Son Preference, Gender Discrimination, and Missing Girls in Rural Spain, 1750–1950

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Relying on longitudinal microdata from a Spanish rural region between 1750 and 1950 (almost 35,000 life courses), this article provides evidence that discriminatory practices affected sex-specific mortality during infancy and childhood. Although it is likely that families also discriminated against girls during the first year of life, female excess mortality was especially visible in the 1–5 age group. While breastfeeding seems to have temporarily mitigated the effects of gender discrimination, sex-specific mortality rates behaved very differently once children were weaned. Parents, therefore, prioritized boys during infancy and childhood in the allocation of food and/or care in order to enhance their survival chances.

Introduction

Son preference is a common feature of traditional societies where girls are considered of lesser value than boys (Williamson 1976; Sen 1990; Das Gupta et al. 2003). Less equal gender roles tend to arise from particular beliefs and values that expect women to be in charge of domestic tasks and therefore discourage their participation in the labor market (Boserup 1989; Alesina, Giuliano, and Nunn 2013; Giuliano 2015, 2018). Property and inheritance rules usually favored males who would then take over the family farm, provide parents with old-age security, and ensure the continuity of the family name (Knodel and De Vos 1980). Moreover, although daughters could help with younger siblings and take care of their parents in old age (Sandström and Vikström 2015, 58; Lynch 2011, 258–260), strict dowry systems could

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make them a drain on family resources (Bhalotra, Chakravarty, and Gulesci 2018).

Gender discrimination against girls, resulting in female excess mortality, has long been practiced in societies characterized by strong patriarchal traditions (Sen 1990; Das Gupta 2003; Bhaskar and Gupta 2007; Drixler 2012; Gupta 2014). Although European women historically enjoyed considerably better status than their counterparts in other regions, they were nonetheless discriminated against in many dimensions, especially in Southern and Eastern Europe (Szoltysek et al. 2017; Kok 2017; Carmichael and Rijpma 2017; Dilli, Carmichael, and Rijpma 2019). There is, however, little evidence that gender discriminatory practices increased female mortality in infancy and childhood in historical Europe. According to Lynch (2011), household formation patterns, as well as cultural and religious values, limited excess female mortality, and thus the number of "missing girls in historical Europe" (also in Derosas and Tsuya 2010).

Several studies have, however, challenged this view and suggested that gender discrimination was more important than previously assumed. On the one hand, son preference influenced the propensity to have additional children in Sweden, Germany, Italy, and Spain (Kolk 2011; Sandström and Vikström 2015; Reher and Sandström 2015; Manfredini, Breschi, and Fornasin 2016; Marco-Gracia, 2021a).[1] In this regard, families with only female offspring were more likely to continue childbearing. In the Italian case, this was more visible among those households that depended on sons to take over the family farm. There is scattered evidence suggesting that families resorted to female infanticide as a means of controlling the size and sex composition of their offspring (Bechtold 2001; Hynes 2011; Hanlon 2016; Beltrán Tapia and Raftakis 2019; Beltrán Tapia and Marco-Gracia 2020).[2] It also appears that gender-discriminatory practices were affecting girls' net nutritional status and increasing female mortality rates during infancy and childhood via an unequal allocation of food, care, and/or workload (Tabutin 1978; Johansson 1984; Pinnelli and Mancini 1997; Baten and Murray 2000; McNay, Humphries, and Klasen 2005; Horrell and Oxley 2016; Beltrán Tapia and Gallego-Martínez 2017, 2020).

Unveiling patterns of gender discrimination in infancy and childhood is, however, especially challenging. For biological reasons, males are more vulnerable, and their mortality rates are naturally higher, especially during the first year of life. This frailty was especially visible in the high-mortality environments that characterized preindustrial Europe due to poor living conditions, lack of hygiene, and the absence of public health systems (Beltrán Tapia 2019). High-quality data are therefore needed to distinguish between mortality risks resulting from intrahousehold discrimination and those arising from other factors (Kok 2017, 44).

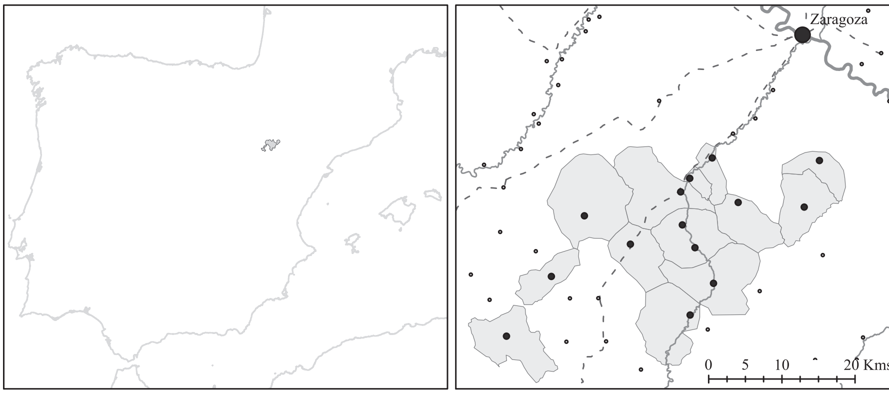
Relying on longitudinal microdata from a rural region in northeastern Spain between 1750 and 1950 (almost 35,000 individuals), this article provides evidence that discriminatory practices affected sex-specific mortality rates during infancy and childhood. In this regard, although it is likely that gender discrimination also increased female mortality during the first year of life, the gender mortality gap especially widened at ages 1–5. While breastfeeding seems to have temporarily mitigated the effects of gender discrimination, sex-specific mortality rates behaved significantly different once the children were weaned. The female penalty was even more visible in children born at high parities when additional children further strained limited household resources. Moreover, having no male siblings is related to lower male mortality rates in early childhood. It appears that parents prioritized boys in the allocation of food and/or care in order to enhance their survival chances and secure at least one male heir. Girls' mortality rates remained significantly higher than those of boys until age 5, a feature that clashes with the female biological advantage.

