

## Public health challenges and emerging diseases: the case of São Paulo

Doenças emergentes e desafios à saúde pública.  
O caso de São Paulo

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**Abstract** *The author discusses the challenges posed by emerging infectious diseases in 100 years of public health in the state of São Paulo, Brazil. With an advanced and organized public health system, São Paulo responded to the emergence of infectious diseases by creating research institutions and control programs. The late 19th century witnessed the first modern research institution in microbiology, in response to the bubonic plague. A changing economy led to constant changes in ecosystems. The late 20th century presents a wide array of both emerging and rapidly changing infectious diseases. The present situation calls for creative solutions. Ecosystem analysis and more agile epidemiological surveillance are seen as the best alternatives.*

**Key words** *Communicable Diseases; Epidemiological Surveillance; Ecosystem; Public Health*

**Resumo** *O artigo apresenta uma discussão a respeito dos desafios enfrentados pela saúde pública paulista durante cem anos de ocorrência de doenças infecciosas emergentes. Com uma saúde pública avançada e organizada, São Paulo respondeu a esses desafios por meio da criação de instituições de pesquisa e programas de controle. O final do século XIX assistiu à criação do primeiro instituto moderno de pesquisa em microbiologia, em resposta à ocorrência da peste bubônica. Uma economia em transformação determinou a constante mudança dos ecossistemas. O final do século XX traz uma vasta gama de doenças infecciosas, emergentes ou em rápida transformação. A situação presente pede soluções criativas. A análise de ecossistemas e uma vigilância epidemiológica ágil são apresentadas como as soluções mais viáveis.*

**Palavras-chave** *Doenças Transmissíveis; Vigilância Epidemiológica; Ecossistema; Saúde Pública*

## Introduction

The last two decades of the 20th century have put public health to the test. Resource limitation, due to the dominance of liberal ideas in capitalist countries and the failure of socialist policies elsewhere, has been aggravated by expanding health problems. The widespread perception of the threat posed by emerging infectious diseases has been a decisive issue for change in disease control policies and reordering of infectious disease surveillance and control policies. AIDS has played a particularly important role in this perception (Lederberg et al., 1992).

Emerging infectious diseases are already an undeniable public health problem worldwide. However, this is not the issue under discussion herein. Rather, I discuss the challenges to public health brought about by emerging infectious diseases. Such diseases are a new problem. Can the public health system cope with them? If so, how, and at what cost?

In order to exemplify the challenges to public health posed by emerging diseases, I chose to analyze the field's last 100 years in São Paulo, Brazil's most prosperous state.

## Public Health in São Paulo

São Paulo is located in the Southeast of Brazil and has a population approaching 35 million. The field of public health has an outstanding history in São Paulo, beginning in the late 19th century, with the creation of the *Serviço Sanitário* (Sanitary Service), soon after the demise of the monarchic regime and the declaration of the Republic (Blount, 1972a, 1972b; Ribeiro, 1993; Silva, 1999). Not that there was no public health system during the monarchy; it simply was not a priority on the official agenda. At the time São Paulo, unlike other states of Brazil, consisted of more than just its capital city. The economy was centered in the prosperous interior. Santos was being equipped as a modern seaport, and railways were being built to transport the prime crop and source of wealth, coffee. As coffee plantations replaced the forest and spread westward, new towns and a growing population of mostly European immigrants occupied the plateau that makes up most of São Paulo's territory (Denis, 1909; Monbeig, 1952; Dean, 1976; Silva, 1986b).

At the time the *Serviço Sanitário* was created, urban yellow fever was the state's most critical infectious disease problem. Towards the end of the monarchy, a devastating epidemic

nearly wiped out Campinas, the state's second-largest city, next to the capital. Ribeirão Preto and Sorocaba also suffered extensive epidemics, threatening coffee production in the former and the state's incipient textile industry in the latter (Ribeiro, 1993; Donalisio, 1999).

