The impact of maternal death on the survival of enslaved children in Suriname, 1830-1863

Authors:

Matthias Rosenbaum-Feldbrügge[1]* (matthias.rosenbaum-feldbruegge@ru.nl)
Björn Quanjer[1]* (bjorn.quanjer@ru.nl)
Kristina Thompson[2]* (kristina.thompson@wur.nl)

[1] Radboud University Nijmegen, the Netherlands
[2] Wageningen University, the Netherlands
* Authors contributed equally to this work.

Abstract: Studies have shown strong relationships between maternal mortality and children's survival outcomes in historical and contemporary low-income contexts. However, this relationship has never been studied among an enslaved population, who encountered extremely harsh living conditions. Examining this relationship among different populations may reveal similarities and differences across contexts. The present study addresses this gap, by examining the life courses of children born between the years of 1830 and 1863 and enslaved in Suriname (n=18,946). Maternal death's relationship to children's hazard of death from age 6 months to twelve years was analysed with Cox proportional hazards models. For all children, experiencing maternal death was associated with 1.85 times the hazard of death (95% CI: 1.59 – 2.15), relative to not experiencing maternal death. This relationship was largest among infants, and decreased as children aged. We found that mothers were critical to childhood survival among people who were enslaved in Suriname. This was especially the case when children were infants, likely due to the importance of maternal care and breastfeeding on survival. These findings closely align with those of other studies, and reflect the importance of maternal care on childhood survival across time and space.

Keywords: Slavery; Maternal mortality; Child survival; Life course: Cox proportional hazards

Introduction

The death of a parent profoundly disrupts a child’s life. Experiencing parental death has been associated with worse social, economic, and mental and physical health-related outcomes (Björkenstam et al. 2016; Feigelman et al. 2017; Kailaheimo-Lönnqvist & Kotimäki 2020; Marks et al. 2007; Rosenbaum-Feldbrügge 2019). One of the most extreme ways in which a parent’s death may impact a child is an increased risk of death during childhood (Quanjer et al. 2023; Smith et al. 2014). In particular, the death of the mother, as the main source of nutrition during infancy and the main caregiver throughout childhood, has been found to be particularly harmful. Research on historical (pre-twentieth) Europe and North America (e.g. Beekink et al. 1999; Jaadla & Lust 2021; Pavard et al. 2005; Velková & Tureček 2022; Willführ & Gagnon 2013) and on contemporary Global South populations (e.g. Anderson et al. 2007; Houle et al. 2015; Målqvist et al. 2012; Moucheraud et al. 2015; Sear et al. 2002) universally shows that experiencing maternal death is associated with a higher infant and child mortality risk (see Sear and Mace 2008 for an overview).

In this study, we examined the relationship between maternal death and infant and child survival among the enslaved population of the former Dutch plantation colony Suriname. This relationship has never been studied among an enslaved population. Enslaved people in the nineteenth century encountered extremely harsh living conditions. To date, maternal death's relationship to child survival has been studied among nineteenth-century populations who generally experienced better living conditions.

This represents a knowledge gap, because it is not yet clear how variations in living conditions may impact the strength of this relationship. On the one hand, the relationship between experiencing maternal death and childhood survival outcomes may be stronger among enslaved populations, because maternal care was all the more important to buffer living conditions' effects. On the other hand, survival outcomes may have been less affected by maternal death. For instance, nutritional intake may have been equally poor for those who lost their mother and those who did not (e.g. Kiple & Kiple, 1977). Additionally, mothers may have been less able to provide care and support for their (newborn) children because they were forced to work. Studying this relationship in different settings with varying living conditions may help shed light on why maternal death is related to childhood survival outcomes.

We are able to explore this relationship due to recent innovations in linking life course data. Until now, demographic research on enslaved populations based its findings on cross-sectional censuses mainly available in the British Caribbean from the 1810s onwards (Higman 1995; Meredith John 1988), and small 19th century plantation samples in the US, Jamaica, and Suriname (Everaert 2011; Forster and Smith 2011; Lamur 1977, 1981, 1987; Steckel 1986a, 1986b; Van Stipriaan 1993). Research therefore focussed on aggregated mortality and fertility statistics. Longitudinal micro-datasets, which enable life course research and the reconstruction of family networks, were not available. In this study, we used a novel and unique population reconstruction database of people enslaved in Suriname between 1830 and 1863 (Van Galen et al. 2023a), which is the result of a large online crowd sourcing project combined with linking algorithms (Mourits & Rosenbaum-Feldbrügge 2022). The dataset contains longitudinal, life course data on more than 90,000 enslaved individuals (Rosenbaum-Feldbrügge et al. 2023a). We also used a dataset on the crop grown on the Surinamese plantations (Rosenbaum-Feldbrügge et al. 2023b), which allowed us to study how living conditions may have varied for enslaved people in Suriname. While previous studies have used cross-sectional population information (e.g. Meredith John 1988), or have used life course information from single plantations (Forster & Smith 2011), our study is the first to use longitudinal microdata to study an enslaved population to this scale.

Mechanisms linking maternal death and childhood survival

Experiencing maternal death may be related to childhood survival outcomes through several pathways. While children are especially reliant on mothers for nutrition during the first year(s) of life, being unable to be cared for and to breastfeed are not the only ways in which maternal death may impact childhood survival. Research has shown a smaller, but still significant effect of maternal death on the survival of older children (Houle et al. 2015; Quanjer et al. 2023; Velková & Tureček 2022). This may be in part because mothers provide essential care to children throughout childhood, including protection from hazards and providing adequate nutrition.

Epidemiological factors may also partially explain this relationship. For instance, a genetic predisposition that increases the risk of earlier death may be shared between mother and child (Li et al. 2014; Rostila & Saarela 2011). This relationship may also be partially due to the presence of infectious diseases in the household. A child may have been weakened by the same infectious disease of which their mother died. Alternatively, experiencing maternal death may signal that they are likely to encounter infections throughout development (Bengtsson & Lindström 2003).

Still, these material and biological pathways do not appear to fully explain maternal death's relationship to childhood survival. The loss of children's primary caregiver, whether through death or absence, has been associated with an increased risk of death in childhood, even in contemporary, high income contexts, when children's material needs are generally sufficiently met (Kailaheimo-Lönnqvist & Kotimäki 2020; Li et al. 2014; Rostila & Saarela 2011). It therefore appears that psycho-social factors also may contribute to an increased risk of death.

Context

This study is set in the plantation colony Suriname in the mid-nineteenth century. In this period, Suriname was a Dutch colony, which was taken over from the British in 1667. The plantations were worked by forced labor from enslaved people shipped from Africa, and produced products such a sugar, wood, coffee, and cotton. During the nineteenth century most plantations shifted towards sugar production. It is estimated that some 213,000 enslaved people were brought from West Africa to Suriname between the seventeenth and nineteenth centuries (Neslo 2016; Van Stipriaan 1993). However, in the 1830s, fewer than 46,000 enslaved persons and 5,100 freedman and their descendants lived in the colony (Neslo 2016; Van Stipriaan 1993).

Like in other sugar-producing colonies in the Caribbean (Higman 1995), the enslaved population of Suriname experienced extraordinarily high mortality rates and natural population decreases. In our research period, as shown in Figure 1, crude death rates both among plantation- and privately owned enslaved ranged between 30 and 50 and exceeded crude births rates considerably (Lamur 1977).

[Figure 1 about here]

Infectious disease outbreaks are likely responsible for the mortality peaks evident in Figure 1. Particularly in the 1840s, the Surinamese population was hit by severe flu and dysentery epidemics and experienced high crude death rates exceeding 50 per 1000 (Van Stipriaan 1993). Later on, in 1851, there was a yellow fever outbreak, followed by a smallpox outbreak in the latter half of the 1850s (Van Stipriaan 1993).

The majority of people enslaved in Suriname were living and working as field laborers on plantations with a population of more than 100 people.

However, around 25% were owned by private owners in the capital and only city Paramaribo. These enslaved people mainly worked as craftsmen and in the service sector (Engerman and Higman 2003; Van Galen et al. 2023a).

The owner(s) of enslaved women automatically owned their newborn children. Consequently, the mother´s name was carefully recorded in historical sources such as the slave registers. Only with the permission of the government were slave owners allowed to separate (minor and adult) children from their mothers through transfers (Van Lier 1977). This was an extremely rare occurrence. In the period 1832-1863, not more than 130 separation requests were submitted, and requests for separating children below the age of 12 from their mothers were persistently declined (Ten Hove 1996).

While we therefore have information about children's mothers and can be confident that children lived with their mothers in childhood, this is not the case for children's fathers. Enslaved children´s fathers were not registered. Enslaved couples were not allowed to contract a civil marriage in Suriname before the abolition of slavery. Nevertheless, there is evidence that fathers were involved in family-life and that the nuclear two-parent family frequently occurred on Caribbean and Surinamese plantations (Browne and Burnard 2017; Higman 1975, 1977; Lamur 1993; Van Stipriaan 1993).

As in many other Caribbean plantation economies, sugar was the dominant crop grown in Suriname, and was grown by around half of the plantations by the end of this study's period. Sugar was followed by coffee, cotton, and timber (Engerman & Higman 2003; Rosenbaum-Feldbrügge et al. 2023b; Van Stipriaan 1993). Surinamese plantations were mainly located in an unhealthy swampy climate in the coastal marshes (Lamur 1981), which required the digging and continuous maintenance of canals, dykes and ditches, a job mostly done by enslaved men (Van Galen et al. 2021).

Working conditions on sugar plantations were particularly harsh because of heavy manual labour intensity and the fact that the entire production cycle took place on the plantation. During harvest season, additional night shifts were introduced because harvested sugar cane had to be processed quickly (Follett 2005; Higman 1995). Accordingly, previous research on Suriname demonstrated that crude mortality rates on sugar plantations were considerably higher than on cotton plantations with less harsh working conditions (Van Stipriaan 1993). Also in the British Caribbean, the enslaved population on sugar plantations faced the highest mortality rates (Engerman and Higman 2003; Follett 2005; Higman 1995; Meredith-John 1988). Whereas workload on coffee plantations was less harsh than on sugar plantations, it required exposure in the unhealthy wet seasons (Meredith John 1988).

In the seventeenth and eighteenth centuries, pregnant enslaved women in Suriname and the British Caribbean were typically regarded as burden by their owners and could not expect compassion and less onerous working conditions (Bush-Slimani 1993; Van Stipriaan 1993). Just after the abolition of the trans-Atlantic slave trade in the 1810s, slave owners were more willing to increase fertility and natural increase. They therefore lightened the workload of pregnant women and neo-natal infants (Bush-Slimani 1993; Van Stipriaan 1993).

