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AFTER 1492: WHAT DO THE NUMBERS TELL US?

DEPOIS DE 1492: O QUE OS NÚMEROS NOS DIZEM?

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Abstract

The indigenous populations of the Americas experienced a sea-change in demographic patterns following the establishment of sustained contact with peoples from the Old World. Conventional wisdom maintains that epidemics of highly contagious "crowd" diseases such as smallpox decimated indigenous populations, and that demographic collapse may have been in the range of 90 percent of contact population levels calculated from estimates based on little concrete evidence. Over time indigenous populations acquired immunities and recovered. This article suggests, based on the presentation of two detailed case studies, that the conventional wisdom regarding post-1492 indigenous demographic patterns should be reconsidered, and that well-documented case studies will refine our understanding of demographic patterns.

Key Words: "Virgin Soil" Epidemics, Contact Population Estimates, Demographic Rebound.

Resumo

As populações indígenas das Américas experimentaram uma mudança radical nos padrões demográficos após o estabelecimento de contato sustentado com povos do Velho Mundo. A sabedoria convencional sustenta que epidemias de doenças de "multidão" altamente contagiosas, como a varíola, dizimaram populações indígenas, e que o colapso demográfico pode ter ocorrido na faixa de 90 por cento dos níveis populacionais de contato calculados a partir de estimativas baseadas em pouca evidência concreta. Com o tempo, as populações indígenas adquiriram imunidades e se recuperaram. Este artigo sugere, com base na apresentação de dois estudos de caso detalhados, que a sabedoria convencional relativa aos padrões demográficos indígenas pós-1492 deve ser reconsiderada e que estudos de caso bem documentados irão refinar a nossa compreensão dos padrões demográficos.

Palavras-chave: Epidemias de "Solo Virgem"; estimativas de população de contato; recuperação demográfica.

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Two topics have dominated the debate over post-1492 Native American historical demography for some 70 years. The first is how many people lived in the Americas at the time of first sustained contact with people from the Old World? There is no easy answer to this question, and the range of guestimates is from the low to the high and excessively high. Scholars have arrived at the guestimates using different methods in the face of the lack of hard evidence. The second question is if there was catastrophic demographic collapse following sustained contact, and what were the causes of demographic change? A discussion of the case study of central Mexico after 1519 provides an opportunity to discuss the issues and different academic interpretations.

The question of indigenous demographic patterns in sixteenth-century central Mexico has generated considerable debate. The studies that have defined the conventional wisdom on the question are those of Alfred Crosby who proposed the model of "virgin soil" epidemics, and the members of the "Berkeley School" (Lesley Simpson, Sherburne Cook, Woodrow Borah), who engaged in the exercise of trying to estimate the pre-contact size of the indigenous populations of central Mexico.[2] Crosby`s model of "virgin soil" epidemics hypothesized heavy mortality in the first epidemics following sustained contact with Europeans, but a gradual lessoning of epidemic mortality with the passing of time.[3] In a 1991 article Crosby further elaborated on his hypothesis, and stated that sustained contact always resulted in catastrophic demographic collapse.[4] Henry Dobyns

[2] See, for example, Woodrow Borah, and Sherburne F. Cook. "La despoblación del México central en el siglo XVI" **Historia mexicana**. 1962, p. 1-12, that summarizes the findings of longer academic studies. The most important of the publications in the series are Sherburne Cook and Woodrow Borah, **The Indian population of central Mexico, 1531-1610**. Berkeley and Los Angeles: The University of California Press, 1960; Woodrow Borah and Sherburne Cook. **The Population of Central Mexico in 1548: An Analysis of the Suma de visitas de pueblos.** Berkeley and Los Angeles: The University of California Press, 1960; Woodrow Borah and Sherburne Cook. **The aboriginal population of central Mexico on the eve of the Spanish conquest**. Berkeley and Los Angeles: The University of California Press, 1963. In a 1995 article Robert McCaa provided a useful overview to different estimates of the population of Mexico at contact. See "Fue el siglo XVI una catastrofe demografica para Mexico? Una respuesta basada en la demografía histórica no cuantitativa," ***Cuadernos de Historia***, 1995, p. 123-136. The estimates of depopulation range from more than 50 percent, perhaps as high as 75 percent, and in some areas such as coastal regions more than 90 percent.

[3] Crosby, Alfred W.. "Virgin soil epidemics as a factor in the aboriginal depopulation in America," **The William and Mary Quarterly: A Magazine of Early American History**, 1976, p. 289-299.

[4] Crosby, Alfred W.. "Infectious Disease and the Demography of the Atlantic Peoples," **Journal of World History**, 1991, p. 119-133. The statement appears on p. 123.

elaborated on the model. He argued that epidemics spread across the Americas decimating indigenous populations.[5] In an academic study and edited volume, Noble David Cook presented mostly qualitative evidence of the effects of epidemics on the indigenous populations of the Americas.[6] Linda Newsome noted in one study that: "For all New World Peoples 1492 heralded demographic disaster from which many have never recovered."[7] Newsome attributed demographic collapse to several factors that included the effects of highly contagious Old World diseases such as smallpox and violence and mistreatment of indigenous peoples. The author further noted that the indigenous population of the Americas dropped from some 50 millions in 1492 to some five millions in 1650.[8]

The estimate of the size of the contact population of central Mexico has been important in several generations of scholarly assumptions made regarding sixteenth-century indigenous population decline. In their last studies Cook and Borah estimated a population in the range of 18 to 30 million, and a mid-point figure of 25 million. Although there is no question that the indigenous population of central Mexico was large at the point of contact, the Cook-Borah estimate was an example of what can be called "fuzzy math." Later sixteenth-century tribute censuses provide a reasonable foundation for population estimates. However, the problem was with the figure of 25 million. Cook and Borah relied on the *suma de visitas* to extrapolate the size of the population in 1519.[9] The suma de visitas was a series of reports on the tribute obligations of some central Mexican jurisdictions prepared around 1550. The reports were prepared for royal officials to understand the status of tribute obligations, and not to provide reliable demographic information. The reports used different categories to indicate the