This article supports previous studies that challenged the idea that there were no missing girls in Spain, at least in the nineteenth century (Beltrán Tapia and Gallego-Martínez 2017; Beltrán Tapia 2019). In this regard, it shows that the high sex ratios in infancy and childhood found in previous studies were not driven by problems with the quality of the registers, but by female excess mortality. In addition, the microdata used here sheds light on how these societies ended up displaying unbalanced numbers of boys and girls by illustrating not only when these discriminatory practices were taking place but also the mechanisms at play. While Beltrán Tapia and Marco-Gracia (2020) show that families disguised instances of female infanticide as natural deaths in the same area of study, this article demonstrates that discriminatory practices continued through infancy and childhood. This behavior was, however, less visible during the first year of life because, once infants were accepted into the family, breastfeeding protected boys and girls alike. Sex differences in mortality rates, nonetheless, clearly resurfaced when children were weaned. Discriminatory practices during childhood seem to have been part of a generalized cultural system that privileged boys in terms of access to food and/or care. These practices were shared both by farmers and landless laborers and proved to be persistent. Although definitely more important during the nineteenth century, discriminatory patterns affecting sex-specific mortality rates during infancy and childhood were still visible during the first decades of the twentieth century.

As in other historical contexts where agriculture was the main economic activity (Alesina , Giuliano, and Nunn 2013; Giuliano 2018), Spanish women did not enjoy the same status as men: legally subordinated to their fathers and husbands, they were expected to remain within the domestic realm and those who did work in paid jobs received significantly lower wages (Camps 1998; Sarasúa 2002; Borderías, Pérez-Fuentes, and Sarasúa 2010; Borderías and Muñoz 2018). Our findings, therefore, show that gender discrimination also translated into how parents treated their sons and daughters. Our area of study, however, did not share the stricter patriarchal values that existed in other European regions, especially in Eastern Europe (Szoltysek et al. 2017; Beltrán Tapia et al. 2021). Nuclear households prevailed, and inheritances were equally distributed among all children, regardless of their sex. In addition, women maintained full control of the resources they brought to the marriage and were entitled to freely dispose of their patrimony through wills at their death (Jarque Martínez and Salas Ausens 2007, 126–127). Likewise, although it is true that women did not enjoy the same status as men in the labor market (lower salaries, fewer workdays, etc.), female wage labor was widespread and women's contribution was crucial to the household economy (Borderías and Muñoz 2018; Germán Zubero 2009, Lana Berasain 2007). Revealing female excess mortality in such a context, therefore, opens up the possibility of finding similar or even more extreme manifestations of son preference in other European regions. Female excess mortality during childhood was also present in nineteenth-century population samples from Italy, Sweden, and Belgium (Alter, Derosas, and Nystedt 2004, 334–337; Oris, Derosas, and Breschi 2004, 366).

Lastly, the existence of female excess mortality derived from discriminatory practices in infancy and childhood also puts into question the implications derived from historical life tables (Coale and Demeny 1966). The observed gender gap in mortality rates can no longer be considered solely the result of the interaction between biological dimensions and different disease environments. The way societies treated their children affected their chances of survival and, if gender discrimination was in place, life tables are likely overestimating female mortality rates and/or underestimating male ones. Routinely relying on life tables at face value perpetuates the notion that some gender gaps in mortality are the result of "natural" factors when they are actually mediated by differential treatment. This is especially problematic in areas exhibiting relatively high child sex ratios, so this investigation stresses the need to consider behavioral factors when analyzing sex-specific mortality patterns in these contexts. Moreover, as Harris and Ross (1987, 155) argue, failing to consider these practices distorts our understanding of the demographic transition. Part of the decline in infant and child mortality from the late nineteenth century onwards resulted from gradual changes in how parents treated their sons and daughters as the trade-off between child-rearing costs and benefits evolved. In this regard, the improvement in female labor market opportunities and the status of girls reduced the relative mortality rates of female infants and girls in Italy and Spain during the late-nineteenth and early twentieth century (Pinnelli and Mancini 1997; Beneito and García-Gómez 2019).

FIGURE 1 Study area: Middle Huerva (Aragón, Spain)



NOTE: Dark dots refer to the localities studied here (except Zaragoza, the provincial capital) and the corresponding shaded areas to their municipal boundaries. Apart from rivers (in gray) and main roads (dotted lines), the map also depicts neighboring villages (white dots).

Data and historical background

This study focuses on a small rural area in Aragon, in northeastern Spain, that is located around 19–40 kilometers away from Zaragoza, the regional capital (see Figure 1). This area, a combination of plains and foothills near the Huerva river, comprises 13 small municipalities.[3] Their total population was approximately 5,525 inhabitants in 1750, 8,315 in 1857, and 9,556 in 1950. The statistical analysis relies on the complete church registers of these villages, whose records provide high-quality information on all births, marriages, and deaths that occurred from 1575 onwards (although the starting date varies by location; more details about the "Alfamén and Middle Huerva Database" can be found in Marco-Gracia 2017, 2019, 2021a). The quality of registration greatly improved from the mid-eighteenth century,[4] so this article focuses on the period 1750–1950. Document D1 in the online Appendix containing supplementary materials provides an example of the death records. In total, the whole dataset contains information on 63,175 individuals (name, sex, place, and date of birth, parents' names, date of death, etc.) born between 1750 and 1950, thus allowing to reconstitute their complete life histories (and their families). This longitudinal dataset has also been complemented with information on occupation and literacy contained in population lists (1747–1830), population censuses (1857, 1860), and electoral rolls (1890–1955).[5]

An additional institutional mechanism contributes to the exceptional quality of these records. During the Epiphany Mass, the first festivity of each year (January 6), the local priest read aloud all birth, marriage, and death registers from the previous year to make sure that every event was recorded. The priest consigned in the source that this reading was made during the Misa Mayor, the High Mass.[6] Claims occurred rarely but, when they were made, a register was added to the previous year's book, thus further evidencing how meticulously these records were kept. This procedure was also in the interest of the families because the existence of the church register was required for many subsequent formalities. Our records indicate that this mechanism to correct potential errors in the records was at a place at least from the late eighteenth century.