Surinamese mothers were thought to have had relatively long birth intervals, estimated to be more than three years on average (Van Stipriaan 1993). As in other Caribbean colonies, large birth intervals may be due to long lactation periods of around 18 to 24 months, during which mothers refrained from sexual intercourse (Klein and Engerman 1978). As periods of lactation in West African cultures were also often two to three years, Klein and Engerman (1978) claimed that long lactation periods in the Caribbean may be due to residual cultural practices from Africa. However, Lamur (1983, 1987) instead argued that harsh working conditions on sugar plantations and protein-deficient nutrition largely contributed to longer birth intervals. Long breastfeeding periods among Surinamese mothers have also been regarded as an indicator for enslaved women´s anti-natalist attitudes and conscious decisions to limit the number of children born into slavery (Lamur 1987; Van Stipriaan 1993).

The transition away from breast milk and towards solid food and manual feeding has been identified as a difficult adjustment period, which was accompanied by elevated rates of mortality among enslaved children on plantations in the United States (Steckel 1986b). Manual feeding introduced unsanitary implements and contaminated food or liquid. Moreover, both in the United States and the Caribbean a starchy flour- or corn-based pap replaced breast milk, which lacked sufficient protein and was probably deficient in calcium and iron (Inniss 2006; Steckel 1986b), making children vulnerable to kwashiorkor and other deficiency diseases (Campbell 2006; Kiple & Kiple 1977).

Given the long lactations periods and the deficient alternatives for mother´s milk, we hypothesized that maternal death in infancy and early childhood had a detrimental effect on child health, perhaps even stronger than those effects observed for other populations in the nineteenth century (Beekink et al. 1999; Jaadla & Lust 2021; Pavard et al. 2005; Velková & Tureček 2022; Willführ & Gagnon 2013). We also likewise expected smaller but still significant effect sizes for children of older ages.

Data and Methods

Database construction

This study is based on Surinamese slave registers, which were introduced in 1826 to combat the then-illegal transatlantic slave trade. Changes in ownership, such as sales or inheritance, as well as vital events were noted, making it possible to follow enslaved life courses longitudinally up until the abolition of slavery in 1863 (Van Galen et al. 2023a). This contrasts with the British triennial censuses of enslaved individuals in the Caribbean, which are cross-sectional, and consequently do not allow for detailed individual-level analysis of demographic outcomes (Higman 1995). With the help of hundreds of citizen scientists, the scanned Surinamese slave registers were transcribed and checked. The public version of the slave registers was published in 2019 (Van Galen et al. 2019), which was intended to facilitate genealogical research for a wide audience. In 2023, the scientific version of the Surinamese slave registers, which contains the cleaned and linked life courses of the enslaved population, was published online open access (Rosenbaum-Feldbrügge et al. 2023a). For a detailed description of the sources and data, see Van Galen et al. (2023a).

The initial slave register series, covering the period 1826-1830, is lost from the archives, but the four subsequent series spanning the periods 1830-1838, 1838-1848, 1848-1851, and 1851-1863, which are referred to as series 1-4 in this study, are preserved. However, particularly in series 1 and series 2 many books are missing. For instance, in series 1, only 20% of the plantation books and two thirds of the private owner books have been preserved. Only series 4 is nearly complete, with all plantation books and all but one private owner books available (for more details see Van Galen et al. 2023a). To further increase complexity, the four series contain different sets of individual information. While owner´s name, enslaved name, sex, and changes such as transfers, births, and deaths are recorded in all four series, information on age and year of birth, mother´s name and exact birth and death dates differs between the four series. Exact birth and death dates are only registered from 1850 onwards. Before then, we only have information on the date births and deaths were recorded (which can differ quite significantly from the actual event dates). In the beginning of series 1, the (estimated) ages of the enslaved population are recorded as well as the birth years of the newborn children. In series 2, however, we only know the birth years of the newborn children. Just for series 3 and 4 birth years for the entire population are recorded.

Mother linking and sample construction

To link children to their mothers, we applied an algorithm specifically designed to link slave records based on first names only (Mourits & Rosenbaum-Feldbrügge 2022). Throughout the entire study period, the colonial government carefully registered the mother names of newborn children. We only allowed name-matches with a Levenshtein distance (Levenshtein 1965) of 2 or lower, that occurred within the same series, and within the same owner (private or plantation). Whereas plantation names are standardized and needed to match exactly, we allowed for a Levenshtein distance of 5 or lower for private owner names. In addition, we excluded matches with women who were younger than 14 or older than 52 years of age at the time of birth, and removed matches with women who had already left the observation period before the birth of the child and with women who had not yet entered at the moment of birth. When children were linked to more than one potential mother, we chose the match with the lowest Levenshtein distance. In the preserved slave registers 25,510 births were recorded, of which 25,426 contained the mother's name. Of these children, we successfully linked 21,968 (86.4%) child-mother pairs. The remaining children were either not linked because no correct match was identified (1,881; 7.4%) or because more than one possible mother was identified (1,584; 6.2%). This happened often on larger plantations where certain popular names were given to more than one enslaved woman of childbearing age. Table 1 illustrates that linking success among plantation-owned enslaved increases over time: children born in series 3 and 4 were more likely to be linked than those born in series 1 and 2. Linking success was lowest on plantations in series 2 because in this series newborn children were often entered on a different folio than adults. In cases where only the children´s folio was preserved, it was not possible to link children to their mothers. On plantation Vossenburg, for instance, all 46 children born during Serie 2 could not been linked to their mothers because the adult folio has not been preserved.

[Table 1 about here]

To check the quality of the links, we calculated the birth intervals of mothers with more than one child. For children whose exact birth year was not recorded, we used the date of birth registration instead. Out of the 21,968 children, 508 have unrealistic birth intervals below 365 days with regard to their older/younger sibling(s). When excluding those cases, the average birth interval between consecutive births was 1,162 days, which is in line with the long lactation periods mentioned earlier. Finally, in the analysis we excluded 219 mother-child pairs with missing information on the reason for why they were written off the slave registers. This results in 21,241 enslaved children born between 1830 and 1863 who were successfully linked to their mothers. This represents 83.3% of all newborn children registered in the Surinamese slave registers in the study period.

In this study's analyses, we only include children with complete covariate information (n=20 excluded), those who were born after their mothers died and/or who died at birth (n=95 excluded), and those who were observed until age six months (n=2,180 children excluded), yielding a final sample of 18,946. There is ample evidence that infant mortality was systematically under-recorded among enslaved populations (see Steckel 1986a for the US, Higman 1995 for the British Caribbean, Johansen 1981 for the Danish Caribbean, and Everaert 2011 for the Dutch Caribbean). In Suriname, slave owners were required to register births with the colonial administration within three days if the baby was born in Paramaribo, the capital city, and within a month if the baby was born on a plantation. In practice, however, the gap between the date of birth and the date of registration varied by up to four months. Slave owners were also not obliged to report stillbirths and births of children who died before registration (Van Galen & Hassankhan 2018). This problem is not unique to our dataset (e.g. Steckel 1986a; Van Stipriaan 1993), and therefore we decided to study infant mortality from age 6 months onwards.

Analyses

Data were analysed in Stata version 17. Sample characteristics were first computed. We also descriptively explored the relationship between the survival probability of children who did and did not experience maternal death with a Kaplan-Meier curve and log-rank test. We also descriptively explored the timing between mother and child's death.

Cox proportional hazards models were used to examine maternal mortality's relationship to the hazard of death. The proportional hazards assumption was tested using log-minus-log plots. In this study, the hazards of death at different ages in infancy and early childhood were the outcomes. We studied mortality for the whole age group (6 months – 12 years), and in three different age intervals, namely infancy (6 months – 1 year), early childhood (1 – 5 years), and later childhood (5 – 12 years), in line with Quanjer et al. (2023). In each age-stratified model, children who were alive at the start of a given interval were considered the population at risk. If a child was alive at the end of a given interval, they were censored at the end of the interval.

Experiencing maternal death within a given age interval was included as a time-varying variable, and experiencing maternal death in the previous age intervals (6 months – 1 years in the analyses examining survival from 1 – 5 years; 6 months – 1 year and 1 – 5 years in the analyses examining survival from 5 – 12 years) was included as a dummy variable.

Only children who were alive when their mother died are considered to have experienced maternal death.

A number of covariates that likely impacted the strength of the relationship between experiencing maternal death and the hazard of death were also included. Child's sex was accounted for, as there is evidence that girls have a survival advantage in very early life.

We controlled for birth cohort based on series. We also included mother's age at birth as a categorical covariate. There is evidence that mothers under the age of 25 (e.g. Donrovich et al. 2018) and mothers over the age of 35 have an increased risk of dying themselves, and of their children dying.

Birth order was also accounted for. Children born later are found to be at higher risks of death throughout their lives (Noghanibehambari & Fletcher 2023). Mothers have also been found to be at increased risk of death with first and higher-order (ninth and greater) pregnancies (Garenne et al. 1997). This variable is affected by the censored time frame. Children born close to the start of our research period are overstated as firstborns as we do not have information on children born before 1830.

We also controlled for plantation product. As mentioned, living conditions have been shown to vary by plantation product. We did not additionally control for plantation size or location, as plantation product, size and location are strongly associated with one another. For instance, sugar plantations were largest, whereas cotton plantations were located by coastal marshes (Lamur 1981).

Further, season of birth was controlled for. There is evidence that, among children enslaved in the southern United States, there was a seasonal pattern to mortality, with an increased risk of children ages 1-4 dying during the summer months (Steckel 1979). In tropical Suriname, season is largely characterized based on rainy and dry months (Van Stipriaan 1993).

We also performed several additional analyses. First, we replicated our main analyses while using multilevel survival models with Weibull distributions and random intercepts for children with the same mothers, plantations, and plantation districts. Because intra-familial factors may have been related to infant and child mortality outcomes, failing to account for sibling clustering may result in incorrect inferences (Lynch & Greenhouse 1994). Including plantation and district accounted for otherwise-unobserved factors relating to living standards, including infectious disease prevalence and labour conditions. Because district and product type are collinear, product type is not accounted for in these analyses.

Additional Cox models with slightly different set-ups to our main analyses were run. First, we replicated our main analyses while excluding children who died within 30 days of their mothers, to remove children who potentially died of the same infectious disease as their mother. To explore whether children were most at risk when breastfeeding (which is thought to occur until age 1.5 on average), analyses were stratified by ages 6 months to 1.5 years, and 1.5 to 5 years. Also, to understand whether excluding children who died before the age of 6 months impacted our findings, our main analyses were run when including children from birth. Further, we stratified the full-sample analyses by birth cohort (based on register series), to explore whether experiencing maternal death's relationship to the risk of death among children changed over time. Finally, we stratified results based on plantation type, to test whether the strength of maternal death's relationship to the hazard of a child dying differed based on living conditions. We reported these results in the Appendix.

Results

Table 2 presents the results of the sample characteristics. Of the 18,946 children in this study's sample, 28.70% died between the ages of 6 months and 12 years of age. A small share of children (7.70%) experienced the death of their mothers before they turned 12 years old.