[5] Dobyns, Henry. **Their number become thinned: Native American population dynamics in eastern North America**. Knoxville: University of Tennessee Press, 1983.
[6] Cook, Noble David. **Born to die: disease and New World conquest, 1492-1650**. Cambridge: Cambridge University Press, 1998; Cook, Noble David; Lovell, William George (eds). **Secret judgments of God: Old world disease in colonial Spanish America.** Norman: University of Oklahoma Press, 2001.
[7] Newsome, Linda. "The Demographic Collapse of Native Peoples of the Americas 1492-1650" **Proceedings of the British Academy,** 1993,p. 247-288. The quote appears on p. 247.
[8] Ibid, p. 277.
[9] The most recent edition of the suma de visitas is Castro, René García (coordinador y editor), **Suma de visitas de pueblos de la Nueva España, 1548-1550.** Toluca: Universidad Autónoma del Estado de México, Facultad de Humanidades, 2013.

number of tributaries, and the categories cannot be reconciled to provide the basis of a reliable population estimate. The assumptions Cook and Borah made about the information provided in the suma de visitas and their nuancing of the data could not overcome the deficiencies in the data of the reports to extrapolate a contact population size. In the absence of reliable data, it is impossible to know the size of the indigenous population in 1519.

The discussion of the sixteenth-century decline of the indigenous population of central Mexico has assumed a more than 90 percent drop in numbers based on the flawed Cook-Borah estimate of 18-30 million with a mid-point of 25 million in 1519. The Crosby hypothesis and the studies of Dobyns and Noble David Cook have also made assumptions about the short and long-term effects of epidemics based largely on qualitative sources in the absence of quantitative sources that have figured in the debate over post-contact demographic patterns in Mexico. There is, for example, no discussion of possible short-term demographic rebound or recovery following outbreaks, which is a pattern documented for post-epidemic European populations. Moreover, the debate on post-contact demographic patterns has generally ignored comparative studies of European populations during the same period that have a foundation in more sophisticated methodologies and detailed quantitative sources, and can provide useful insights to demographic patterns in central Mexico. Moreover, recent research on the population of late medieval England suggests that chronic ailments were more important than epidemics in shaping demographic patterns which is not a factor considered in the discussion of the effects of disease in central Mexico or the Americas.[10]

There is a general consensus that the Americas had large populations at the time of sustained contact with the Old World, although there will never be and can be agreement on the numbers. It is methodologically impossible to arrive

[10] See, for example, the detailed reconstruction of English demographic patterns from the sixteenth to nineteenth centuries of Wrigley, Edward Anthony; Schofield, Roger S. Schofield. **The population history of England 1541-1871**. Cambridge: Cambridge University Press, 1989. A recent study of England during the late medieval period argued that chronic health problems and not epidemics were more important in determining demographic patterns. See Robb, John et al. "The greatest health problem of the Middle Ages? Estimating the burden of disease in medieval England". **International Journal of Paleopathology**, 2021, p. 101-112.

at reliable population estimates. The second question is what happened to indigenous populations following the establishment of sustained contact, conquest, and the spread of Old-World diseases? There is qualitative but not quantitative data for the sixteenth-century. We can get a sense of what happened in the different regions of the Americas for which there is some information, although not with precision. There is more reliable information for the seventeenth and eighteenth centuries, and detailed case studies can provide useful insights to the processes of demographic change after 1492. We examine here two well detailed case studies. They are of the Jesuit Guarani missions in the Rio de la Plata region of South America in the years 1609-1767, and the Franciscan missions established in California between 1769 and 1834. These case studies document different patterns of fertility, mortality, and gender and age structures of indigenous populations.

These case studies have been chosen for analysis here because of the ample documentation that exists to reconstruct the vital rates of the indigenous populations, as well as the effects of periodic epidemics. There are previous studies of the populations of these missions, and particularly of those among the Guaraní. Ernesto Maeder, for example, published studies of the mission populations.[11] Maeder compiled population data on the missions. However, his approach was descriptive rather than analytical, and he did not use the population data to calculate vital rates. Calculating the percentage difference between two or more population figures fails to explain trends in demographic patterns. Maeder collaborated with Italian historical demographer Massimo Livi-Bacci in a more sophisticated analysis of demographic patterns on the missions.[12] However, there were methodological flaws in their analysis, and specifically in the calculation of vital rates.[13]

[11] See, for example, Maeder, Ernesto J.; Bolsi, Alfredo S.. **La población de las misiones guaraníes entre 1702-1767**. Asunción: Universidad Católica Nuestra Señora de la Asunción, 1974; Ernesto J. Maeder, "La población de las Misiones de Guaraníes (1641-1682). Reubicación de los pueblos y consecuencias demográficas". **Estudos ibero-americanos**, 1989, p. 49-68.
[12] See Livi-Bacci, Massimo; . Maeder, Ernesto J.. "The Missions of Paraguay: the demography of an Experiment". **Journal of Interdisciplinary History**, 2004, p. 185-224.
[13] For a critique of the Livi-Bacci and Maeder article see: Jackson, Robert H.. "The Population and Vital Rates of the Jesuit Missions of Paraguay 1700–1767". **Journal of Interdisciplinary History**, 2008, p. 401–431.