However, given that we rely on local records, we do not have all the information on those individuals who migrated in/out of our study area. Children may have moved out with their families and died somewhere else, so we cannot observe their age of death. Similarly, an individual may have moved into our study area, so we can have information on his/her death but not on his/her birth. The analysis of infant and child mortality is therefore restricted to those individuals for whom we have complete information. In this regard, we consider all observations for which we know both the birth and age of death. In addition, we also consider those who married and therefore were alive during their infancy and childhood.[7] Given that migration was predominantly male, we are excluding a larger proportion of males. This is crucial because, although we do not know their age of death, it is likely that these individuals did not die before age 10. Excluding them from the sample artificially increases male mortality rates because they are no longer in the denominator and thus makes finding female excess mortality even more challenging. Moreover, twins not only suffered extremely high mortality rates but also generated an unexpected shock to the household resources that can distort our analysis. We are interested in observing what happens within "ordinary" families, so we have excluded from the analysis those children born in families who raised twins. The restricted sample contains 33,924 individuals. Table A1 in the online Appendix shows that these restrictions hardly affect the socioeconomic composition of our sample. As mentioned before, however, the proportion of males is now lower, thus increasing male mortality rates and thus biasing our research strategy against the likelihood of finding gender discrimination.[8]

The study area, covering around 500 km^2, hosted a population whose members mostly lived in nuclear households and were essentially engaged in agriculture (wheat and some wine) and sheep grazing. Our records show that around 85 percent of the male working population was engaged in the agricultural sector between 1800 and 1950. Average marital fertility of complete families (both spouses reaching 49 years old) was relatively stable around six to seven children up to 1900 and declined rapidly thereafter following the demographic transition. Infant and child mortality rates were very high, though, and only around half of the children survived their tenth birthday. In particular, during the second half of the nineteenth century, the average rates of infant and child mortality (aged 1–5) were 193 and 241 deaths per thousand live births, respectively. Mortality rates began declining consistently in the last third of the nineteenth century due to improving living standards. The decline first benefited children in their late childhood and spread later to younger cohorts. Infants and young children were the last ones to join this trend, and their survival chances only significantly increased from 1900 onwards, an improvement that was especially visible during early childhood, when hygienic conditions and mothers' health improved. Anthropometric evidence also indicates that standards of living were extremely low: the average male height was around 160 centimeters in the mid-nineteenth -century, well below the stature of their European counterparts or their fellow Spaniards in other regions of the country (Martínez-Carrión, Cámara, and Pérez-Castroviejo 2016; Hatton and Bray 2010). In an area where most of the population enjoyed living standards close to subsistence levels, household allocative choices mattered and discriminatory practices could have had lethal consequences.

Women had fewer wage labor opportunities than men. The latter played a predominant role in agriculture and cattle rearing. Women's work was mostly seasonal and concentrated in periods when the demand for labor could not be met by men alone. During the rest of the year, women performed simple tasks (if any) such as tossing wheat. It is true that women could be employed as servants in wealthy households (Horn, 1987; Verdon, 2003; Ortega López, 2015; Borderías and Martini, 2020), but the available positions in our study area were limited. Work opportunities for older girls were similar but even more limited than for adult women. Adolescent women, therefore, suffered double discrimination because of their age and their sex, which included a shorter annual working period and wages lower than men's. Economic factors may consequently be at the root of son preference since, in a context of near-subsistence living standards, boys could cover their cost to the household from younger ages and even provide extra income for the family. Girls, on the contrary, were in a worse position not only because it was more difficult for them to earn income, but also because provision had to be made for their dowry. There is evidence that this custom was a burden for the families and therefore militated against girls (Martín Rodríguez 1984, 264).[9]

It is indeed likely that girls' inferior status could have resulted in an unequal allocation of resources within the household, both in terms of nutrition and educational investments (Sarasúa 2002; Borderías, Pérez-Fuentes, and Sarasúa 2014). Literacy rates, for instance, show that parents invested differently in boys' and girls' education: while around 40 percent of men were literate in 1860, less than 5 percent of women were able to read and write. Crucially, Beltrán Tapia and Marco-Gracia (2020) show that families in this region were neglecting a significant fraction of their female babies during the nineteenth century, a phenomenon which was especially visible at higher parities and among landless and semilandless families who were subject to harsher economic conditions and therefore more likely to resort to extreme decisions under difficult circumstances. Next sections address whether these underlying attitudes towards boys and girls also translated into their respective survival chances during infancy and childhood.

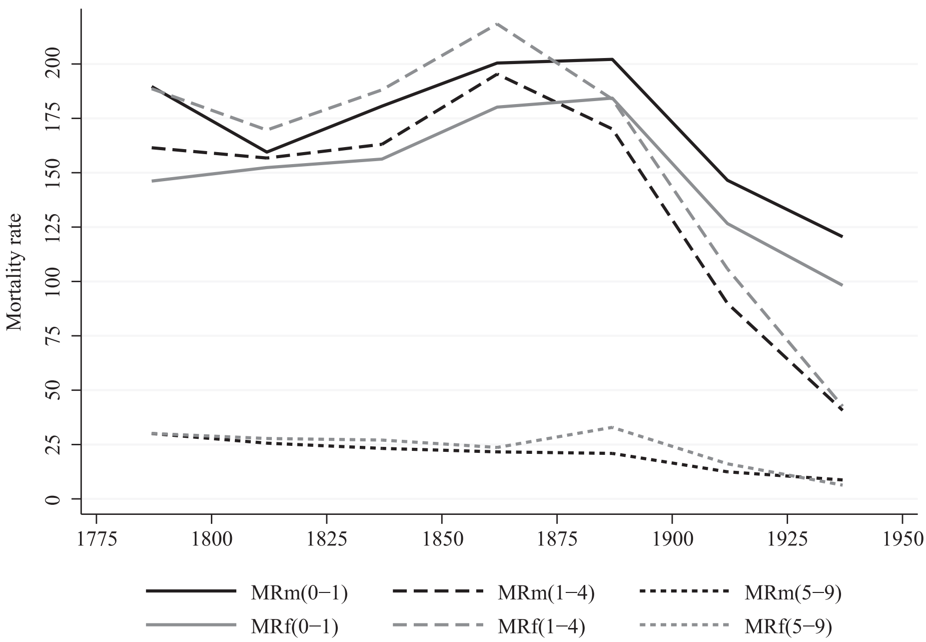
Mortality rates in infancy and childhood

In contexts characterized by low standards of living and high mortality rates, son preference may generate an unequal allocation of resources and thus have deleterious effects on girls' health. However, finding patterns of gender discrimination against girls is especially challenging due to the female biological advantage. Males are more vulnerable, and their mortality rates are thus higher both at birth and during the first year of life (Waldron 1998; Drevenstedt, Crimmins, and Vasunilashorn 2008; Zarulli et al. 2018). This frailty was especially visible in the high-mortality environments that characterized preindustrial Europe.[10] This is illustrated in Figure A1 in the online Appendix using information from as many European countries and periods as possible (taken from the Human Mortality Database). These graphs show that higher average mortality rates are associated with a wider gap between male and female mortality rates, especially during the first year of life.