Regarding additional covariates, a slightly larger share of children ages 6 months and older (50.60%) were girls. In terms of birth cohort, the smallest share (10.30%) was born between 1830 and 1838, while 22.38% was born between 1839 and 1848, 12.07% was born between 1849 and 1851, and the majority (55.26%) was born between 1852 and 1863. In terms of birth season, the largest share of children surviving until age 6 months was born during the major rainy season, in May through August (32.23%), followed by the major dry season (24.52%), the minor dry season (20.38%), and the minor rainy season (20.38%).

Regarding the mother's age at the child's birth, a majority (57.93%) are unknown. This is because information on mother's age is not available until 1848, in series 3. Of children whose mother's age at their birth was known, the largest share of mothers was between the ages of 20 and 24 (10.61%), followed by being ages 35 and older (9.54%), being between the ages of 25 and 29 (9.54%), and being between the ages of 14 and 19 years old (5.05%).

In terms of birth order, a large minority of children were firstborns (43.88%) as mentioned in section 2.3 and are followed by children with increasing numbers of older siblings. Only 3.27% of children were sixth through tenth born.

In this study’s sample, the largest share of children was owned by private owners (31.53%). The remaining children lived on plantations, most commonly sugar plantations (23.26%). Only 5.40% of children’s living situation are unknown as information on plantation product was not available.

District is included to account for any unobserved regional factors that may have affected health. The coastal districts of Coronie (4.5%) and Nickerie (3.0%) were far away from the capital. These districts were only accessible by sea and had predominantly British plantation owners and grew sugar cane and cotton. The plantations along the Commewijne river - Beneden Commewijne (6.0%), Beneden Cottica (20.3 %), boven Commewijne (5.8%), and boven Cottica and Perica (10.4%) - had a vast irrigation network of dykes. This created a wet and open landscape where sugar, coffee and cotton were grown. The more inland regions such a Para (7.0%) and the plantations along the Suriname river (8.6%) were situated in the middle of the rain forest where we find timber and sugar plantations.

[Table 2 about here]

Figure 2 presents a Kaplan-Meier curve of survival probability among children enslaved in Suriname. The probability of survival was significantly different between those who had experienced maternal death and those who had not (p-value = 0.000), based on the results of a log-rank test. The differences in survival between children who experienced maternal death and those who did not appear to be largest in the first 2.5 years.

[Figure 2 about here]

We also descriptively explored the timing between mother and child's death. Among the 298 children who died after their mothers, the median length of time between their mothers’ deaths and their own was 1.16 years. The length of time between maternal and child death clearly varies by the child's age. Children under one year died a median of four months after their mothers. Children who died between one and five years died a median of 7.5 months after their mothers. Among children ages five to twelve years old, the median time span was just over 2 years.

Table 3 presents the results of the Cox proportional hazards regressions. Throughout childhood, children whose mothers had died had higher risks of death. This was particularly the case in very early life. Experiencing maternal death between the ages of 6 months to 1 year was associated with 6.34 times the hazard of death (95% CI: 3.39- 11.85), relative to not experiencing maternal death. This relationship weakened in strength as children aged. For children ages one to five years, having their mother die was associated with 1.96 times the hazard of death (95% CI: 1.57 - 2.45), relative to not having their mother die. Among five to twelve year-olds, experiencing maternal death was associated with 1.441 times the hazard of death (95% CI: 0.98 - 2.12), relative to not experiencing maternal death.

It appears that the effects of maternal loss on children's survival outcomes are strongest shortly after losing their mother. Experiencing maternal death in an earlier period was infrequently related to a higher hazard of death. For instance, experiencing maternal death before age one was not related to an increased hazard of death between the ages of one and five.

Additional analyses are reported in the Appendix. In multilevel survival models, clustered at mother, plantation and district levels (Table A.1), the relationship between experiencing maternal death in a given interval and the hazard of death were broadly similar compared to the Cox proportional hazards models. The amount of variance at different levels also changed per period. As children age, the relative contribution of household-level factors, which are accounted for by clustering among children who share a mother, increased, while the relative contribution of district and plantation remained similar or decreased.

Based on the results of Cox proportional hazards models that excluded children who died within 30 days of their mothers (Table A.2), we found similar results for the full sample, as well as children ages one to five, and children ages five to twelve. However, for children ages six months to one year, the relationship between maternal death and childhood survival was weaker when removing children who died within 30 days of their mothers. For children in this age group, experiencing maternal death was associated with 3.17 times the hazard of death (95% CI: 1.31 - 7.65), relative to not experiencing maternal death.

Table A.3 presents the results of Cox proportional hazards models stratified by ages 6 months – 18 months, and 18 months – 5 years. These results were very similar to those for children ages 6 months – 1 year, and ages 1 year – 5 years, respectively. Table A.4 examines the relationship from birth onwards. The results do not change substantially.

In the analyses stratified by birth cohort and plantation product (Figure A.1 and Figure A.2), no significant differences were found in the strength of the relationships between maternal death and childhood survival outcomes.

[Table 3 about here]

Discussion

This study brings a new perspective to the demography of enslaved populations in the Caribbean and North America. A few studies on the topic were published in the 1980s and 1990s (e.g. Higman 1995; Lamur 1987; Meredith John 1988; Steckel 1986a, 1986b; Van Stipriaan 1993), but has been largely neglected by demographers and historians in recent decades. The data used in this study - longitudinal data on the enslaved population of Suriname - allows scholars to conduct innovative research into the living standards of enslaved populations.

More specifically, we analysed how mothers' deaths affected children ´s survival chances between the ages of six months and twelve years. We found an increased mortality hazard for children of deceased mothers compared to their peers who did not experience maternal death. This association was strong and significant for infants and young children, but decreased with age and became insignificant for children aged 5-12.

Our findings align with those of Sear and Mace (2008), which summarised the findings of sixteen studies examining this relationship in diverse historical and contemporary low-income contexts. The authors argued that mothers keep infants and young children alive even among populations that experience extremely harsh living conditions and persistent population declines. This contradicts Kiple and Kiple (1977)'s suggestion that enslaved mothers were so depleted that the nutritional value of mother's milk was too low to protect children against untimely death. If this were the case, we likely would have found weaker relationships between maternal death and childhood survival.

Rather, our findings, particularly those examining the risk of death among infants, are strikingly similar to other studies set in historical contexts, where broadly similar levels of medical and sanitation infrastructure and knowledge were present. We found that experiencing maternal death in infancy was associated with six times the hazard of death, relative to not experiencing it. When we included children younger than six months (table A.4) this increased to 7.3 times the hazard of death. These rates are comparable to those found in methodologically similar studies on historical Dutch, Estonian, German, and Canadian populations, in which experiencing maternal death in infancy was associated with between 4.5 and 7.5 times the hazard of death, relative to not experiencing maternal death (Fox et al. 2017; Jaadla & Lust 2021; Quanjer et al. 2023).

Unfortunately, comparing our findings directly to those of studies set in contemporary, low-income contexts is less straightforward. In these studies, analyses that do not consider the precise timing of an event, e.g. logistic regression looking at the odds of death within a given period, were used (Sear & Mace 2008). Nonetheless, it appears that a relationship between experiencing maternal death and children's survival are correlated in contemporary, low income contexts. This is especially the case for children under two years of age (e.g. Moucheraud et al. 2015; Ronsmans et al. 2010; Sear & Mace 2008). In these studies, a relationship between maternal death and childhood survival is not found for older children. In comparison to our study, this may be due to the presence of stronger kin networks (e.g. Sear & Mace 2008), and/or due to vast improvements in medical care, public health and sanitation. It therefore appears that the relationship between experiencing maternal death and infants' and young children's survival is relatively consistent across contexts.

The effect of maternal death on childhood survival also decreased as children aged. In particular, the effect of maternal death on child mortality weakens at around ages 18 to 24 months (Table A.3, which corresponds with the age at which children were likely weaned (Lamur 1987). Alternatives to mother's milk (flour- or corn-based pap) were nutritionally deficient and detrimental to child health. It is not known if women enslaved in Suriname nursed others' children. However, given the energy-demanding work and harsh living conditions on plantations, this seems unlikely. Our findings underscore that mother's milk was crucial for enslaved children's survival chances before their second birthdays.

Even so, we find an adverse effect of maternal death up until age five. During this stage of childhood, a mother's role has fully shifted from the sole source of nutrition to caregiver. The corresponding effect sizes are very similar to those estimated in a study on boys born in freedom in the Netherlands between 1850 and 1922 (Quanjer et al. 2023). A possible explanation for this finding is that extended (kin) networks on plantations may have been able to protect orphaned, weaned children from harm. This perhaps occurred to a similar extent as the Dutch population in the nineteenth and beginning of the twentieth century (Quanjer et al. 2023).

We found additional support for the importance of kin networks based on the results of the mixed-effects survival analyses, with clustering at the district, plantation, and family levels. The variance between maternal families on the same plantations and same districts increased as children got older. This suggests that unobserved kinship effects become more important as children get older, compared to the outside living conditions and the disease environment that dominate in the first year of life.

That said, a shared disease environment was still likely an important factor in the relationship between maternal death and children's survival, particularly in infancy. We found evidence for this with children's death often occurring shortly after their mothers'. First, experiencing maternal death in an earlier period was rarely associated with a higher mortality risk. For instance, the effect of experiencing maternal death before the age of one was not related to children's survival chances between ages one and five. Second, excluding children who died within 30 days after their mother's deaths almost halved the infant mortality hazard ratio (see table A.2). Accordingly, it seems plausible that children often died of the same causes, likely infectious diseases such as flu, dysentery, yellow fever, and smallpox, as their mothers.

We also explored whether varying living standards – as proxied by plantation type – played a role in childhood survival. Earlier research on Suriname and the Caribbean demonstrated that crude death rates were higher on sugar plantations relative to other crops (Engerman and Higman 2003; Van Stipriaan 1993). Likewise, our results show that infant and child mortality risk was higher on sugar plantations than on cotton and timber plantations. However, infant and child mortality on sugar plantations did not differ significantly from coffee plantations, where enslaved people had highest workloads during the wet seasons. During these months, water- and mosquito-borne illnesses were likely more prevalent (Meredith John 1988). Only among children ages five through twelve, mortality risk was higher on sugar than on all other plantations. This might be related to the heavy workload on sugar plantations to which children as young as age five were subjected. It is therefore clear that children's survival chances varied by the living conditions on plantations.

It is less clear if variable living conditions impacted the relationship between maternal death and childhood survival. Did the loss of a mother's care matter more, less, or the same in harsher living conditions? We explored this question in Figure A.2, where we studied the association between maternal death and child survival for different plantation types. The association was stronger on the less deadly cotton and timber plantations, although the differences were not significant. It appears the harmful effect of maternal death was universal rather than limited to specific plantation types. This chimes with our main findings, which show strikingly similar results across studies. This points to the mechanisms linking maternal death and childhood survival being relatively consistent across contexts.

