Extended abstract

Title: The Defenceless Child: Socio-economic and gender differentiated child mortality responses to losing one's mother in 19th century Sweden

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Introduction

Child bereavement, when a child loses someone close to him or her, has in all times been a potentially devastating event for the child's chances of survival (Sear & Mace, 2008). Notably so, if the deceased person was the mother (Sear & Mace, 2008). Today, the early loss of parents is a major issue in developing nations in Asia and Africa, forcing many children to grow up without the crucial resources offered by their mothers (Andersson et al. 1996; Hillis et al. 2022; Koblinsky et al. 1994). The recent COVID-19 pandemic might have left as many as 10.5 million children without a parent, potentially causing not only trauma, but an increased risk of poor educational outcomes, abuse, and, perhaps most crucial of all, death (Hillis et al. 2022).

Though the association between maternal death and child mortality differs between countries and seem to be stronger in developing than developed countries, it is continuously present (e.g. Anderson et al. 2007; Becher et al. 2004; Borgerhoff Mulder, 2007; Li et al. 2014; Mailhot Vega et al. 2018; Masmas et al. 2004; Ronsmans et al. 2010; see review in Sear & Mace, 2008).

The current issues in developing countries and continued impact in developed nations poses the question whether the effect of losing one's mother was equally strong in historical populations as it is in developing countries today. A large literature has indeed found that the loss of one's mother severely increased the risk of child mortality in the period around the 19th century, when many now developed countries were industrializing, and that it was a far more important factor than both gender, socio-economic status, and the loss of one's father (e.g. Andersson et al. 1996; Beekink et al. 1999; Brittain, 1992; Kok et al. 2011; Lee et al. 2004; Pavard et al. 2005; Reher & González-Quinones, 2003; Tymicki, 2009; van Dijk & Mandemakers, 2018; van Poppel & van Gaalen, 2008; for a review, see Sear & Mace, 2008).

But while attempts to establish whether the effect on child mortality of maternal death differs between individuals of different socio-economic status and between boys and girls have been made on modern populations (though mainly on stratified samples), few historical studies have been able to perform large enough explorations in order to do the same due to the rarity of losing one's mother also in historical societies (Li et al. 2014; Masmas et al. 2004; van Poppel & van Gaalen, 2008). Understanding the fundamental factors that put children at risk is crucial

as socio-cultural factors, related to both socio-economic status and the sex of the child, such as breastfeeding practices, environment, social support systems, and gender preferences might have made and continuously make the combined effect significantly worse for certain groups (Lithell, 1981; Mosley & Chen, 1984).

The SwedPop database, including large parts of the Swedish population and covering the initial industrializing phase in the nation's history during the 19th century, offers a unique opportunity, given the sizeable sample, to examine both the group divided (stratified) *and* interaction effect on under-five mortality between gender/socio-economic status and the loss of one's mother in a historical population (SwedPop, 2024; SWEDPOP Databases, 2024). By utilizing this data, the analysis can be taken to a higher level of detail and contribute to our understanding of historical societies and the risks associated with maternal death.

Thus, the aim of this study is to examine the relationship between early maternal death (during the neonatal (first 28 days of life) and infancy (up to one year) periods) and under-five mortality (neonatal, post-neonatal (day 29-365), and age 1-4 years (day 366 to one day before turning 5 years) mortality) in Sweden for the period 1790-1910. Furthermore, the paper will use interactions between socio-economic status/gender and maternal death to investigate group specific patterns in under-five mortality responses during the set *risk* periods (neonatal, post-neonatal, and 1-4 years). To guide the study, two research questions will be utilized:

1. Does the impact of maternal death differ by socio-economic status?
2. Does the impact of maternal death differ by gender?

Data and methods

The study uses, in similarity with previous research on the topic, longitudinal individual-level data in a Cox proportional hazards model to estimate the relative hazard of death between groups using time to event (death) as the dependent variable, with the independent variables: maternal death, gender, and socio-economic group, and controls for the mother's occupation, if the father was alive and known during the risk period, birth order, season, database, and birthyear. Socio-economic status is defined using HISCLASS and grouped into six categories (van Leeuwen & Maas, 2011). Only biological children are included as to not receive confounding effects. The regions included in the study comprises Scania, Sundsvall, Linköping, Västerbotten, and the Northern inland (the western parts of the regions Jämtland and Norrbotten), and the capital city Stockholm, which gives a wide coverage of the country but where regional-specific patterns could limit the representability of the study slightly.

Furthermore, the small number of cases where the mother died before the child will inevitably make the results somewhat unstable, and caution must be taken in interpretation.

Theoretical focus and expectations

A general expectation, based on the findings of previous literature (see references in introduction), is that the loss of the mother, during the first year of life, will have a much larger effect on child mortality during the infancy then if the child reaches the age 1-4 years, primarily due to the (at least partial) absence of the vital breastfeeding period for many of these children.

To further distinguish the mechanisms (gender and socio-economic status) that may have impacted the effect of maternal death on child mortality, one must consider how the family might have reacted to such a devastating event, where role and kin selection theories state that family members behaviour will adapt to the new situation and give extra care to kin with close family connections (Birch & Okasha, 2015; Turner, 2002). This said, in an extraordinary situation such as the death of the mother, there could be a ranking behaviour among kin where for example a son, as the "future" of the family, is prioritized over a daughter (Birch & Okasha, 2015). This has also been shown, to some extent, by the literature.

