Does the Healthy Migrant Effect Extend to the Next Generation? Infant Mortality and Parental Migration Status in the Antwerp District, 1846–1906 Cohorts

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Does the Healthy Migrant Effect Extend to the Next Generation?

Infant Mortality and Parental Migration Status in the Antwerp District, 1846–1906 cohorts

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ABSTRACT

This study examines whether the healthy migrant effect extends to the next generation by analyzing infant mortality by parental migration status in the Antwerp district for cohorts born between1846–1906. During this period, the region experienced large-scale migration from within Belgium and neighboring countries. Using longitudinal data from the Antwerp COR*-database, I conduct survival analysis to examine whether and how parental migration status impacted infant mortality. Cox proportional hazard models reveal that infants born to domestic migrant mothers had significantly lower mortality risks compared to those of native mothers — a 17 to 19% lower risk of dying. This effect remained robust after adjusting for the infant's sex, birth year, legitimacy status, maternal age at birth, and paternal socioeconomic status. No such advantage was observed for infants of international migrant mothers, likely due to their mothers' lower social integration. While infants of both domestic and international migrant fathers also exhibited lower mortality risks than those of native-born fathers, these effects were considerably smaller than those of domestic migrant mothers and not statistically significant.

Keywords: Healthy migrant effect, Infant mortality, Antwerp COR*-database, Antwerp, Survival analysis

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1 INTRODUCTION

The healthy migrant effect has been observed in various historical and contemporary contexts. Migrants are, on average, healthier and outlive natives, even if they originate from areas with higher mortality and have lower education and socio-economic status than non-migrants (Markides & Rote, 2019; Vang et al., 2016). Although the healthy migrant effect is not universal — occasionally, excess mortality among migrants has also been observed (Bakhtiari, 2018; Potarca & Bernardi, 2018) — it has been documented across a multitude of migrant groups in various societies and time periods (Alter & Oris, 2005; Lu & Qin, 2014; Puschmann et al., 2016a). Several explanations have been proposed — including selective return migration, differences in early life conditions, and variations in lifestyle — but most scholars attribute the phenomenon to positive selection in the area of origin: only the healthiest individuals move away from the communities in which they grew up, and the healthier they are, the more likely they are to migrate (multiple times) and to move further. Consequently, migrants form a selective group of particularly healthy and robust individuals (Lu, 2008; Puschmann et al., 2017).

While non-migrating siblings do not seem to have a health advantage — suggesting that the healthy migrant effect results from individual rather than family selection — it remains unclear whether the children of migrants benefit from their parents' health advantage (Mourits & Puschmann, 2023). The key question is whether migrants pass the healthy migrant effect on to their offspring — under the idea that healthy parents produce healthy children — or whether the advantage diminishes over time, disappears in the next generation, or even turns into a disadvantage, potentially because of adverse circumstances, such as discrimination and social exclusion. For the first generation, it has been observed — both in historical and contemporary contexts — that the healthy migrant effect diminishes or completely disappears over time, the longer migrants reside in their new destination. This pattern suggests a convergence in health between migrants and non-migrants over the life course (Bakhtiari, 2018; Kesztenbaum & Rosenthal, 2011; Loi & Hale, 2019). Thus, the question remains: do the offspring of migrants benefit from their parents' health advantage?

