Disease at the Front Lines: Municipal Public Health Efforts against Smallpox during Brazil’s Era of Epidemics

~ Ian Read ~
iread@soka.edu

January, 2012

126th annual meeting of the American Historical Association
Chicago
7 January 2012
Session 154
Governing Communities: The Latin American Municipality in the Long Nineteenth Century
Brazil’s “era of epidemics” stretched from 1849 to about 1910 and was characterized by the appearance of several fearsome new contagious diseases and increasing epidemic virulence. Yellow fever appeared for the first time in more than 150 years in 1849, and cholera and bubonic plague were recorded as official causes of death for the first time in 1854 and 1899 respectively. While bubonic plague resulted in small isolated outbreaks, yellow fever and cholera killed hundreds of thousands along the Brazilian coast and its major waterways during the second half of the nineteenth century. By 1910, however, the world had changed again: mosquito eradication programs banished yellow fever from most urban areas, chlorine and sewage treatment eliminated the cholera vibrio from drinking water, and vaccines and rat campaigns reduced bubonic plague to an uncommon killer.¹ Three important infectious diseases disappeared nearly as quickly as they had appeared, bringing the era of epidemics to an end. As much as these three diseases spread terror, unsteadied governance, depleted local and provincial or state treasuries, tarnished Brazil’s commercial reputation, and dissuaded immigrants from landing in the “torrid zone,” another contagious disease rose and fell along with the others, but killed more than yellow fever, cholera and bubonic plague combined.²

¹ Gilberto Freyre argued that the First Republic “marked the beginning of control over diseases which until the twentieth century had taken a great toll of the Brazilian population: smallpox, yellow fever, cholera morbus, bubonic plague, tuberculosis.” Order and Progress: Brazil from Monarchy to Republic. Berkeley, Calif.: Univ. of California Press, 1986, 379.

² After complaining about the devastation caused by yellow fever in 1889, the Rio News wrote Brazil “is never free from [smallpox’s] devastations. [...] If the actual cost in money could be computed, there is not a Brazilian who would credit the figures. The large sums spent by the general and provincial governments every year in medical commissions, medicines, and other forms of official relief, are in reality only a small part of the actual cost. Added to these the money expended by private individuals in combating the disease, the expenses of the refugees, the enhanced cost of food, the destruction in infected clothing, bedding and other property, the losses to merchants, manufacturers, and all the professions in industries which form a part of any well-organized community, and also the wages of laboring people thrown out of employment by the stagnation or suspension of all business, and the aggregate will be something appalling. To this, also, should be added the check to immigration caused by these terrible epidemics of fever and small-pox.” Rio News, XVI, 37 (September 15, 1889); Cooper Collection ( “CC”), box 2, f-56. For more on the “Era of Epidemics”, see Read, Ian, The Hierarchies of Slavery in Santos, Brazil, 1822-1888. Stanford, California: Stanford University Press, 2012, Ch. 5; Ibid., 2009, "Sickness, Recovery, and Death
Between 1850 and 1900 smallpox killed more than a million Brazilians, a number that exceeded the total amount of deaths from this disease before and after these five deadly decades. While smallpox’s overall mortality gradually declined during the second half of the nineteenth century, its epidemics often worsened until about 1900. After this point, far fewer people died from smallpox on average, making what had long been one of Brazil’s top killing afflictions a disease more commonly associated with a bygone era.

In order to account for smallpox’s rise and fall we need to look at public health. Imperial and provincial governments were relatively uninvolved in the battle against smallpox. Instead, the front lines were fought within the municipal districts by town councils and local vaccinators, some of whom were aware that several European governments had greatly lowered smallpox incidence as early as the 1830s. In Brazil, officials working in hundreds of municipal townships across the vast empire regulated vaccine distribution and housed vaccinators, ordered quarantines and the removal and basic care of destitute victims, and paid for isolation hospitals, disinfection measures and sanitary police visits. Despite these mostly uncoordinated efforts and the huge local costs involved, municipal measures against smallpox had little effect in reducing the number of epidemics or the intensity of outbreaks. Only during the early Republican period when, first, health services were regularized and centralized, second, state and municipal governments increased funding for public health measures, and third, new medical technology and


