Parental loss and offspring longevity.

Does the timing of parental death affect survival chances after 50?

Robyn Donrovich and Koen Matthijs
Family and Population Studies (FaPOS), KU Leuven (Belgium)

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Background and motivation

This paper aims to contribute to research on parental effects on offspring mortality. In particular, we aim to study the impact of parental death across the lifespan, as the effects of parental death on child's adult mortality risk in later life have rarely been studied in detail, especially in the case of offspring longevity. While researchers have found that the death of a parent can affect the quality of life and standard of living of the remaining spouse, there is very little known about the lasting impact on children.[1] Because infants and children grow up in the home of their parents, and their fate is completely in the hands of their family members, studies have been largely concerned with infant and young child survival. In previous historical studies, many findings have suggested that parental loss during the early stages of child development has dire consequences on short-term mortality risk for infants and children, especially in the case of maternal mortality[1,2], given that a mother is the primary food source, through breastfeeding, and caretaker of the infant. Though a father's contribution to the family, especially economically, is important for its members' well-being, a mother's survival is deemed critical for the infant, whereas a father's absence is often of lesser significance for its survival.[1,3]

Parental relationships in later life

A parent who has had a longer lifespan often increases his or her offspring's chances to reach an advanced age, as evidence suggests longevity may be, in part, genetically inherited. In addition to this biological explanation, kinship relationships, and in particular, inter-generational ties are some of the most profound bonds an individual will have in his or her life. As such, parental presence, absence or death can have lasting implications on health and survival in later life. While kin often provide emotional and economic support and help with the childrearing of their children, e.g. in the case of maternal grandmothers, an opposing situation may arise in later life, as relationships can change and develop over the life course.

[1] Högberg, U., & Broström, G. (1985). The demography of maternal mortality: 7 Swedish parishes in the 19th century. *International Journal of Gynecology & Obstetrics*, 23, 489−497.
[2] Pavard S., Gagnon, A., Desjardins, B. and Heyer, E. (2005). Mother's death and child survival: the case of early Quebec. *Journal of Biosocial Science*, 37, 209-227.
[3] Ronsmans, C., Chowdhury, M. E., Dasgupta, S. K., Ahmed, A., and Koblinsky, M. (2010). Effect of parent's death on child survival in rural Bangladesh: a cohort study. *The Lancet*, *375*(9730), 2024-2031.

Whereas parental benefits may be the highest in early development, and possibly during reproductive ages, family bonds may also become a burden, due to family obligations in later life. For example, if an elderly parent can no longer take care of him or herself, he or she may become dependent on the adult child or children for social and financial support, and in turn, kinship roles may reverse through time.

Research aims

The aims for this study are (i) to better understand the complex relationship between parental death and child longevity (defined as survival past age 50), through biological mechanisms (correlations between parent lifespan and child risk in later life) as well as possible social pathways based on the timing and duration of loss at different points of a child's life, and (ii) to distinguish whether male and female offspring are impacted similarly or dissimilarly at different points of their life, while controlling for important determinants in early and later life.

Data and methods

Parental death impact will be tested quantitatively using survival analysis. Data has been extracted from the COR*-sample, which contains linked micro level demographic data on individual life courses, through use of population registers and vital statistics, for Antwerp city and its surroundings during the period 1846-1920.[4] Individuals who had survived to age 50 will be followed from age 50 until death or until the end of the study period in 1920, as we are interested in later life mortality risk. The final study group is 425 (216 men and 209 women) born from 1800-1859 who have been linked through the sources to both a Mother ID number and Father ID number. Because we have information on linked parents, siblings sharing the same mother and father were also identified (see Figure 1 for family details and distribution). Of our study group there were 171 deaths by the end of the study period in 1920. Individuals were censored if they emigrated out of the Antwerp area after age 50 and did not return, though in this study group there was only one person who met that criteria.

