# The Effects of Social Value on Child Mortality: the Case of El Sagrario Parish, Zacatecas, México, 1835-1845*

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## Abstract

*The main objective of this paper is to reveal the effect of social value in child mortality in the city of Zacatecas, Mexico, between 1835 and 1845. The source of the data analysed was the departures of deaths of the parish of El Sagrario, and the statistical techniques of historical demography were used under the approach of demographic anthropology. The results indicated differences in the causes of mortality by sex, gender, and age. In neonatal mortality there was a greater number of deaths due to infectious processes (fevers), especially diseases related to the respiratory system, and there was a male predominance (53 per cent). From the second year of life female mortality has a predominance. Due to gastrointestinal infections, fevers, nutritional deficiencies, and epidemic diseases (measles), women recorded higher mortality (53 per cent), especially from measles. These results suggest that the cultural value attributed to gender had a fundamental role towards the care provided to children.*

## Introduction

Mortality is a demographic phenomenon that serves as an indicator of the level of health of societies, their conditions and quality of life, as well as the degree of development of a society.[2] This investigation tries to demonstrate the effects of social

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2 A. Chamberlain, *Demography in Archaeology*, (Cambridge, 2006); P. Hernández, 'La antropología demográfica o el estudio antropológico de los hechos vitales de la población', in A.B. Solis and L.G. Quintero (eds), *La Complejidad de la Antropología Fisica. Tomo I*, (Mexico City, 2011), pp. 245–66, https://mediateca.inah.gob.mx/islandora_74/islandora/object/libro:608 [accessed on 10 July 2022]; H. Behm and I. Behm, 'Las diferencias sociales ante la muerte infantil en América Latina', *Revista Chilena de Salud Pública* 19 (2015), pp. 88–95, https://doi.org/10.5354/0719-5281.2015.36389.

value in child mortality, especially in the causes of death between boys and girls five years of age and under. The case study is the parish of El Sagrario located in the city of Zacatecas, between the years 1835 and 1845.

Child mortality can be expressed differently in relation to sex, gender, and age. This is due to a combination of biological, social and environmental factors; it is also influenced by the lifestyle and behaviour of the mother. The differences in mortality by gender serve as an indicator of the roles of men and women in a society; they also tell us about their status.[3] In principle, sex and gender must be differentiated. Sex is defined by the differences between men and women determined at the time of their conception. These differences are enhanced in their later physiological development. Sex differences can be the characteristics of the chromosome and sex organs. Gender, on the other hand, refers to the activities, behaviour and attitudes attributed to people according to their biological sex, it is a learned cultural behaviour that varies according to the society under study.[4]

According to biological sex, in neonatal mortality there are a greater number of deaths in men than in women, especially within 24 hours after birth. The possible cause of this difference may be genetic factors, related to the X chromosome (XX women, XY men). Men are more vulnerable to X-linked recessive disorders; women are protected from them, because they may contain the copy of another normal chromosome. The X chromosome contains genes that influence the proper functioning of the immune system, also related to female hormones. This contributes to a greater resistance of women to contracting infectious diseases. Also, boys tend to be born larger than girls, which affects the difficulties during childbirth. Therefore, the risk of death for both mother and child is higher when the baby is a boy.[5]

3 See A. Hinde, 'Sex differentials in mortality in nineteenth-century England and Wales', paper presented at the Economic History Society Conference, Cambridge, April 2011; and G.L. Drevenstadt, E.M. Crimmins, S. Vasunilashorn and C.E. Finch, 'The rise and fall of excess male infant mortality', *Proceedings of the National Academy of Sciences of the United States of America* 105 (2008), pp. 5,016-21, https://doi.org/10.1073/pnas.0800221105.

4 G.J. Armelagos, 'Introduction: sex, gender and health status in prehistoric and contemporary populations', in A.L. Grauer and P. Stuart-Macadam (eds) S*ex and Gender in Palaeopathological Perspective* (Cambridge, 1998), pp. 1-10, https://assets.cambridge.org/97805210/21210/excerpt/9780521021210_excerpt.pdf.

5 I. Waldron, 'Sex differences in human mortality: the role of genetic factors', *Social Science and Medicine* 17 (1983), pp. 321-33, https://doi.org/10.1016/0277-9536(83)90234-4; J. Fischer, N. Jung, N. Robinson and C. Lehmann, 'Sex differences in human responses to infectious diseases', *Infection* 43 (2015), pp. 399-403, https://doi.org/10.1007/s15010-015-0791-9; M.A. Eoghan, M.P. Geary, M.P. O'Connell and D.P. Keane, 'Effect of fetal sex on labour and delivery: Retrospective review', *British Medical Journal* 326 (2003), p. 137, https://doi.org/10.1136/bmj.326.7381.137.

Boys have higher mortality from most causes of death, but there are certain causes that are especially influenced by sex differences. Girls have more vigorous immune responses and greater resistance to infection, so they have lower mortality from infections and respiratory diseases. Boys are usually born at a shorter gestation period than girls. Their lungs are underdeveloped and make them more susceptible to infectious diseases during the first months of life.[6]

Child mortality by gender might be different. Many countries and societies report higher female mortality due to living conditions, undernutrition, and limited access to health and care by the parents of girls.[7] The preferential treatment of the child cannot be argued in every case that female mortality exceeds male mortality, but several studies have found that boys had more nutritious diets, were breastfed longer than girls, and had better access to medical treatment when they became ill.[8]

Social value is related to the economic value of children by gender. In the past in most societies (and in the present in some societies), boys represented a better investment because they could start working at an early age (around 10 years old) and thereby generate income for the family. They also were favoured by property and inheritance rules and they could ensure the continuity of the family name. In contrast, girls presented a cost for the dowry necessary to marry that made them a burden for the family resources. They could work at later ages, but after they married they would no longer contribute to the income of their natal family. Gender discrimination against girls is reflected in female excess mortality, especially after weaning ages, when the allocation of food becomes unequal between boys and girls. The social value of girls and boys will determine the types and quality of food supply, the duration of

6 Waldron, 'Sex differences in human mortality'; Drevenstadt *et al*., 'Rise and fall of excess male infant mortality'.

7 Waldron, 'Sex differences in human mortality'; F.J. Beltrán Tapia and D. Gallego-Martínez, 'Where are the missing girls? Gender discrimination in 19th-century Spain', *Explorations in Economic History* 66 (2017), pp. 117–26, https://doi.org/10.1016/j.eeh.2017.08.004; E.A. Hammel, S.R. Johansson and C.A. Ginsberg, 'The value of children during industrialization: sex ratios in childhood in nineteenth-century America', *Journal of Family History* 8 (1983), pp. 346–66, https://doi.org/10.1177/036319908300800404; S. Stinson, 'Sex differences in environmental sensitivity during growth and development', *Yearbook of Physical Anthropology* 28 (1985), pp. 123–47.

