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Yaws in the Americas, 1950–1975

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Yaws was introduced into the Americas by African slaves beginning in the 16th century and may have already been present before the arrival of Columbus. In the 1950s, programs for the eradication of yaws were undertaken in almost all American countries in which yaws was endemic. By mass treatment of cases and contacts with penicillin, the programs against yaws have dramatically reduced the incidence of reported cases throughout the Western Hemisphere from >44,000 cases per year during 1950–1954 to 437 cases in 1975. In Brazil, efforts against yaws reduced the numbers of patients treated by 99% between 1965 and 1974. By 1975, yaws apparently remained a significant public health problem in only a few communities in Brazil, Colombia, Dominica, Ecuador, Haiti, Peru, St. Lucia, and St. Vincent, and possibly in Guiana and Surinam. It may be possible to eliminate infectious yaws entirely from the Western Hemisphere within the next few years.

After more than two decades of intermittent programs for the eradication of yaws in the Western Hemisphere, yaws is apparently now a public health problem in only a few South American and Caribbean communities. The purpose of this paper is to review the progress and current status of yaws and programs for eradication of yaws in the Americas. This subject has not been comprehensively reviewed in more than a decade.

In addition to yaws, a crippling disease of the skin and bones that is transmitted by skin-to-skin contact mostly among children and that is caused by *Treponema pertenue,* two other treponemal diseases occur in the New World. Unlike yaws, venereal syphilis (*Treponema pallidum*) may attack the cardiovascular and central nervous systems and is a potential killer. In pinta (*Treponema carateum*), damage is limited to discoloration of the skin. The serologic responses shared by victims of yaws, syphilis, or pinta are indistinguishable by all currently employed tests.

Before discussing the prevalence of yaws, a brief historical review will put the modern problem in perspective. Yaws has occurred in the Western Hemisphere at least since the early 16th century, but medical historians dispute whether it was first introduced by infected slaves from Africa or whether the diseased slaves added to an already established problem [1–3]. Oviedo described an outbreak of yaws in Hispanola in 1526 [1]. After 1558, travelers to Brazil described the spreading of yaws among the Indians of Rio de Janeiro, Bahia, and Maranhao [4]. Yaws was also common among slaves in North America during the colonial period [5].

Early accounts of yaws in the Americas are complicated by confusion of yaws with venereal syphilis, which probably was present in pre-Colombian North, Central, and South America. The conquistadores and European immigrants apparently helped the spread of syphilis to previously uninfected parts of the New World [6].

Pinta has apparently been present since time immemorial [3]. The Aztec emperor Montezuma II selected "pintados" to bear his litter [7]. Cortez referred to "color peculiarities" in the skin of Mexicans in a letter to Charles V [1].

Several countries such as Jamaica, Surinam, and Colombia undertook intensive treatment campaigns in attempts to control yaws early in the 20th century, soon after arsenic and bismuth became available for therapy [8, 9]. These efforts had limited impact on public health, however, because the treatment required a series of painful injections administered over several weeks and because asymptomatic contacts, including latent cases, were not treated.

Status of yaws during 1950–1955. By the early 1950s the two major American foci of yaws were in Brazil, where there were an estimated

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350,000–500,000 cases in a population of 52 million [4, 10], and in the Republic of Haiti, where an estimated one million or more of that country's 3.5 million inhabitants were infected [11]. In Haiti, which officially reported >45,000 cases in 1949 and >17,000 in 1954, yaws was the most important public health problem in the country [10].

Yaws was still highly endemic in the Dominican Republic and in most of the islands of the Lesser Antilles (figure 1). The disease was no longer endemic in Puerto Rico and was "not a public health problem" in Martinique and French Guiana by this time [14]. Elsewhere on the mainland yaws was endemic in British Guiana, Venezuela, among a largely black population along the Pacific coast of Colombia, Panama, and northern Ecuador, and in humid northeastern regions of Peru. Guatemala and Costa Rica reported only sporadic cases. Mexico reported none, but yaws was not a notifiable disease in Mexico [15].

In the Americas, as elsewhere, yaws has been a problem primarily of remote populations, a factor that has complicated the problems of diagnosis of latent cases and treatment, even after penicillin therapy became available. The situation was further complicated by the occurrence of venereal syphilis in urban areas of the region, and pinta in rural areas of Mexico, Colombia, Ecuador, Venezuela, and Bolivia [16]. In the early 1950s there were an estimated 400,000 cases of pinta in Colombia and >500,000 cases in Mexico [16, 17]. Pinta was also reported in Argentina, Brazil, Cuba, Guatemala, the Guianas, and Honduras.