If resources/socio-economic status weights in as a mitigating factor in accordance with the fundamental cause theorem by Link and Phelan (1995), this is likely to either reflect the use of breastfeeding, possibility to afford wet-nursing, exposure to disease through living environment, and/or availability of family/kin network. All of which should mean that higher classes potentially have a reduced risk compared to other groups but that surprising interactions could exist where, for example, certain groups did not practice breastfeeding.

Findings and conclusions

The findings (see Table 1 for an excerpt of the results), in accordance with the expectations, show a high effect of maternal death among neonatal, post-neonatal, and infant children if the mother died in the neonatal or infancy period. For children age 1-4, there is a persistent effect that however is far lower than that of children under the age of one. As expected, there is furthermore a difference in the effect between boys and girls in favour of male children, primarily in the early period between 1790-1877, with a significant interaction between gender and maternal death among post-neonates and infants if the mother died in the neonatal or infancy periods, respectively. Regarding socio-economic status, the results are much more scattered, with small indications of an effect in favour of the upper, non-manual working group, but where the base effect of maternal loss is the dominant factor for all socio-economic groups.

Table 1: Hazard ratios of maternal death (Deceased Mother: DM) in the infancy (IP) period

	1790-1910		1790-1877		1878-1910	
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Infant	1-4 years	Infant	1-4 years	Infant	1-4 years
DM (IP):	6.573***	1.813***	5.684***	1.958***	7.120***	1.559
	(0.605)	(0.319)	(0.722)	(0.450)	(0.953)	(0.424)
G: Ref: Male						
Female	0.826***	0.929***	0.836***	0.904***	0.817***	0.955***
	(0.00629)	(0.00910)	(0.00919)	(0.0127)	(0.00862)	(0.0131)
Interaction DM x G						
DM (IP) x Female	1.118**	1.145	1.169**	1.196	1.063	1.080
	(0.0631)	(0.121)	(0.0913)	(0.173)	(0.0865)	(0.168)
SEG: Ref: Non-manual						
Medium skilled (MS)	1.116***	1.329***	0.929**	1.133***	1.238***	1.460***
	(0.0208)	(0.0282)	(0.0333)	(0.0461)	(0.0278)	(0.0370)
Farmers (F)	1.335***	1.134***	1.173***	0.970	1.329***	1.174***
	(0.0198)	(0.0210)	(0.0239)	(0.0245)	(0.0303)	(0.0342)
Lower/unskilled (LU)	1.259***	1.407***	1.171***	1.193***	1.345***	1.561***
	(0.0180)	(0.0240)	(0.0256)	(0.0319)	(0.0253)	(0.0344)
Farm workers (FW)	1.253***	1.249***	1.111***	1.084***	1.289***	1.306***
	(0.0202)	(0.0245)	(0.0245)	(0.0294)	(0.0313)	(0.0388)
Unknown (U)	1.454***	1.272***	1.170***	0.969	1.547***	1.525***
	(0.0217)	(0.0240)	(0.0263)	(0.0276)	(0.0323)	(0.0397)
Interaction DM x SEG						
DM (IP) x MS	1.403**	1.241	1.861***	0.879	1.205	1.637
	(0.192)	(0.328)	(0.408)	(0.409)	(0.218)	(0.575)
DM (IP) x F	0.967	1.147	1.070	1.015	0.975	1.441
	(0.101)	(0.226)	(0.153)	(0.261)	(0.150)	(0.443)
DM (IP) x LU	1.021	1.024	1.169	0.747	0.949	1.481
	(0.106)	(0.205)	(0.169)	(0.208)	(0.141)	(0.439)
DM (IP) x FW	0.969	1.340	1.117	1.318	0.916	1.252
	(0.113)	(0.280)	(0.171)	(0.346)	(0.167)	(0.459)
DM (IP) x U	0.877	1.379	1.365**	1.222	0.648***	1.648
	(0.0974)	(0.289)	(0.215)	(0.358)	(0.102)	(0.506)
Subjects	660,264	535,126	287,887	245,305	372,995	290,293

Notes: All regressions include controls for mother's occupation, if the father is known and alive, birth order, season, database, and birthyear, standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1, Source: SwedPop. (2024). Version 3 of harmonised data in SwedPop [dataset]. SwedPop. https://doi.org/10.48524/SWEDPOP-V3-0

The time dimension of the interaction term concerning gender poses the question if this was a feature of pre-industrial Sweden, where fertility was high and it potentially was considered more important to favour a boy as an investment for the future when faced with the devastating event of maternal death (Birch & Okasha, 2015). That a significant effect cannot be found for the later period might be due to rapid cultural changes in connection to industrialization and modernization that made families alter their behaviour and values (Low et al. 1991).

Socio-economic status on the other hand seems to have plausibly been of only minor importance. This shows, in accordance with the findings by van Poppel and van Gaalen (2008), that resources such as family/kin network and financial means might not have been enough to mitigate the devastating effect of losing one's mother.

Lastly, though the results of this study contribute to the existing literature by extending the analysis to incorporate interaction terms as compared to using controls or stratified samples, it is important to remember that even highly significant results should be interpreted carefully as the number of cases where a mother died before the child turned one are very low.

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