Limitations

Despite this study's strengths, it nonetheless has several limitations that are important to consider. The main limitation of our study is an artefact of the colonial state's registration practices, namely the under-registration of infant deaths in the first months after birth. This is a black box, as we do not know whether under-registration occurred randomly, or whether it was correlated with factors like district, crop, or mother’s survival. For instance, it might be that the registration of a young infant’s death was more likely after a mother died during childbirth, because the mother´s death had to be reported anyway. To avoid these issues, we examined the relationship between maternal death and child mortality from age six months onwards, when under-registration was no longer problematic.

We also were unable to explore the potential buffering effects of other family members’ care on infant and child survival. In particular, we do not know whether or not a child had a father present on the same plantation, which likely impacted their survival chances. As mentioned, there is qualitative evidence that children’s fathers played important roles in child-rearing. However, we are unable to consider the role of children’s fathers, as no information on fathers was recorded in the slave registers.

Our sample is also limited to people who were enslaved between 1830 and emancipation in 1863, with all survivors lost to observation in 1863. Linkages to other sources will help to expand this sample. Future research will benefit from the ongoing efforts to publish data on slave registers in the Dutch Antilles (see Van Galen et al. 2023b for Curacao) and on the Surinamese civil registers (Rosenbaum-Feldbrügge et al. 2023c for the birth certificates of Paramaribo, 1828-1921), which enables long-term and individual-level analysis into the demographic legacies of slavery. This allows us to expand our knowledge on the interplay between context and demographic mechanisms.

Conclusion

Even with these limitations, this study adds significantly to the literature on the demography of enslaved populations. It is the first to use longitudinal microdata to explore demographic outcomes among an enslaved population to this scale. Studying the relationship between maternal death and the hazard of children's death in a population who experienced extremely harsh living standards enables us to explore moments of convergence and divergence with other studies. Our findings align closely with other historical studies set in Europe and North America. Even with differences in living conditions reflected in unfree labour and much higher crude death ratios in Suriname, the effect of maternal care on young children seems to have operated relatively similar compared to other contexts. We also find evidence for the importance of breastfeeding and the broader epidemiological environment in very early life, and for the importance of intra-household factors in later childhood, possibly indicating the importance of kin networks. This study adds to the body of evidence showing that the importance of maternal care on childhood survival, particularly in infancy, persists across time and space.

References

Anderson, F. W. J., Morton, S. U., Naik, S., & Gebrian, B. (2007). Maternal mortality and the consequences on infant and child survival in Rural Haiti. *Maternal and Child Health Journal*, 11(4), 395–401. https://doi.org/10.1007/s10995-006-0173-0

Beekink, E., van Poppel, F., & Liefbroer, A. C. (1999). Surviving the loss of the parent in a Nineteenth-Century Dutch provincial town. *Journal of Social History*, 32(3), 641–669.

Bengtsson, T., & Lindström, M. (2003). Airborne infectious diseases during infancy and mortality in later life in southern Sweden, 1766–1894. *International Journal of Epidemiology*, 32(2), 286–294. https://doi.org/10.1093/ije/dyg061

Björkenstam, E., Dalman, C., Vinnerljung, B., Weitoft, G. R., Walder, D. J., & Burström, B. (2016). Childhood household dysfunction, school performance and psychiatric care utilisation in young adults: A register study of 96 399 individuals in Stockholm County. *Journal of Epidemiology and Community Health*, 70, 473-480. 10.1136/jech-2015-206329

Browne, R. M., & Burnard, T. (2017). Husbands and Fathers: The family experience of enslaved men in Berbice, 1819–1834. *New West Indian Guide/Nieuwe West-Indische Gids*, 91(3-4), 193-222.

Bush-Slimani, B. (1993). Hard labour: Women, childbirth and resistance in British Caribbean slave societies. *History Workshop*, 36, 83-99.

Campbell, G. (2006). Children and slavery in the new world: a review. *Slavery and Abolition*, 27(2), 261-285. https://doi.org/10.1080/01440390600765722

Donrovich, R., Puschmann, P., & Matthijs, K. (2018). Mortality clustering in the family. Fast life history trajectories and the intergenerational transfer of infant death in late 19th-and early 20th-century Antwerp, Belgium. *Historical Life Course Studies, 7*, 47-68. https://doi.org/10.51964/hlcs9285

Engerman, S.L., & Higman, B.W. (2003). The demographic structure of the Caribbean slave societies in the eighteenth and nineteenth Centuries. *In: Knight, F.W. (eds) General History of the Caribbean. Palgrave Macmillan, New York*. https://doi.org/10.1007/978-1-349-73770-3_3

Everaert, H. (2011). Changes in fertility and mortality around the abolition of slavery in Suriname. *The History of the Family*, 16(3), 235-249. https://doi.org/10.1016/j.hisfam.2011.04.004

Feigelman, W., Rosen, Z., Joiner, T., Silva, C., & Mueller, A. S. (2017). Examining longer-term effects of parental death in adolescents and young adults:

Evidence from the National Longitudinal Survey of Adolescent to Adult Health. *Death Studies*, 41, 133-143. 10.1080/07481187.2016.1226990

Follett, R. (2005). 'Lives of living death': The reproductive lives of slave women in the cane world of Louisiana. *Slavery and Abolition*, 26(2), 289-304. https://doi.org/10.1080/01440390500176616

Forster, M. & Smith S.D. (2011). Surviving slavery: mortality at Mesopotamia, a Jamaican sugar estate, 1762–1832*. J. R. Statist. Soc. A*. 174(4), 907-929.

Fox, J., Willführ, K., Gagnon, A., Dillon, L. & Voland, E. (2017). The consequences of sibling formation on survival and reproductive success across different ecological contexts: A comparison of the historical Krummhörn and Quebec populations*. The History of the Family*, 22 (2-3), 364-423.

Garenne, M., Mbaye, K., Bah, M. D., & Correa, P. (1997). Risk factors for maternal mortality: a case-control study in Dakar hospitals (Senegal). *African journal of reproductive health*, 14-24.

Higman, B.W. (1975). The slave family and household in the British West Indies, 1800-1834. *The Journal of Interdisciplinary History*, 6 (2), 261-287.

Higman, B.W. (1977). Methodological problems in the study of the slave family. *Annals of the New York Academy of Sciences*, 292, 1, 161-173.

Higman, B. W. (1995). *Slave populations of the British Caribbean, 1807-1834*. University of the West Indies Press.

Houle, B., Clark, S. J., Kahn, K., Tollman, S., & Yamin, A. (2015). The impacts of maternal mortality and cause of death on children's risk of dying in rural South Africa: Evidence from a population based surveillance study (1992-2013). *Reproductive Health*, 12 Suppl 1(Suppl 1), S7. https://doi.org/10.1186/1742-4755-12-S1-S7

Inniss, T. (2006). From slavery to freedom: Children's health in Barbados, 1823–1838. *Slavery and Abolition*, 27(2) 251-260. https://doi.org/10.1080/01440390600765672

Jaadla, H., & Lust, K. (2021). The effect of parental loss on child survival in nineteenth

century rural Estonia. *History of the Family*, 26, 336–351. https://doi.org/10.1080/1081602X.2021.1905022

Johansen, H. C. (1981). Slave demography of the Danish West Indian islands. *Scandinavian Economic History Review,* 29(1), 1-20.

Kailaheimo-Lönnqvist, S., & Kotimäki, S. (2020). Cause of parental death and child's health and education: The role of parental resources. SSM -

Population Health, 11, 100632. https://doi.org/10.1016/j.ssmph.2020.100632

Kiple, K. F., & Kiple, V. H. (1977). Slave child mortality: some nutritional answers to a perennial puzzle. *Journal of Social History*, 10(3), 284-309.

Klein, H. S., & Engerman, S. L. (1978). Fertility differentials between slaves in the United States and the British West Indies: a note on lactation practices and their possible implications. *The William and Mary Quarterly: A Magazine of Early American History*, 357-374.

Lamur, H.E. (1977). Demography of Surinam plantation slaves in the last decade before emancipation: The case of Catharina Sophia. *Annals of the New York Academy of Sciences*, 292, 1, 591-596.

Lamur, H. E. (1981). Demographic performance of two slave populations of the Dutch speaking Caribbean. *Boletin de estudios latinoamericanos y del Caribe*, (30), 87-102.

Lamur, H.E. (1983). Westafrikaanse invloed op de demografische ontwikkeling van Surinaamse plantageslaven in de 19e eeuw? *OSO. Tijdschrift voor Surinaamse taalkunde, letterkunde en geschiedenis*, 2, 139- 148.

Lamur, H.E. (1987). Fertility differentials on three slave plantations in Suriname. *Slavery & Abolition*, 8(3), 313-335.

Lamur, H. E. (1993). The slave family in colonial 19th-century Suriname. *Journal of Black Studies*, 23(3), 371-381.

Levenshtein, V. I. (1965). Binary codes capable of correcting deletions, insertions, and reversals. *Dokl. Akad. Nauk SSSR*, 163:4, 845–848.

Li, J., Vestergaard, M., Cnattingius, S., Gissler, M., Bech, B. H., Obel, C., & Olsen, J. (2014). Mortality after Parental Death in Childhood: A Nationwide Cohort Study from Three Nordic Countries. *PLOS Medicine*, 11(7), e1001679. https://doi.org/10.1371/journal.pmed.1001679

Lynch, K. A., & Greenhouse, J. B. (1994). Risk factors for infant mortality in nineteenth-century Sweden. *Population Studies*, 48(1), 117-133.

Målqvist, M., Hoa, D. T. P., & Thomsen, S. (2012). Causes and determinants of inequity in maternal and child health in Vietnam. *BMC Public Health*, 12(1), 641. https://doi.org/10.1186/1471-2458-12-641

Marks, N. F., Jun, H., & Song, J. (2007). Death of Parents and Adult Psychological and Physical Well-Being: A Prospective U.S. National Study. *Journal of Family Issues*, 28(12), 1611–1638. https://doi.org/10.1177/0192513X07302728

Meredith John, A. (1988). Plantation slave mortality in Trinidad. *Population studies*, 42(2), 161-182.

Moucheraud, C., Worku, A., Molla, M., Finlay, J.E., Leaning, J., & Ely Yamin, A. (2015). Consequences of maternal mortality on infant and child survival: a 25-year longitudinal analysis in Butajira Ethiopia (1987-2011). *Reproductive Health*, 12, S4.

Mourits, R., & Rosenbaum-Feldbrügge, M. (2022). Property to Person [Linking algorithm]. https://github.com/RJMourits/P2P

Neslo, E (2016). *Een ongekende elite. De opkomst van een gekleurde elite in koloniaal Suriname 1800-1863*, Doctoral dissertation Utrecht University.