Existing studies on this issue show mixed results. I will first discuss findings from studies on contemporary societies, followed by a discussion of historical studies on the topic. Hummer et al. (2007) found that infants born to Mexican immigrants in the United States between 1995 and 2000 had about a 10% lower mortality risk during the first hour, first day, and first week of life compared to infants born to American-born women. DeCamp et al. (2015) confirmed that infants of Mexican-born women in Los Angeles County had lower mortality risks than those of U.S.-born women. Vidiella-Martin & Been (2023) documented lower mortality risks among infants of immigrant mothers in the Netherlands who were born extremely preterm, compared to equally early born infants of native-born mothers. Tang et al. (2019) found that domestic migrant mothers in contemporary Shanghai had a lower likelihood of pregnancy complications and gestational diabetes but that their infants faced increased health risks compared to those of native-born Shanghai women. Choi et al. (2019) observed that, in Australia, infants of mothers born in Africa and various Asian and Middle Eastern countries had elevated risks of stillbirth and preterm delivery and were more often in need of immediate care after birth compared to infants of Australian-born mothers. Finally, Wallace et al. (2023) detected that children of immigrants in various European countries today face increased risks of stillbirth as well as heightened perinatal, neonatal, and infant mortality risks. The authors point out, among other things, the importance of addressing racism, xenophobia, and discrimination in the healthcare system as well as in broader society. They recommend reevaluating integration policies, promoting full participation, and combating inequalities in education, income, social protection, and other areas.

Several historical studies have also investigated the health of the infants and children of migrants (Bakhtiari, 2018; Dribe et al., 2020; Eriksson & Niemesh, 2016; Oris et al., 2023; Olson & Thornton, 2011; Preston et al., 1994). Eriksson and Niemesh (2016) examined infant mortality among African Americans who migrated from the rural South to the urban North of the United States during the first half of the 20th century. They found that infants born in the North to parents originating from the South faced a higher mortality risk compared to those born in the South. This was largely attributed to the generally higher infant mortality rates in urban areas and the tendency of migrants to settle in unhealthy neighborhoods. Bakhtiari (2018) analyzed childhood mortality in the U.S. in 1910 by migration status and found that children of European immigrants faced higher mortality risks compared to children born to white, U.S.-born parents. However, their mortality risks remained lower than those of African American children. Dribe et al. (2020) reported similar findings for migrants in general. However, by disaggregating the data by nationality, they observed significant differences.

While children of Mexican, Canadian, Irish, and Hungarian parents had higher mortality risks, those of Russian, Scandinavian, German, and Dutch parents actually experienced lower mortality risks than children of native-born white American parents. The authors attributed these differences to varying levels of societal integration — a view supported by their finding that children of immigrant parents who had married native-born white Americans enjoyed a mortality advantage.

The study most similar to mine was conducted by Oris et al. (2023). They examined the survival chances of infants and children born to native and domestic migrant mothers in Madrid between 1916 and 1926. Their findings showed that children of mothers from Castilla-La Mancha had slightly better survival chances than those of Madrid-born mothers, while those from Castilla y León fared slightly worse. Overall, they concluded that maternal migration status had a limited effect. However, children born to mothers originating from more distant regions of Spain enjoyed significantly better survival chances after the first three months of life. The authors explained this by their higher socio-economic status, which enabled them to avoid the poor and unhygienic neighborhoods that contributed to high infant and child mortality at the time.

This study examines the survival chances of infants by parental migration status in the Antwerp district for cohorts born between 1846 and 1906. Previous research on the city of Antwerp identified a healthy migrant effect among both domestic and international migrants aged 30 and over during the period 1850–1930 (Puschmann et al., 2016a). Building on this, the current study explores whether this effect extended to the next generation by assessing the mortality risks of infants born to migrant mothers and fathers, and whether these infants experienced a survival advantage compared to those of native-born parents. To do this, I use life course data from vital registration records and population registers, retrieved from the Antwerp COR*-database (Matthijs & Moreels, 2010; Puschmann et al., 2022). I generate Kaplan-Meier survival curves and fit survival models — i.e., Cox proportional hazard models — initially including only the variables of interest, i.e., the mother's and father's migration status. In subsequent models, I add controls for the newborn's sex, birth year, and whether the child was legitimate or illegitimate, the mother's age at birth and the father's socio-economic status.