Eradication of yaws in the Americas, 1950–1970. With the advent of cheap, stable, long-acting penicillin in the late 1940s, infections with yaws could be cured by a single im injection. The stage was set for a new attack on the treponematoses.

In July 1950, Haiti began a mass campaign against yaws, the first such "pilot project" in the hemisphere, with the assistance of the Pan American Sanitary Bureau (PASB; later called the Pan American Health Organization [PAHO]), the World Health Organization (WHO), and the United Nations Children's Emergency Fund. The original strategy called for treatment of clinically apparent cases of yaws at "collecting points" in temporary field clinics [10]. This strategy was

Figure 1. Areas (shaded) where yaws was endemic in the Americas in 1955 [12, 13].

later changed to house-to-house visits to improve coverage of the population and to include presumptive therapy of close contacts of cases even when the contacts had no visible lesions. A similar program was started in the Dominican Republic in 1954 [10].

Even by 1952 pilot programs against yaws in Haiti and elsewhere and against endemic syphilis (bejel) in Bosnia, Yugoslavia, were so successful that the First International Conference on Yaws Control in Bangkok called for efforts for worldwide control of yaws [18]. Three years later the goal became worldwide eradication of yaws [19]. In the Americas, the Pan American Sanitary Conference at Santiago had already passed a resolution in 1954 making the eradication of yaws an official goal for the hemisphere [10].

Brazil began a program to eradicate yaws in 1956 with house-to-house surveys in endemic areas and an operational definition of yaws (for purposes of treatment) as any person with skin ulcerations. Prevalence rates varied from 3.8% in Rio Grande do Norte to 27.1% in Minas Gerais [20]. Jamaica, which had reduced the local prevalence of yaws with penicillin campaigns in the late 1940s and early 1950s, gave priority to a program for the eradication of malaria rather than eradication of yaws in 1955 [8].

By 1960 virtually all American countries where yaws was endemic had vigorous internationally assisted programs bent on complete elimination of the disease. A total of 5.2 million cases and contacts were treated in WHO-assisted programs in 13 countries of the Americas between 1950 and 1960 [21]. Throughout the American tropics officially reported cases of yaws declined from 19,696 in 1950 to <3,000 cases in 1960 (no official data are available for Brazil for either year). In Haiti, sample surveys in 1958–1959 revealed that prevalence rates for yaws for the entire country had been reduced to 0.32% from an estimated 30%–60% at the beginning of the decade. Only about 40 infectious cases remained in the entire country [22]. The annual report of the director of the PASB for 1958 could reasonably and confidently state: "In Haiti, yaws eradication can be considered almost an accomplished fact... and it is anticipated that by the end of 1959 it will be possible to declare yaws eradicated from Haiti." Statistics for other programs are also impressive [20, 23, 24].

The decline of yaws continued into the early 1960s. In Haiti, yaws occurred in only 0.0006% of the population in 1962 [25]. Transmission of yaws was apparently stopped completely in Tobago in 1959 and in neighboring Trinidad in 1961 [26]. Only 23 known cases of yaws remained in the Dominican Republic in 1963 [27]. The Brazilian program, which reportedly treated 297,681 cases and 228,107 contacts during initial mass campaigns in 1957, treated 16,307 cases and 13,532 contacts in 1965 [28, 29]. By 1965, only 680 cases of yaws were officially reported for all of the Americas [30].

The early successes were followed by suspension of national programs in St. Lucia, the Dominican Republic, Haiti, Ecuador, and Colombia, beginning as early as 1959 [27, 31]. In the first three countries, brief increases in transmission followed the interruption of efforts against the disease [27, 28]. Overall, the reported incidence continued to decline, and only 381 cases were officially reported in 1969 for the hemisphere (figure 2).

Status of yaws in the Americas, 1970–1975. Yaws is still endemic in only four important areas in the Americas (figure 3). In the Lesser Antilles yaws remains endemic on Dominica, St. Lucia, and St. Vincent. Only nine cases were reported by the first two islands in 1975, and transmission of yaws is confined to one or two very small areas on each island (author's unpublished observations) [35]. Infectious yaws has not been seen in Trinidad or Tobago for several years, although hundreds of old latent cases were officially reported in 1970–1974 (B. S. Mahabir, personal communication).

Jamaica and the Dominican Republic have not reported yaws since 1972, and Haiti is the only know focus in the Greater Antilles where yaws is endemic. Because of the former prevalence of yaws in Haiti, that country remains a favorite showplace of what campaigns against yaws have accomplished, since the disease has long since ceased to be an important public health problem there. But Haiti is also an example of how yaws has continued at low levels of transmission without being eradicated.