Although the previous section stressed the quality of parish records, registering deaths required paying the funeral fee, so underreporting of deaths might be an issue.[11] However, if anything, this would affect girls more than boys (Knodel 1988), so female mortality rates would then actually be even higher. Therefore, the gender gaps reported here would only provide a lower threshold of the impact of gender discrimination. This is more likely to have affected infants, so it is plausible that our results underestimate the importance of female deaths during the first days or weeks.

Figure 2 plots the evolution of sex-specific mortality rates for different age groups (0–1, 1–4, and 5–9) between 1775 and 1950. As expected, due to the female biological advantage, more boys than girls were dying during the first year of life. In contrast, girls' mortality rates were higher at older ages, and especially between their first and the fifth birthday. This is striking, because male frailty continues throughout childhood, especially during the second year of life (Waldron 1998; WHO 2019). Therefore, either more girls or fewer boys were dying than should be expected, thus suggesting that discriminatory practices were widening the gender gap in mortality during the 1–4 age group. Infant and, especially, child mortality rates dropped significantly after the late nineteenth century, but the gender gap favoring boys was still visible in the first decades of the twentieth century. Mortality rates in late childhood (5–9) were much lower and kept slowly declining throughout our study period. It is nonetheless remarkable that girls at this age group suffered a mortality spike in the second half of the nineteenth century.

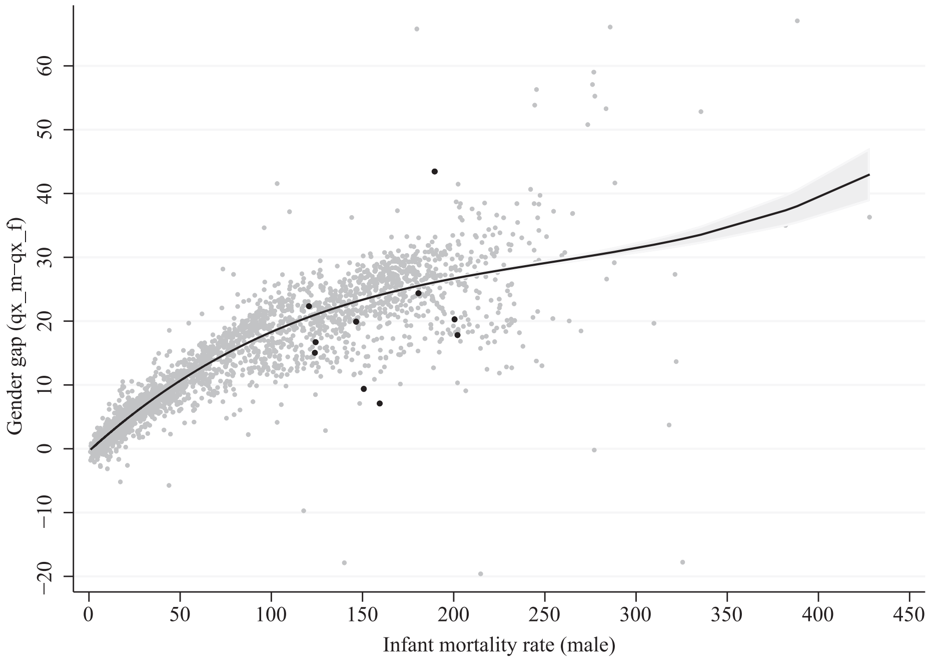
FIGURE 2 Mortality rates in infancy and childhood, by sex, 1775–1925



NOTE: MRm and MRf refer to male and female mortality rates, respectively. Age groups between brackets.
SOURCE: AMHDB.

As explained above, the sex-specific mortality rates during early childhood (1–4) stand in marked contrast to what should be expected considering that females are less vulnerable during this age span. The gender mortality gap during the first year of life favored girls, but this was expected for the same reasons. It is, however, still possible that gender discrimination may have also played a role during the first year of life despite not fully compensating girls' biological advantage. Figures 3–5 put our case study in international perspective using information from the Human Mortality Database. These figures, which plot historical mortality rates by age group (0–1, 1–4, and 5–9) and the corresponding gender gap for as many European countries and periods as possible, further confirm that the gender gaps we observe in our study area do not conform to what would be expected. The black dots depicting the corresponding figures from our data are always well below the international trend: the gender gap is subsequently smaller and therefore more girls (or less boys) are dying than expected, according to those mortality rates. The disparity is widest for the 1–4 age group, but it is also significant during the first year of life. This means that, even though we observe more boys than girls dying at that age, the gap is smaller than it should be, thus suggesting that some sort of discrimination was affecting sex-specific mortality rates.

FIGURE 3 Mortality rates and the gender gap in infancy (aged 0–1), 1750–2016

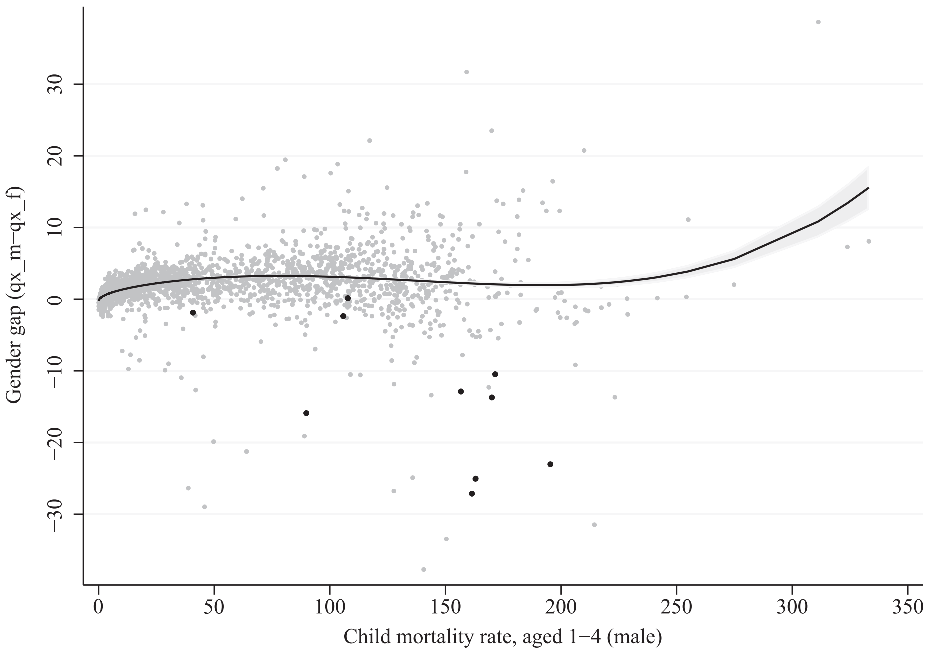


SOURCE: Human Mortality Database and AMHDB. Coverage varies by country. The black dots refer to the observations in our Spanish sample.