2 DATA AND METHODS

The data for this study were retrieved from the 2010 release of the Antwerp COR*-database (Matthijs & Moreels, 2010). The database consists of a letter sample, including all individuals whose last name started with "COR", as well as their spouses and other household members, from the population of the Antwerp district in the 19th and early 20th centuries. It is based on data from population registers and vital registration records of births, marriages, and deaths. The sample is representative of the larger population in terms of several key characteristics, including socio-economic status and migration status. The database enables life course reconstructions and family reconstitution and has been used for longitudinal studies on topics such as mortality, partner choice, marriage, fertility, migration, and social inclusion (Puschmann et al., 2022).

For the present study, all live births in the larger Antwerp district were selected from the birth certificates for the period 1846–1906. This period represents the part of the database that fully covers birth and death certificates, as well as the population register, ensuring that all infant births and deaths in the study are comprehensively documented. The study population consists of a total of 5,622 live births, of which 926 (16.5%) died within the first year of life in the study area. After selecting the live births from the database, I computed the variables for the survival analysis: survival time in days and failure status, i.e., whether the infant died within the first year of life (n failures = 926). Additionally, 24 infants were right-censored due to leaving the study area before their first birthday, and their survival time was adjusted accordingly.

Next, the main variables of interest were constructed: 1) migration status of the mother and 2) migration status of the father, based on their birthplace information. Parents born in the Antwerp district are considered natives (coded as 0); parents born elsewhere in Belgium are treated as domestic migrants (coded as 1); and parents born abroad are treated as international migrants (coded as 2). Parents whose birthplace was unknown were placed in a separate category (coded as 3).

Subsequently, I created the control variables: sex (0 = female; 1 = male), birth year (continuous), (il)legitimacy (0 = legitimate; 1 = illegitimate), age of the mother at birth (0 = < 20; 1 = 20–29; 2 = 30–39; 3 = 40+), and SES of the father. The latter is based on the father's occupational title at birth, which is coded in the database using the Historical International Standard Classification of Occupations (HISCO) (van Leeuwen et al., 2002). The HISCO code for each occupation in the database was recoded into HISCAM, a continuous occupational stratification scale ranging from 0 (very low SES) to 100 (very high SES) (Lambert et al., 2013). The variable was then recoded into a categorical variable consisting of: 1) high class (HISCAM ≥ 90), 2) middle class (HISCAM ≥ 50 and < 90), 3) working class (HISCAM < 50), and 4) unknown (no occupation present). Among the high class, we find occupations such as professor, doctor, lawyer, and high-ranking officers in the army, such as lieutenants and captains. The middle class consists mostly of clerks and craftsmen, ranging from bakers, tailors, and shoemakers to diamond workers, as well as farmers. The lower classes consist of various groups of unskilled and lower-skilled laborers and farm workers. Summary statistics for all variables are provided in Appendix 1. What stands out from these, is the relatively high share of mothers (15,8%) and especially fathers (19,53) with an unknown migration status, which is a weakness of the data that might potentially bias some of the results in the analysis.

When the dataset was ready, I conducted survival analysis using Stata 11.1. I produced Kaplan-Meier survival estimates by the migration status of the mother (Graph 1) and separately for the father (Graph 2). Subsequently, I fitted Cox (1972) proportional hazard models, with all-cause mortality (ages 0–1) as the failure event. All individuals were censored either after death or after leaving the study area. For those who did not die or leave the study area before their first birthday, they were censored after 365 days. In the first models, I included only the variables of interest, i.e., migration status of the mother and migration status of the father, separately. The results are displayed in the form of forest plots (Graph 3). Then I combined migration status of the father and the mother in one model and stepwise added control variables on the child and the parents in the next models (Table 1): sex of the infant, (il)legitimacy and birth year, age of the mother, and subsequently also socio-economic status of the mother. To check whether the proportionality assumption was violated, I examined the Schoenfeld residuals. No evidence of a violation of the assumption was found, as p-values for all variables were larger than 0.05, suggesting that the variables were not correlated with time.