8 Stinson, 'Sex differences in environmental sensitivity'; P. Hernández and L. Márquez, 'Los niños y la niñas del antiguo Xochimilco: un estudio de mortalidad diferencial', *Revista Española Antropología Física* 31 (2010), pp. 39–52; Beltrán Tapia y Gallego-Martínez, 'Where are the missing girls?'; F.J. Marco-Gracia and F.J. Beltrán Tapia, 'Son preference, gender discrimination and missing girls in rural Spain, 1750-1950', *Population and Development Review* 47 (2021), pp. 665-89, https://doi.org/10.1111/padr.12406.

breastfeeding and the parental investment in sons and daughters, especially in times of crisis.[9]

## Historical context

The city of Zacatecas is located in the state of the same name, in the central north of Mexico (Figure 1), its altitude is 2,400 m above sea level. It was founded on 8 September 1546, due to the great production of silver, and was granted the category of city by the Spanish monarch Felipe II in 1585. It was one of the main commercial cities of the viceroyalty and one of the obligatory transit points of the New Spain communication network.[10]

Zacatecas was built in a place that was not feasible for agriculture, it depended on other sites for food provision, mainly from Michoacán and the Bajío area. Since its foundation, the water supply was a serious problem, there were public structures for water access, the sources for which were the rain and water provided by *norias*.[11] The economic activities were mining, agriculture, livestock and commerce; the mining determined the growth of the regional economy.[12]

El Sagrario parish initially had a provisional character in the newly founded city of Zacatecas, it was an adobe temple built on the land of Cerro de la Bufa between 1567 and 1585. The Virgin Mary was the main patron saint: she was called Our Lady of the Zacatecas. In 1605 the temple had to be demolished due to its deterioration; reconstruction lasted from 1612 to 1625. In 1689 it was almost completely destroyed by fire. In 1718 the current parish began to build a new temple, which consisted of

9 Armelagos, 'Introduction: sex, gender and health status'; L.C. Chen, E. Huq and S. D'Souza, 'Sex bias in the family allocation of food and health care in rural Bangladesh', *Population and Development Review,* 7 (1981), pp. 55-70, https://doi.org/10.2307/1972764; Hammel *et al.*, 'The value of children during industrialisation', M. Koenig and S. D'Souza', 'Sex differences in childhood mortality in rural Bangladesh', *Social Science and Medicine* 22 (1986), pp. 15-22, https://doi.org/10.1016/0277-9536(86)90303-5; E. Recéndez, 'Vicisitudes familiares en el Zacatecas del Siglo XVIII: el caso de los Izquierdo Gutiérrez', *Procesos Históricos: Revista de Historia y Ciencias Sociales,* 28 (2015), pp. 39-51; Marco-Gracia and Beltrán Tapia, 'Son preference, gender discrimination and missing girls'.

10 F. Langue *Los Señores de Zacatecas: una Aristocracia Minera del Siglo XVIII Novohispano* (Mexico City, 1999).

11 P.J. Bakewell, *Minería Sociedad en el México Colonial Zacatecas (1546-1700)* (Mexico City, 1984); M. Ruiz, 'La salud y la costumbre a finales del siglo XVIII', in E. Hurtado Hernández (ed.) *La Ciudad Ilustrada: Sanidad, Vigilancia y Población, Siglos XVIII y XIX* (Mexico City, 2011), pp. 91–113; J.L. Raigoza, 'Salubridad en el Zacatecas colonial', in Hurtado Hernández, *La Ciudad Ilustrada*, pp. 17–34. *Norias* were waterwheels used to raise water into aqueducts.

12 J. Flores Olague, *Breve Historia de Zacatecas* (San Diego, CA, 2003); H. Cross, 'The mining economy of Zacatecas, Mexico in the nineteenth century' (unpublished PhD thesis, University of California Berkeley, 1970).

three naves when it was solemnly dedicated from 14-17 August 1752. Its first tower was finished on 5 January 1782. The second tower was built by the master Dámaso Muñetón until 1904. The colonial dome was replaced in 1844 by another that imitated the Loreto temple of Mexico City. In 1862 it obtained the rank of cathedral (Figure 2).[13]

**Figure 1** **Map showing location of state of Zacatecas**


**Source**: MéxicoReal, Estado de Zacatecas de la República Mexicana [n.d.] http://mr.travelbymexico.com/759-estado-de-zacatecas/ [accessed 17 February 2020].

The houses of the main lords of Zacatecas, as well as the Plaza Mayor, were in the vicinity of El Sagrario parish. The construction material of these houses was of higher quality: the facade of the typical house was made of stone, it had two floors, a store, a back room, a farmyard and a vegetable garden. The owners of these houses were wealthy merchants, miners, and officials.[14]

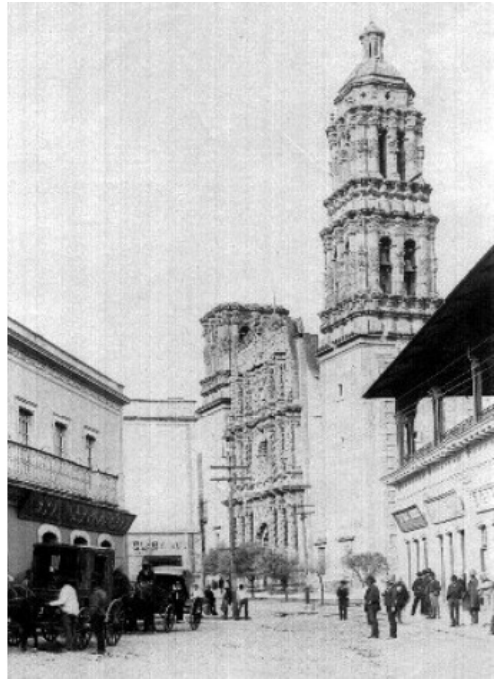
The places destined for the burials of the people who died in Zacatecas were El Sagrario parish, La Vieja Veracruz Hospital, La Merced, La Inmaculada Concepción (Santo Domingo), the San Francisco Temple and the Patronage Church. However, in

13 Bakewell, *Minería Sociedad en el México Colonial Zacatecas*; E. Amador, *Bosquejo Histórico de Zacatecas* (Zacatacas, Mexico, 1892); M. Toussaint, 'La catedral de Zacatecas y el arte del virreinato', *Anales del Instituto de Investigaciones Estéticas* 12 (1975), pp. 11–20.

14 F. García González, *Familia y Sociedad en Zacatecas: la Vida de un Microcosmos Minero Novohispano 1750-1830* (Mexico City, 2000), pp. 42–103.

1833, due to the cholera epidemic, the state government found it necessary to build cemeteries outside the city. The cemeteries created were Bracho and Del Refugio. At first the Del Refugio cemetery had a provisional character specifically for burying those who died from the epidemic, however in 1834 formal construction began on a site towards the south of the city in an uninhabited area called Isabelica. Three chapels were built, two to bury the corpses in drawers or tombs and one to celebrate mass. The rest of the land was destined for 'charity burials'. El Sagrario parish was in charge

**Figure 2 Catedral of Zacatecas around 1900**



**Source:** Mediateca Instituto Nacional de Antropología y Historia, *Gente Frente a la Catedral de Zacatecas* [n.d.] https://www.mediateca.inah.gob.mx/repositorio/islandora/object/fotografia%3A369557 [accessed 1 April 2022].

of carrying out the registration of the burials. Rich and poor alike were buried in this cemetery. Due to the growth of the city, it was closed in 1884.[15] The deaths of children under six years of age analysed in this study belong to the charity books of the Del Refugio cemetery.

The population of Zacatecas fluctuated in relation to booms and crises in the mining industry. Its ethnic composition according to the civil register of 1826 was 21 per cent creoles and peninsular, 26 per cent indigenous and 53 per cent castes, with a greater number of mulattoes.[16] According to the census of the government of the State of Zacatecas of 1828, the city of Zacatecas had a population of 15,991 people, of which approximately 2,810 were under five years of age. The figure is tentative because children were often not counted in censuses for census purposes (military recruitment) and the ages given by relatives were approximate.[17]

The Zacatecas intendency was established in 1799; it divided the city into four major barracks, subdivided in two smaller barracks in each. The purpose of the intendency was a better administration of justice and public order.[18] The growth of the city went north and south, and it maintained its structure and its organization by barracks during the first half of the nineteenth century.[19] The barrack analysed for this investigation was number 3, where the parish of El Sagrario was located. According to the record of Francisco Delgadillo, in barrack 3 around 355 families lived, distributed in 324 houses. In total there were 1,770 people; the average age was 27 years, and 75 per cent were aged between 0 to 39 years. There were 120 children aged 0-4 years (58 boys and 62 girls).[20] Most of the population of Zacatecas was buried in Del Refugio cemetery.