3 A conservative guess on smallpox mortality in Brazil during the second half of the nineteenth century is 20 deaths per 10,000 per year. This figures comes from average mortality rates in Rio de Janeiro, Niteroi, Santos, Belem, and Porto Alegre. Based on this assumption, more than one million Brazilians died from smallpox between 1850 and 1900, vastly more deaths than all other contagious diseases except, perhaps, tuberculosis. While the population of Brazil expanded during the twentieth century, and smallpox continued to take lives, the average mortality appears to have dropped below 5 per 10,000 in most places.
knowledge crossed the Atlantic, could the Brazilian government enact policies to end one of its most destructive scourges.

This paper addresses an important but oddly neglected topic. Historians have claimed that disease (or the fear it created) played a role in some of the most important historical events of Brazil’s formation as a modern nation. Some have examined the ways that anxiety over smallpox and yellow fever provided ammunition for the abolition of the slave trade.\textsuperscript{4} A few have suggested that contagious disease was one of several reasons why the monarchy collapsed, and one historian has given evidence that yellow fever caused enormous economic damage during a period of incipient industrialization.\textsuperscript{5} Cholera and smallpox were the principle causes of death during the War against Paraguay (1865-1870) and Great Drought (1877-79), not combat or starvation.\textsuperscript{6} Attempts to eradicate disease through sanitation and hygiene are said have been how Brazilian elite legitimated social control over the urban poor. Despite this list of important events triggered or affected by


disease, historians know so little about how and when specific diseases killed Brazilians, they often confuse or misplace them in their timelines. Furthermore, we do not know why yellow fever, cholera, bubonic plague, and smallpox turned Brazil’s reputation as a healthy country into a pestilent one after 1850. Historians cannot even say for sure what sickened and killed Brazilians during Imperial and First Republican periods. I believe that attention to this topic will contribute to an explanation for sharp fluctuations in foreign trade and broad governmental transitions during the Imperial period, Brazil’s meteoric population increase after 1890, and, in the big picture, regional and even hemispheric inequality.

Before moving forward, let me quickly talk about nosology, or the popular and scientific naming of categories of disease. I don’t think we should distrust accounts of smallpox any more than any other widespread and tangible historical phenomena. Smallpox, for example, was one of the most identifiable illnesses for millennia, easily spotted by the medically untrained and requiring no autopsy when it killed. Typically, its victims experienced severe flu-like symptoms soon followed by the appearance of flat, red spots, usually first on the face, hands, arms and then on the chest and back (Figure 1.). “Within a day or two, many of these lesions turn into small blisters filled with clear fluid, which then

---

8 Before 1850, Brazil avoided the pandemics of influenza and cholera that struck North America and Europe, a fact often cited by travelers. Brazilian officials, particularly in São Paulo and Minas Gerais frequently commented on the good health of Brazil before the second half of the nineteenth century. See Read, Ian. 2009. "Sickness, Recovery, and Death Among the Enslaved and Free People of Santos, Brazil, 1860-1888," Americas. 66, no. 1: pg. 57-58. Criticism mounted severely of Brazil’s health and the efforts of the government to provide effective sanitation as the century wore on. For example, the Rio News reported that “Rio de Janeiro is quite as widely celebrated for its pestilential epidemics as it is for its unique and beautiful scenery.” Rio News, XVIII, 31 (August 4, 1891); CC, personal notes, box 2, f-57. Meade, Teresa A. "Civilizing" Rio: Reform and Resistance in a Brazilian City, 1889-1930. University Park, Pa: Pennsylvania State University Press, 1997, 64.
9 More is known now about what sickened and killed slaves.
10 Sebastião Barroso wrote “smallpox is not a disease whose diagnosis leaves room for discussion.” Modalidades clinicas da febre amarelle. Formas benignas e formas graves, (1922), pg. 9; CC, personal notes, box 8, f-49.
turns into pus. Scabs begin to form eight to nine days later and eventually fall off, leaving deep, pitted scars.”¹¹ In its worst form, smallpox developed under the skin, leading to internal hemorrhaging and a painful death. With its particular timing, location and appearance of rashes, mortality and movement, this disease is wholly unlike other illnesses, cutaneous or otherwise.