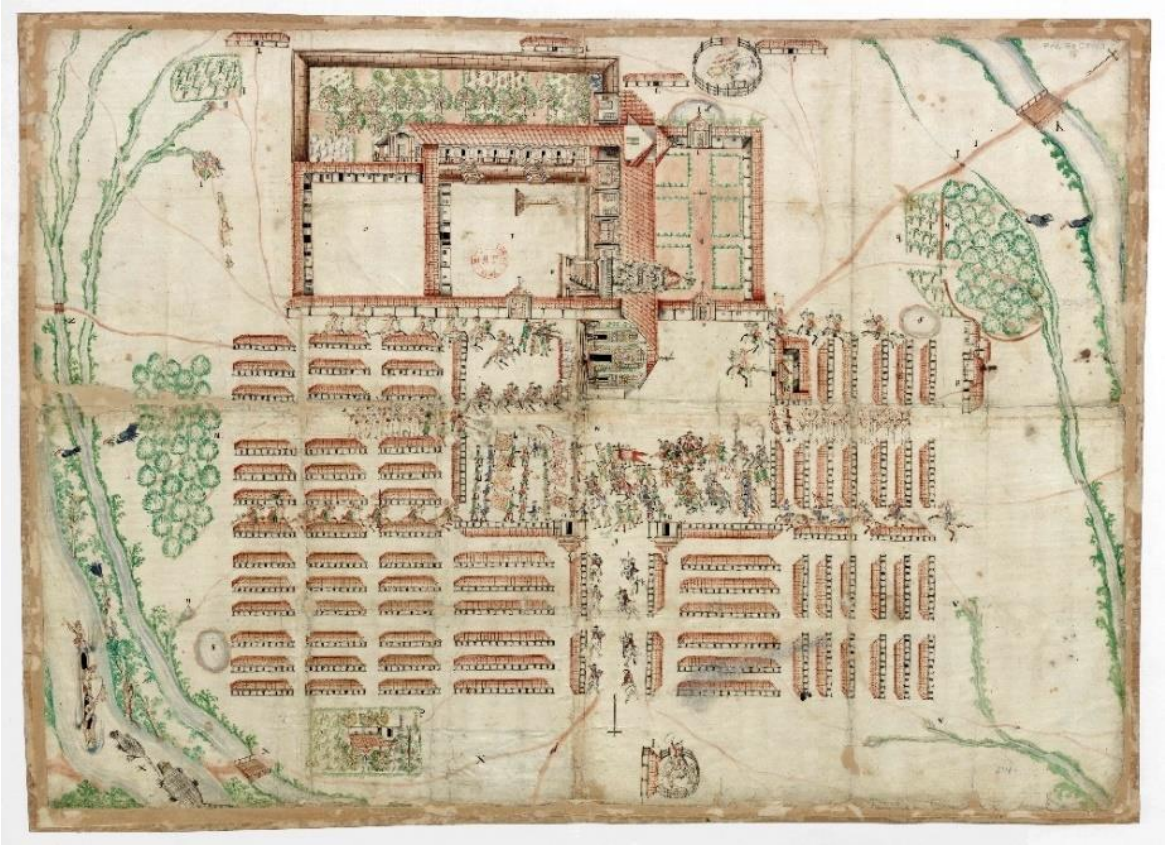
Sacramental registers of baptisms, marriages, and burials do not exist for the missions among the Guaraní. They were destroyed in the first decades of the nineteenth-century when the region became a war zone. However, the vital rates and demographic patterns of the mission populations can be reconstructed from detailed censuses the Jesuit missionaries prepared. Sacramental registers do exist for the Franciscan missions in Alta California, and they, in conjunction with population censuses, are used to reconstruct the vital rates of the indigenous peoples brought to live on the missions. These two case studies also document different patterns between the more sedentary Guaraní who practiced shifting swidden agriculture, and the indigenous peoples of Alta California who were hunters and gatherers. The Franciscans who staffed the California missions implemented policies of social control in line with the Bourbon Reform imperative to accelerate the integration of indigenous peoples into colonial society. These policies, such as incarcerating older girls and single women in unsanitary dormitories at night, were a factor in the demographic patterns on the missions. The Jesuits stationed on the missions among the Guaraní, on the other hand, did not implement similar policies of social control.

Demographic Patterns on the Jesuit Guaraní Missions

The mission urban plan played an important role in determining demographic patterns on the missions, and particularly of the spread of lethal epidemics of diseases such as smallpox and measles. Large populations lived in spatially compact communities where contagion spread easily. Typical was the urban plan of San Juan Bautista mission documented in two plans drafted in the early 1750s. The plans show the compact housing of the mission residents (see Figures 1-3). There were instances of catastrophic epidemic mortality, as in the case of the 1737-1740 smallpox epidemic, which was one in a series of outbreaks exacerbated by poor crops and famine between 1733 and 1740. Most of the missions experienced a net decline in population during the period of crisis (see Table 1), and in some instances catastrophic mortality during the smallpox epidemic that claimed the lives of more than half the population of individual mission communities. The population of San Lorenzo mission, for example,

dropped from 6,513 recorded in 1732, to 974 at the end of 1739. Mortality during 1739 reached 557 per thousand population.[14]

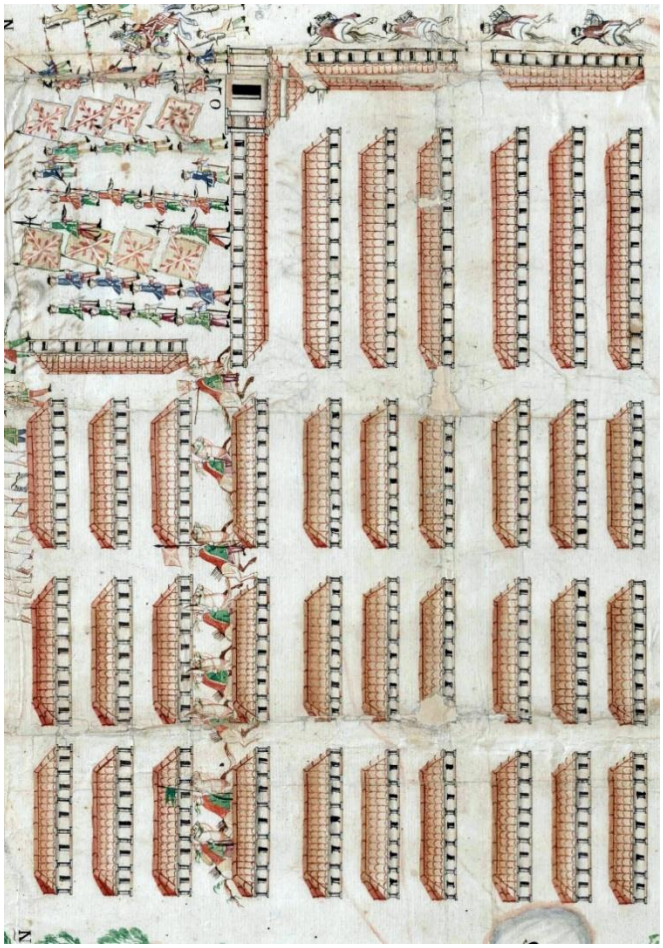
Figure 1: A c. 1754 diagram of San Juan Bautista Mission. Pueblo de San Juan que es uno de los del Uruguay que se intentan entregar a Portugal. Biblioteque Nationale de France.