3 HISTORICAL CONTEXT

During the 19th century, Antwerp grew into the largest city in Belgium, attracting large numbers of urban in-migrants, mainly from the Flemish countryside (especially from the larger Antwerp province) and to a lesser extent from French-speaking Wallonia and the neighboring countries: Germany, the Netherlands, France and England. Demographic pressure, agricultural crises, and innovations and scaling up in farming pushed migrants toward Antwerp city. The city's evolving port, handling an ever-growing volume of passengers and goods, acted as a major pull factor. Initially, Antwerp attracted mainly male migrants, as the port offered jobs primarily suited to men. However, in the last decades of the 19th century, the number of female migrants — some accompanying their families, others arriving as singles — began to rise as well, including those who migrated from greater distances (Greefs & Winter, 2016; Winter, 2009).

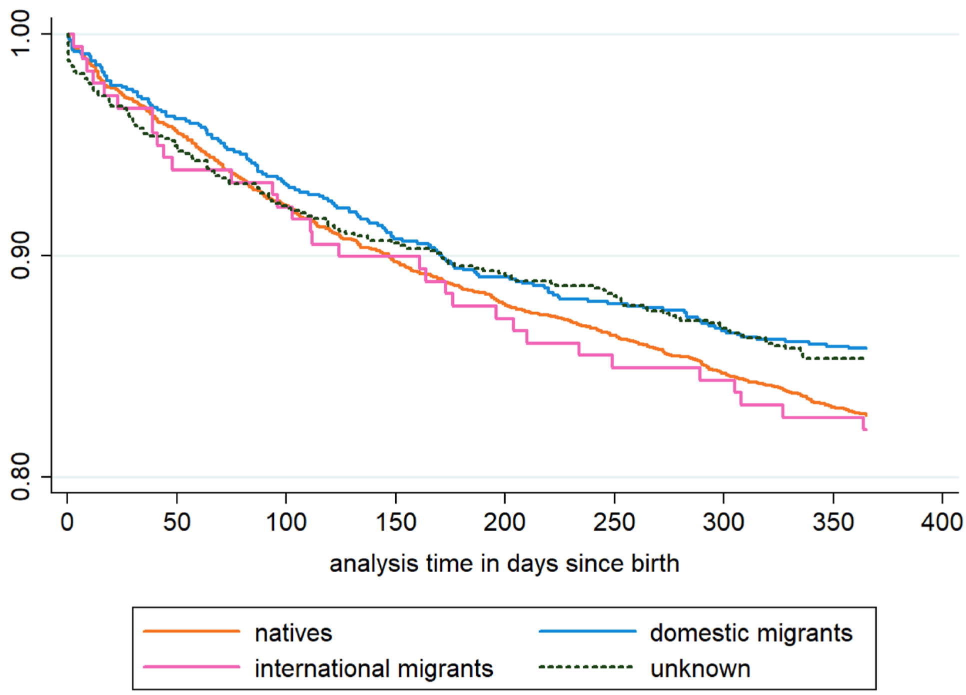
The rise of the port went hand in hand with the decline of Antwerp's textile industry, which could no longer compete with cheap linen from England. The transition from an industrial to a port city negatively affected the working and living conditions of the working class. It led to a decrease in real wages, which translated into heightened economic insecurity. Women, who had previously been heavily involved in the textile industry, were particularly affected, as the port offered few employment opportunities for them. As a result, the percentage of women active in the labor market declined, while others were forced to work as waitresses, domestic servants, or prostitutes (Lis, 1986). The growing insecurity and vulnerability in the lives of women is reflected in the rise of bridal pregnancies and out-of-wedlock fertility, as well as the increasing infant mortality in Antwerp from the mid- to late 19th century, with significant peaks during epidemic outbreaks, which were linked to rising population pressure (Donrovich et al., 2018; Vries & Puschmann, 2023).