Figure 1.


This paper presents the first systematic evidence that smallpox increased as a problem across Brazil after 1850.

[INFORMALLY DISCUSS CHARTS]

As shown in Table 1, smallpox epidemics also increased in its frequency across the province and (after 1889) the state of São Paulo. The province was reported by its president to have been free of smallpox for 12 out of the 20 years between 1840 and
1859. Between 1870 and 1890, however, there were only four years in which the disease did not strike one of the province's municipal districts. The Paulista government may have been less aware or reported fewer epidemics during the middle of the century, but the provincial vaccination institute was required to make note of outbreaks and these reports were available both periods for president when they gave their annual speeches.

Table 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of SP municipalities with reported outbreaks</th>
<th>Year</th>
<th>Number of SP municipalities with reported outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1837</td>
<td>“Throughout the province”</td>
<td>1873</td>
<td>“Throughout the province”</td>
</tr>
<tr>
<td>1838</td>
<td>“Throughout the province”</td>
<td>1874</td>
<td>8</td>
</tr>
<tr>
<td>1843</td>
<td>15</td>
<td>1875</td>
<td>21</td>
</tr>
<tr>
<td>1848</td>
<td>“Throughout the province”</td>
<td>1876</td>
<td>1</td>
</tr>
<tr>
<td>1851</td>
<td>3</td>
<td>1877</td>
<td>1</td>
</tr>
<tr>
<td>1853</td>
<td>2</td>
<td>1878</td>
<td>10</td>
</tr>
<tr>
<td>1854</td>
<td>15</td>
<td>1879</td>
<td>4</td>
</tr>
<tr>
<td>1857</td>
<td>4</td>
<td>1882</td>
<td>5</td>
</tr>
<tr>
<td>1858</td>
<td>1</td>
<td>1884</td>
<td>1</td>
</tr>
<tr>
<td>1859</td>
<td>1</td>
<td>1885</td>
<td>2</td>
</tr>
<tr>
<td>1861</td>
<td>1</td>
<td>1886</td>
<td>13</td>
</tr>
<tr>
<td>1862</td>
<td>6</td>
<td>1887</td>
<td>4</td>
</tr>
<tr>
<td>1863</td>
<td>“Throughout the province”</td>
<td>1888</td>
<td>2</td>
</tr>
<tr>
<td>1865</td>
<td>“Throughout the province”</td>
<td>1889</td>
<td>5</td>
</tr>
<tr>
<td>1867</td>
<td>8</td>
<td>1890</td>
<td>22</td>
</tr>
<tr>
<td>1869</td>
<td>“Throughout the province”</td>
<td>1891</td>
<td>21</td>
</tr>
<tr>
<td>1870</td>
<td>“Throughout the province”</td>
<td>1892</td>
<td>68</td>
</tr>
<tr>
<td>1871</td>
<td>4</td>
<td>1893</td>
<td>29</td>
</tr>
</tbody>
</table>

Provincial President and State Reports 1837-1893

Smallpox grew to be a more frequent and intensely virulent problem as population grew, transportation infrastructure expanded and improved, and migrants and immigrants poured into the province and state. São Paulo's population more than doubled between 1856 and 1890, and then nearly doubled again by 1910. Some of this increase came from
new arrivals; European settlers or Northeasterners came looking for opportunities among the expanding fields of coffee trees. Many traveled by train. The length of railroads in Brazil grew from 16 kilometers in 1854 to 14,801 kilometers in 1901. Between 1867 and 1901, a quarter to a third of all of Brazil’s rails were in São Paulo alone. Finally, newly macadamized roads invited wagons and mule trains that carried coffee to the coast and manufactured goods inlands. Such changes placed a quickly growing pool of susceptible individuals into more frequent contact with the virus.