Emilio Ribas was sent to control yellow fever in São Paulo's main cities. Mosquito control was implemented for the first time, based on the ideas and work of Carlos Finlay in Cuba. Around the end of the 19th century, bubonic plague reached Santos, Rio de Janeiro, and other Brazilian seaports. It was the first known outbreak of bubonic plague in Brazil. A strong public outcry and government determination to contain the outbreak were crucial to the formation, in 1899, of the country's first biotechnology center, which later became the Butantan Institute. The small laboratory was mounted on a farm near the city of São Paulo to produce plague antisera (Stepan, 1976; Ribeiro, 1993; Silva et al., 1998).

We are discussing the challenges that emerging diseases pose to public health. One hundred years ago, an emerging disease was decisive in bringing modern science to public health.

Coffee had been Brazil's main cash commodity for many years. It is a demanding crop, requiring fertile soil and a rather particular climate. Moreover, coffee-growing is labor-intensive (Milliet, 1939; Holloway, 1972).

São Paulo was ideal for coffee production, and its territory was occupied in a relatively short period of time. Starting in the 1850s, when coffee production burgeoned in São Paulo, and through the 1950s, when industry began to replace agriculture as the driving force in the state's economy, agriculture reached the state's western borders. In its wake, this intensive and extensive pressure on the ecosystem left only a fragment of the original forest and a densely occupied territory, a complex railway network, and a growing array of cities and towns (Monbeig, 1952; Furtado, 1977; Santos, 1996; Silva, 1999).

## Recent changes in the ecosystem

According to the 1950 national census, about 50% of the state's population was urban, a proportion that would reach more than 90% at present. During the period in which coffee dominated the economy, São Paulo's population grew many times over, mainly due to European (mostly Italian) immigration. This labor force had to reside close to the coffee plantations, which required year-round attention (Keller, 1970, 1977).

The latter half of the 20th century witnessed an increasing variety of ecosystems, as opposed to the rather uniform ecosystem created by the coffee agribusiness. As the soil was depleted, coffee moved on to the neighboring state of Paraná. São Paulo, using the capital accumulated by coffee, would turn to a more sophisticated agriculture, more capital – and technology – intensive and less labor-intensive. The 1929 stock market crash put a damper on coffee expansion, but only for a decade. The 30 years following World War II witnessed the urbanization of predominantly rural diseases, like Chagas disease, mucocutaneous leishmaniasis, trachoma, endemic goiter, ancylostomiasis, and sylvatic yellow fever, among others. Schistosomiasis became predominantly urban in some areas. *Aedes aegypti* was re-introduced in 1985 and dengue soon followed. Mucocutaneous leishmaniasis, South American blastomycosis (paracoccidioidomycosis), and trachoma were now reported within town and city limits. The agricultural labor force was now hired under new rules and lived in urban areas. Improved roads and the automotive industry were driven by labor legislation that made year-round employment anti-economical for agricultural capital. The migrant labor force helped shape new ecosystems, eliminating the distinctions between rural and urban areas (Santos, 1996; Barata, 1998).

In short, the 20th century was characterized by profound ecological changes in São Paulo. It also saw a constant flow of emerging infectious diseases, beginning with the 1899 bubonic plague outbreak in Santos. In the early 20th century, the São Paulo medical community identified mucocutaneous leishmaniasis in the state. The outbreak occurred during the construction of a railroad from Bauru (in the center of the state, then the westernmost agricultural frontier) to Bolivia. South American blastomycosis was identified among immigrant workers on the coffee plantations, yellow fever in the larger cities of the interior, trachoma and ancylostomiasis in the rural labor force, and Chagas disease in the area occupied by coffee plantations (Bayma, 1914; Pessoa, 1969; Silva, 1986b; Ribeiro, 1993; Silva, 1999).

Not all diseases that were prevalent to the point of posing a real public health problem were autochthonous. Yellow fever was introduced from Africa. Trachoma came with European immigrants. Even Chagas disease, autochthonous to the New World, was in part introduced. *Triatoma infestans*, the most efficient and prevalent vector, is not found in natural habitats in São Paulo or even in neighbor-

ing states. The species was introduced at some stage the state's history, possibly in the late 18th or early 19th century, when horses and mules were imported over land from the pampas (Argentina, Uruguay, and the southernmost Brazilian state of Rio Grande do Sul) to supply transportation. Mule trains were the sole means of transportation for gold from Minas Gerais to the coast in the 18th century and during the early decades of the coffee agribusiness (Silva, 1986b; Wills, 1996; Silva, 1999).