Number of children in the family represented	**Count**
1	102
2	102
3	87
4	80
5	25
6	6
7	14
9	9
Total individuals, n	**425**
Total number families	**211**

Figure 1. Family breakdown of men and women in the study

[4] Mattijs, K. & Moreels, S. (2010). The Antwerp COR*-database: A unique Flemish source for historical-demographic research. *The History of the Family*, 15(1), 109-115.

We performed survival analysis using a Gompertz proportional hazard model chosen as it fits human adult mortality well, which generally follows the Gompertz distribution of monotonically increasing hazards with age. Further, given that our models include only children and siblings that share a mother and father, we specified our models using the shared frailty option in order to account for intragroup correlations, in this study, a within-family effect distinguished on the basis of mother ID. Table 1 lists our preliminary selected control variables, including our main variables of interest: age at father's death and age at mother's death and maternal and paternal lifespan (mother and father age at death).

Table Preliminary variables

Variable	Type	Variable	Type
Gender	categorical	**Age at father's death**	categorical
Female (ref)		Less than 15 (ref)	
Male		15-34	
		35-49	
Birth cohort	categorical	50+	
1800-29 (ref)		Unknown	
1830-39			
1840-49		**Mother's age at death**	continuous
1850-59		30-104	
Father occupation*	categorical	**Father's age at death**	continuous
Professionals (ref)		35-94	
Foreman, skilled, and lower skilled			
Farmers		**Number of children**	continuous
Unskilled and day laborers		1-16	
Unknown			
		Civil status (time-varying)	categorical
Mother age at birth	categorical	Unmarried	
15-24		Married (ref)	
25-34 (ref)		Widowed	
35-49		Unknown	
Siblings	continuous	**Own occupation***	categorical
0-15		Professionals (ref)	
		Foreman, skilled, and lower skilled	
Birth order	categorical	Farmers	
Only child or 1st born (ref)		Unskilled and day laborers	
2nd born		Unknown	
3rd or higher born			
missing			
Age at mother's death	categorical		
Less than 15 (ref)			
15-34			
35-49			
50+			
Unknown			

* based on HISCO, the Historical International Standard Classification of Occupations (Van Leeuwen and Maas, 2005)

Preliminary results

Kaplan-Meir curves in Figures 2 and 3, show the survival estimates of ego's different age categories at mother's death and father's death, respectively. Experiencing a mother's death before age 15 relates to a lower probability to die compared to later ages, fairly consistently

from age 50 on. Mother's death occurring in the age group 50+ is a higher risk category until around age 60, when the age group of 15-34 becomes a more disadvantaged group. In terms of the father, death that took place between 15-34 have lower survival chances compared to other groups from age 50, while losing a father at 35+ has marginally better survival chances. Whereas the lowest age groups experience better survival chances for mother's death across ego's lifespan, this age category for father's death produces inconsistent results from age 50 until ego death, and does not exhibit a clear pattern.