In order to shed more light on the nature of these patterns, Figure 6 displays both daily mortality rates during the first 10 years of life and the subsequent gender mortality gap between 1750 and 1900, when gender discrimination was potentially more important than during the later period (1901–1950). Given that mortality is highest during the first days/weeks, including these first weeks in the visualization would prevent noticing any pattern because it would completely distort the scale of the *y*-axis. We have, therefore, excluded the first month.[12] Regardless of what may have been happening during the first four weeks of life, this plot suggests that weaning had especially deleterious effects on girls' health. While male and female mortality rates fell dramatically following a very similar trend during the first months of life, something changed abruptly around the sixth to seventh month for both sexes alike. Breastfeeding seems to have protected boys and girls equally but, as soon as they were weaned, girls began to die at a higher rate,[13] a situation that continued throughout infancy and childhood.

As discussed above, the higher mortality of males during the first months of life is clearly associated with biological factors. Breastfeeding does not imply competition for resources because there is only one infant that can benefit from it. The introduction of solid food, however, seems

FIGURE 4 Mortality rates and the gender gap in early childhood (aged 1–4), 1750–2016

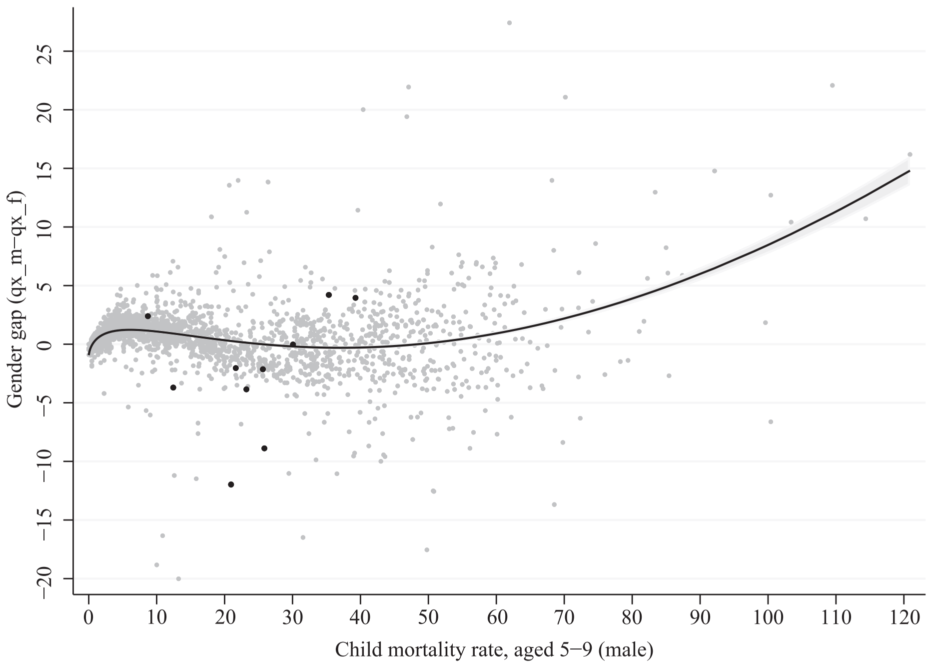


SOURCE: Human Mortality Database and AMHDB. Coverage varies by country. The black dots refer to the observations in our Spanish sample.

to have unleashed discriminatory practices in the quantity or quality of the food that was given to boys and girls. Alternatively, weaning and the subsequent loss of the protective effect of breastfeeding surely increased the likelihood that these children contracted gastrointestinal diseases due to the prevailing hygienic conditions (Guinnane and Ogilvie 2014; Pérez Moreda, Reher, and Sanz-Gimeno 2015). It is therefore also plausible that, when ill, parents devoted more attention and care to their sons than to their daughters. In high-mortality contexts as the one present in our study area, minor differences in how these children were treated were likely to have had lethal consequences for the less favored. Girls continued dying in higher numbers as children grew older, especially during the 2–5 age group, thus suggesting that both nutrition and care were likely playing a role in shaping their chances of survival.

The patterns observed before are statistically significant, even after controlling for individual characteristics. Table 1 reports the results of estimating a logit model assessing whether being female affected the probability of dying at different stages of infancy and childhood between 1750 and 1900. This exercise controls for the number of surviving siblings at the beginning of those stages (at birth, 1, 2, or 5 years old), as well as

FIGURE 5 Mortality rates and the gender gap in childhood (aged 5–9), 1750–2016

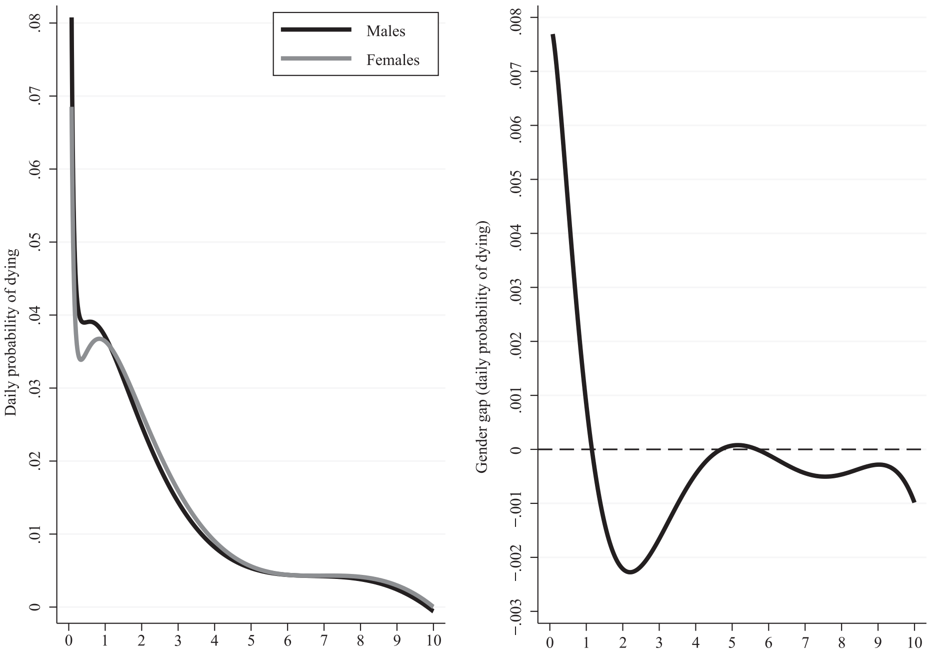


SOURCE: Human Mortality Database and AMHDB. Coverage varies by country. The black dots refer to the observations in our Spanish sample.

village- and period fixed effects (odd columns). An additional set of potential confounding factors (mother's age, father's occupation, and literacy) are also considered (even-numbered columns). Summary statistics for the variables employed in the statistical analysis are reported in Table A2 in the online Appendix. This analysis basically confirms the shape of the graphs above: the survival female advantage dramatically decreased during the first year of life and completely disappeared between aged 1–2. Girls in the 2–5 age group actually suffered higher mortality than boys.