15 A. Medina and B. Contreras, *El Camposanto* '*Del Refugio*' *y el Cólera Morbus en la Ciudad de Zacatecas (1834-1840): Apuntes para su Historia* (Zacatecas, Mexico, 2011), pp. 15–44.

16 García González, *Familia y sociedad en Zacatecas*, p. 113.

17 García González, *Familia y sociedad en Zacatecas*; S. Toledo and H. Klein, 'La población de la ciudad de Zacatecas en 1857', *Historia Mexicana* 42 (1992), pp. 77–102; see also A. von Humboldt, *Ensayo Político sobre el Reino de la Nueva España* (Paris, 1822), https://archive.org/details/ensayopoliticos00arnagoog/page/n9/mode/2up [accessed on 12 July 2022].

18 Google Arts and Culture, *Map of the Zacatecas Intendancy* [n.d.] https://artsandculture.google.com/story/map-of-the-zacatecas-intendancy/xAICQSRoLfhIJg writes: '[i]n the 18th [c]entury, the Spanish crown divided The Viceroyalty of New Spain into 12 intendancies in order to have more control over the tax collection and the political landscape'.

19 R. Garner, *Zacatecas, 1750-1821: the Study of a Late Colonial Mexican City* (Michigan, 1970); Toledo and Klein, 'Población de la ciudad de Zacatecas en 1857'; Langue, *Los Señores de Zacatecas*; F. García González, 'Vida cotidiana y cultura material en el Zacatecas colonial', in P. Gonzalbo Aizpuru (ed.), *Historia de la Vida Cotidiana en México,* Vol. 3 (Mexico City, 2005), pp. 45–70; Ruiz, 'La salud y la costumbre'.

20 García González, *Familia y Sociedad en Zacatecas*, pp. 118–22.

The political situation in Mexico during the first half of the nineteenth century was characterized by instability and constant internal warfare, mainly between the protagonists of two types of government, centralist and federal. Zacatecas supported a federal government, had a large army, and fought against the centralist government of Antonio Lopez de Santa Anna. The result of the battle was the defeat of Zacatecas in May of 1835.[21] As punishment the centralist government systematically stripped what had become the state of Zacatecas of its most effective resources, especially taxes. It took over the administration of La Casa de Moneda (the mint) and later acquired the tobacco tax agencies, which were the main money generator for the state.[22] As a consequence, economic instability led to an increase in the cost of basic products, most notably corn (the staple food of the population) which rose from 21.7 to 29.7 *reales* per bushel.[23]

## The role of women in historical Mexico

The Catholic Church had a conception of women linked to medieval theology, which saw women as the source of all evils, and justified their subordinate position to men by their fragility, their inferiority, and their need to be guided and controlled. In a family, the natural position of the woman was to stay at home and take care of the housework, while the man provided for the maintenance of the whole family. This vision was transferred to the New World during colonisation, and the clergy tried to apply the model to indigenous women, who were considered more fragile due to their indigenous condition.[24]

In the first year of their life the children were with the mother. According to historical information, the feeding of the child in Mexico during the colonial period and part of the post-independence period resulted from the conjunction of the mixture of indigenous and Spanish traditions. The main diet was breast milk for at least 12 to 15 months of life. After this stage, the child was weaned by his or her mother, who provided him or her with small amounts of food such as 'atole', tortillas, vegetables,

21 Flores Olague, *Breve Historia de Zacatecas*, pp 110–11.

22 E. Martínez Rivera, 'La Casa de Moneda de Zacatecas: del antiguo régimen a la federación', in A. Hernández Chávez and M. Teran Fuentes (eds), *Federalismo, Ciudadanía y Representación en Zacatecas*, (Zacatecas, Mexico, 2010), pp. 165–86.

23 See Cross, 'Mining economy of Zacatecas'.

24 See P. Gonzalo Aizpuru, 'Mujeres y familias en el México colonial: con amor y reverencia', *Anuario de Historia de América Latina* 35 (1998), pp. 1–24; C. Pizzigoni, ' "Como frágil y miserable": las mujeres nahuas del Valle de Toluca', in Gonzalbo Aizpuru, *Historia de la Vida Cotidiana en México,* Vol. 3*,* pp. 501–29.

and cocoa.[25] It was believed that the child should eat little, so the mothers chose minimal portions of the family food that was not always of the best biological quality. Chocolate and 'atole' were consumed by mothers to 'increase and thicken the milk', though the use of chocolate was restricted for children.[26] In New Spain, the nannies and wet nurses settled in the homes that required them, they could even take their own children with them. The availability of black or mulatto slaves and Indian or mestizo girls made this resource within the reach of many women.[27]

The gender distinction between boys and girls was learned after the three years of life, when education began. The girls were educated in home or schools called 'amiga', where they were taught to memorise the catechism, to be obedient, to be silent, to read and rarely to write. They learned sewing, embroidery, and weaving, skills that could make them good housewives and mothers. On the other hand, the boys learned to read different types of letters, to carry out basic arithmetic operations, to add, subtract and multiply. They were taught useful professions and habits of responsibility. In Zacatecas, boys were able to work from the age of ten years in the mines; other professions were shoemakers, masons and carpenters. They could complete their education in convents and schools in the city.[28]

It is necessary to clarify that the life of women in the cities and rural communities was different. The women who lived in the countryside were still subjected to traditional customs. They collaborated in agricultural work, they dedicated most of their time to heavy household tasks in which they were trained since childhood, such as carrying water or firewood, lighting the fire, and maintaining it during the day, making dough and preparing tortillas. Indigenous marriages were performed at puberty—between ages 15 and 17 years—and young women waited for their relatives to find partners for them. On the other hand, the women from cities like Zacatecas, while living in the houses of their parents, were to an extent protected from the need to carry out domestic duties: they could dedicate themselves to feminine tasks that would serve them for marriage. At 12 years old they were considered maidens; they were considered in this way until they got married. Some entered female convents; the more affluent could be distracted with visits, walks, and devotions; while poor women had to integrate into work activities, mainly as servants.[29]

25 M. Rodríguez Pinto, 'La pediatría durante la Colonia en México', in I. Ávila Cisneros, F. Padrón Puyou, S. Frenk and M. Rodríguez Pinto (eds), *Historia de la Pediatría en México* (Mexico City, 1997), p. 283. 'Atole' is a traditional Mexican corn-based drink.

26 See Rodríguez Pinto, 'La pediatría durante la Colonia', p. 283.

27 P. Gonzalbo, *Vivir en Nueva España: Orden y Desorden en la Vida Cotidiana* (Mexico City, 2009), pp. 112–15.

28 See Gonzalbo, *Vivir en Nueva España*; Pizzigoni, ' "Como frágil y miserable" '; García González, *Familia y Sociedad en Zacatecas*.

29 See Gonzalbo, *Vivir en Nueva España*.

At the beginning of the nineteenth century, the population of the city of Zacatecas was feminised. This was true especially during the mining crises, when the male population left the city in search of work in other cities. This situation made the marriage market for women difficult; they were forced to marry men whose qualifications and ability to support a family were less certain. The situation varied by social class. The wealthy Spanish maidens had the best dowry; their marriages were arranged by their families, usually to men of high standing, and almost always the groom was considerably older than the bride. The poorer young women were left to marry the less attractive possibilities, defined on the basis of ethnicity, professional ability and family support.[30] Some women, however, found even attracting such partners difficult. According to the historical data from Zacatecas, most of the unmarried women were those whose parents had died before they got engaged or who did not have a dowry. There were few options available to these women: they could remain single or enter a convent in the city.[31]

This situation implied different behaviours for taking care of children according to the financial situation of the family. Differences are expected to be found especially during times of mining and food crises.