Noghanibehambari, H. & Fletcher, J. (2023). The Early Bird Catches the Worm: The Effect of Birth Order on Old-Age Mortality. *Population and Development Review*, 49(3), 531-560.

Pavard, S., Gagnon, A., Desjardins, B., & Heyer, E. (2005). Mother's death and child survival: The case of early Quebec. *Journal of Biosocial Science*, 37(2), 209–227. https://doi.org/10.1017/s0021932004006571

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., Chowdhury, M. E., Dasgupta, S. K., Ahmed, A., & Koblinsky, M. (2010). Effect of parent's death on child survival in rural Bangladesh: a cohort study. *The Lancet, 375*(9730), 2024-2031. https://doi.org/10.1016/S0140-6736(10)60704-0

Rosenbaum-Feldbrügge, M. (2019). The impact of parental death in childhood on sons' and daughters' status attainment in young adulthood in the Netherlands, 1850–1952. *Demography,* 56(5), 1827-1854. https://doi.org/10.1007/s13524-019-00808-z

Rosenbaum-Feldbrügge, M., Mourits, R. J., A.B., M., Janssen, J., Quanjer, B., van Oort, T., Kok, J., & van Galen, C.W. (2023a). *Suriname slave and emancipation registers dataset version 1.1 [Dataset].* Retrieved from https://hdl.handle.net/10622/CSPBHO

https://doi.org/10.4054/DemRes.2019.40.28

Rosenbaum-Feldbrügge, M., van Galen, C.W. & Swaters, D. (2023b). *Suriname plantation dataset version 1.0 [Dataset].* Retrieved from https://hdl.handle.net/10622/VTL43W

Rosenbaum-Feldbrügge, M., Mourits, R. J., van Oort, T., & van Galen, C. W. (2023c). *Suriname burgerlijke stand: Geboorteakten Paramaribo (1828–1921) [Dataset].* Retrieved from https://nationaalarchief.sr/onderzoeken/alle-genealogie/genealogie-burgerlijke-stand/persons

Rostila, M., & Saarela, J. M. (2011). Time does not heal all wounds: Mortality following the death of a parent. *Journal of Marriage and Family*, 73(1), 236–249. https://doi.org/10.1111/j.1741-3737.2010.00801.x

Sear, R., Steele, F., McGregor, I. A., & Mace, R. (2002). The effects of kin on child mortality in rural Gambia. *Demography*, 39(1), 43–63. https://doi.org/10.1353/dem.2002.0010

Sear, R., & Mace, R. (2008). Who keeps children alive? A review of the effects of kin on child survival. *Evolution and Human Behavior*, 29(1), 1–18. https://doi.org/10.1016/j.evolhumbehav.2007.10.001

Smith, K. R., Hanson, H. A., Norton, M. C., Hollingshaus, M. S., & Mineau, G. P. (2014). Survival of offspring who experience early parental death: Early life conditions and later-life mortality. *Social Science & Medicine*, 119, 180–190. https://doi.org/10.1016/j.socscimed.2013.11.054

Steckel, R. H. (1979). Slave mortality: Analysis of evidence from plantation records. *Social Science History*, 3, 86-114.

Steckel, R. H. (1986a). Birth weights and infant mortality among American slaves. *Explorations in Economic History*, 23, 173-198.

Steckel, R. H. (1986b). A dreadful childhood: the excess mortality of American slaves. *Social Science History*, 10(4), 427-465.

Ten Hove, O. (1996). Surinaamse slavernij: De gescheiden verkoop van moeder en kind(eren) [Surinamese slavery: The separate selling of mother and child(ren)]. *OSO. Tijdschrift voor Surinaamse taalkunde, letterkunde en geschiedenis*, 15, 41-54.

Van Galen, C. W., & Hassankhan, M. S. (2018). A research–note on the slave registers of Suriname, 1830–1865. *The History of the Family*, 23(3), 503-520. https://doi.org/10.1080/1081602X.2018.1507917

Van Galen, C.W., A.B., M., Mourits, R.J. & Rosenbaum-Feldbrügge, M. (2019). *Suriname: Slavenregisters Dataset 1830-1863* [Dataset]. National Archives of the Netherlands, The Hague. Retrieved from: https://www.nationaalarchief.nl/onderzoeken/zoekhulpen/suriname-slavenregisters-1816-1863

Van Galen, C. W., Quanjer, B., Rosenbaum-Feldbrügge, M. & Kraijo, M. (2021). Endless digging and endless picking. Sex ratios and gendered labour in Surinamese plantations, 1830-1863. *Historical Life Course Studies*, 10, 46-52. https://doi.org/10.51964/hlcs9566

Van Galen, C. W., Mourits, R.J., Rosenbaum-Feldbrügge, M., A.B., M., Janssen, J., Quanjer, B., Van Oort, T. & Kok, J. (2023a). Slavery in Suriname. A reconstruction of life courses, 1830-1863. *Historical Life Course Studies*, 13, 191-211. https://doi.org/10.51964/hlcs15619

Van Galen, C.W., Quanjer, B., Kraijo, M., Langenfeld, E., Rosenbaum-Feldbrügge, M., Mourits, R., Van Oort, T. & Kok, J. (2023b). *Curacao slave register dataset version 1.0 [Dataset]. Retrieved from:* https://hdl.handle.net/10622/1OV0RM

Van Lier, R. (1977) *Samenleving in een grensgebied, een sociaal historische studie van Suriname.* Emmering Amsterdam.

Van Stipriaan, A. (1993). *Surinaams contrast: roofbouw en overleven in een Caraïbische plantagekolonie, 1750-1863* (p. 494). Brill.

Velková, A., & Tureček, P. (2022). Influence of parental death on child mortality and the phenomenon of the stepfamily in western Bohemia in 1708–1834. *The History of the Family*, 27(3), 434–452. https://doi.org/10.1080/1081602X.2021.1986738

Willführ, K. P., & Gagnon, A. (2013). Are stepparents always evil? Parental death, remarriage, and child survival in demographically saturated Krummhörn (1720-1859) and expanding Québec (1670-1750). *Biodemography and Social Biology*, 59(2), 191–211. https://doi.org/10.1080/19485565.2013.833803

Tables

Table 1: Share of successful mother links by series and type of ownership

	Plantation-owned		**Privately-owned**	
	Children born	Share linked	Children born	Share linked
Series 1 (1830-1838)	552	78.3	1,834	81.1
Series 2 (1838-1848)	3,690	73.8	2,623	89.2
Series 3 (1848-1851)	1,968	89.6	861	84.8
Series 4 (1851-1863)	10,865	90.1	3,033	89.1

Table 2: Sample characteristics (n=18,946)

	Obs.	%/Mean (SE)
Died between the ages of 6 months and 12?		
No	13,508	71.30%
Yes	5,438	28.70%
Mother died between the ages of 0 and 12?		
No	17,488	92.30%
Yes	1,458	7.70%
Sex		
Female	9,586	50.60%
Male	9,360	49.40%
Birth cohort (based on series)		
1830-1838	1,951	10.30%
1839-1848	4,240	22.38%
1849-1851	2,286	12.07%
1852-1863	10,469	55.26%
Birth season		
Minor rainy (December – January)	3,862	20.38%
Minor dry (February – April)	4,332	22.86%
Major rainy (May – August)	6,106	32.23%
Major dry (September – December)	4,646	24.52%
Age of mother at birth		
14-19 years	957	5.05%
20-24 years	2,011	10.61%
25-29 years	1,808	9.54%
30-34 years	1,468	7.75%
≥35 years	1,727	9.12%
Unknown	10,975	57.93%
Birth order		
First	8,313	43.88%
Second	4,780	25.23%
Third	2,825	14.91%
Fourth	1,609	8.49%
Fifth	800	4.22%
Sixth-Tenth	619	3.27%
Plantation product/type		
Sugar	4,406	23.26%
Coffee	3,140	16.57%
Cotton	2,071	10.93%
Timber	1,227	6.48%
Mixed/other	1,106	5.84%
Unknown	1,023	5.40%
Private owner	5,973	31.53%
Plantation district		
District Coronie	843	4.45%

District Nickerie	585	3.09%
Divisie Para	1,329	7.01%
Divisie Saramacca	554	2.92%
Divisie beneden Commewijne	1,135	5.99%
Divisie beneden Cottica	3,851	20.33%
Divisie boven Commewijne	1,090	5.75%
Divisie boven Cottica en Perica	1,964	10.37%
Divisie boven Suriname en Thorarica	1,622	8.56%
Private owner	5,973	31.53%

Table 3. The relationship between experiencing maternal death and the hazard of dying, Cox proportional hazards models

	Full sample (n=18,946; n failures=5,438)			Ages 6 months – 1 year (n=18,946; n failures=976)			Ages 1 – 5 years (n=17,175; n failures=3,785)			Ages 5 – 12 years (n=8,943; n failures=677)		
	Hazard ratio	95% Confidence interval		Hazard ratio	95% Confidence interval		Hazard ratio	95% Confidence interval		Hazard ratio	95% Confidence interval	
Mother died during observation window?												
Yes	1.85	1.59	2.15	6.34	3.39	11.85	1.96	1.57	2.45	1.44	0.98	2.12
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother died between 0 and 6 months?												
Yes	1.35	0.96	1.89	0.61	0.25	1.46						
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.						
Mother died between 0 and 1?												
Yes							1.15	0.80	1.65	1.16	0.45	3.02
No							Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother died between 1 and 5?												
Yes										0.95	0.58	1.56
No										Ref.	Ref.	Ref.
Sex												