Source: Biblioteque Nationale de France.

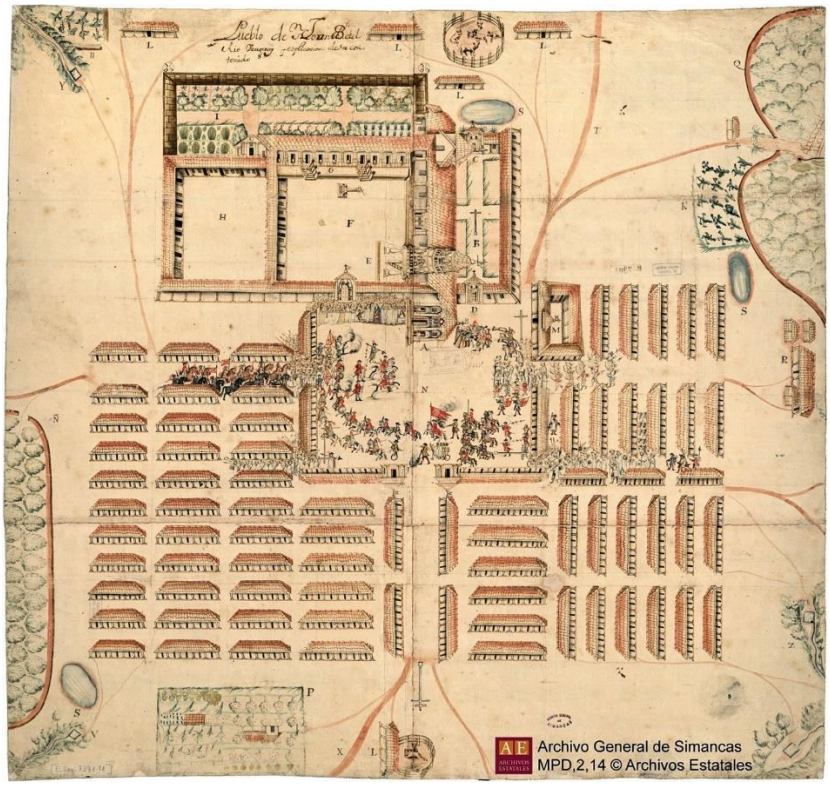
Figure 2: Detail of the diagram showing the housing for the mission population.

[14] Jackson, Robert H.. **A Population History of the Missions of the Jesuit Province of Paraquaria**. Newcastle upon Tyne: Cambridge Scholars Publishing, 2019, p. 270-271.



Source: Biblioteque Nationale de France.

Figure 3: A second c. 1753 version of the diagram of San Juan Bautista mission.



Source: Archivo General de Simancas, MPD 02 014; Pueblo de San Juan que e uno de los del Uruguay que se intentan entregar in Portugal [Hand written cartographic material] ID / Call number: GE C-2769 (RES).

The mortality crisis that occurred between 1733 and 1740 killed some 90,000, and reduced the size of the populations of the Jesuit missions from a recorded high of 141,182 in 1732 to 73,910 at the end of 1740. Because of the detailed Jesuit censuses, it is possible to reconstruct mortality patterns and the effects of the epidemic on a year-by-year basis. Most but not all of the missions experienced a net decline in population during the eight years of the crisis. A combination of factors contributed to the mortality crises and the heavy population losses. One was the mobilization of thousands of Guaraní militiamen. The second was the high population densities of the mission communities and the large number of children and young adults born since the last major epidemic in 1718, who had not been exposed to contagion and were thus highly susceptible to smallpox. Epidemics occurred about once a generation when there was a sufficient number of people, those born since the previous outbreak, to sustain the chain of infection, since the mission populations were not large enough to sustain contagion in endemic form. The third was the drought and famine

conditions that contributed to large scale flight from the missions as people left in search of food and to escape disease. Flight also exacerbated the crisis by further spreading contagion.

People in movement spread disease. This can be seen in two ways during the crisis of the 1730s. The first was the posting of Spanish troops and mission militia on the Río Tebicuarí for months. Military encampments were notoriously unsanitary, and the evidence shows that the heaviest mortality during a lethal 1733 epidemic was on the missions located closest to the encampment in what today is southern Paraguay. The Jesuits reported a total of 18,773 burials in 1733, a net loss in population of some 13,000, and particularly the heavy mortality at the three missions located closest to the militia camp.

Famine resulted in the flight of Guaraní from the missions. This was an established Guaraní pattern in periods of poor crops, and also reflected a fundamental clash between the Jesuit goal of converting the mission residents into a more sedentary population and the traditional Guaraní economy that had a basis in shifting agriculture and settlement supplemented by hunting and the collection of wild plant foods. The Jesuits reported in 1735 that 8,022 Guaraní fled the missions, including the group that created the community on the edge of mission territory that was politically, socially, and spatially organized along the lines of the mission communities they had abandoned. At the end of 1735 during the spring and summer an epidemic spread through the missions, and continued into 1736. There was also an epidemic that spread through the herds of mission livestock.

No mission census survives, but the carta anua reported that deaths in 1734 reached 16,222. There was a distinct mortality pattern related to the famine conditions. Some 10,132 adults and 6,090 *párvulos* or young children under the age of ten died. Deaths in 1735 totaled 6,044, and more young children died than did adults. The Jesuits reportedly baptized 4,520, and the total population of the missions dropped by 1,524. In 1736, the Jesuits recorded 5,004 baptisms as against 7,787 deaths and a net decline in numbers of 2,723.[15] Mortality was

[15] Masy Rafael Carbonell de. **Estrategias de desarrollo rural en los pueblos guaraníes**. Barcelona: Instituto de Cooperación Iberoamericana, 1992, 377.

particularly high at Loreto in 1736, where a total of 1,321 died which was a crude death rate per thousand population of 308.1. The Jesuits prepared general censuses, but also a series of more detailed tribute censuses that were required to enumerate the number of tributaries and the amount of tribute that was to be paid to the Crown. Royal officials had new tribute censuses prepared about once a generation, or roughly every 20 years. The tribute censuses recorded the population by *cacicazgo* and family, but also tribute categories such as *reservado*, or exempted men. The tribute categories need to be carefully separated from the strictly demographic information.