## Materials and methods

The materials used for this study are the parish records of El Sagrario from 1835 to 1845. The death certificates are from Del Refugio cemetery, founded in 1833 on the outskirts of the city after the cholera epidemic. The parish records were used to construct mortality rates. There are certain limitations with this source. The denominators for the mortality rates were obtained from registers of baptisms instead of births, which presents a difficulty if there was a large interval of time between birth and baptism, since the children who died in that time would not be registered in the baptismal certificates. However, in the Mexican case, there was great concern about the fate of children's souls, so baptism was carried out in the shortest possible time, often immediately after birth. Thus is it likely that the vast majority of infant deaths took place after baptism.[32] There could also be omissions in the parish registers when the priest became ill or died. Parents may deliberately not have declared the birth of stillborn children. Finally, in the case of epidemics there could be a delay in the

30 This description is adapted from Gonzalbo, *Vivir en Nueva España.*

31 See Recéndez, 'Vicisitudes familiares en el Zacatecas'.

32 L. Henry and A. Blum, *Techniques D'Analyse en Démographie Historique* (Paris, 1988); C. Morin, 'Los libros parroquiales como fuente para la historia demográfica y social novohispana', *Historia Mexicana* 21 (1972), pp. 389–418.

transcripts. Against these limitations, an advantage of the El Sagrario archive is that the death registers include the cause of death, age, and sex of the deceased.

The methods employed were the statistical techniques of historical demography under the focus of demographic anthropology. With the information of sex, age, cause of death, date of deceased and burial place was built a database in Excel covering the deaths of all those aged under six years of age. The infant mortality was then obtained as the total number of deaths of children under one year of age during a certain year or period divided by the number of live births of that same year or period.[33]

The sex ratio of births is the number of males born per 100 females; the universal norm is about 105 boys per 100 girls. If there is a discrepancy it could suggests a sex preference.[34] The age of the individuals was divided into seven categories: the first is from zero to 28 days, which represents neonatal mortality; the second is from one month to just under one year (infant mortality); the third is from one year to just under two years; the fourth is the two-year age group; the fifth is the three-year-olds; the sixth the four-year-olds and the seventh the five-year-olds. This grouping was carried out with the objective of elucidating the mortality in a more specific way.

The classification of the causes of death was made based on the World Health Organization's International Classification of Diseases, which was modified according to the causes found in the parish register and the diseases described in a book of Venegas (professor of medicine) from 1785 entitled *Compendium of Medicine: or Medical Practice*. With this information the classification was: (1) fevers, (2) viral diseases, (3) respiratory infections, (4) gastrointestinal infections, (5) nutritional deficiencies, (6) complications related to childbirth, (7) diseases related to the eruption of teeth and weaning processes, (8) congenital abnormalities, (9) infections in the nervous system, circulatory and genitourinary system, (10) skin diseases, (11) accidents and (12) indeterminate conditions.

## Results

The data come from the period 1835-1845. More exactly, we have continuous series of data for two periods: the first from 21 April 1835 to 24 May 1838; the second from 7 April 1841 to 31 December 1845. In these two periods there were a total of 2,528 children's deaths at ages up to and including five years. The general distribution of age at death by sex is presented in Figure 3. Deaths at ages under two years have a male predominance, after two years there are more female deaths than male. The number

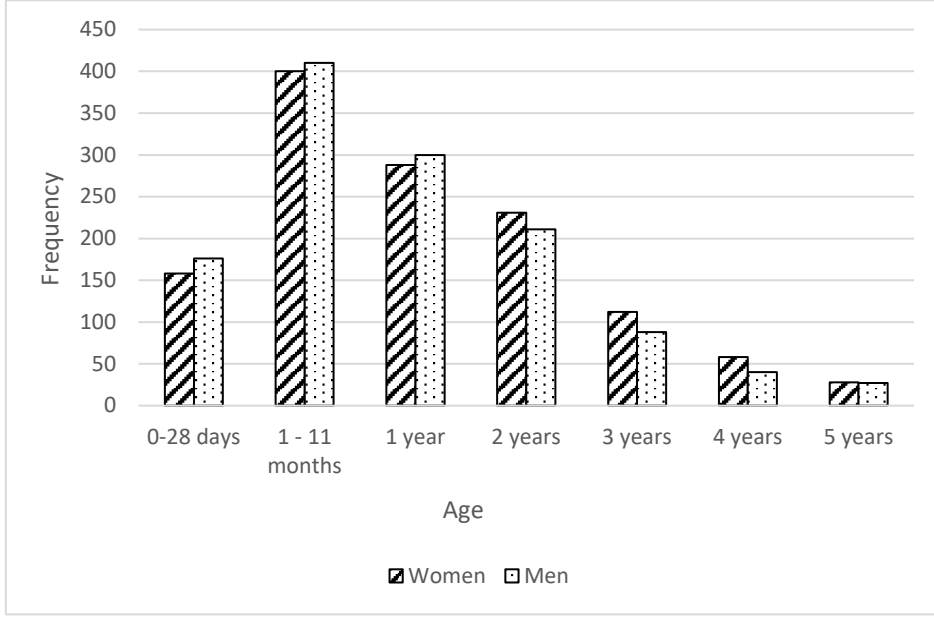
33 Henry and Blum, *Techniques D'analyse en Démographie Historique*.

34 J. Lazarus, 'Human sex ratios: adaptations and mechanisms, problems and prospects', in I.C.W. Hardy (ed.) *Sex Ratios: Concepts and Research Methods* (Cambridge, 2002), pp. 287-313; G. Hanlon, 'Routine infanticide in the West 1500-1800', *History Compass* 14 (2016), pp. 535–48, https://doi.org/10.1111/hic3.12361.

of deaths by sex and year of study (ignoring the years without information) is presented in Figure 3. The greatest proportions of female deaths were in 1836 and 1841. In 1836 there was a measles epidemic and in 1841 the *Actas de Cabildo* reported a drought and high temperatures.[35]

Baptismal records were available for the years 1835-1837 and 1841-1844. Hence infant death rates could only be calculated for these years (Figure 5). There were differences between male and female infant mortality in relation to the years of registration, suggesting that socioeconomic, cultural, and environmental variables had an effect on infant mortality, not only biological variables. If the male-female

**Figure 3** **Distribution of deaths by age group and sex, Zacatecas, Mexico, 1835-1845**

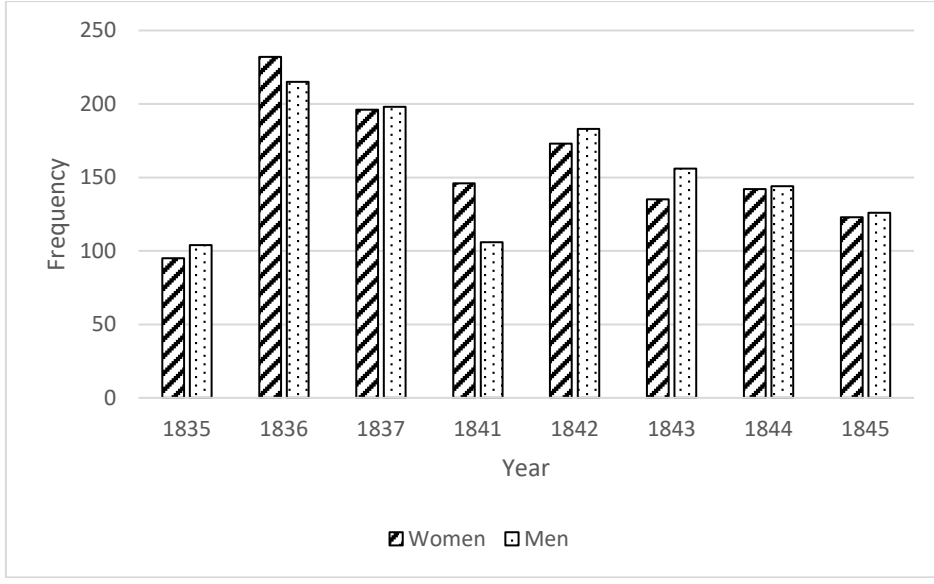



**Note:** Data are available for the periods 21 April 1835 to 24 May 1838, and from 7 April 1841 to 31 December 1845.

**Source:** Parish records of Zacatecas, Mexico.

35 The *Actas de Cabildo* were the minutes or records of the local authority. The *Cabildo* was the local government council.