The social inclusion of migrants was not always a smooth process, due to cultural differences and limited human capital (Puschmann et al., 2016b). The former was mainly true for international migrants and those from the Walloon provinces, while the latter was typical of Flemish rural-to-urban migrants. Overall, the process of social inclusion was easier in Antwerp than in other major port cities, such as Rotterdam and Stockholm. Migrants who arrived as children fared much better than those who arrived after their 30th birthday. International migrants performed very well in the labor market, holding higher positions on average than natives. Internal migrants initially had to content themselves with lower positions, but the longer they stayed, the better integrated they became in the labor market. Those who stayed long enough ultimately outperformed natives. However, migrants' access to marriage and reproduction was severely hampered, especially for international migrants and French-speaking Walloon migrants. Migrants who did marry often did so with fellow migrants, and mixed marriages were much less common than would be expected if partner selection were random, suggesting that many migrants and natives lived segregated lives and that cultural barriers prevented long-distance migrants from becoming socially integrated (Puschmann, 2015; Puschmann et al., 2013, 2016b).

4 RESULTS

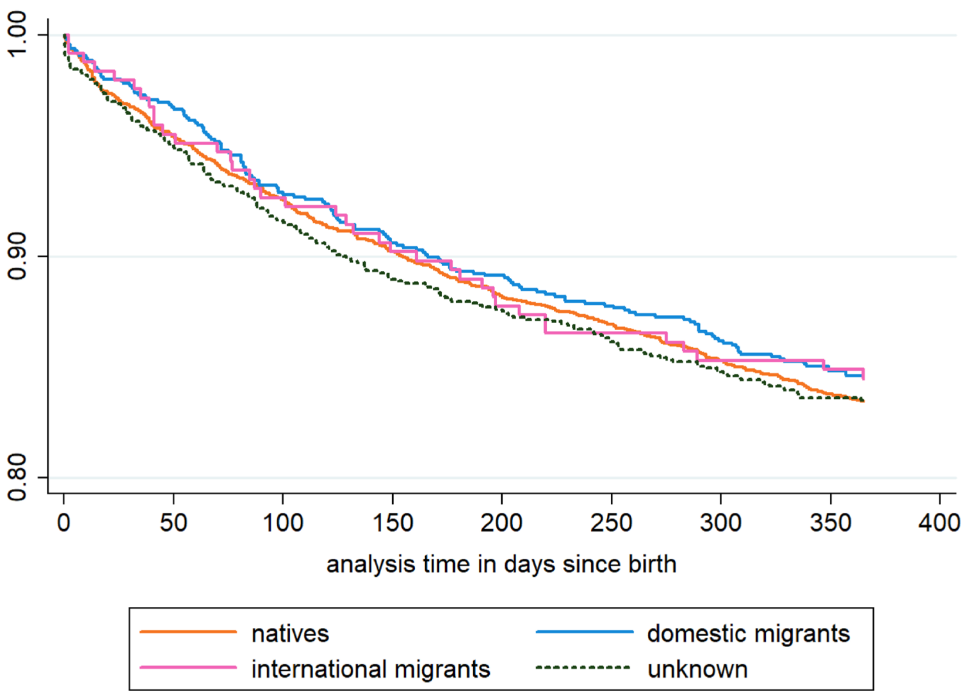
Graph 1 displays the Kaplan-Meier survival curves of infants in the study population by the migration status of the mother. There are few, if any, differences in survival chances by maternal migration status during the neonatal phase (0–27 days). Only the survival rate of infants with mothers of unknown birthplace seems to have been somewhat lower. However, in the post-neonatal phase (28 days to 1 year), differences begin to appear and grow gradually over time. The survival chances of infants born to domestic migrant mothers and mothers with an unknown migration status were somewhat better compared to those of native mothers, and even more so compared to infants of international migrant mothers. However, given the jagged line for the latter category, these observations are less reliable due to small sample sizes. Indeed, there are only 179 (= 3.18%) international migrant mothers in the study population.

