography, sociology, econometrics, etc. (Aalen *et al.*, 2010). The respond variable of interest is the time until a studied event occurred (SAS Institute Inc., 2009). This method was developed for longitudinal data (Allison, 2010) what fully corresponds with the historical data set. One of the most important advantages of the survival analysis is the possibility to work also with incomplete data. That means, in the survival analysis we are able to cope with the problem of censoring (Aalen *et al.*, 2010).

For the survival analysis it was possible to use the exact lengths of life or time duration from initial event (e.g. birth, marriage) to the studied one (e.g. marriage, birth of child). This length was calculated in days as the difference of the date of the initial event and the studied one.

**Figure 1: Survival probability from birth to death, males and females who got married in Jablonec in 1800–1861**



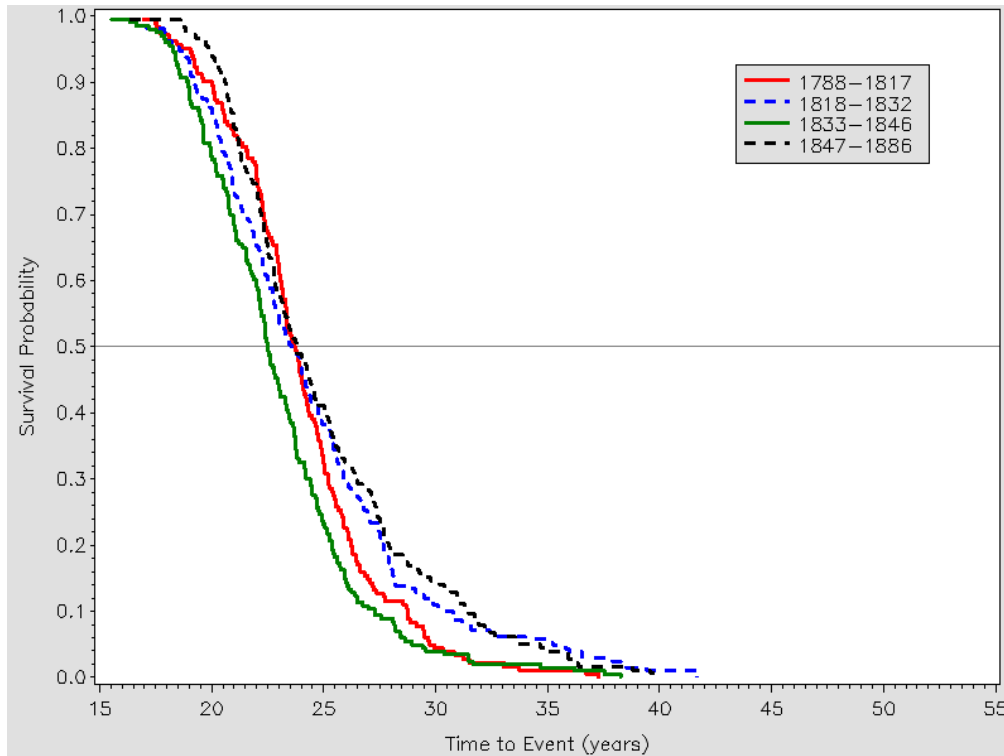
**Note:** M = males; F = females; censored events are marked by symbol “+”; Output from the SAS software

The simplest survival analysis could be done for the time durations from birth to death of the analyzed persons (in Figure 1 represented by the survival curve). It is clear, that the survival probability was almost at all ages higher for males than for females. The reasons could be found in higher mortality of adult women associated with the motherhood – the maternal mortality. The survival probability approached for both sexes at the age of about 50 years (ca 18 250 days), after the end of the reproductive period of women. Censoring in this type of analysis was present in cases where the date of death was not available – in such cases the last information about the person (the last date where the person was still alive) was the date of birth of the last child.

The analysis was done for various birth cohorts so as the changes in cohort mortality could be traced. Similarly the reproductive behavior was analyzed using the time duration from birth to the marriage or from birth to the birth of the first child. Family behavior was studied through the time durations from

marriage to the birth of the first child or the length of birth intervals in the family. All the analyses could be done according to birth cohorts of parents or according to marriage cohorts (groups of people who entered to marriage in similar time period). Such a type of analysis could be presented by the analysis of time duration from birth to marriage according to marriage cohorts (Figures 2 and 3).