**Figure 4** **Deaths at ages 0-5 years by sex and calendar year, Zacatecas, Mexico, 1835-1845**




**Note:** Data are available for the periods 21 April 1835 to 24 May 1838, and from 7 April 1841 to 31 December 1845.

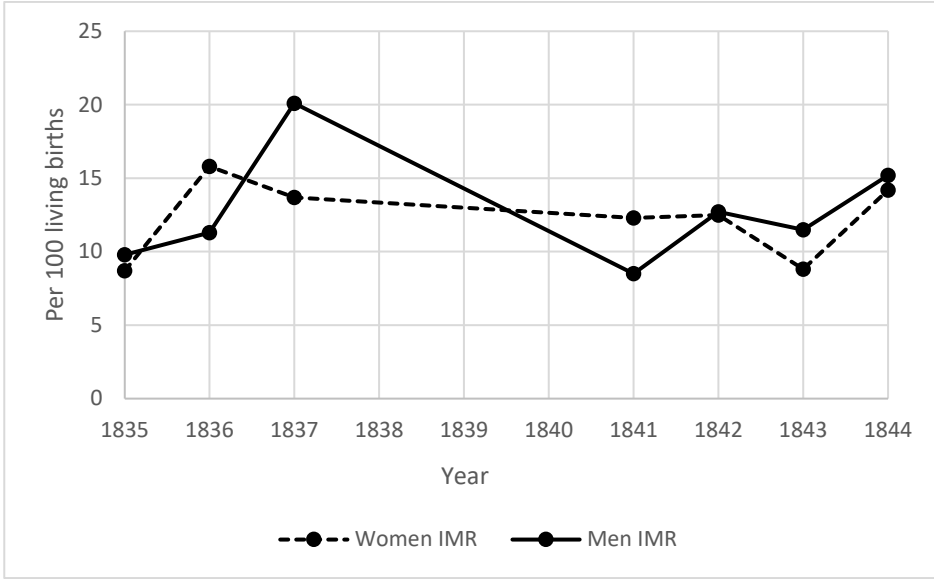
**Source:** Parish records of Zacatecas, Mexico.

differential in infant mortality has been a biological difference due entirely to genetic factors related to chromosomes, each year we should see a higher male than female mortality, which it was not always true. In 1836, for example, female infant mortality was higher than male infant mortality, according to the causes of death, there was a measles epidemic that caused more deaths in girls under one year old. In 1837 the opposite sex differential in mortality is seen.

It is interesting to observe the sex ratios of births. The universal norm is 105 males per 100 females, because there is a tendency to have more male births than female births to compensate for the higher male mortality in the postnatal life.[36] The sex ratio of births in El Sagrario was 94 males per 100 females in 1835, 106 males per 100

36 See Hanlon, 'Routine infanticide in the West'; S.H. Orzack, J.W. Stubblefield, V.R. Akmaev and J.E. Zuckerman, 'The human sex ratio from conception to birth', *Proceedings of the National Academy*

**Figure 5** **Infant mortality rates (IMRs) by sex and year of study, Zacatecas, Mexico, 1835-1845**




**Note:** The available data only allow the calculation of IMRs for the years 1835-1837 and 1841-1844.

**Source:** Parish records of Zacatecas, Mexico.

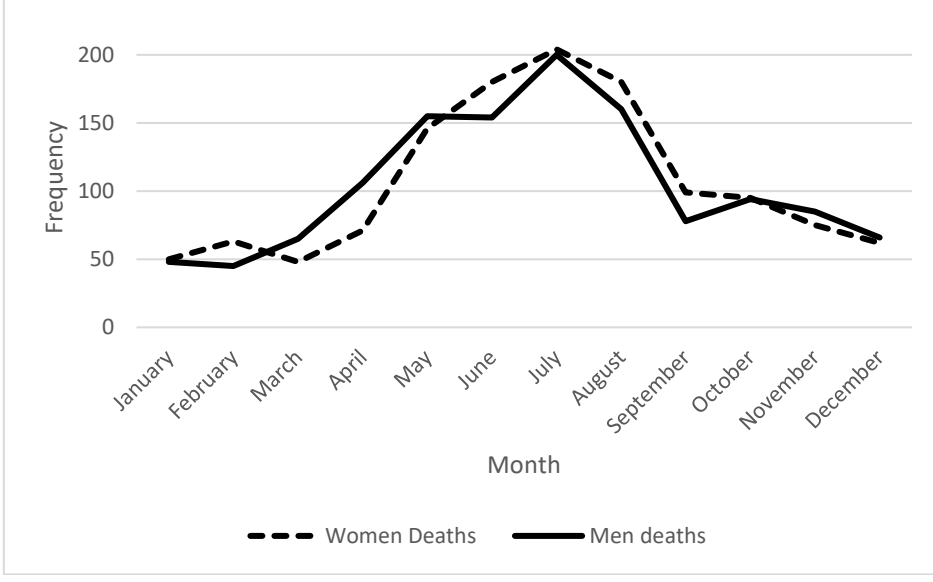
females in 1836, 102 in 1837, 110 in 1841, 97 in 1842, 95 in 1843 and 102 in 1844. While small numbers will produce random variation, it is noteworthy that the years of highest relative female infant mortality of 1836 and 1841 coincide with the years when there were substantially more births of boys than girls.

Mortality, as well as births and marriages, varies throughout the year. All three are influenced by factors such as seasonal changes in the climate, agricultural work, and by religious prohibitions. In this study, seasonal mortality among those aged five years and under is analysed to observe the impact of these factors (Figure 6). The highest mortality in both sexes occurred during summer. Mortality increased in May, when temperatures in the city of Zacatecas (both now and in the past) are highest (mean

*of Sciences* 112,16 (2015), pp. E2,102- 111, https://doi.org/10.1073/pnas.1416546112; Lazarus, 'Human sex ratios'.

daily maximum 32°C).[37] The reason for the mortality peak during summer might be because food shortages during these months raised the price of basic products. This particularly affected people's standard of living and among them children were more vulnerable to developing malnutrition due to the distribution of food within the family, where children, especially girls, received food last.[38]