The fact that the gender gap in mortality is hardly visible even during the first year of life when the additional set of controls are included (even-numbered columns) further suggests that discriminatory practices were either increasing female mortality rates or decreasing male ones during infancy, a pattern that was also evident when comparing the gender gap existing in our study area with international figures (see Figure 3). The female penalty is even clearer when analyzing those children born at high parities when additional children further strained household resources. Given the female biological advantage, adverse circumstances should inflict a deadlier toll on boys. The empirical analysis, however, provides evidence that the opposite was true, especially after weaning (see Table A3 in the online

FIGURE 6 Sex-specific daily probability of dying and gender mortality gap (age 0–10), 1750–1900



NOTE: In order to help detecting these patterns, the first month of life has been excluded from the visualization.
SOURCE: AMHDB.

Appendix, which restricts the analysis to those children born at parity 4 or higher). Male excess mortality is not visible now when children are aged 6–12 months and the female penalty increases during the 2–5 age group.

Rather than a conscious family decision that affected a small number of families, gender discriminatory practices that affected sex-specific mortality rates during infancy and childhood seem to have been part of a generalized cultural system that privileged boys. There are very little differences between socioeconomic groups: Table A4 in the online Appendix shows that the gender mortality gap hardly changes between children born in families of landowners and the landless and semilandless. Moreover, these widely shared attitudes persisted over time: Table A5 in the online Appendix shows that the patterns found here did not change during the first half of the twentieth century. If anything, the female penalty became even more pronounced during the second year of life. We should bear in mind, though, that, by slicing the sample into smaller units, these analyses are noisier and the statistical results less precise.

Unfortunately, qualitative direct evidence on how parents treated their children is scarce or nonexistent. The analysis of the causes of death can be useful in deepening our understanding of what was happening within those

TABLE 1 Probability of dying, by age, 1750–1900

	Dependent variable: Probability of dying, by age group							
	At birth		First week		2–4 weeks		1–6 months	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Female	−0.347***	−0.418	−0.221**	−0.137	−0.196**	−0.077	−0.174***	−0.058
	(0.134)	(0.282)	(0.098)	(0.231)	(0.084)	(0.179)	(0.059)	(0.101)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	26,768	6,083	26,306	5,849	25,700	5,912	24,803	5,742
Pseudo R2	0.0237	0.0436	0.0130	0.0165	0.0136	0.0260	0.0104	0.0175

	Dependent variable: Probability of dying, by age group							
	6–12 months		1–2 years		2–5 years		5–10 years	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Female	−0.125***	−0.159*	0.036	0.049	0.065	0.140*	0.087	0.079
	(0.040)	(0.095)	(0.039)	(0.097)	(0.053)	(0.074)	(0.076)	(0.121)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	22,908	5,309	21,076	4,852	17,796	4,070	14,896	3,463
Pseudo R2	0.0080	0.0187	0.0092	0.0155	0.0125	0.0180	0.0166	0.0278

Coefficients are estimated using a logit regression model. Robust standard errors in parentheses (clustered at the village level); *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; For simplicity, the intercept is not reported. The first set of controls include child order, the number of children alive at the beginning of the period (at birth, 0, 1, 2, or 5 years), village and period fixed effects. The second set of controls include mother's age, father's occupation, and father's literacy.

families. This information, however, presents important limitations, so we should be cautious interpreting it. Priests only began registering the cause of death in the 1870s, and not in all villages, so the number of observations is limited. More importantly, not only the accuracy of the diagnosis is sometimes doubtful, but it also reflects the ultimate cause of death, not what caused this event. These problems are especially acute in the case of children. A large number of newborns who only survived a few hours are registered as deaths from weakness ("*debilidad*"). Similarly, a significant fraction of those dying within the first year shows up as deaths from teething ("*dentición*"). This information nonetheless seems to confirm the idea that son preference affected the allocation of resources within the family. Table A8 in the online Appendix classifies the cause of death of children aged 0–5 between 1870 and 1950. Girls died in greater proportion than boys from digestive and infectious diseases.[14] In the period analyzed, both causes of death are associated with pathogens to which all children are exposed, so no differences by sex could be expected. Nutritional and health conditions nonetheless influence the possibility of overcoming the disease, especially in the case of digestive diseases that cause dehydration and weight loss. The results therefore suggest that girls were slightly worse off than boys in terms of nutritional status.[15]

Son preference and sex-specific mortality rates during infancy and childhood

In order to shed more light on the mechanism underlying these patterns, we now investigate whether individual characteristics, such as the number of siblings and the sex composition of those children, could accentuate discriminatory practices that translated into differential mortality rates for boys and girls. Tables 2 and 3 report the results of estimating the effect of the number of surviving children, as well as whether there were no males or females among them, on the sex-specific probability of dying at different stages of infancy and childhood (while panel A assesses the effect on male mortality, panel B does the same for females). This model controls for parity, village- and period fixed effects (odd-numbered columns) and then adds an additional set of other potential confounding factors: mother's age, father's occupation, and literacy (even-numbered columns). This analysis focuses on the period 1750–1900 when sex discrimination was potentially more important. Given that discriminatory practices are probably more visible in large families due to the pressure that additional children exerted over household resources, Tables A6 and A7 in the online Appendix replicate the analysis focusing only on children born at high parity (4 or above). We should bear in mind, though, that the female biological advantage implies that boys should suffer more under adverse circumstances, so not observing