The censuses reported the absence of 2,620 male tributaries, but because of the narrow scope of the enumerations they did not record the number of absent women and children. The individual censuses contain summaries, but it is also useful to extract more complete data from the complete texts of the counts. The tribute census for Los Santos Mártires mission reported the absence of seven tributaries in the Spanish settlements ("*tierras de Españoles*"). The census for Santos Cosme y Damián summarized the time that fugitives had been absent. One tributary had been absent for four years, nine for three years, nine for two years, 21 for one year, and eight fled the mission in 1735. In other words, there were instances of flight from the mission community prior to the crisis.[16] The largest number of fugitives was from two groups of missions. The first were from the missions located east of the Uruguay River, and from Santa María la Mayor located close to the west bank of the river. A total of 160 tributaries reportedly were absent from Santa María, 327 from San Nicolás, 166 from San Luis Gonzaga, 262 from San Lorenzo, and 153 from Santo Ángel Custodio. The second was the group of missions located in what today is southeastern Paraguay that were closest to the zone where the mobilized mission militia was posted and also the fugitive community on Iberá Lake. It is possible that some of the fugitives were militiamen who had been mobilized, and then voted with their feet to avoid militia service or to search for food. The largest number of fugitives was 333 from

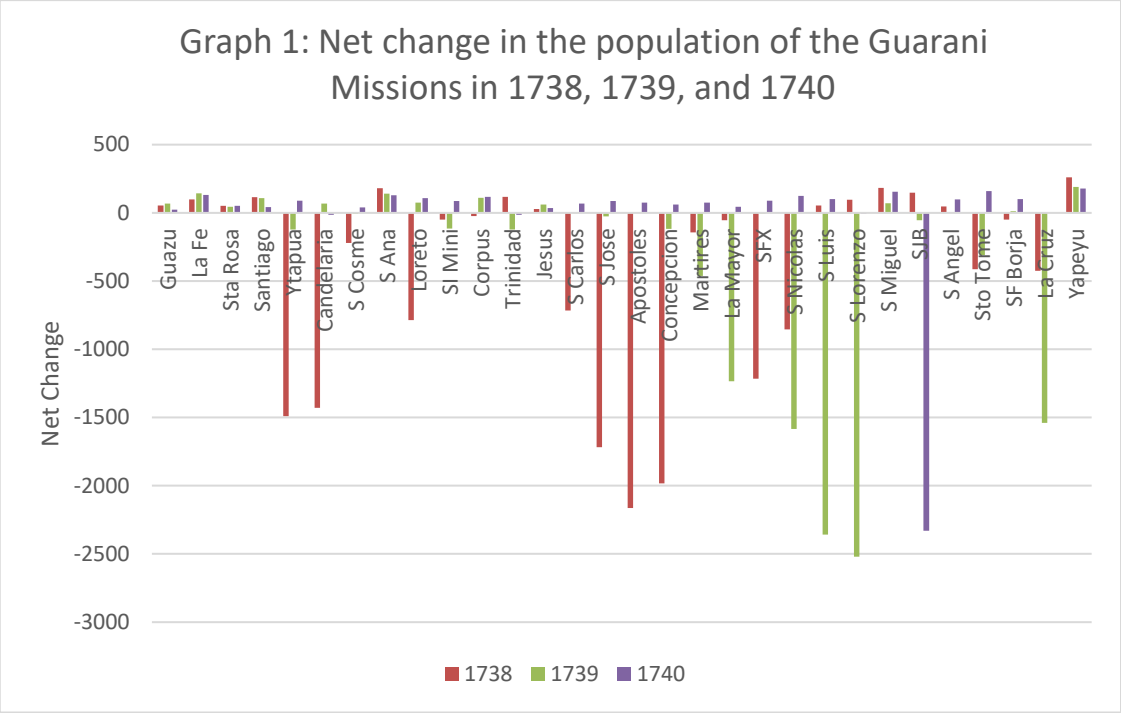
[16] Francisco María Raspart, S.J., **Los Santos Mártires del Japón**, August 15, 1735, Padrón de los tributarios de esta Reducción de los Santos Mártires del Uruguay, AGN, Sala 9-17-3-6; Buenaventura Suárez, los Santos Cosme y Damián, August 16, 1735, Padrón del Pueblo de S. Cosme y Damián que se hizo este presente año de 1735, AGN, Sala 9-17-3-6.

San Ignacio Guazú, 291 from Nuestra Señora de Fe, 141 from Trinidad, and 120 from Ytapúa. Lesser numbers of tributaries fled the other missions. Graph 1 documents an excess of mortality at some missions, but not on the scale of the catastrophic mortality two years earlier in 1733. The heaviest mortality was among the group of missions located on the east bank of the Paraná River, such as San Ignacio Miní. At the same time the population of some missions experienced net growth.

The carta anua reported that the year 1737 was less problematic as regards climate conditions, but also reported that a lethal smallpox epidemic spread to the missions from Asunción, and other urban centers in the region at the end of the year. Three missions evidenced elevated mortality in 1737 during the warmer summer months. The death rate at Ytapúa was 104.1 per thousand population in 1737, but the epidemic continued into 1738 and perhaps flared up again at the beginning of 1739. The total number of burials in the three years was 2,405, and the death rate 530.1 per thousand population. The crude death rates at Jesús and Trinidad were 184.2 and 154.1 per thousand population respectively.[17] In three years (1738-1740) the Jesuits reportedly buried 35,104 people on the missions, and a net decline of 22,575. The epidemic broke out after five years of crisis in the missions, and the movement of people, mobilization of the mission militia, and

[17] Jackson, **A Population History**, p. 200-277.

river traffic helped spread the contagion. Moreover, the smallpox outbreak was more generalized and lasted for a longer period of time (see Graph 1).[18]



Source: Table 1.