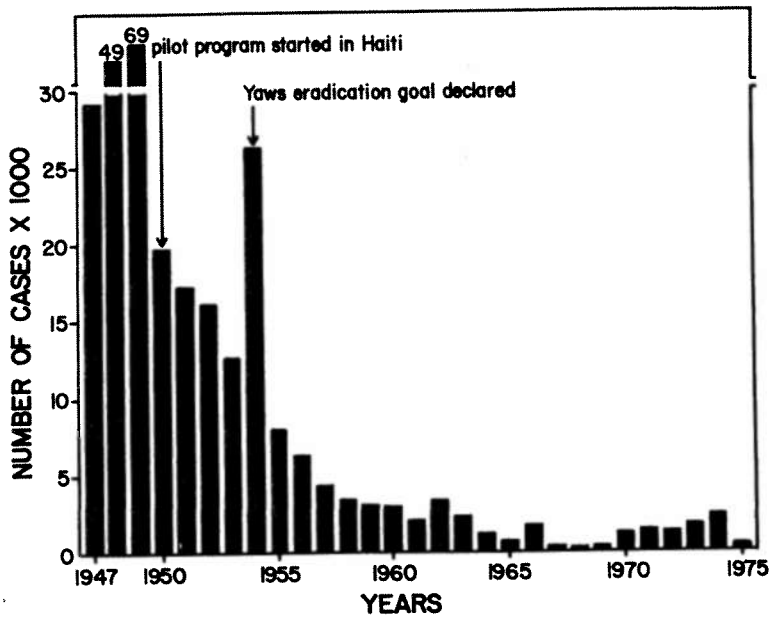

Figure 2. Officially reported cases of yaws in the Americas, 1947–1975. Almost 10,000 cases that occurred in Jamaica in 1952 and 1953 [8] and large numbers of Brazilian cases are not included (see text) [14, 26, 30, 32–34].

The Pacific coastal areas of Choco and Nariño Departments in Colombia, Esmeraldas State in Ecuador, and a small area in northeast Peru appear to be the only remaining endemic foci on the mainland, according to official reports. Ecuador began a renewed effort at eradication in 1973, and Colombia intensified its campaign against yaws at about the same time [32]. These two countries reported 416 of the 437 cases officially reported in the Americas in 1975. I am aware of unofficial reports of a few cases of yaws in Guiana and Surinam in recent years, but the status of the disease in those two countries is uncertain.

Figure 3. Areas (shaded) where yaws was endemic in the Americas in 1975 [32].

Table 1. Numbers of patients treated for yaws during initial mass treatment activities in Brazil, 1965–1974 [29, 37–46].

State	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Rondonia	345	307	610	965	117	27	109	182	2	60
Acre	642	300		791	26					
Amazonas	105	581	2,551	1,302	2,939	2,996	362	715		38
Para	8,308	3,127	2,923	228	71	105				
Amapa	177	19	286	352	365		77	42	16	20
Maranhao	1,342	1,492	329	1,349	474			185		
Rio Grande do Norte	890	176	67			7				
Alagoas	2		85							
Sergipe	2,601	4,678	4,425							
Bahia	129	1,114	614	681						
Espirito Santo	779	471	190	256	100	82	33			
Rio de Janeiro	942	2,115	1,909	1,385	806					
Mato Grosso	45	104	178	56	13					
Minas Gerais				56						
Ceara					5					
Total	16,307	14,484	14,167	7,421	4,916	3,217	581	1,124	18	118

Reports on the status of yaws in Brazil have generally not been available, even to the PAHO, for over 10 years [36]. For that reason, and because of the critical importance of the Brazilian yaws situation to any assessment of yaws in this hemisphere, data from the Brazilian campaign against yaws are included here in greater detail than might otherwise seem warranted (table 1). This information is summarized from annual issues of the *Anuario Estatistico do Brasil* [28, 29, 37–46], a publication of the Brazilian government. The Brazilian campaign reduced the number of patients with yaws treated in initial mass campaigns by 99% between 1965 and 1974, while the number of states with cases of yaws treated in initial activities was reduced from 13 to two. In 1974 the campaign reported treating only 33 additional cases (in Alagoas State) in the course of reinspections (vs. >8,000 cases treated during reinspections in 1965) [29, 37]. Thus, the occurrence of yaws has been drastically reduced in Brazil, but the disease had not yet been eradicated there as of 1974.

The prevalence of pinta has also been greatly reduced throughout the Americans, especially in Mexico and Colombia, but the exact status of that disease is not known [47]. Mexico began a national campaign for eradication of pinta in 1960 [7]. In Colombia, the decline of reported pinta has paralleled that of reported cases of yaws over the last 20 years, even without a specific campaign against pinta (author's unpublished observations).