*Figure 2: Survival probability from birth to marriage, females (according to marriage cohorts)*



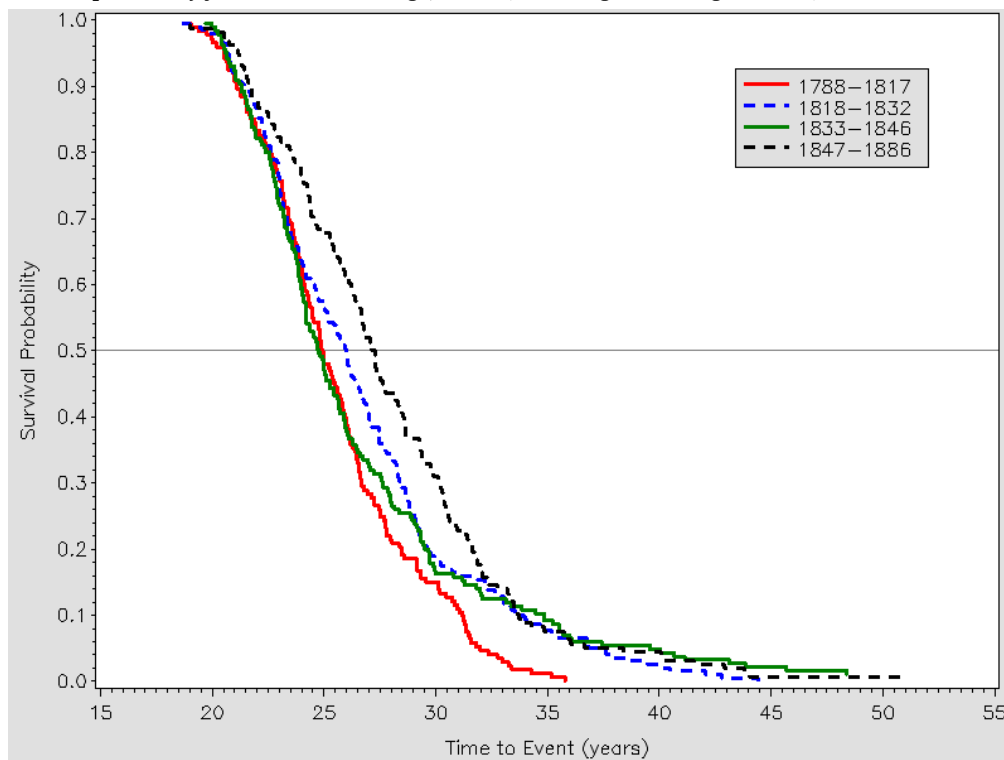
*Note: In the legend, there are marriage cohorts – i.e. the analysis was done separately for groups of marriages according to years of the marriage; Output from the SAS software*

Change in the age at marriage was more visible for men (Figure 3) than for women (Figure 2). Probably this change could be related to the coming of drapers from Liberec to Jablonec in the 1810s. For drapers the departure from Liberec meant that they were independent of the guild rules. So they could get married without the permission of the guild. When they arrived to Jablonec, they wanted to get married soon and to settle down. As a result, they got married earlier (at lower age) than the later marriage cohorts. However, this could be taken only as one of more possible hypotheses, and for its evaluation and correct description of the reality it is necessary to know the detailed history of Jablonec.

Thanks to the detailed data it was possible to do the analysis of reproductive behavior from more perspectives – e.g. according to pre-marriage conceptions or occupation type of the man. The influence of such factors is not always statistically significant, but it helps to illustrate details of reproductive and family behavior in the studied period.

All the performed analyzes confirm the usefulness of contemporary analytical approaches also in the field of historical demography. Thanks to that it is possible to learn more about the life in the past and gain the most from the unique data source as (individual records from) parish registers are.

**Figure 3: Survival probability from birth to marriage, males (according to marriage cohorts)**



**Note:** In the legend, there are marriage cohorts – i.e. the analysis was done separately for groups of marriages according to years of the marriage; Output from the SAS software

## References

- AALEN, O.O. – BORGAN, O. – GJESSING, H.K. 2010. *Survival and Event History Analysis : A Process Point of View*. 2010. Springer Science+Business Media, LLC. ISBN 978-1-4419-1909-0.
- ALLISON, P.D. 2010. *Survival Analysis Using SAS ®: A Practical Guide*, Second Edition. Copyright © 2010, SAS Institute Inc., Cary, North Carolina, USA.
- ALTER, G. 1998. L'event history analysis en démographie historique. Difficultés et perspectives. *Annales de démographie historique*, 1998, No. 2, pp. 25–35.
- SAS Institute Inc. 2009. *Survival Analysis Using the Proportional Hazards Model Course notes*. 2009 SAS Institute Inc. Cary, North Carolina, USA.
- FIALOVÁ, L. 1994. Changes of Nuptiality in Czech Lands and Slovakia. *Journal of Family History*, 1994, 19, č. 2, s. 107-115.
- FIALOVÁ L. 1998. On the Population development through population change in the Chech Lands in the 18th century. *Second European Social Science History Conference*. Amsterdam, 5–7 March 1998.
- FIALOVÁ, L. 2004. Domestic Staff in the Czech Lands at the Turn of the 19th and 20th centuries in the Light of Statistical Figures. In: Fauve-Chamoux, Antoinette (ed.). 2004. *Domestic Service and the Formation of European Identity. Understanding the Globalization of Domestic Work, 16th-21th Centuries*. Bern: Peter Lang AG, European Academic Publishers, 2004. S. 141-159.
- HENRY, L. *Technique d'analyse en démographie historique*. Paris: INED, 1980. 177 s.