However, despite the heavy mortality, the populations of the missions rebounded or recovered following the epidemic. The resiliency of the mission populations resulted from several factors. One was the formation of new families and increased birth rates in the years following the outbreak. This can be seen, for example, in the case of San Lorenzo mission. In the non-crisis year 1724 the population of San Lorenzo Mártir totaled 5,224, and in that year the Jesuits recorded 52 marriages, or 10 marriages per thousand population. The first epidemic during the series of mortality crises of the 1730s struck San Lorenzo Mártir in 1733. The population was 6,100 and the number of marriages increased to 155 or 24 per thousand population. The same pattern occurred following the devastating 1738–1740 smallpox epidemic. At the end of 1739, 974 Guaraní

[18] Jackson, Robert H.. **Regional Conflict and Demographic Patterns on the Jesuit Missions among the Guaraní in the Seventeenth and Eighteenth Centuries**. Leiden: Brill Academic Publishers, 2019, p. 21-24.

remained at the mission, and the number of marriages was 122, or 25 per thousand population.[19]

Two other factors explain the resilience of the Guaraní mission populations. One was a pattern of a balanced gender structure in the mission population. In other words, the female population generally constituted the majority in the mission populations, as seen in the case of San Lorenzo mission. Females as a percentage of the total population of San Lorenzo dropped in 1739 as a result of heavier smallpox mortality among women and girls. This was evidence of the TH-2 response in the immunological system of women and girls that exacerbates and infections by pathogens such as smallpox and measles resulting in higher mortality.[20] Nevertheless, and despite the heavier mortality, women and girls still constituted the majority, and there was a large enough pool of potential sexual partners to form new families. This stands in marked contrast to the California missions discussed below, where heavy chronic mortality among women and girls resulted in a pronounced gender imbalance.

The second factor was the high birth rates among the Guaraní mission populations, and the survival of more young children to adulthood. There were high rates of infant mortality, as was also the case of the California missions discussed below. However, more children survived in non-crisis years. Moreover, the evidence shows that women tended to marry at a young age soon after puberty, at around age 13. This meant that women had the potential to bear more children during their cycle of fertility. This was also an important factor in the pattern of moderate to high birth rates. The case of San Luis Gonzaga mission is illustrative. In 20 non-crisis years the crude birth and death rates per thousand population averaged 61.2 and 39.6 respectively. In other words, the mission population grew at a robust average rate of 2.2 percent per year.

A Different Scenario: Demographic Patterns on the California Missions

Demographic patterns on the California missions were very different. A recent detailed study based on bioarchaeological and documentary sources

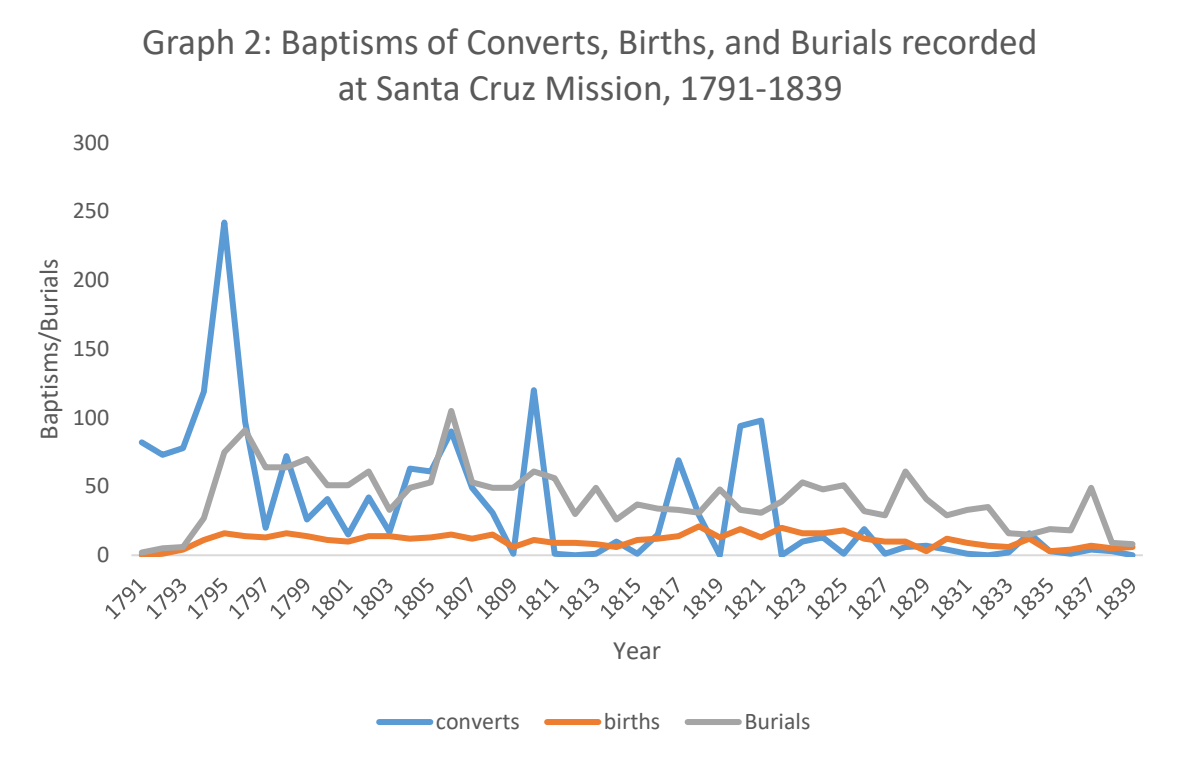
[19] Jackson, **A Population History**, p. 87-88.
[20] Ibid, p. 82-83.

showed a lack of evidence of the effects of epidemic mortality prior to the establishment of the missions after 1769.[21] The missions were relatively geographically isolated. Few epidemics spread to the missions, and there was chronically high infant mortality and mortality among girls and women. Chronic syphilis contributed to the high mortality, and especially among newborn children infected by the mother through the placenta. The Franciscans treated syphilis with mercury pills, a poison. Another important factor was inadequate medical and prenatal medical attention, and poor hygiene. The Franciscans were obsessed with the sexuality of the indigenous peoples, and in a policy of social control incarcerated single women and older girls at night in dormitories characterized by conditions of poor sanitation. This practice contributed to the chronically high mortality. By the early nineteenth-century a gender imbalance had developed in the mission populations, and had become worse by the time of secularization in the mid-1830s. Population figures give the appearance of periods of growth, but the numbers only expanded during periods of active recruitment and congregation of indigenous peoples from outside of the mission communities. The populations then dropped as the number of baptisms of converts declined. At the point of secularization, the populations of most of the missions had already begun to drop significantly.[22]