Whither the eradication of yaws? There appears to be no insurmountable epidemiologic barrier to the eradication of infectious cases of yaws from the Americas in a few years. No animal reservoir of yaws has been demonstrated in this hemisphere [48]. Eradication of infectious yaws, however, would require better surveillance of the disease at local and international levels and more aggressive case finding and follow-up in areas where the disease is known or suspected to occur. A revised strategy for dealing with yaws has been described elsewhere [49].

As the situation now stands, yaws may gradually disappear from this hemisphere without more coordinated efforts. But as long as it remains, the potential for widespread outbreaks will continue. In Africa, this potential for renewed transmission has already been tragically demonstrated in Ghana, and there is evidence of increasing transmission in several other African countries [49]. In the Americas, it only remains to deliver the coup de grace to yaws, thereby eliminating another source of misery from the hemisphere.

References

1. Moll, A. A. Aesculapias in Latin America. W. B. Saunders, Philadelphia, 1944. 639 p.

2. Hudson, E. H. Treponematosis and African slavery. Br. J. Vener. Dis. 40:43–52, 1964.
3. Hackett, C. J. On the origin of the human treponematoses (pinta, yaws, endemic syphilis and venereal syphilis). Bull. W.H.O. 29:7–41, 1963.
4. Guimaraes, F. N. Yaws in Brazil. Bull. W.H.O. 8:225–237, 1953.
5. Parramore, T. C. Non-venereal treponematosis in colonial North America. Bull. Hist. Med. 44:571–581, 1970.
6. Henschen, F. The history and geography of diseases. Delacorte Press, New York, 1962, p. 123–124, 131, 133.
7. Langagne, A. E. Program for the eradication of pinta (spotted sickness) in Mexico. *In* Proceedings of the World Forum on Syphilis and Other Treponematoses. U.S. Public Health Service publication no. 997. Washington, D.C., 1964, p. 171–177.
8. Gentle, G. H. K. Yaws survey—Jamaica, 1963. Br. J. Vener. Dis. 41:155–162, 1965.
9. Ablanque, L. La endemia del pian en el litoral del Pacifico correspondiente al departamento del valle. Revista de Higene (Bogota) 17:105–110, 1936.
10. Pan American Sanitary Bureau. Quadrennial report of the director, 1954–1957. Pan American Sanitary Bureau official document no. 25. Pan American Sanitary Bureau, Washington, D.C., 1958, p. 15, 33–35.
11. Pan American Sanitary Bureau. Annual report of the director, 1970. Pan American Sanitary Bureau official document no. 109. Pan American Sanitary Bureau, Washington, D.C., 1971, p. 28.
12. Pan American Sanitary Bureau. Annual report of the director, 1955. Pan American Sanitary Bureau official document no. 16. Pan American Sanitary Bureau, Washington, D.C., 1956, p. 45–48.
13. Pan American Sanitary Bureau. Annual report of the director, 1956. Pan American Sanitary Bureau official document no. 19. Pan American Sanitary Bureau, Washington, D.C., 1957, p. 46.
14. Anonymous. Morbidity statistics, yaws. Epidemiological and vital statistics report no. 12. World Health Organization, Geneva, 1959, p. 104–107.
15. Pan American Sanitary Bureau. Reported cases of notifiable diseases in the Americas, 1949–1958. Scientific publication no. 48. Pan American Health Organization, Washington, D.C., 1960, p. 39.
16. Marquez, F., Rein, C. R., Arias, O. Mal del pinto in Mexico. Bull. W.H.O. 13:299–322, 1955.
17. Fox, H. Carate (pinta) as observed in Colombia, South America. Archives of Dermatology and Syphilology 18:673–691, 1928.
18. World Health Organization. First International Symposium on Yaws Control. World Health Organization monograph series no. 15. World Health Organization, Geneva, 1953. 418 p.
19. World Health Organization. Report of the Second International Conference on Control of Yaws: Nigeria, 1955. J. Trop. Med. Hyg. 60:27–38, 62–73, 1957.
20. Pan American Sanitary Bureau. Annual report of the director, 1959. Pan American Sanitary Bureau official document no. 34. Pan American Sanitary Bureau, Washington, D.C., 1960, p. 76–78.
21. Guthe, T. Measure of treponematoses problem in the world. *In* Proceedings of the World Forum on Syphilis and Other Treponematoses. U.S. Public Health Service publication no. 997. Washington, D.C., 1964, p. 11–20.
22. Expert committee on venereal infections and treponematoses. Fifth report. World Health Organization technical report series no. 190. World Health Organization, Geneva, 1960, p. 32.
23. Pan American Sanitary Bureau. Annual report of the director, 1960. Pan American Sanitary Bureau official document no. 38. Pan American Sanitary Bureau, Washington, D.C., 1961, p. 53–54.
24. Pan American Sanitary Bureau. Annual report of the Director, 1958. Pan American Sanitary Bureau official document no. 30. Pan American Sanitary Bureau, Washington, D.C., 1959, p. 56–58.
25. Idsoe, O., Kiraly, K., Causse, G. Venereal disease and treponematoses – the epidemiological situation and WHO's control programme. W.H.O. Chronicle 27: 410–417, 1973.
26. Pan American Sanitary Bureau. Annual report of the director, 1963. Pan American Sanitary Bureau official document no. 56. Pan American Sanitary Bureau, Washington, D.C., 1964, p. 20.
27. Pan American Sanitary Bureau. Quadrennial report of the director, 1962–1965. Pan American Sanitary Bureau official document no. 72. Pan American Sanitary Bureau, Washington, D.C., 1966, p. 21.
28. Conselho Nacional de Estatistica. Anuario estatistico do Brasil, 1961. Vol. 22. Rio de Janeiro, 1962, p. 320.
29. Conselho Nacional de Estatistica. Anuario estatistico do Brasil, 1966. Vol. 27. Rio de Janeiro, 1967, p. 354.
30. Pan American Sanitary Bureau. Reported cases of notifiable diseases in the Americas, 1965. Scientific publication no. 149. Pan American Sanitary Bureau, Washington, D.C., 1967. 60 p.
31. Pan American Sanitary Bureau. Annual report of the director, 1967. Pan American Sanitary Bureau official document no. 86. Pan American Sanitary Bureau, Washington, D.C., 1968, p. 26, 210, 263.
32. Pan American Sanitary Bureau. Annual report of the director, 1975. Pan American Sanitary Bureau official document no. 143. Pan American Sanitary Bureau, Washington, D.C., 1976. p. 17.
33. Pan American Sanitary Bureau. Reported cases of notifiable diseases in the Americas, 1963. Scientific publication no. 114. Pan American Health Organization, Washington, D.C., 1965. 55 p.
34. Pan American Sanitary Bureau. Annual report of the director, 1972. Pan American Sanitary Bureau official document no. 124. Pan American Sanitary Bureau, Washington, D.C., 1973, p. 16.
35. Lees, R. E. M. A selective approach to yaws control. Can. J. Public Health 64 (Suppl.):52–56, 1973.
36. World Health Organization. Communicable diseases in the Americas, 1969–72. W.H.O. Chronicle 29:140–153, 1975.