Smallpox mortality dropped considerably after 1892, even though São Paulo’s population and economy continued to grow at a fast clip, because the government replaced ineffective policies with effective ones or strengthened and financed weak and underfunded public health efforts. During the nineteenth century, governments and communities around the world used three broad approaches to reduce the risk of smallpox: isolation, disinfection, and vaccination. Considering the near futility of isolation and disinfection and the risks of inoculation, it is not surprising that governments quickly gave attention to the Edward Jenner’s new invention of vaccination in 1798. The history of vaccination in Europe, Brazil and São Paulo has been written in some detail, but it is

14 A discussion of the changing medical practices in regard to smallpox is beyond the scope of this paper. Treatment can be found in Langaard and Chernoviz’s popular medical guidebooks. See Chernoviz, Pedro Luiz Napoleão. Formulario ou guia medica. Pariz: Em casa do autor, (1864), 620-621; and Langaard, Theodoro J. H. Diccionario de medicina domestica e popular. Rio de Janeiro: Laemmert, (1865), 287-295. For new therapies that became popular in the 1880s, see Du Castel, “Tratamento da variola,” O Brazil-Medico, Revista Semanal de Medicina e Cirurgia. 5, 38 (1891), 304-305; CC, box 6, f-266
important to say that between 1804, when the first vaccination was performed in Brazil, and 1846, a number of institutions were created and laws passed to promote vaccination. Vaccine institutes were created in Rio de Janeiro and in many of the provinces, and vaccine was distributed in small quantities to rural areas. By imperial decree, vaccination became mandatory for people residing in Brazil in 1846. That year, a new vaccine institute was created in Rio de Janeiro to distribute vaccine to provincial and municipal authorities throughout the nation.

National and provincial governments established vaccine institutions and made vaccination obligatory by law, but placed the management of vaccination and the enforcement of the law in the hands of township councilmen. These measures did little to prevent smallpox outbreaks for three reasons. First, vaccination institutions were underfunded and ill-equipped to distribute vaccine to millions of Brazilians, even in the wealthiest urban areas. Second, there is no evidence that cow-pox existed in its natural form among cattle herds in Brazil. Despite a large reward promised for any individual who could manufacture a bovine vaccine, the Vaccine Institute had to order its vaccine from Paris and London until 1887. When a small glass capillary tube of vaccine was attained by a vaccinator at one of the institutes, it had traveled for months over sea and land in a mostly unpreserved state. This meant that many vials of vaccine became contaminated, disabling the variola virus. Among thousands of vaccinations given in São Paulo between 1804 and 1846, only about 1 or 2 percent of its residents each year were vaccinated.

1840 and 1871, about one of every four vaccinations did not produce its intended effect.\textsuperscript{17} Finally, Brazilians felt a deep distrust toward vaccination. This was somewhat understandable considering how often vaccine failed and because vaccinators practiced the “arm-to-arm” method. Pure vaccine was rare and valuable, so vaccinators renewed their supply by taking pus from the individuals they had vaccinated. Such a practice could transmit other diseases, such as syphilis. The “arm-to-arm” method struck most as an unpalatable procedure in itself, but a great deal of additional distrust stemmed from an understanding of disease as divinely ordained and beyond the control of men.\textsuperscript{18} The vaccine revolt of 1904 in Rio de Janeiro is the most famous expression of long-running fears against vaccination, but vaccinators had been turned away at gunpoint decades earlier.\textsuperscript{19}

Rather than reducing municipal power over public health, the vaccination laws of 1828 and 1846 increased the power of township officials, since they were given the right and responsibility to enforce it.\textsuperscript{20} Township councilmen set and collected fines for violators but avoided paying most of the costs of the vaccinators’ salaries and supplies of vaccine. By the second half of the nineteenth century, the majority of townships included codes in their ordinances (\textit{codigo posturas}) that regulated vaccination. Among 216