These patterns can be visualized in a case study of baptisms and burials and crude birth and death rates on Santa Cruz mission (established in 1791) summarized in Graphs 2-3. The case study shows the ebb and flow of the congregation of non-Christians on the mission, death rates chronically higher than birth rates, and few epidemic outbreaks. Chronic ailments and not epidemics accounted for high mortality.[23] One manifestation of demographic collapse on the missions was extreme gender and age imbalance mentioned

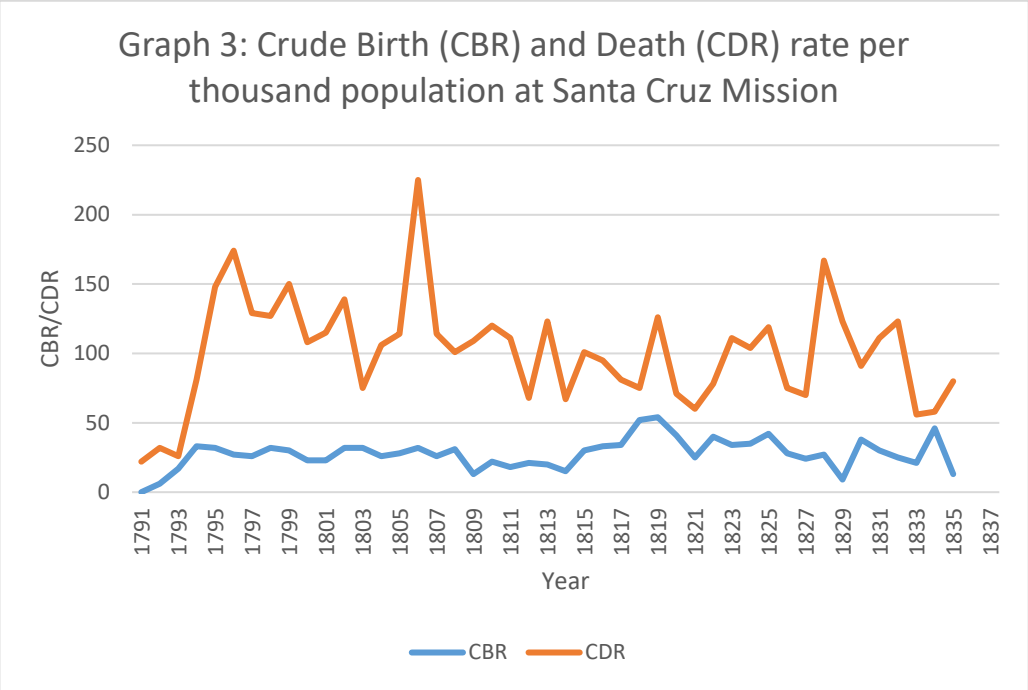
[21] Jones, Terry L. et al. "Historic and Bioarchaeological evidence supports late onset of post-Columbian epidemics in Native California," **PNAS**, 2021, p. 1-7.
[22] For a more detailed discussion of demographic patterns on the California missions see: Jackson, Robert H.. **Indian Demographic Decline: the Missions of Northwestern New Spain, 1687-1840**. Albuquerque: University of New Mexico Press, 1994, p. 83-116; Jackson, Robert H.. **The Bourbon Reforms and the Remaking of Spanish Frontier Missions**. Leiden: Brill Academic Publishers, 2022, p. 210-233.
[23] A recent study of medieval England suggests that chronic ailments and not epidemics such as the bubonic plague posed the greatest medical threat to people. See Robb, John *et. al.*, "The greatest health problem of the Middle Ages? Estimating the burden of disease in medieval England". **International Journal of Paleopathology**, 2021, p. 101-112.

above. In the years 1791 to 1832, the Franciscans baptized 1,133 girls and women. In 1832, the female population was 87, or a mere 31 percent of the total (see Table 2). Men could not easily find sexual partners, and a manifestation of this was the increasing number of widowers unable to find a sexual partner following the death of a spouse.[24] The number of widows was between two and three percent of the population while the number of widowers totaled 77 in 1828 which was 21 percent of the population.[25] The gender imbalance can also be visualized in the case study of the decline in the female population on five missions established among the indigenous communities collectively known today as the Chumash (see Graph 4). The decline in the female population was also a factor in low birth rates.



Source: Jackson, Robert H.. **The Bourbon Reforms and the remaking of Spanish Frontier Missions**. Leiden: Brill Academic Publishers. 2022, p. 319-320.

[24] Jackson, **Indian Demographic Decline**, *p.* 113.
[25] Jackson, **The Bourbon Reforms**, p. 225-226.



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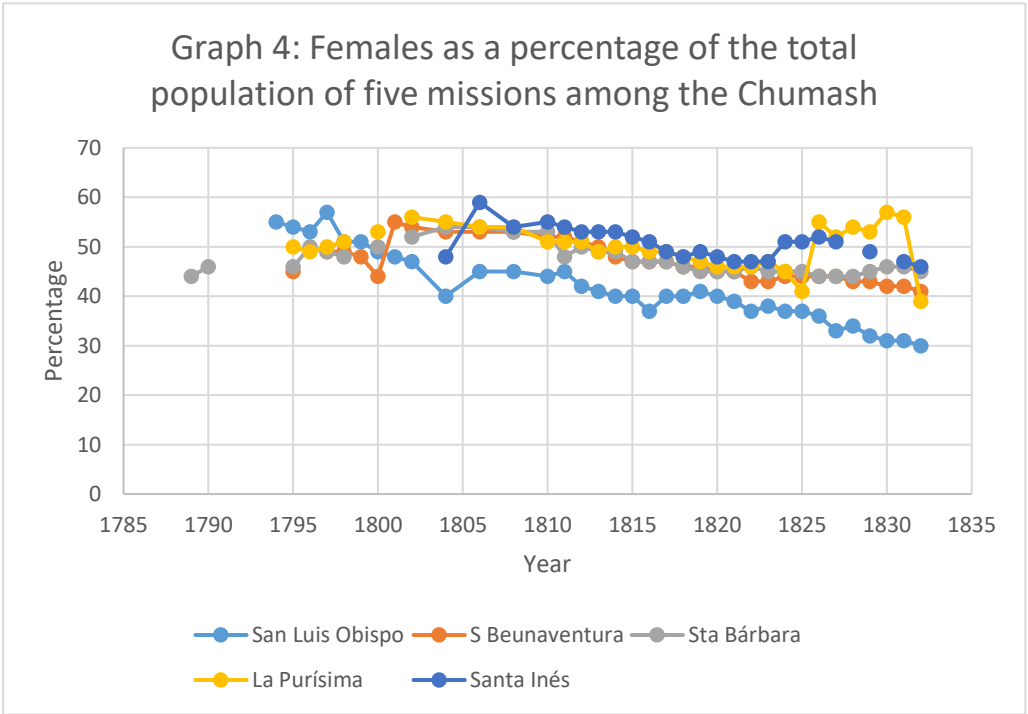