Graph 1 *Kaplan-Meier survival curves by migration status of the mother (n = 5,622)*



Source: Antwerp COR-database.*

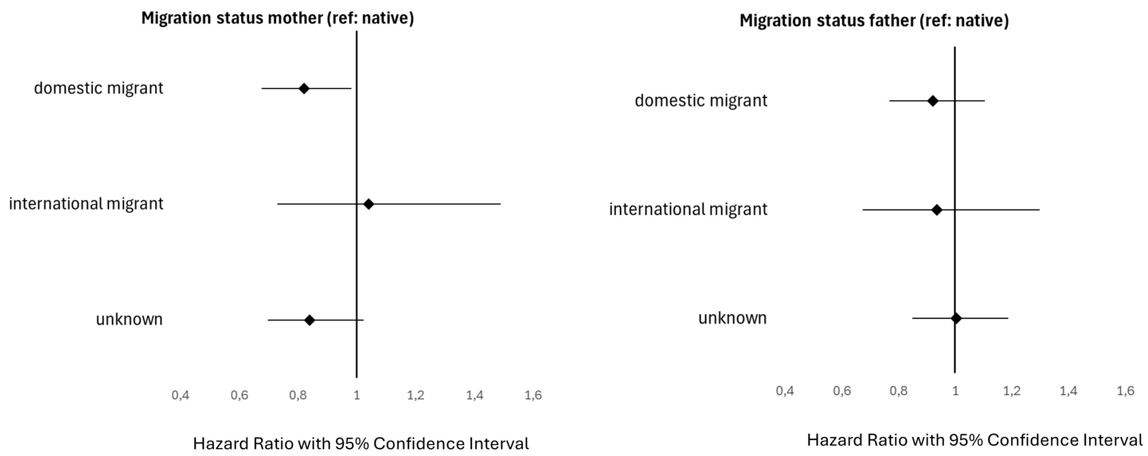
Graph 2 *Kaplan-Meier survival curves by migration status of the father (n = 5,622)*



Source: Antwerp COR-database.*

Graph 2 shows the survival curves of infants in the study population by the migration status of the father. Again, there are few differences in the survival curves during the neonatal phase, although infants with fathers of unknown migration status fared slightly worse. In the post-neonatal phase, small differences in the survival curves emerge. Infants of migrant fathers generally had somewhat higher survival chances than those of native fathers for most of the period, but the differences were smaller than those observed for maternal migration status. Over the entire period, infants with fathers of unknown migration status fared worse. Infants with international migrant fathers initially did somewhat better than those with native fathers, until about 180 days, after which they fared worse, and then better again toward the first birthday. However, as with the previous analysis, it is clear that the estimates for international migrant fathers (n = 246; 4.35% of the total study population) are less reliable due to the small sample size.

Graph 3 *Cox proportional hazard models for infant mortality (Unadjusted; n = 5,622)*



Source: Antwerp COR-database.*

Graph 3 displays the results of the Cox regression on infant mortality for the two main variables of interest in separate unadjusted models by ways of forest plots: migration status of the mother and migration status of the father. The only significant effect is found for domestic migrant mothers. Infants born to these mothers have a lower hazard ratio (HR: 0.82) of mortality in the first year of life compared to infants born to native Antwerp mothers. The results for children born to migrant fathers — both domestic and international — point in the same direction, although the effects are smaller (HR for domestic migrants: 0.92; HR for international migrants: 0.93) and not significant.