\textsuperscript{17} Provincial reports, 1840-1871
\textsuperscript{18} A writer for the \textit{Rio News} wrote that “a telegram to the \textit{Gazeta de Noticias} says that on the 19\textsuperscript{th} [of August, 1889], the image of Our Lady of Apparecida had been taken to Guaratinguetá [São Paulo], where the small-pox has reappeared.” He sarcastically added that “the telegram does not say whether the image was vaccinated, but the presumption is that it was.” \textit{The Rio News}, XVI, 34 (August 26\textsuperscript{th}, 1889); CC, box 2, F-55.
\textsuperscript{19} When smallpox spread along the entire course of the Rio São Francisco, vaccinators sent by the government were seen to be “assassins.” Visconde de Mont’allegre, “Relatorio da repartição dos negocios do Imperio apresentado a Assemblea Geral Legislativa na 1a sessão da 8a legislatura pelo respectivo ministro e secretario d’estado”; CC, personal notes, box 2, f-52.
\textsuperscript{20} Imperial Decree 464, that made vaccination obligatory and created the Instituto Vaccinico do Imperio, gave Provincial Vaccination Commissioners (Comissarios Vaccinadores Provinciæs) and advisory role to town councils, but their advice was not enforceable. Part 5 of article 21 stated that the Commissioners were to “propose to township councils all measures, upon which it depended, so that vaccine could be effectively propagated, and obstruct the development of the epidemic of smallpox, as soon as it manifests itself anywhere in the municipality.” \textit{Collecção das Leis do Imperio do Brasil} (1846), tomo 9, section 16, part 2, 93
ordinances passed by 99 municipalities in São Paulo between 1865 and 1889, three-quarters contained codes that mentioned vaccination. Most of these rules reinforced the imperial decree that all residents be vaccinated, but they also fined residents who did not return to the vaccinator eight days after vaccination to determine efficacy and extract pus for more vaccinations. Some laws called for heads of families, fathers, tutors and teachers to bring children and dependents, without specifically declaring that this mostly adult male group also had to be vaccinated. There were other rules that applied specifically to school principles and farmers. Fines for refusing vaccination or not returning for the check-up and extraction usually ran from 2 to 10 mil-reis, but could run as high as 30 mil-reis. In comparison, a month’s wage for unskilled labor was about 100 mil-reis in the 1870s.21

Vaccination codes largely conformed to the 1846 vaccination law, but other anti-smallpox measures were more diverse. About half of the 216 Paulista township ordinances carried anti-smallpox measures unrelated to vaccination. Before 1870 for instance, town ordinances more commonly called for residents had to hang a black or colored flag from their door when a smallpox victim was within. A few township councils mandated that doctors or families disclose cases of smallpox when they appeared. After 1870, town councils criminalized the entrance of smallpox victims, with as much as a month in jail (or a large fine) for anyone who knowingly entered or hid someone with smallpox. Slave traders were especially given the legal duty to keep infected slaves out of township and to notify officials when cases appeared within their coffles.

By the 1870s and 1880s, more townships attempted to remove and care for smallpox victims who were indigent or homeless. When epidemics were severe, this could

21 ADD: Double-check this wage figure
quickly deplete a township treasury. The number of isolation hospitals and clinics increased as townships attempted to contain the contagion. Some townships even compelled the police or doctors to remove the first few individuals infected by smallpox, regardless of whether they were destitute or homeowners. Finally some codes regulated burial. Corpses of smallpox victims had to be transported in a hermeneutically sealed casket or buried in an isolated corner of the cemetery, as if the ghost of the smallpox victim would rise from the ground and infect cemetery visitors.²²

In total, about 560 articles within this large set of ordinances were written with purpose of diminishing the risk of smallpox. Did this body of law or the efforts of township councils and salaried vaccinators have any effect in the battle against smallpox? Townships can be divided into two groups, those with more or stringent anti-smallpox measures, and those with rules that were relatively minimal. We might expect to see that the group with stringent rules to have been more successful in preventing outbreaks of smallpox. This, however, was not the case. Towns that were reported to have been struck by epidemics between 1840 and 1892 did not have fewer or less stringent smallpox prophylaxis or vaccination ordinances. Only stringent prophylaxis rules may have slightly reduced the risk of contagion.