**Figure 6** **Monthly distribution of deaths at ages five years and under by sex: Zacatecas, Mexico, 1835-1845**




**Note:** Data are available for the periods 21 April 1835 to 24 May 1838, and from 7 April 1841 to 31 December 1845.

**Source:** Parish records of Zacatecas, Mexico.

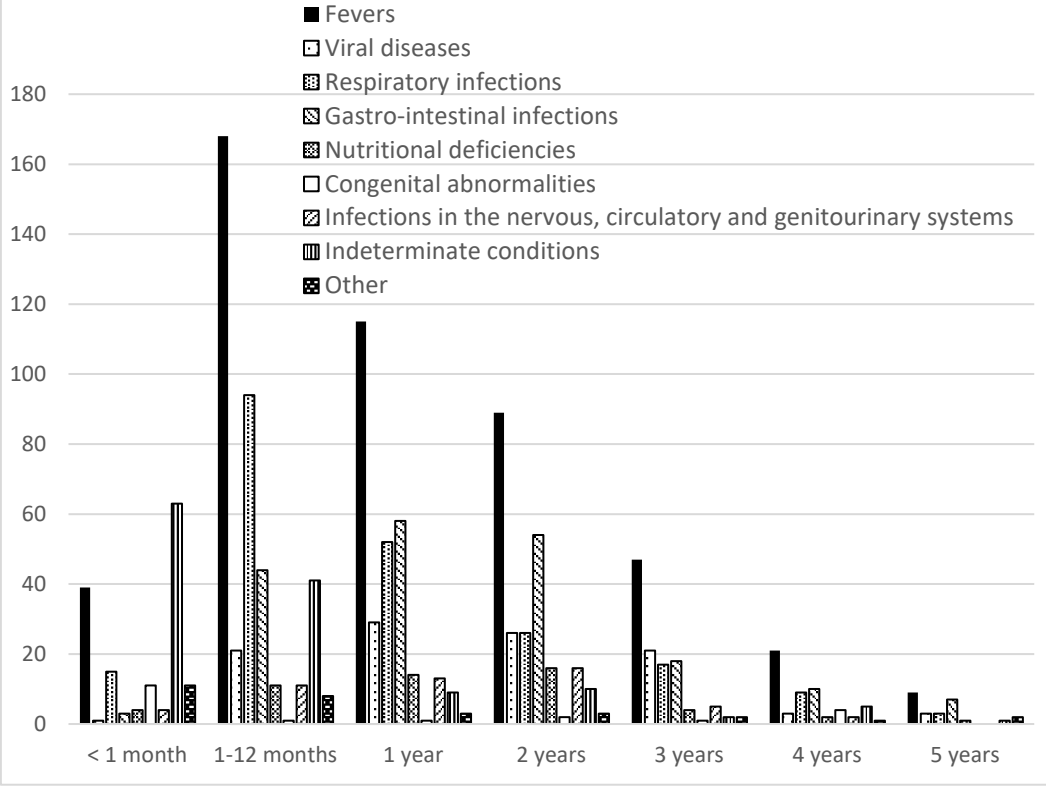
The distribution of causes of deaths by sex and age group helps to clarify the interrelationships among biological, cultural, socio-economic and environmental

37 See E. Amador, *Bosquejo Histórico de Zacatecas*, (Mexico City, 1892).

38 E. Florescano, *Origen y Desarrollo de los Problemas Agrarios de México 1500-1821*, Lecturas Mexicanas, (Mexico City, 1986); Armelagos, 'Introduction: sex, gender and health status'; see also Marco-Gracia and Beltrán, 'Son preference, gender discrimination and missing girls'.

factors in the mortality of children at ages five years and under. We present this by age at death for girls (Figure 7) and boys (Figure 8).

**Figure 7 Distribution of deaths by age and cause of death for females: Zacatecas, Mexico, 1835-1845**



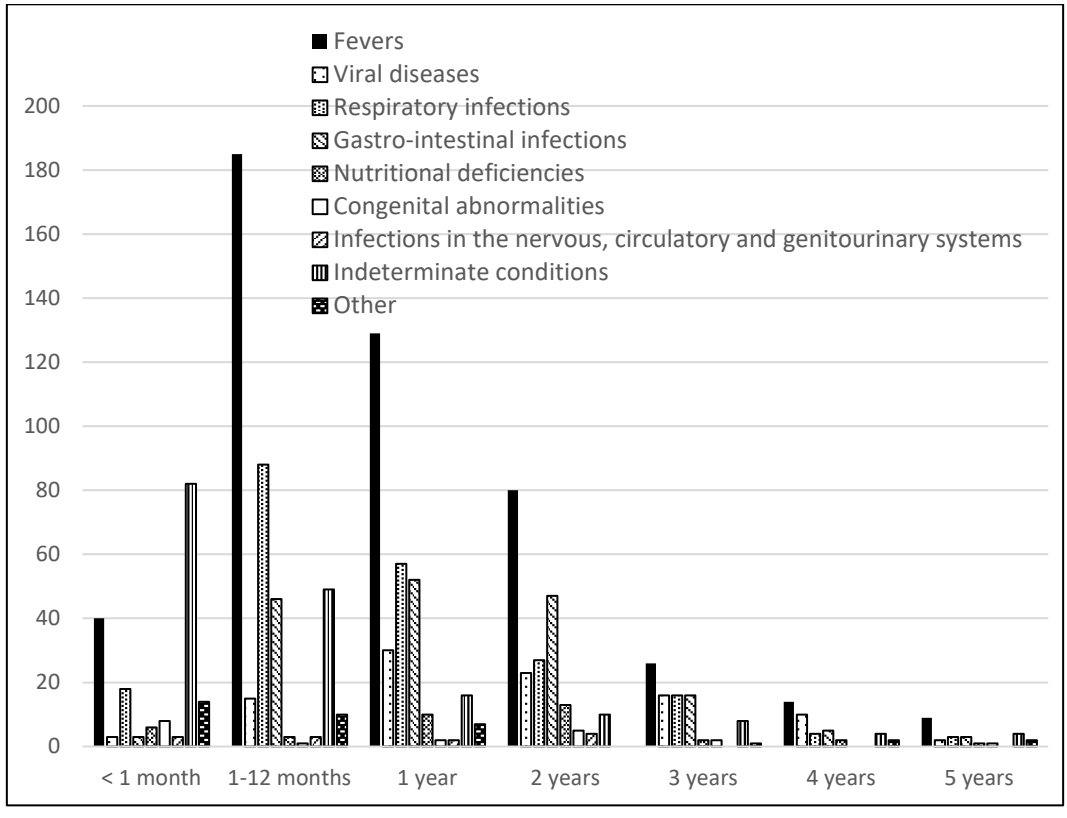

**Note:** Data are available for the periods 21 April 1835 to 24 May 1838, and from 7 April 1841 to 31 December 1845.

**Source:** Parish records of Zacatecas, Mexico.

Figures 7 and 8 show that the main cause of death in both male and female neonatal mortality was 'indeterminate conditions'. In this category what was actually recorded

in the data were the words '*se ignora*', which mean 'unknown'. This could include rapidly developing deadly diseases like umbilical tetanus, as the neonatal period coincides with the incubation period of the *clostridium tetani* bacterium (3 to 28 days). Other Mexican studies have found umbilical tetanus to be the main cause of neonatal death; for example Pilar Hernández, who analysed Hermosillo in Sonora state in 1898

**Figure 8** **Distribution of deaths by age and cause of death for males: Zacatecas, Mexico, 1835-1845**




**Note:** Data are available for the periods 21 April 1835 to 24 May 1838, and from 7 April 1841 to 31 December 1845.

**Source:** Parish records of Zacatecas, Mexico.

found that umbilical tetanus caused 32 per cent of neonatal deaths.[39] In Santiago de Querétaro parish between 1838 and 1858, a condition called '*alferecía*' was found to be the main cause of neonatal death. Luz María Espinosa and Liliana Ruiz, the authors of the study, related '*alferecía*' to umbilical tetanus because one of its symptoms is convulsive fever; this disease caused the death of 42 per cent of those who died at ages under 28 days, of whom 81 per cent died in the first two weeks of life.[40] Likewise, Eilidh Garrett and Ros Davies, who studied the Isle of Skye, Scotland, in 1880 found that the probable cause of neonatal deaths was umbilical tetanus, although it was not explicit in the causes of death.[41] The bacteria are contracted when the umbilical cord is cut with dirty instruments; the disease is therefore related to unsanitary conditions. It is common when there are animals near the houses, which was a characteristic of nineteenth century Mexican homes.[42]