Female	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Male	1.07	1.01	1.13	1.09	0.96	1.23	1.05	0.98	1.11	1.18	1.01	1.37
Age of mother at birth												
14-19 years	0.83	0.71	0.96	1.06	0.75	1.49	0.79	0.66	0.94	0.74	0.48	1.16
20-24 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
25-29 years	0.88	0.78	1.00	1.27	0.97	1.67	0.83	0.72	0.96	0.66	0.45	0.95
30-34 years	0.91	0.80	1.03	1.02	0.76	1.38	0.91	0.79	1.06	0.71	0.49	1.04
≥35 years	0.91	0.81	1.03	1.03	0.77	1.37	0.85	0.73	0.98	1.09	0.80	1.51
Unknown	0.94	0.85	1.04	1.01	0.79	1.28	0.94	0.83	1.05	0.87	0.65	1.15
Birth order												
First	1.04	0.95	1.13	0.98	0.80	1.19	1.05	0.95	1.16	1.00	0.78	1.29
Second	1.07	0.98	1.17	1.10	0.89	1.34	1.06	0.95	1.17	1.08	0.83	1.41
Third	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Fourth	1.03	0.91	1.16	1.06	0.82	1.38	1.05	0.91	1.21	0.80	0.53	1.22
Fifth	1.07	0.92	1.25	1.08	0.77	1.52	1.08	0.90	1.30	1.01	0.60	1.69
Sixth-Tenth	1.06	0.89	1.27	1.12	0.77	1.64	1.08	0.87	1.34	0.766	0.38	1.54
Plantation product/type												
Sugar	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Coffee	1.08	1.00	1.17	1.01	0.83	1.23	1.16	1.06	1.28	0.699	0.54	0.90
Cotton	0.72	0.65	0.79	0.97	0.76	1.22	0.66	0.58	0.75	0.712	0.54	0.94
Timber	0.49	0.42	0.56	0.66	0.48	0.91	0.42	0.35	0.51	0.642	0.46	0.91
Mixed/other	1.06	0.950	1.19	1.38	1.07	1.79	0.99	0.86	1.14	1.049	0.76	1.45
Unknown	0.83	0.73	0.95	1.07	0.80	1.44	0.78	0.67	0.91	0.795	0.55	1.15
Private owner	0.90	0.83	0.97	1.03	0.86	1.23	0.83	0.76	0.910	1.124	0.91	1.39
Birth cohort (based on series)												
1830-1838	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1839-1848	1.18	1.06	1.31	1.43	1.09	1.88	1.24	1.09	1.41	0.771	0.59	1.01
1849-1851	1.05	0.92	1.19	1.08	0.78	1.49	1.01	0.86	1.17	1.158	0.86	1.56

1852-1863	1.27	1.13	1.42	1.46	1.10	1.94	1.26	1.10	1.45	1.169	0.87	1.57
Birth season												
Minor rainy (December – January)	0.95	0.87	1.03	1.24	1.03	1.49	0.87	0.79	0.95	1.056	0.84	1.33
Minor dry (February – April)	0.94	0.87	1.01	1.08	0.89	1.30	0.88	0.80	0.97	1.082	0.86	1.36
Major rainy (May – August)	1.04	0.97	1.12	1.06	0.89	1.27	1.01	0.93	1.10	1.213	0.99	1.49
Major dry (September – December)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Likelihood-ratio chi^2	332.32			82.91			322.87			75.84		

Figures

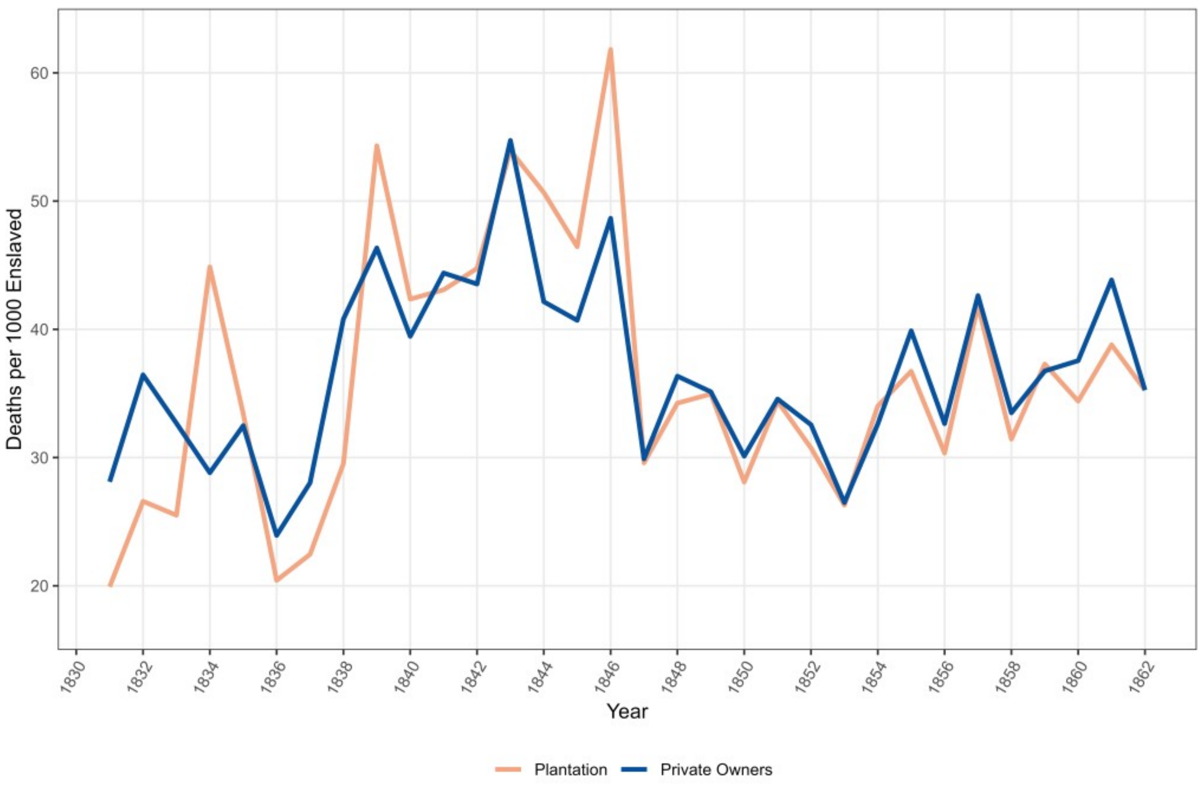


Figure 1: Crude death rates among plantation-owned and privately-owned enslaved, Suriname 1830-1863. Source: Rosenbaum-Feldbrügge et al. (2023a).

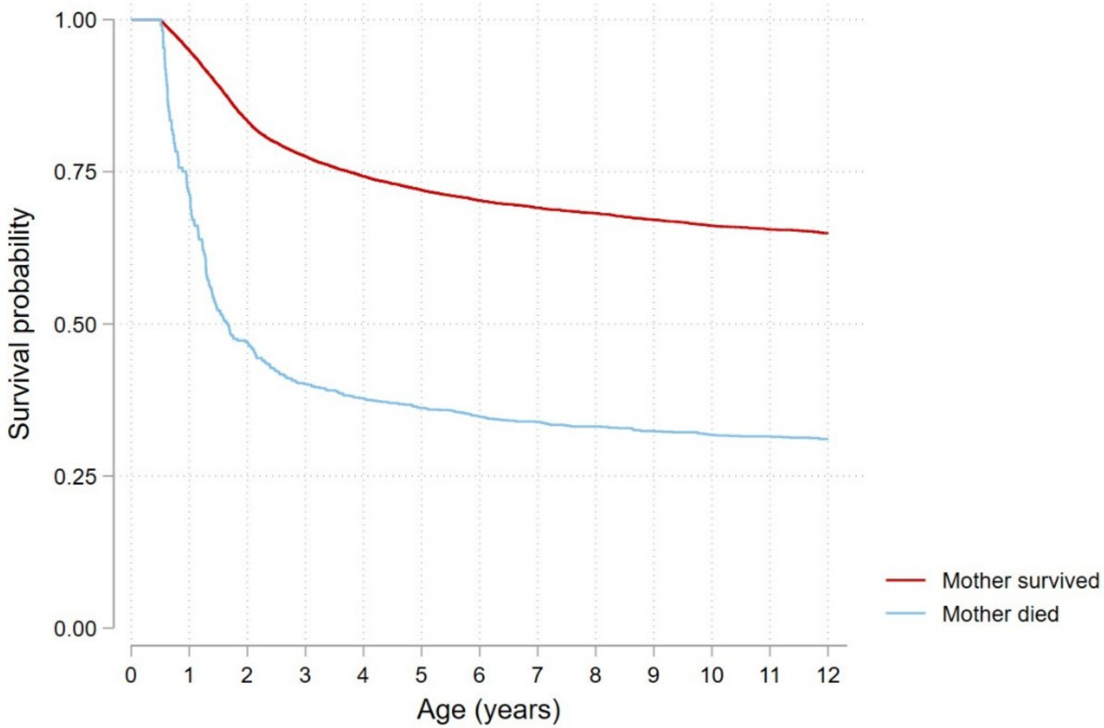


Figure 2. Kaplan-Meier curve (ages 6 months to 12 years), stratified by maternal survival outcomes.

Appendix

Table A.1. The relationship between experiencing maternal death and the hazard of dying, mixed effects survival models, clustered at sibling, plantation and district levels

	Full sample (n=18,946; n failures = 5,438)			Ages 6 months – 1 year (n=18,946; n failures = 976)			Ages 1 – 5 years (n= 17,175; n failures = 3,785)			Ages 5 -12 years (n = 8,943; n failures = 677)		
	Hazard ratio	95% Confidence interval		Hazard ratio	95% Confidence interval		Hazard ratio	95% Confidence interval		Hazard ratio	95% Confidence interval	
Mother died during observation window?												
Yes	1.26	1.04	1.52	6.12	2.50	14.95	1.74	1.33	2.27	1.68	1.06	2.65
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother died between 0 and 6 months?												
Yes	3.35	2.29	4.90	1.20	0.44	3.24						
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.						
Mother died between 0 and 1?												

Yes							1.63	1.05	2.52	1.18	0.39	3.61
No							Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother died between 1 and 5?												
Yes										0.89	0.48	1.63
No										Ref.	Ref.	Ref.
Sex												
Female	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Male	1.06	0.99	1.13	1.60	1.00	1.35	1.03	0.95	1.11	1.14	0.95	1.38
Age of mother at birth												
14-19 years	0.78	0.66	0.92	0.99	0.637	1.45	0.78	0.64	0.95	0.59	0.35	1.00
20-24 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
25-29 years	0.83	0.73	0.96	1.18	0.873	1.60	0.79	0.67	0.93	0.71	0.47	1.08
30-34 years	0.85	0.74	0.99	1.00	0.720	1.40	0.87	0.74	1.04	0.58	0.37	0.91
≥35 years	0.85	0.74	0.98	1.04	0.755	1.42	0.79	0.67	0.93	0.99	0.69	1.42
Unknown	0.87	0.76	1.00	1.08	0.819	1.43	0.84	0.72	0.99	0.79	0.56	1.11
Birth order												
First	0.99	0.89	1.10	1.05	0.82	1.33	1.02	0.91	1.16	0.89	0.6	1.22

					5						5	
Second	1.01	0.91	1.12	1.13	0.893	1.44	1.00	0.88	1.13	1.04	0.75	1.43
Third	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Fourth	1.10	0.96	1.26	1.00	0.729	1.37	1.14	0.97	1.34	0.81	0.49	1.35
Fifth	1.12	0.94	1.35	1.02	0.680	1.53	1.15	0.93	1.42	1.14	0.62	2.09
Sixth-Tenth	1.19	0.96	1.47	0.98	0.621	1.55	1.26	0.99	1.61	1.02	0.49	2.13
Birth cohort (based on series)												
1830-1838	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1839-1848	1.13	0.93	1.377	1.30	0.819	2.07	1.23	0.99	1.55	0.83	0.52	1.32
1849-1851	0.99	0.81	1.22	1.03	0.625	1.70	0.93	0.73	1.20	1.35	0.83	2.17
1852-1863	1.41	1.15	1.72	1.48	0.934	2.35	1.25	0.99	1.58	1.21	0.74	1.95
Birth season												
Minor rainy (December – January)	0.94	0.85	1.04	1.21	0.965	1.51	0.87	0.77	0.98	1.05	0.79	1.39
Minor dry (February – April)	0.92	0.84	1.02	1.02	0.813	1.28	0.88	0.78	0.99	1.02	0.77	1.35
Major rainy (May	1.04	0.95	1.13	1.04	0.850	1.28	1.00	0.91	1.11	1.14	0.89	1.47