There were also changes in urban ecosystems. São Paulo, the capital, once a provincial village where most of the inhabitants spoke the indigenous Guarani language, is now a metropolis with more than 14 million habitants. Urban sprawl was not painless or disease-free. Spotted fever, schistosomiasis, influenza, yellow fever, and meningococcal meningitis were the epidemiological consequences of different phases of urban growth (Silva, 1985).

The occupation and transformation of the plateau brought about an almost continuous string of emerging diseases, in a fashion well described by Pavlovsky in the 1930s (Pavlovsky, s.d.). This phenomenon had a strong effect on the organization of public health in São Paulo. Parasitology and microbiology were given great impetus in the public health research institutes. The technological capability of these institutes was considerable. A good example was the outbreak of what became known as São Paulo typhus, later renamed Brazilian spotted fever. In 1929, urban sprawl extended the capital city westward. British capital invested in urban development created new areas. Soon after the first owners occupied their homes, there was an outbreak of a previously unidentified disease. Researchers from the Butantan Institute, working closely with physicians from the Emilio Ribas Hospital (specializing in infectious diseases), were quickly able to identify the infective organism. The same group also described the main aspects of the disease, including its epidemiology and transmission, and even produce a vaccine, albeit insufficiently efficacious (Piza et al., 1932; Dias et al., 1939; Silva et al., 1998).

### Responding to the challenges

The succession of emerging diseases, a constant threat to the rural labor force, prompted São Paulo to develop a strong and professional public health system, together with research and academic centers. In time, control programs were organized, particularly when tech-

nology emerging from World War II became available for civilian use. Malaria and Chagas disease were controlled. Trachoma and mucocutaneous leishmaniasis disappeared. Ancylostomiasis was no longer a problem. The rural environment appeared to be under control, a public health success story. Urbanization and the economic and social changes in the rural areas of the state where doubtless instrumental in controlling many of these diseases. However, there was also an intense public health effort towards their control, without which most of these diseases would still pose major problems, as in other areas of Brazil (Silva, 1986a; Ribeiro, 1993).

Urban sprawl, especially in the new metropolis of São Paulo, led to new infectious disease problems. Urban schistosomiasis had been detected in 1959, but appeared to be little more than a nuisance. In fact, the first schistosomiasis focus had been identified in 1923, in Santos, but it was only during the 1960s that the disease came to be seen as a serious threat (Aranes, 1924; Silva, 1983, 1986a; Silva et al., 1989).

It was in the early 1970s that intense migration to the sprawling metropolis really began to show its ugly side. Meningococcal disease was not new to São Paulo. Outbreaks had occurred since the early 20th century, but none with the proportions of the two successive epidemics (serotype C, followed closely by serotype A), the largest epidemics of meningococcal disease in the state's history (Waldman et al., 1995).

The new rural scenario spawned diseases of its own. Permanent employment in the labor-intensive coffee plantations gave way to temporary work in the orange groves and sugar cane plantations (Keller, 1970).

### **The present situation and its determinants**

In the aftermath of the epidemics described above, there was widespread agreement over the need for efficient epidemiological surveillance. A strong surveillance awareness and tradition took shape in São Paulo, fostering the advancement of a comprehensive vaccination program leading to the control of measles, vaccination for rubella, and broad coverage with other vaccines. São Paulo is still at the forefront of vaccination in Brazil, having recently initiated the replacement of the problematic Fuenzalida rabies vaccine (suckling-mouse virus vaccine) with the more modern tissue culture virus vaccine.

After the control of rural endemic diseases, the public health focus shifted to urban areas,

concerned with the meningococcal epidemics of the early 1970s and the limited vaccination coverage in the aftermath of the epidemics. The meningococcal disease epidemics in the early 1970s had pinpointed the need for adequate epidemiological surveillance.