Municipal public health laws during the Empire may have made little difference, but the population size of townships and their proximity to railroads mattered. The average population of those struck by smallpox in the epidemic of 1892-93 was 243 percent larger than those not struck. Having a railroad station, however, appears to have increased the risk of smallpox epidemics more than having a relatively large population. Seventy nine

²² Municipal ordinances, 1864-1890, Assembleia Legislativa do Estado de São Paulo. http://www.al.sp.gov.br
percent of townships with railroad centers reported smallpox (figure 5) in the 1892-93 epidemic. Only a third (33%) of those without stations was struck. Of course, population and railroad stations went hand-in-glove: the larger the city the more likely it was to have a station. Nonetheless, the correlation between epidemics and railroad stations is stronger than that between epidemics and large populations. Table 2 compares the correlation of epidemics and four factors: railroad stations, population, population growth between 1872 and 1890, and navigable rivers. It shows that township with railroad stations were far more likely to be struck by smallpox than those that grew quicker than average or that were near navigable rivers. Contemporaries were not blind to the fact that trains carried smallpox and, in fact, stations were closed when epidemics occurred. Three local outbreaks reported by the Diário Oficial do Estado de São Paulo in 1891 occurred within walking distance of the São Paulo, Bocaina, and Conchas train stations.
Figure 5. Smallpox outbreaks along the railroads in February, 1892

![Map of smallpox outbreaks along the railroads in February, 1892.]

Table 2. Correlations between smallpox epidemics and various factors

<table>
<thead>
<tr>
<th></th>
<th>Train Station</th>
<th>Population</th>
<th>Population change</th>
<th>Navigable river</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallpox epidemic</td>
<td>0.467</td>
<td>0.357</td>
<td>0.102</td>
<td>0.029</td>
</tr>
</tbody>
</table>

Smallpox greatly declined as a threat by the mid-1890s in São Paulo because public health efforts conducted by state and municipal officials vastly improved. The Republican government that replaced the Monarchy in a largely bloodless coup in 1889 decentralized and centralized public health authority in Brazil. Public health was decentralized when the
Republican government placed much more authority over policy into the hands of state
governments, with the notable exception of port inspections and seaboard quarantine
decisions. But many state governments, including São Paulo’s, centralized their authority
over public health by passing health codes and laws binding throughout the state. For
example, the Republican government left it up to states to mandate vaccination, something
that São Paulo did in 1891. But unlike the Imperial law of 1846 that had placed the power
of enforcement in the hands of township councils, this state law penalized infractions with
a 10 to 100 mil-reis fine regardless of township and stipulated that the civil and military
police would take “appropriate measures” to ensure vaccination.23 In July 1892, the
Paulista state government created a powerful new Sanitary Service that included “a council
to advise the executive on matters relating to public health.” The Sanitary Service was the
region’s first agency broadly “committed to the progress in public health.”24

While public health authority transferred from the federal and municipal levels to
the state level under the Republic, townships became far more active in addressing public
sanitation and health. The Paulista townships of Campinas, Riberão Preto, and Franca
expanded their regulation over health inspections, water and sewage, and street sanitation,
as my co-panelist Anne Hanley has recently shown. In Campinas, “hygiene delegates” had
considerable power to enter homes and buildings suspected of health code violations,
compelling vaccinations, and could even order the demolition of buildings identified as

23 Lei n. 37, de 1o de Julho de 1892. Assemblea Legislativa do Estado de São Paulo,
http://www.al.sp.gov.br/repositorio/legislacao/lei/1892/lei%20n.37,%20de%201892.htm (Accessed December
10, 2011)
unhealthy.\textsuperscript{25} Professor Hanley writes that municipal efforts toward sanitation and hygiene “entailed, at least on paper, a massive undertaking.”\textsuperscript{26} Such an undertaking would not have been possible without money: municipal spending expanded three-fold between 1886 and 1900 among the seven municipalities surveyed. Between 7 and 27 percent of this money went toward public health.\textsuperscript{27}