– August)												
Major dry (September – December)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Constant	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Between-district variance	0.03	0.01	0.12	0.01	0.00	0.21	0.06	0.02	0.21	0.00	0.00	0.00
Between-plantation variance (within the same district)	0.15	0.11	0.21	0.10	0.04	0.22	0.20	0.15	0.28	0.07	0.02	0.31
Between-mother variance (within the same plantation)	0.24	0.17	0.33	0.06	0.00	11.08	0.22	0.14	0.34	0.46	0.16	1.28
Individual variance	3.80			1.69			3.03			2.52		
Likelihood ratio test vs Weibull model	410.80			16.10			363.82			7.22		

Table A.2. The relationship between experiencing maternal death and the hazard of dying, excluding children who died within 30 days of their mothers, Cox proportional hazards models

	Full sample (n=18,925; n failures = 5,417)				Ages 6 months – 1 year (n=18,925; n failures = 971)				Ages 1 – 5 years (n= 17,159; n failures = 3,771)				Ages 5 -12 years (n = 8,941; n failures = 675)			
	Hazard ratio	p-value	95% Confidence interval		Hazard ratio	p-value	95% Confidence interval		Hazard ratio	p-value	95% Confidence interval		Hazard ratio	p-value	95% Confidence interval	
Mother died during observation window?																
Yes	1.62	0.00	1.38	1.90	3.17	0.01	1.31	7.65	1.61	0.00	1.26	2.06	1.34	0.15	0.90	1.99
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother died between 0 and 6 months?																
Yes	1.54	0.01	1.09	2.16	1.21	0.73	0.41	3.56								
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.								
Mother died between 0 and 1?																
Yes									1.40	0.08	0.96	2.03	1.25	0.65	0.48	3.27

No									Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother died between 1 and 5?																
Yes													1.03	0.92	0.62	1.70
No													Ref.	Ref.	Ref.	Ref.
Sex																
Female	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Male	1.07	0.02	1.01	1.13	1.09	0.19	0.96	1.23	1.05	0.18	0.98	1.11	1.18	0.03	1.02	1.38
Age of mother at birth																
14-19 years	0.83	0.01	0.71	0.96	1.06	0.76	0.75	1.49	0.79	0.01	0.66	0.94	0.74	0.19	0.48	1.16
20-24 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
25-29 years	0.88	0.04	0.78	0.99	1.26	0.010	0.96	1.65	0.83	0.01	0.72	0.96	0.64	0.02	0.44	0.93
30-34 years	0.91	0.12	0.80	1.03	1.01	0.96	0.74	1.36	0.91	0.22	0.79	1.06	0.71	0.08	0.49	1.04
≥35 years	0.91	0.14	0.81	1.03	1.03	0.85	0.77	1.37	0.85	0.03	0.74	0.98	1.08	0.63	0.79	1.49
Unknown	0.94	0.20	0.85	1.03	1.01	0.92	0.80	1.28	0.93	0.23	0.83	1.05	0.87	0.32	0.65	1.15
Birth order																
First	1.04	0.39	0.95	1.13	0.97	0.80	0.80	1.19	1.05	0.31	0.95	1.17	1.01	0.92	0.79	1.31
Second	1.07	0.13	0.98	1.17	1.08	0.44	0.88	1.33	1.06	0.27	0.96	1.18	1.09	0.52	0.84	1.4

																2
Third	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Fourth	1.03	0.62	0.92	1.16	1.05	0.75	0.80	1.36	1.06	0.46	0.92	1.21	0.81	0.33	0.53	1.24
Fifth	1.08	0.32	0.93	1.26	1.07	0.68	0.76	1.51	1.09	0.35	0.90	1.31	1.02	0.95	0.61	1.70
Sixth-Tenth	1.07	0.48	0.89	1.28	1.11	0.58	0.76	1.63	1.09	0.43	0.88	1.35	0.77	0.47	0.39	1.55
Plantation product/ type																
Sugar	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Coffee	1.08	0.07	1.00	1.17	1.01	0.96	0.82	1.23	1.16	0.00	1.06	1.28	0.70	0.01	0.54	0.91
Cotton	0.71	0.00	0.65	0.79	0.96	0.70	0.76	1.21	0.66	0.00	0.58	0.75	0.71	0.01	0.53	0.93
Timber	0.49	0.00	0.42	0.56	0.66	0.01	0.48	0.91	0.42	0.00	0.35	0.50	0.65	0.01	0.46	0.91
Mixed/ other	1.07	0.28	0.95	1.19	1.38	0.01	1.07	1.79	0.99	0.94	0.87	1.14	1.05	0.75	0.76	1.46
Unknown	0.84	0.01	0.74	0.95	1.07	0.63	0.80	1.44	0.78	0.00	0.70	0.92	0.80	0.23	0.55	1.16
Private owner	0.90	0.01	0.83	0.97	1.02	0.81	0.85	1.23	0.83	0.00	0.76	0.91	1.13	0.26	0.91	1.39
Birth cohort (based on series)																
1830-1838	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.

1839-1848	1.18	0.00	1.06	1.32	1.44	0.01	1.09	1.89	1.25	0.00	1.10	1.42	0.77	0.06	0.59	1.01
1849-1851	1.05	0.43	0.93	1.20	1.08	0.64	0.78	1.50	1.01	0.86	0.87	1.18	1.16	0.34	0.86	1.57
1852-1863	1.28	0.00	1.14	1.43	1.49	0.01	1.12	1.98	1.27	0.00	1.10	1.45	1.17	0.29	0.87	1.58
Birth season																
Minor rainy (December – January)	0.95	0.21	0.88	1.03	1.24	0.03	1.03	1.49	0.87	0.00	0.79	0.96	1.06	0.61	0.84	1.34
Minor dry (February – April)	0.94	0.12	0.87	1.02	1.07	0.49	0.89	1.29	0.89	0.01	0.81	0.97	1.09	0.46	0.87	1.36
Major rainy (May – August)	1.04	0.27	0.97	1.12	1.06	0.55	0.89	1.26	1.01	0.81	0.93	1.10	1.22	0.07	0.99	1.50
Major dry (September – December)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Likelihood-ratio chi^2	310.30	0.00			68.31	0.00			305.71	0.00			74.79	0.00		

Table A.3. The relationship between experiencing maternal death and the hazard of dying, using different age characterizations, Cox proportional hazards models

	Ages 6 months – 18 months (n=18,946; n failures = 2,064)				Ages 18 months– 5 years (n= 15,509; n failures = 2,790)			
	Hazard ratio	p-value	95% Confidence interval		Hazard ratio	p-value	95% Confidence interval	
Mother died during observation window?								
Yes	6.31	0.00	4.63	8.62	1.59	0.00	1.21	2.10
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Mother died between 0 and 6 months?								
Yes	0.58	0.04	0.35	0.96				
No	Ref.	Ref.	Ref.	Ref.				
Mother died between 0 and 18 months?								
Yes					0.97	0.88	0.63	1.49
No					Ref.	Ref.	Ref.	Ref.
Sex								
Female	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Male	1.06	0.17	0.98	1.16	1.04	0.35	0.96	1.12
Age of mother at birth								
14-19 years	0.84	0.16	0.66	1.07	0.82	0.05	0.67	1.00
20-24 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
25-29 years	0.97	0.73	0.80	1.17	0.88	0.12	0.74	1.040
30-34 years	0.95	0.62	0.78	1.16	0.93	0.40	0.78	1.10

≥35 years	0.88	0.21	0.73	1.07	0.86	0.08	0.73	1.02
Unknown	0.95	0.55	0.81	1.12	0.95	0.46	0.83	1.090
Birth order								
First	0.99	0.83	0.86	1.13	1.09	0.17	0.97	1.22
Second	1.09	0.24	0.95	1.25	1.04	0.56	0.92	1.17
Third	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Fourth	0.98	0.84	0.81	1.18	1.09	0.31	0.92	1.28
Fifth	1.16	0.20	0.92	1.46	1.00	0.98	0.80	1.26
Sixth-Tenth	1.06	0.69	0.81	1.38	1.11	0.41	0.86	1.44
Plantation product/type								
Sugar	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Coffee	1.19	0.01	1.05	1.36	1.07	0.20	0.96	1.19
Cotton	0.91	0.27	0.78	1.07	0.60	0.00	0.52	0.70
Timber	0.60	0.00	0.47	0.75	0.38	0.00	0.31	0.47
Mixed/other	1.25	0.02	1.04	1.50	0.92	0.33	0.79	1.08
Unknown	0.96	0.72	0.78	1.19	0.76	0.00	0.63	0.90
Private owner	1.01	0.86	0.89	1.15	0.76	0.00	0.68	0.84
Birth cohort (based on series)								
1830-1838	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1839-1848	1.25	0.02	1.04	1.49	1.29	0.00	1.11	1.50
1849-1851	0.94	0.58	0.76	1.17	1.05	0.62	0.88	1.25
1852-1863	1.35	0.00	1.12	1.63	1.25	0.01	1.07	1.47
Birth season								
Minor rainy (December – January)	1.07	0.29	0.94	1.22	0.84	0.00	0.75	0.95
Minor dry (February – April)	1.00	0.97	0.88	1.13	0.86	0.001	0.78	0.96
Major rainy (May – August)	1.07	0.28	0.95	1.20	1.00	0.95	0.91	1.11

Major dry (September – December)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Likelihood-ratio chi2	201.58	0.00			236.74	0.00		