Table 1 *Cox proportional hazard models for infant mortality (n = 5,622)*

	Model 1	**Model 2**	**Model 3**
	HR	HR	HR
Migration status mother			
Native	Ref	Ref	Ref
Domestic migrant	0,82**	0,81**	0,83*
International migrant	1,04	1,04	1,08
Unknown	0,69**	0,75	0,75
Migration status father			
Native	Ref	Ref	Ref
Domestic migrant	0,98	0,94	0,95
International migrant	0,96	0,96	0,96
Unknown	1,28**	1,18	1,22
Sex			
Female		Ref	Ref
Male		1,04	1,03
Legitimacy			
Legitimate		Ref	Ref
Illegitimate		1,08	1,13
Birth year		1,00***	1,01***
Age mother			
< 20			Ref
20–29			0,75*
30–39			0,71*
40+			0,63**
SES Father			
Elite			Ref
Middle class			1,41
Laborers			1,60
Unknown			1,21

Note: *$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Antwerp COR-database.*

In the final part of the analysis, I fit Cox proportional hazard models with both variables of interest included simultaneously (Model 1). Subsequently, I add control variables. In Model 2, I add characteristics of the child: sex, year of birth, and whether the child was legitimate. In Model 3, I add characteristics of the parents: age of the mother at birth and SES of the father at birth. The results from the multivariate analysis largely confirm the descriptive results as well as the unadjusted models. I find a survival advantage only for infants born to domestic migrant mothers. In Model 1, there is an 18% lower risk of mortality for infants born to domestic migrant mothers. This effect is significant and remains constant and significant in Models 2 and 3 when I add control variables for the infant and the parents. In Model 1, there is also a significant effect for mothers and fathers with an unknown migration status. However, after controlling for other factors, these effects are no longer significant. The hazard rates indicate a minor survival advantage for infants of domestic (HR: 0.98) and international migrant fathers (HR: 0.96). However, both results are not significant. In the case of the latter category, this is likely due to a lack of statistical power. Infants born to fathers with an unknown migration status have a significantly higher mortality risk (HR: 1,28) in model 1, but when the controls are added the effect becomes insignificant.

5 CONCLUSION AND DISCUSSION

This research showed that infants of domestic migrant mothers in late 19th- and early 20th-century Antwerp had better survival chances than those born to native mothers. This effect persisted even after controlling for infant and parental characteristics. These findings suggest that the healthy migrant effect may be transmitted from mother to child, with healthier mothers giving birth to healthier infants. However, the Kaplan-Meier survival curves showed that the health advantage only clearly emerged in the post-neonatal phase, suggesting it is less likely to be biologically driven (e.g., by genetic disorders, prematurity, birth complications, or low birth weight) and more likely linked to social and environmental factors (e.g., lower risks of infectious diseases, malnutrition, weaning problems, or environmental pollution). This finding, of course, raises new questions: Is the survival advantage among infants of domestic migrant mothers due to the mothers simply being healthier? Or is it because these mothers were better able to protect their children from health hazards — for instance, by breastfeeding more frequently or for longer durations — compared to native-born mothers? This may itself reflect better health, but could also be shaped by different living and working conditions, or a combination of both.

No survival advantage was found for infants of international migrant mothers. Although not significant, their hazard rates were even slightly above 1. I believe that the absence of a health advantage among this group may have been due to the lower social integration of their mothers. Previous research highlighted that international migrant women who lost their spouses had a much higher mortality risk compared to domestic migrants in similar situations (Donrovich et al., 2014). This suggests that international migrant women in Antwerp had fewer family members and friends to rely on for social and financial support. Due to cultural differences, they may have also found it harder to build such a network (Puschmann et al., 2016b). Moreover, international migrant women in Antwerp had a higher risk of remaining single and were more likely to give birth to one or more illegitimate children, underlining their lack of social support and vulnerability. By contrast, domestic migrant women had an even lower risk of giving birth to an illegitimate child than native-born Antwerp women (Vries & Puschmann, 2023). We might therefore tentatively conclude that the healthy migrant effect is only transmitted from mothers to children if the mothers are well integrated into the destination society. This could explain the mixed results in the literature, where in some cases, the offspring of migrants enjoy a survival advantage, while in others, they face a disadvantage or no difference.