The main cause of death in the other age groups was fever, possibly typhoid fever due to the unsanitary conditions of the city of Zacatecas at that time. Between ages 1 month and 3 years the next most common causes of death were respiratory infections and gastro-intestinal infections. The post-neonatal mortality related to fevers might be meningitis. Children born to mothers with tuberculosis often develop the disease in the first months of life. One of the forms of meningitis is rapid (bacterial meningitis), it happens in hours or days, while tubercular meningitis manifests in days or weeks. This disease is characterised by high temperatures in the body, convulsions and stiff neck, as well as a great lethality.[43] Luz María Espinosa and Liliana Ruiz also found that causes of post-neonatal mortality were related to meningitis, tooth eruption, and worms.[44]

The distribution of causes of death for boys and girls was broadly similar (Figures 7 and 8). The main differences between the sexes were, first, that accidental and violent deaths were more common in boys than in girls: specific accidental causes of death were 'his mother drowned him' and 'suffocation', the second of which could refer to

39 P.O. Hernández Espinosa, 'El sarampión y la mortalidad infantil en el distrito de Hermosillo en 1898: un ensayo de antropología demográfica', *Cuicuilco: Revista de la Escuala Nacional de Antropología y Historia* 22,63 (2015), pp. 273-92, here at pp. 285–6.

40 L.M. Espinosa Cortes and L. Ruiz Arregui, 'Morir por "alferecía" en la parroquia de Santiago de Querétaro, México, 1838-1851', *Diálogos: Revista Electrónica* 19 (2018), pp. 158-80, https://dialnet.unirioja.es/servlet/articulo?codigo=6358828 [accessed 15 July 2022].

41 E. Garrett and R. Davies, 'Birth spacing and infant mortality on the isle of Skye, Scotland, in the 1880s: a comparision with the town of Ipswich, England', *Local Population Studies* 71 (2003), pp. 53–74.

42 See García González, *Familia y Sociedad en Zacatecas*; Garrett and Davies, 'Birth spacing and infant mortality'.

43 D. Werner, *Donde no Hay Doctor: una Guía para los Campesinos que Viven lejos de los Centros Médicos* (Berkeley, CA, 2010).

44 Espinosa Cortes and Ruiz Arregui, 'Morir por "alferecía" ', p. 161.

sudden infant death syndrome or might have been an example of infanticide practices aimed at restricting family growth.[45] Second, gastro-intestinal diseases and nutritional deficiencies were relatively more common among girls than boys. In girls the mortality due to gastro-intestinal infections and nutritional deficiencies was high, especially at ages 1 and 2 years; the nutritional deficiencies recorded were scurvy, anaemia and rickets. This could suggest a difference in the diet that decreased the nutritional state of girls and made them more vulnerable to infections.

## Discussion

The average of the infant mortality rate in El Sagrario parish in Zacatecas from 1835 to 1845 was 125 per thousand live births. This figure does not coincide with the infant mortality rate calculated for Mexico in the nineteenth century, which is 250 deaths per thousand live births.[46] Other studies, such as that of the parish of San Luis de la Paz, Guanajuato, in the eighteenth century, calculated an infant mortality rate of 165 per thousand live births.[47] In the Santa María la Redonda parish in Mexico City, for the period 1840-1849, an infant mortality rate (IMR) of 373 per thousand live births was calculated.[48] In Tlaxcala in the Santa Inés Zacatelco parish in the period from 1800 to 1807 the IMR was 209 per thousand live births.[49] In the parish of Santa María El Cardonal, Hidalgo, it was calculated at 250 per thousand live births in the period 1800-1858 [50]. In El Sagrario parish in the city of Guadalajara, the IMR for the period 1800-1850 was 300 per thousand live births.[51] The figures may vary due to the size of the population aggregates: in the city of Guadalajara in 1830 a population of 40,662 people

45 E.G.R de Hansen, ' "Overlaying" in 19th-century England: infant mortality or infanticide?', *Human Ecology* 7 (1979), pp. 333–52, https://doi.org/10.1007/BF00888101; P.O. Hernández Espinosa, *La Regulación del Crecimiento de la Población en el México Prehispánico* (Mexico City, 2006).

46 J. Fuentes and M. Rosado, 'Urbanizacion y mortalidad en Merida, Yucatan, 1880-1910', *Salud Problema,* nueva epoca 2, 2 (1997), pp. 7-20, here at p. 13.

47 C.A. Rabell Romero, 'Evaluacion del subregistro infantiles de defunciones: una crítica a los registros parroquiales de San Luis de la Paz, México, 1735-1799', *Revista Mexicana de Sociología* 38 (1976), pp. 171-85, here at p. 177.

48 See A. Ortega Muñoz, 'Demografía histórica y paleodemografía. Análisis comparativo del comportamiento demográfico en la ciudad de México, siglo XIX', (unpublished Masters thesis, El Colegio de Mexico, 2002).

49 C. Morin, *Santa Ines Zacatelco (1646-1812): Contribución a la Demografía Histórica del México Colonial* (Mexico City, 1973), p. 78.

50 E.Y. Peña Sánchez, *Perfiles de Mortalidad en Población Subadulta: Jurisdicciòn Parroquial de Santa María de El Cardonal, Siglo XIX* (Mexico City, 2005), p. 85.

51 L. Oliver, 'La mortalidad en Guadalajara, 1800-1850', in M. Bronfman and J. Gómez de León (eds) *La Mortalidad en México: Niveles, Tendencias y Determinantes* (Mexico City, 1988), pp. 167-204, here at p. 192.

was calculated, while Mexico City in 1838 had an estimated 205,430 inhabitants.[52] In Zacatecas by 1828 there were 15,991 people, less than half the number in Guadalajara and barely 8 per cent of the population of Mexico City. However, this would not explain the higher infant mortality rates calculated in other parishes with a smaller population than that of Zacatecas, such as Santa María El Cardonal, Hidalgo with a population of 1,442 for 1791.[53] Therefore, it is likely that there was underreporting of deaths of children under one year of age in Zacatecas.

However, if we compare the proportion of all deaths that occurred to children aged five years and under during the period from 1835 to 1845 in Zacatecas (El Sagrario parish), which was 47 per cent, it coincides with other studies from Mexico of the nineteenth century. In Santiago de Querétaro parish, the average proportion of deaths under five years of age to total deaths for the period 1838-1851 was 49 per cent.[54] In the parish of Santa María El Cardonal, Hidalgo, the average number of deaths of children under 16 years of age in the period 1800-1858 was 47.5 per cent of the total of all deaths.[55] In a study of Morelia, Michoacán in the period 1802-1808 it was 45.5 per cent, while in years of epidemics such as the measles epidemic of 1826-1827 it rose to 80 per cent.[56] In Zacatecas there is no information on the measles epidemic of 1826, but there is information on that of 1836, in which the deaths of children under five years of age rose to 67 per cent of all deaths ($n$ = 447). In another study of Santa María de los Lagos parish in the state of Jalisco, in which the consequences of the 1826 measles were also observed, it is revealed that in normal years the mortality of children under seven years of age was around 51-57 per cent of all deaths between 1820 to 1829; due to the measles of 1826 the proportion rose to 67 per cent.[57] Therefore, our results for the proportion of all deaths in El Sagrario, Zacatecas, that occurred to children aged five years and under is consistent with other studies from the first half of the nineteenth century from states such as Querétaro, Hidalgo, Jalisco and Michoacán.

The mortality of children aged five years and under during the period 1835-1845 in Zacatecas reveals some effects of cultural practices, environmental conditions, and

52 L. Márquez, *La Desigualdad ante la Muerte en la Ciudad de México: el Tifo y el Cólera* (Mexico City, 1994); Oliver, 'La mortalidad en Guadalajara'.