By the late 1970s, coinciding with the global upsurge of emerging diseases, a succession of events gradually drew the attention of the public health establishment to the new ecosystems that had replaced the rather uniform one constituted by the coffee agribusiness (Silva, 1999).

Brazilian purpuric fever, the renewed occurrence of trachoma, and the continuous identification of peri-urban mansoni schistosomiasis foci highlighted the new rural reality. Migrant workers, mostly from neighboring states (but also from the Northeast) living in substandard housing on the outskirts of towns with insufficient urban infra-structure were now the center of a new epidemiological context (Silva, 1986a, 1986b; Silva et al., 1989).

Migrant farm workers were not the only problem. A wide range of diseases would leave no doubt that the emergence and re-emergence of diseases had not a single cause, but distinct determinants.

Rocio encephalitis, Brazilian purpuric fever, AIDS, mucocutaneous leishmaniasis, hepatitis C, serotype B meningococcal disease, hantavirus, and more recently visceral leishmaniasis were more than sufficient to highlight the diverse ecosystems and their rapidly changing context (The Brazilian Purpuric Fever Study Group, 1992; Gomes, 1994; Waldman et al., 1995; Silva, 1998; Donalisio, 1999).

This situation has been fundamental in the change (still slow, unfortunately) in the state's disease surveillance and control agencies.

The change has not followed an established blueprint, but is consequent to an evolving mind-set concerning disease surveillance and control. Information technology has contributed greatly to this change of philosophy, as elsewhere in the world, but emerging and re-emerging diseases were (and still are) central to the issue (Silva, 1998).

Decentralization of both surveillance and control activities began after the re-introduction of *A. aegypti*. *A. aegypti* surveillance and control had been coordinated by the Federal government, even in São Paulo. Since the situation had been under control for some 40 years, state health authorities had never given the issue a second thought. When the vector reappeared, the Federal government lacked sufficient resources to cope with the problem at the state level. The state public health system took

over, but soon began an active decentralization program, working closely with local administrations (Donalizio, 1999).

The increasingly dominant concepts include smaller, more versatile units, capable of coping with different situations on short notice, better information exchange, greater inter-agency integration and collaboration, an enhanced surveillance network, and prompt and effective action to control outbreaks at the very beginning. Such concepts are responsible for changes in attitudes and policy that are gradually taking place. They exist as a response to new challenges, i.e., new diseases demanding new control programs (Silva, 1992).

Emerging diseases have occurred in São Paulo at different stages in the last 100 years (The Brazilian Purpuric Fever Study Group, 1992; Silva, 1998), and have been instrumental to changes in public health vis-à-vis infectious disease control policies. However, in the last 20 years the emergence and re-emergence of diseases has accelerated, as elsewhere in the world. There is also a greater diversity of ecosystems, created by economic diversification, now a far cry from the coffee agribusiness of a century ago. Accelerated change is needed to keep pace with rapid transformations in both the ecosystems and the resulting epidemiological situations.

Ecosystem analysis is not a standard public health tool. Epidemiology relies mostly on past

events, from which trends are inferred. In the present situation, with rapidly evolving scenarios, such trends have a rather limited value, as complexity and diversification of ecosystems tend to expand. Ecosystem analysis may become a valuable tool in the near future, as it brings a more refined predictive capacity to epidemiology.

### Possible alternatives for the future

What are the solutions? To accept that the situation can be solved is most certainly an illusion. There probably is no solution – at best, there may be directions to follow (Silva, 1992). Some of these would be: (a) a more versatile, information-oriented surveillance system, capable of responding to an unstable situation on short notice; (b) long-term epidemiological forecasting (easier said than done, but a necessary exercise nonetheless), as difficult and elusive as long-term economic or meteorological forecasts; and (c) better-trained staff and faster information exchange, prerequisites for effective infectious disease control.

We have been responding to events, but this is not enough. We must anticipate and respond to threats before events occur. The challenge of emerging diseases demands proactive and creative behavior.

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