TABLE 2 Probability of dying, by age, 1750–1900

	Dependent variable: Probability of dying, by age group							
Panel A: Boys	**At birth**		**First week**		**2–4 weeks**		**1–6 months**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Children alive	0.054	0.158	0.032	-0.400*	-0.071	-0.339**	-0.050	-0.173*
	(0.085)	(0.192)	(0.058)	(0.205)	(0.056)	(0.132)	(0.035)	(0.100)
No males	0.082	0.235	0.276**	-0.578	-0.049	-0.110	-0.123	-0.232
	(0.144)	(0.465)	(0.124)	(0.423)	(0.125)	(0.313)	(0.079)	(0.276)
No females	0.197	0.314	0.414***	-0.152	0.128	-0.158	-0.074	-0.488***
	(0.177)	(0.331)	(0.139)	(0.245)	(0.087)	(0.136)	(0.108)	(0.100)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	13,659	3,008	13,332	2,961	13,030	2,957	12,535	2,966
Pseudo R2	0.0263	0.0619	0.0182	0.0330	0.0167	0.0489	0.0086	0.0174

	Dependent variable: Probability of dying, by age group							
Panel A: Girls	**At birth**		**First week**		**2-4 weeks**		**1-6 months**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Children alive	0.053	0.283*	−0.021	−0.062	0.008	−0.006	0.009	−0.092
	(0.114)	(0.171)	(0.082)	(0.091)	(0.087)	(0.146)	(0.062)	(0.117)
No males	0.477***	1.053**	−0.028	−0.045	0.064	−0.244	0.046	−0.248
	(0.167)	(0.498)	(0.167)	(0.283)	(0.108)	(0.282)	(0.109)	(0.329)
No females	0.325	−0.302	−0.084	−0.070	0.085	−0.413	0.061	0.049
	(0.223)	(0.383)	(0.190)	(0.355)	(0.154)	(0.308)	(0.089)	(0.103)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	13,109	2,791	12,869	2,801	12,670	2,847	12,268	2,761
Pseudo R2	0.0272	0.0638	0.0181	0.0378	0.0134	0.0402	0.0160	0.0409

Coefficients estimated using a logit regression model. Robust standard errors in parentheses (clustered at the village level); *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; For simplicity, the intercept is not reported. The number of children alive, as well as the fact that none of them are male or female, refer to the beginning of the period analyzed (at birth, 0, 1, 2, or 5 years). The first set of controls include parity, village, and period fixed effects. The second set of controls include mother's age, father's occupation, and father's literacy.

TABLE 3 Probability of dying, by age, 1750–1900

	Dependent variable: Probability of dying, by age group							
Panel A: Boys	6–12 months		1–2 years		2–5 years		5–10 years	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Children alive	−0.050	−0.089	−0.008	−0.066	−0.015	0.053	−0.006	0.049
	(0.040)	(0.065)	(0.028)	(0.067)	(0.038)	(0.068)	(0.037)	(0.075)
No males	−0.056	−0.193	−0.314***	−0.664***	−0.359***	−0.320*	−0.510**	−0.737
	(0.098)	(0.154)	(0.091)	(0.257)	(0.130)	(0.173)	(0.199)	(0.558)
No females	−0.262***	−0.270	−0.131***	−0.256**	−0.396***	−0.344**	−0.479***	−0.118
	(0.097)	(0.226)	(0.049)	(0.122)	(0.088)	(0.169)	(0.149)	(0.276)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	11,505	2,746	10,534	2,497	8,920	2,104	7,505	1,805
Pseudo R2	0.0106	0.0402	0.0116	0.0300	0.0195	0.0399	0.0313	0.0405

	Dependent variable: Probability of dying, by age-group							
Panel A: Girls	6–12 months		1–2 years		2–5 years		5–10 years	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Children alive	0.001	0.055	−0.059**	−0.079	−0.027	−0.096**	−0.028	0.093
	(0.036)	(0.079)	(0.029)	(0.062)	(0.031)	(0.044)	(0.029)	(0.092)
No males	−0.172	−0.108	−0.108	−0.212	−0.453***	−0.644***	−0.387***	−0.259
	(0.173)	(0.281)	(0.093)	(0.275)	(0.081)	(0.220)	(0.099)	(0.427)
No females	0.076	0.239	−0.430***	−0.267	−0.399***	−0.386*	−0.826***	−0.088
	(0.128)	(0.214)	(0.071)	(0.176)	(0.099)	(0.198)	(0.128)	(0.247)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes	No	Yes	No	Yes
Observations	11,403	2,544	10,542	2,348	8,876	1,960	7,391	1,651
Pseudo R2	0.0084	0.0184	0.0145	0.0228	0.0188	0.0253	0.0277	0.0468

Coefficients estimated using a logit regression model. Robust standard errors in parentheses (clustered at the village level); *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; For simplicity, the intercept is not reported. The number of children alive, as well as the fact that none of them are male or female, refer to the beginning of the period analyzed (at birth, 0, 1, 2, or 5 years). The first set of controls include parity, village, and period fixed effects. The second set of controls include mother's age, father's occupation, and father's literacy.

mortality differences between boys and girls would be indirect evidence of gender-discriminatory practices.

In contrast to what happened around birth, when having no surviving brothers is associated with the neglect of female infants (Beltrán Tapia and Marco-Gracia 2020), the sex composition of the siblings did not affect sex-specific mortality rates during the remaining first year of life. The number of siblings, however, seems to have reduced male mortality during the first six months. The mechanism behind this association is unclear, and it is difficult to judge whether it is produced by biological or behavioral considerations. Note, however, that this effect is visible even controlling for parity and mother's age, thus suggesting that nature is not the only driving force here. The analysis of those children born at high parities confirms that boys were somewhat prioritized before turning 6 months: not only was the effect of the number of surviving children even stronger but having no surviving siblings clearly benefited their chances of survival, an effect that is not visible for girls. We should stress again that the fact that boys are biologically more vulnerable makes detecting discriminatory practices more difficult. Moreover, it is very likely that the noncompetitive nature of breastfeeding protected both boys and girls alike during the first months. Although girls were clearly neglected right after birth, it seems that, once the child was accepted, the mother started breastfeeding, thus making discrimination less visible until weaning started.

Discriminatory practices resurfaced during the second year of life. While having no male or female siblings alive (regardless of their sex) reduced male mortality for the 1–2 age group, it did not influence female mortality at that age. Notice also that the coefficients on having no male siblings are much higher than those on having no female siblings. It appears that families were favoring boys when no other siblings (especially males) were alive in order to secure a male heir. The effect of discriminatory practices favoring boys is less visible from aged 2 onwards, probably because children at those ages are more robust, so this behavior did not translate into higher mortality rates. Although analyzing those children born at parity 4 or higher reduces sample size and thus reduces the accuracy of the estimates, it shows that the gender mortality gap created by the absence of male siblings during childhood is even larger at higher parities.