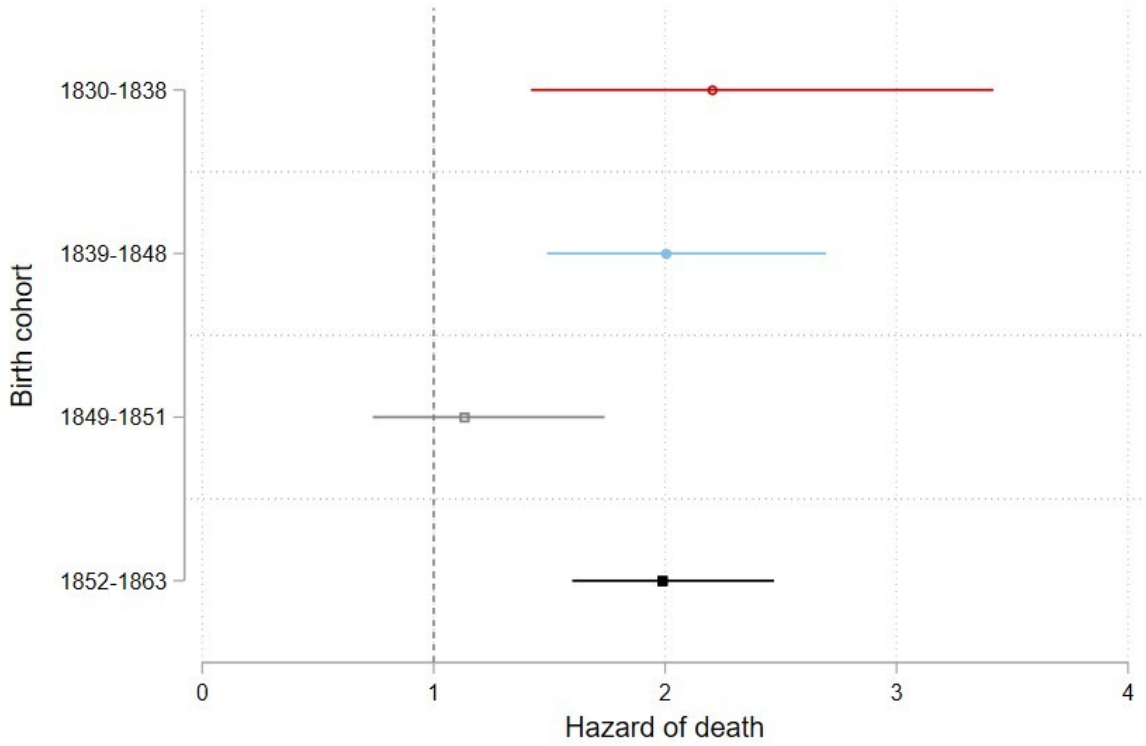
Table A.4. The relationship between experiencing maternal death and the hazard of dying, using all children from birth, Cox proportional hazards models

	Birth –12 years (n=21,120; n failures = 6,932)			Birth– 1 year (n= 21,120; n failures = 2,470)		
	Hazard ratio	95% Confidence interval		Hazard ratio	95% Confidence interval	
Mother died after child's birth?						
Yes	2.41	2.13	2.72	7.31	5.88	9.08
No	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Sex						
Female	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Male	1.08	1.03	1.13	1.12	1.04	1.22
Age of mother at birth						
14-19 years	0.90	0.79	1.03	1.13	0.92	1.40
20-24 years	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
25-29 years	0.87	0.78	0.97	0.99	0.83	1.19
30-34 years	0.88	0.79	0.99	0.87	0.72	1.06
≥35 years	0.92	0.83	1.03	1.00	0.83	1.20
Unknown	0.94	0.86	1.03	1.00	0.86	1.16
Birth order						
First	0.98	0.91	1.06	0.87	0.77	0.99
Second	1.01	0.94	1.09	0.92	0.81	1.05
Third	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Fourth	1.02	0.92	1.13	0.99	0.84	1.17

Fifth	1.11	0.97	1.26	1.14	0.93	1.39
Sixth-Tenth	1.04	0.89	1.21	1.02	0.81	1.29
Plantation product/type						
Sugar	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Coffee	1.06	0.99	1.14	0.99	0.87	1.12
Cotton	0.76	0.70	0.84	0.96	0.82	1.11
Timber	0.56	0.49	0.63	0.77	0.64	0.94
Mixed/other	1.03	0.93	1.14	1.08	0.90	1.30
Unknown	0.92	0.81	1.05	1.17	0.94	1.44
Private owner	0.97	0.91	1.04	1.17	1.05	1.31
Birth cohort (based on series)						
1830-1838	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
1839-1848	1.23	1.11	1.35	1.48	1.24	1.75
1849-1851	1.05	0.94	1.18	1.04	0.84	1.28
1852-1863	1.32	1.20	1.47	1.56	1.31	1.87
Birth season						
Minor rainy (December – January)	0.92	0.86	0.99	0.98	0.87	1.11
Minor dry (February – April)	0.93	0.86	0.99	0.98	0.87	1.10
Major rainy (May – August)	1.04	0.97	1.10	1.04	0.93	1.16
Major dry (September – December)	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Likelihood-ratio chi^2 (p-value)	424.74	0.000		277.86	0.000	

Graphs for appendices

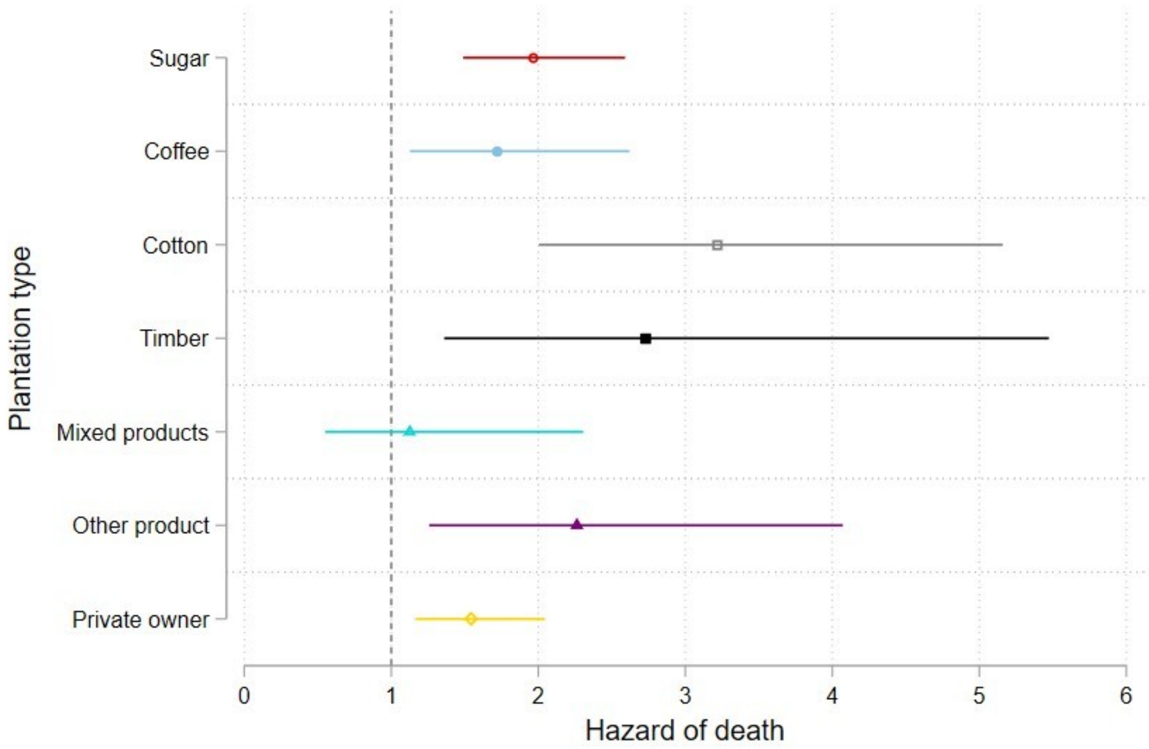
Figure A.1. The relationship between experiencing maternal death and the hazard of dying between 6 months and 12 years, Cox proportional hazards models, stratified by birth cohort *



*Reference category: Not experiencing maternal death

**Adjusted for experiencing maternal death before the age of 6 months , sex, age of mother at birth, birth order, plantation type, season of birth

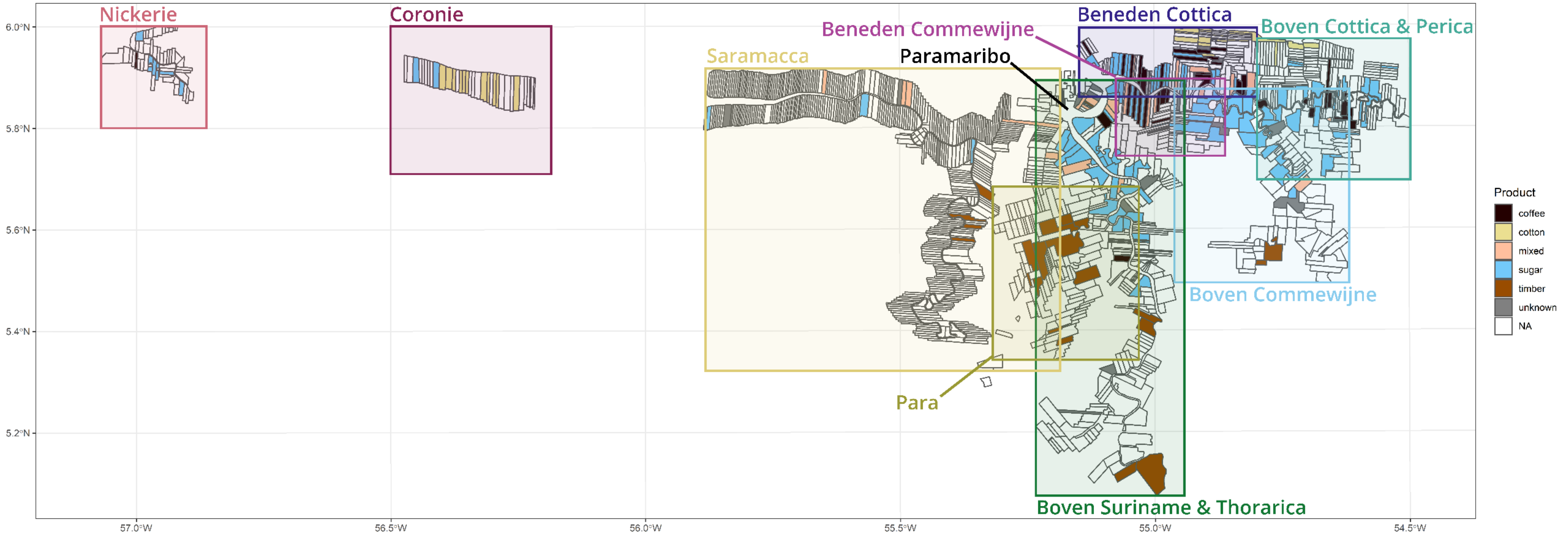
Figure A.2. The relationship between experiencing maternal death and the hazard of dying between 6 months and 12 years, Cox proportional hazards models, stratified by plantation product type



*Reference category: Not experiencing maternal death

**Adjusted for experiencing maternal death before the age of 6 months, sex, age of mother at birth, birth order, birth cohort, season of birth

Figure A.3. Map of the products produced on the plantations* in Suriname 1855 per district



*Note: *the plantations in white are abandoned or were planned and never used.*