Another key reason why the Republican government more ably fought smallpox was because new technology and innovations changed vaccination in Brazil from a fairly expensive, odious and risky procedure into one that was much cheaper and safer. After nearly a decade of trials, a doctor in Rio de Janeiro, successfully reproduced the variola virus in calves. As a result, the number of vials of vaccine increased considerably throughout the Republic.\textsuperscript{28} In 1905, the Paulista government reported that it had vaccinated more than 27,000 people that year. This is about the same number of people who had been vaccinated in total between 1841 and 1872, according to 15 published provincial reports from the period.\textsuperscript{29} Popular resistance may have also diminished, especially when arm-to-arm vaccinations were replaced by the “vacina animal.” Thus, by 1904, when public health officials in Rio de Janeiro were once again facing a severe smallpox epidemic, Emilio Ribas, the director of São Paulo’s Sanitary Service, could largely concern himself with a successful campaign to eradicate yellow fever.\textsuperscript{30}

\begin{footnotesize}
\begin{footnotes}
\item \textsuperscript{25} Hanley, Anne “Public Health in São Paulo, Brazil, 1834-1914,” paper presented at the Economics and Biodemography of Aging and Health Workshop Center for Population Economics, University of Chicago, November 13, 2009, pg. 17-30.
\item \textsuperscript{26} Ibid., pg. 20
\item \textsuperscript{27} Ibid., pg. 46-47
\item \textsuperscript{28} [ADD citations, also mention the growing use of glycerin as a preservative: Vaccination as a preventive of smallpox by William C. Chapman]
\item \textsuperscript{29} The provincial presidential reports published 15 reports with vaccination numbers. It is possible that many more people were vaccinated, but these numbers were not reported.
\item \textsuperscript{30} Blount, Public Health Movement, pg. 117
\end{footnotes}
\end{footnotesize}
Brazil’s era of epidemics was characterized by the appearance of three unfamiliar but terrifying scourges: yellow fever, cholera and bubonic plague. Deadlier than these three, however, smallpox became increasingly virulent in Rio de Janeiro, Belém and Santos until the 1880s, and its epidemic cycle occurred more frequently until the 1890s in all places surveyed. The battle against smallpox, fought mostly by municipal authorities during the Imperial period, was largely fruitless because vaccine quality was low, vaccination was uncoordinated, decentralized, under-resourced, and popular resistance was insurmountable.

Three implications arise from these findings:

1. Evidence is mounting that Brazil’s first railroads helped spread individuals and items infected with the smallpox virus and mosquitoes carrying the yellow fever virus, worsening both diseases. One notable recent attempt to estimate the “social savings” of railroads in Brazil does not consider railroads as creating new contagion networks, with enormous the costs to society.

2. São Paulo’s success may be one important but unrecognized reason why Rio de Janeiro officials took the step to mandate vaccination, sparking the vaccine riots in 1904. By this point, “arm-to-arm” vaccination was replaced by bovine vaccine, greatly diminishing its risks and improving its success rate. Other cities of the republic, such as Rio de Janeiro’s growing rival, São Paulo, had greatly reduced the loss of life from this disease through mandatory vaccination. When Oswaldo Cruz and his public health team were forced to retreat from vaccinating

---


susceptible *Cariocas* after the 1904 riots, the stage was set for Rio de Janeiro’s most horrifying smallpox epidemic. Historians might hesitate to make implicit or explicit ethical arguments that condemn the “social control” of the poor during this episode, when the failures of such control led to an outbreak of a preventable disease that killed thousands of mostly poor *Cariocas* in 1908.

3. Despite Rio’s terrible epidemics, Brazil’s population expanded exponentially between 1890 and 1920 and increased immigration only explains a minor part of this growth. This paper and recent discoveries on tetanus suggest that public health policies, some of which were put in place at the local level during the Republican period, appear to have lowered general mortality. This may have been an important factor behind the exponential population growth. If such a demographic trend had not occurred, Brazil would have been a far less urban and populated place by 1920.

---

33 Between 1872 and 1890 the Brazilian population increased at an average of 230,000 people per year. From 1892 to 1910, the rate of population growth jumped, with about 405,000 more people in Brazil each year because of childbirth or immigration. Based on these numbers, immigration contributed about a third of the total increase, a less important role than the natural increase internal to Brazil. This fact, it must be added, is rarely acknowledged in the literature, nor is the role that health may have played. Agostinho José de Souza Lima listed 21 reasons why infant mortality had improved in Rio de Janeiro in 1888. *Annaes a Academia de Medicina do Rio de Janeiro*, VI serie, Tomo III (1887-1888), 523-525; CC, box 6, f-245.