Conclusion

This study documents that gender discrimination increased female mortality (or reduced male mortality) during infancy and childhood in preindustrial Spain. Although the fact that boys are biologically more vulnerable during the first year of life makes detecting discriminatory practices more difficult, our evidence suggests that boys were somewhat prioritized during this early stage. However, breastfeeding appears to have protected boys and girls alike, thus mitigating the effect of discriminatory behaviors. Sex differences in mortality rates, however, became clearly visible as soon as children were weaned.

Stopping breastfeeding usually translates into higher mortality rates due to the increased incidence of gastrointestinal diseases associated with bad hygiene, the main cause of children's deaths. Access to solid foods also means competition for scarce resources. This turning point dramatically altered the sex-specific mortality patterns in our sample. First, while female mortality rates here behaved as expected and increased around the sixth to eighth month, male mortality rates did not suffer such worsening. Parents seem to have favored boys in terms of food and/or care and thus mitigated the negative effects of weaning, to the point that female exceeded male mortality rates. Second, although overall mortality rates decreased as children grew older, girls continued dying in higher numbers during childhood due to an unequal allocation of food, care, and/or workload within the household.[16] The female penalty was stronger for those children born in already-large families when additional children further strained household resources. The analysis of causes of death also suggests that girls' nutritional and health status was poorer because they died in greater proportion from diseases to which both boys and girls were exposed. Therefore, the allocation of resources within families harmed girls as soon as infants and toddlers began competing for resources. In a society close to subsistence levels where mortality was very high, minor differences in how these children were treated had lethal consequences for those less favored.

The mortality effects of discrimination are visible regardless of whether families had access to land or not, thus evidencing that these practices formed part of a widely shared cultural norm. Moreover, individual-level information shows that parents especially prioritized boys when there were no other male siblings alive in order to enhance the chances of securing a male heir. The results reported here actually underestimate the deadly effect of discriminatory practices, because our research strategy has excluded those individuals whose age of death was unknown, mostly due to migration. Given that these migrants were predominantly male, our conservative approach overestimates male mortality rates and therefore biases our results against the possibility of finding female excess mortality. Moreover, if the underregistration of deaths was affecting mortality rates, this issue would be more important for girls, especially very early in life.

These findings not only illustrate the mechanisms behind excess female mortality but also confirm that the high child sex ratios found in nineteenth-century Spain are not an artifact of the quality of the registers (Beltrán Tapia and Gallego-Martínez 2017, 2020). Although this article strongly challenges the notion that there were no missing girls in historical Europe, the analysis focuses on a small region in northeastern

Spain, so more research is needed to assess whether this behavior was also shared in other European regions. The evidence provided in other studies nonetheless suggests that these patterns were indeed more pervasive than it has been traditionally acknowledged (Tabutin 1978; Johansson 1984; Alter, Derosas, and Nystedt 2004; Oris, Derosas, and Breschi 2004; Beltrán Tapia and Raftakis 2019; Beltrán Tapia 2019; Beltrán Tapia et al. 2021). Accounting for the effect of potential discriminatory practices on mortality rates thus becomes of paramount importance for understanding the demographic transition (Harris and Ross 1987, 55). Not only were female mortality rates "unnaturally" high in some regions, but their decline could be partly explained by gradual changes in how parents treated their sons and daughters from the late nineteenth century onwards as the trade-off between the costs and benefits of child rearing evolved.

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Notes

1 See also Bohnert et al. (2012) for the United States.

2 Interestingly, Hynes (2011) and Hanlon (2016) consider that families could also target boys depending the circumstances.

3 The studied localities are: Alfamén, Aylés, Botorrita, Cosuenda, Jaulín, Longares, Mezalocha, Mozota, Muel, Torrecilla de Valmadrid, Tosos, Valmadrid, and Villanueva de Huerva.

4 Infant and child mortality rates before 1750 are too low, so under-registration of deaths is likely to be an issue. Although registration quality had been improving throughout the 18th century, the year 1774 was especially important: the priests in these villages received a pastoral visit conveying the orders from the Archbishop of Zaragoza. These mandates emphasized the importance of keeping accurate and detailed parish records. While registers before that date only reported the name of the parents, they then began to include that of grandparents and other relatives. Moreover, these records now reported not only where these people lived but also where they were born.

5 Due to the lack of information, data on occupations and literacy is missing for around one-quarter of the individuals. This scarcity is more important in the earlier periods and very low in the final years analysed here.

6 The Epiphany is one of the most important Catholic celebrations, so all villages gathered for the Misa Mayor.

7 Individuals who were born in the study area but migrated with their families as children have not been included in the analysis. We have no reason to believe that these families could be biased in their results since entire families, including male and female children, were migrating.

8 Analyzing a less restrictive sample including those individuals whose age of death is unknown makes the female death penalty even more visible. Results available upon request.

9 Although this evidence is anecdotical, it is interesting to note that a farmer lost his family estate in the late nineteenth century because he had to provide dowries for his eight daughters (Harding 1984, 103).

10 On infant and child mortality in Spain, see Gómez Redondo (1992), Dopico and Reher (1998), Ramiro-Fariñas and Sanz-Gimeno (2000), Cussó and Nicolau (2000), Reher and Sanz-Gimeno (2004), Llopis Agelán, Bernardos Sanz, and Velasco Sánchez (2015), and Pérez Moreda, Reher, and Sanz-Gimeno (2015).

11 In 1697, the synodal constitutions of the Archbishopric of Zaragoza established which ceremonies celebrated in the province involved a fee (and its amount). These constitutions were valid until 1943.

12 Figure A2 in the Appendix provide the whole picture.

13 Given that the abrupt change in mortality happens simultaneously for both boys and girls suggest that there were no differences in the duration of breastfeeding.

14 Boys' deaths, on the contrary, tend to result from respiratory diseases (if we discount those happening during the first weeks of life due to their greater vulnerability).

15 Although the evidence is limited, it seems that son preference was especially encouraged by the fathers. Although losing their father hardly affected girls' relative chances of survival, the death of their mothers worsened excess female mortality early in life (Reher and González-Quiñones 2003; Marco-Gracia 2021b).

16 Child abuse was also pervasive and it sometimes resulted in children dying (Tausiet 2001), so this could also have differentially affected boys and girls.

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