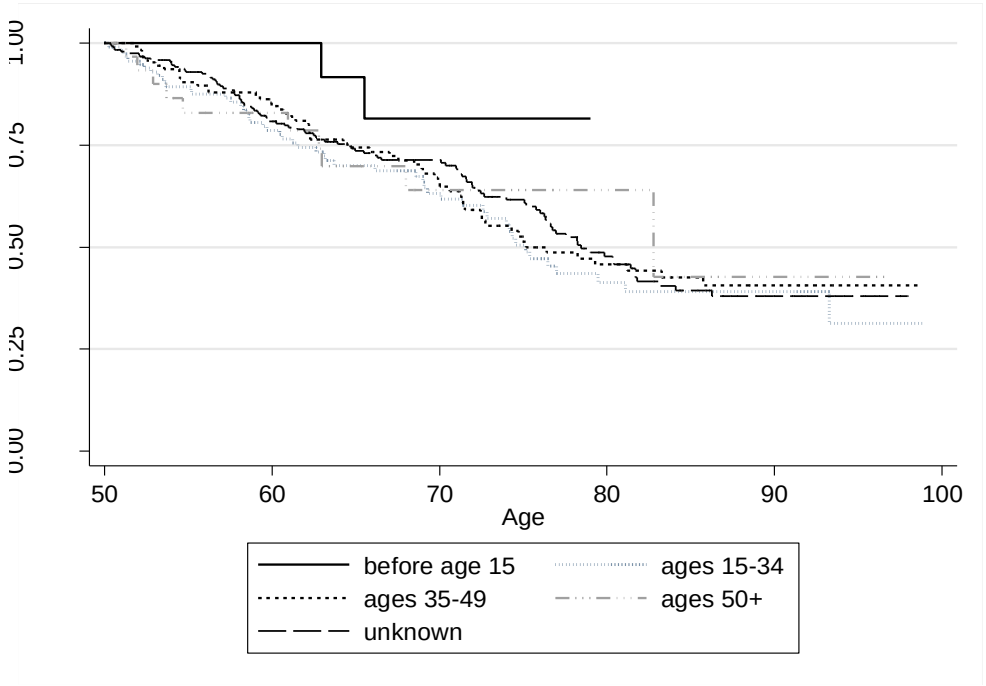

Figure 2. KM-survival curves by ego's age at mother's death

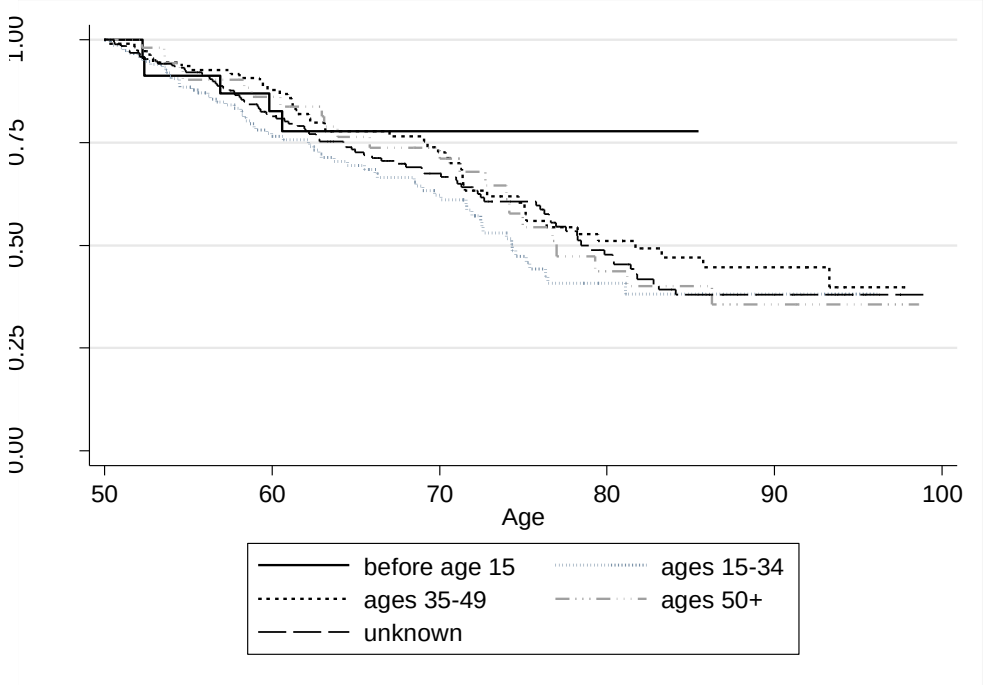

Figure 3. KM-survival curves by ego's age at father's death

Further analysis

After our preliminary findings which suggest differing mortality risk by age group at parental loss, as well as differing results for gender of parent, we will present our full main effects model, standardized for important control variables as presented in Table 1. We will test interactions with our main variables of interest and gender, as the strength of association/or direction of association may be different for men than women. Additionally, we would like to include duration variables to account for the attenuation or accumulation of risk based on parental presence or absence. Finally, constructing additional indicators, such as whether parents co-resided with their offspring at different points of their life may point to the effects of strong family ties, though we suspect that this may lead to either a positive relationship (resource sharing, companionship) or negative relationship (the burden of caring for an older parent) on child's longevity, which is largely dependent on the age of the co-resident parent.

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