Source: Jackson, Robert H.. **The Bourbon Reforms and the remaking of Spanish Frontier Missions.** *Leiden: Brill Academic Publishers*, 2022, p. 215-216.

Conclusions

The case studies examined here challenge basic assumptions that serve as a foundation for the conventional wisdom regarding the demographic patterns of the indigenous populations of the Americas after 1492, and point to the need for more detailed case studies and the utility of comparisons with other contemporary populations such as those of Europe. Epidemics spread to the Jesuit Guaraní missions about once a generation when there was a sufficiently large number of people not previously exposed to contagion and who had little if no immunity to sustain the chain of infection. Those who had been previously exposed and survived acquired a degree of immunity, and stood a better chance of survival if infected again. Those not previously exposed died at higher rates. Epidemic mortality on the missions reached catastrophic levels, and levels hypothesized for the first "virgin soil" epidemics, and this several hundred years following first sustained contact with Old World populations. Despite catastrophic mortality the Guaraní mission populations rebounded or recovered following epidemics with the formation of new families, which generally is a factor not considered in other demographic studies.

Epidemics did not spread to all regions of the Americas with the same frequency, as shown in the case of the Franciscan California missions. Rather, chronic ailments and parasites from unhygienic conditions caused patterns of high mortality, and particularly mortality among young children and women. Epidemics only contributed to the pattern of demographic collapse, and equally important was the pronounced gender imbalance in the mission populations that did not exist on the Jesuit Guaraní missions discussed above. Death rates were consistently higher than birth rates, and the number of women of child-bearing age declined resulting in rapid population loss once the Franciscans could no longer congregate non-Christians on the missions.

The future study of the post-1492 demographic history of the indigenous populations of the Americas needs serious reconsideration based upon detailed case studies that will flesh-out and challenge the assumptions of the conventional wisdom of models such as that of the effects of "virgin soil" epidemics and long-term demographic collapse. Future studies should benefit from a close reading of

academic sources on other contemporary populations, such as those of Europe, to more fully understand the dynamics of epidemic mortality, but also of the importance of chronic non-epidemic ailments in shaping demographic patterns. The conventional wisdom does not adequately explain the play of demographic patterns after 1492.

Table 1: Net Change +/– in the Population of the Guaraní Missions, 1733, 1735–1740

Mission	1733	1735	1736	1737	1738	1739	1740
Guazú	–1076	15	5	56	55	68	23
La Fé	–2472	–1	51	–50	98	143	131
Sta Rosa	–2153	–4	19	42	52	44	52
Santiago	–86	76	37	95	114	107	43
Ytapúa	–604	–17	27	–272	–1491	–122	89
Candelaria	–50	–24	–14	–2	–1429	67	–15
Stoa Cosme	–192	–27	–154	0	–221	–6	39
Sta Ana	–758	53	–187	56	180	140	128
Loreto	–723	–459	–1182	–10	–786	75	108
SI Miní	–247	–320	–437	38	–48	–115	88
Corpus	–306	–346	–178	40	–23	111	118
Trinidad	–227	34	–48	–197	118	–122	–14
Jesús	–154	=10	–24	–292	28	60	35
San Carlos	–91	–31	–30	–56	–716	–2	69
S José	–201	16	–159	92	–1718	–25	88
Apóstoles	–179	34	67	2	–2163	2	76
Concepción	–86	61	5	–12	–1982	–118	62
Mártires	–289	–84	–11	3	–142	–463	75

La Mayor	−323	−130	−169	−25	−53	−1235	44
SFX	−329	−24	−182	27	−1215	−5	89
S Nicolas	−304	−187	−496	15	−853	−1583	125
San Luis	−669	−122	−112	18	53	−2357	101
S Lorenzo	−491	−218	−82	31	96	−2521	−4
San Miguel	150	109	83	135	184	70	155
San Juan	−289	40	−19	114	148	−53	−2329
Sto Ángel	−142	−67	−18	64	48	0	99
Sto Tomé	20	77	3	44	−414	−309	160
SF Borja	−212	138	25	105	−48	13	101
La Cruz	−602	116	114	34	−424	−1540	5
Yapeyú	−407	115	283	37	261	191	179
Yapeyú	1731 181	1732 – 32	1734 – 227				

Source: Catalogo de la Numeración Annual de las Doctrinas del Río Paraná/del Río Uruguay. Ano de 1738, CA; Jackson, Robert H.. **Demographic Change and Ethnic Survival Among The Sedentary Populations On The Jesuit Mission Frontiers of Spanish South America, 1609–1803: The Formation and Persistence of Mission Communities in a Comparative Context.** Leiden: Brill, 2015, p. 213–15, p. 217–2.

Table 2: Female population at Santa Cruz Mission as related to total population and the total number of baptisms of females

Year	Population	Female Population	Females % of Population	Total Baptisms to date
1797	495	238	47	378
1813	398	139	35	789
1814	388	139	36	796
1820	461	175	38	950
1823	474	182	38	1,039
1824	461	184	40	1,060
1825	429	161	38	1,067
1826	428	167	39	1,087

1828	364	114	31	1,102
1832	284	87	31	1,133

Source: Jackson, Robert H.. "Disease and Demographic Patterns at Santa Cruz Mission, Alta California," **Journal of California and Great Basin Anthropology.** 1983, p. 42.

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