53 Peña Sánchez, *Perfiles de Mortalidad en Población Subadulta*, p. 71.

54 Espinosa Cortes and Ruiz Arregui, 'Morir por "alferecía" ', p. 162.

55 Peña Sánchez, *Perfiles de Mortalidad en Población Subadulta*, p. 85

56 O.U. Talavera Ibarra, 'Los brotes y las epidemias de sarampión en Michoacán, Valladolid-Morelia, Pátzcuaro y Uruapan durante la primera mitad del siglo XIX', in C.P. Torres Franco y C. Cramaussel (eds), *Epidemias de Sarampión en la Nueva España y México (Siglos XVII-XX)* (Zamora, Mexico and Hermosillo, Mexico, 2017), pp. 193-224, here at pp. 201–7.

57 C.G. Becerra Jiménez, 'El trienio mortal: 1824-1826 en dos parroquias de los Altos de Jalisco', en Torres Franco and Cramaussel, *Epidemias de Sarampión en la Nueva España*, pp. 139-68, here at p. 158.

socio-economic and political factors, but biological variables had a more determining effect on the mortality. The mother's undernutrition and poor health had a negative effect in the survival of neonates. Biological characteristics such as birth weight and the degree of maturation of the body, influenced the high infant mortality, especially in boys.[58] Similar results have also been found in other studies across the world.[59] Infant mortality was higher in boys than in girls. This is a general trend in past populations, which suggests that the effect of the environment, the living conditions and the insalubrity of the cities, regardless of the geographical origin of the individuals, had a serious effect on the survival of children aged five years and under.

Earlier, we noted that there is evidence that deaths among girls in the second and third years of life were commonly due to gastro-intestinal diseases and nutritional deficiencies and that this reflected the relative social value given to girls and boys. The effect of social value could also be demonstrated in the female mortality in the years of 1836 and 1841. In these years was recorded the highest female mortality. The main cause of death in 1836 was measles, which most affected girls of one and two years old. In 1841 the main cause of death was 'fever': this is not a specific disease, but implies an infection.

Mortality from the second year of life was derived from cultural variables, especially from food distribution during the scarcity. The excess female mortality after the second year of life is also found in the study of Francisco Marco-Gracia and Francisco Beltrán Tapia, who studied child mortality in Aragon, Spain from 1750 to 1950.[60] They found higher female mortality in the age group 1-5 years due to gender discrimination: the families prioritised boys in terms of food, or care, in order to increase their chances of survival. This discrimination was more visible in larger families due to limited resources.[61]

Poor families with limited resources had to distribute food according to their needs. In general, boys were favoured because they represented a better investment, since, in the future they could contribute to the economy of the house, while girls

58 See Waldron, 'Sex differences in human mortality'; Drevenstedt *et al.*, 'Rise and fall of excess male infant mortality'.

59 J. Virgoe, 'Causes of death in a rural south-west Lancashire community in the late eighteenth century', *Local Population Studies* 75 (2005), pp. 33–55; Garrett and Davies, 'Birth spacing and infant mortality'; J. Knodel and A. Hermalin, 'Effects of birth rank, maternal age, birth interval , and sibship size infant and child mortality : evidence from 18th and 19th century reproductive histories', *American Journal of Public Health* 74 (1984), pp 1,098-106, https://doi.org/10.2105/AJPH.74.10.1098; R. Storey, *Life and Death in the Ancient City of Teotihuacan: a Modern Paleodemographic Synthesis* (Tuscaloosa, AL, 1992); S. Scott and C.J. Duncan, 'Malnutrition, pregnancy, and infant mortality: a biometric model', *Journal of Interdisciplinary History* 30 (1999), pp. 37–60, https://doi.org/10.1162/002219599551903.

60 Marco-Gracia and Beltrán Tapia, 'Son preference, gender discrimination, and missing girls'.

61 Marco-Gracia and Beltrán Tapia, 'Son preference, gender discrimination, and missing girls'.

involved more expenses for the dowry or because they worked at later ages than the boys.[62]

The age group with the largest number of deaths was post-neonatal mortality (1-12 months). This is for several reasons. First, when there is a large number of children spaced not far apart, the risk of dying in childhood increases due to competition for resources in a large family.[63] Second, breastfeeding generally lasted between 12 and 15 months. However, the use of wet nurses that came from a different socio-economic status, and who, therefore, had a nutritional status different from the mother, meant that the protection afforded by breastfeeding might have been reduced.[64] Socio-economic conditions are also another probable cause of this high mortality. Most of those buried in Del Refugio belonged to the poorest stratum of the city, where overcrowding was rife and the environment was especially unhealthy. This is because the records belonged to burials of charity, although there were also burials of individuals of high status, marked with the prefix '*Don*' or '*Doña*'.

Another cause was the environment, such as temperature, rainfall and droughts that caused adverse conditions. Personal and public hygiene was also very poor, due to poor management of the water supply, lack of maintenance of public sources, and water contamination with faeces and organic waste from butchers, hospitals, and mining. Furthermore, this situation occurred in conjunction with food shortages that happened from May to October of each year.[65] Of course, it is common to find high infant mortality associated with low socio-economic conditions and water contamination. For example, a recent study by Hannalis Jaadla and Allan Puur found a high mortality due to gastro-intestinal infections during summer in Tartu, Estonia between 1897 and 1900.[66]

62 This point has been made by several researchers, including Koenig and D'Souza, 'Sex differences in childhood mortality in rural Bangladesh'; Stinson, 'Sex differences in environmental sensitivity'; Waldron, 'Sex diferences in human mortality'; Beltrán Tapia y Gallego-Martínez, 'Where are the missing girls?'; Chen *et al.*, 'Sex bias in the family allocation of food'.

63 M. Livi-Bacci, *Historia Mínima de la Poblacion Mundial* (Barcelona, 2012).

64 S.M. Filteau, 'Role of breast-feeding in managing malnutrition and infectious disease', *Proceedings of the Nutrition Society* 59 (2000), pp. 565–72, https://doi.org/10.1017/s002966510000080x; Hernández Espinosa, *Regulación del Crecimiento de la Población*; Rodríguez Pinto, 'La pediatría durante la colonia'; Gonzalbo, *Vivir en Nueva España.*

65 T. Calvo, *Acatzingo: Demografía de una Parroquia Mexicana* (Mexico City, 1973); E. Florescano, *Origen y Desarrollo de los Problemas Agrarios de México 1500-1821*, 2nd edn (Mexico City, 1976); L.W. Konigsberg and S.R. Frankenberg, 'Deconstructing death in paleodemography', *American Journal of Physical Anthropology* 117 (2002), pp. 297–309, https://doi.org/10.1002/ajpa.10039; Peña, *Perfiles de Mortalidad en Población Subadulta.*

66 H. Jaadla and A. Puur, 'The impact of water supply and sanitation on infant mortality: individual-level evidence from Tartu, Estonia', *Population Studies* 70 (2016), pp. 163–79, https://doi.org/10.1080/00324728.2016.1176237.

## Concluding remarks

The way in which the social value, the environmental, the cultural, the economic and political factors affected children aged five years and under varied according to the age group, sex, gender and sometimes in relation to the year. The high mortality of children in this age range in the city of Zacatecas between 1835 and 1845 was the result of the interaction between cultural, socio-economic, political, and environmental factors. The severity of mortality depended on the biological condition of the children (higher male mortality before the age of two) and on cultural factors (higher female mortality from two to four years). In general, food shortages, the rainy season and unhealthy conditions allowed the proliferation and spread of diseases among the least favoured children, such as girls from poor families.

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