We found no evidence that the migration status of the father mattered. The hazard ratios of infants of migrant fathers — both domestic and international — pointed to a small survival advantage, but the effect was not significant. Most likely, the health of mothers is more important for infant survival, given that children spend approximately nine months in the womb and are often breastfed by their mothers. Moreover, existing research on the Netherlands finds that the death of a mother during infancy (0–1) or early childhood (1–5) was associated with a considerably higher risk of child mortality compared to when the father died (Quanjer et al., 2023). These results should not surprise as women acted as the primary caretakers of infants and the role of fathers was mostly confined to that of (financial) provider.

One limitation of this study is the categorization of parental migration status into only three broad groups: natives, domestic migrants, and international migrants. It would be valuable to further distinguish within the domestic migrant group between Flemish and Walloon migrants — especially since this study, along with previous research (e.g., Wallace et al., 2023), highlights the importance of societal integration. Walloon migrants, due to differences in language and culture, may have faced greater challenges integrating into Antwerp society compared to Dutch-speaking Flemish migrants, and this might have resulted in higher mortality among their offspring. Similarly, within the group of international migrants, it would be interesting to examine survival differences among infants by the parents' national origin — for example, comparing Dutch migrants, who share a language with the local population, to migrants from France. However, the current data sample does not support such detailed analysis due to the small number of cases in these specific subcategories. Another limitation is the relatively large proportion of parents with unknown migration status — 16% of mothers and 19.5% of fathers.

Future research could look also into whether the health advantage of children of domestic migrant women in Antwerp persisted into childhood, adolescence, and adulthood, or whether it diminished over time. Additionally, more replication studies are needed to determine whether the results from Antwerp hold in other historical contexts. Is it indeed only the best-integrated migrants who pass on the healthy migrant effect to their offspring? Is maternal migration status always more critical for child survival than the migration status of the father?

To better understand the healthy migrant effect in historical contexts, future research should move beyond all-cause mortality and focus on cause-specific mortality analyses. Which causes of death were migrants and their children less likely to experience compared to natives? By systematically comparing causes of death across various contexts — between migrant and non-migrant populations, as well as between offspring of migrant parents who did and did not exhibit a health advantage — we can better identify the causal mechanisms underlying the healthy migrant effect and its intergenerational transmission or lack thereof. This approach could potentially also shed a light on which health-protective characteristics and behaviors are actually transferred from migrant parents to their children, and which factors contribute to non-transmission or even a reversal of health advantages.

In recent years, an increasing number of cause-of-death registers have been digitized — especially within the SHIP network — and a historical cause-of-death coding and classification scheme for individual-level causes of death, the ICD10h, has been developed (Janssens, 2021; Janssens & Devos, 2022; Reid et al., 2024). The S.O.S. Antwerp (2025) project will provide cause-of-death data for the city of Antwerp covering the period 1820–1946. With these advancements, the necessary data and tools to conduct the proposed analyses are now within reach — not only for Antwerp but also for many other European cities — opening up new avenues for comparative research on the health of migrants and their offspring.

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APPENDIX

Appendix 1 *Summary Statistics*

	Percentage	Mean	SD	Min	Max
Migration status mother					
Native	63.3				
Domestic migrant	17.6				
International migrant	3.1				
Unknown	15.8				
Migration status father					
Native	59.1				
Domestic migrant	17.0				
International migrant	4.4				
Unknown	19.5				
Sex					
Female	49.0				
Male	51.0				
Legitimacy					
Legitimate	93.4				
Illegitimate	6.6				
Birth year		1880.1	16.8	1846	1906
Age mother		30.0	6.6	15	50
< 20	3.0				
20–29	46.1				
30–39	39.2				
40+	11.7				
SES father					
Elite	1				
Middle class	58.2				
Laborers	31.6				
Unknown	9.3				
N of infants	5,622				