37. Fundacao Instituto Brasileiro de Geografia e Statistica. Anuario estatistico do Brasil, 1975. Vol. 36. Rio de Janeiro, 1976, p. 709.
38. Fundacao Instituto Brasileiro de Geografia e Statistica. Annuario estatistico do Brasil, 1974. Vol. 35. Rio de Janeiro, 1975, p. 677.
39. Fundacao Instituto Brasileiro de Geografia e Statistica. Anuario estatistico do Brasil, 1973. Vol. 34. Rio de Janeiro, 1974, p. 684.
40. Instituto Brasileiro de Estatistica. Anuario estatistico do Brasil, 1972. Vol. 33. Rio de Janeiro, 1973, p. 624.
41. Instituto Brasileiro de Estatistica. Anuario estatistico do Brasil, 1971. Vol. 32. Rio de Janeiro, 1972, p. 578.
42. Instituto Brasileiro de Estatistica. Anuario estatistico do Brasil, 1970. Vol. 31. Rio de Janeiro, 1971, p. 596.
43. Instituto Brasileiro de Estatistica. Anuario estatistico do Brasil, 1969. Vol. 30. Rio de Janeiro, 1970, p. 555.
44. Instituto Brasileiro de Estatistica. Anuario estatistico do Brasil, 1968. Vol. 29. Rio de Janeiro, 1969, p. 457.
45. Instituto Brasileiro de Estatistica. Anuario estatistico do Brasil, 1967. Vol. 28. Rio de Janeiro, 1968, p. 485.
46. Conselho Nacional de Estatistico. Anuario estatistico do Brasil, 1963. Vol. 24. Rio de Janeiro, 1964, p. 312.
47. Pan American Sanitary Bureau. Annual report of the director, 1974. Pan American Sanitary Bureau official document no. 136. Pan American Sanitary Bureau, Washington, D.C., 1975, p. 13.
48. Fribourg-Blanc, A., Mollaret, H. H. Natural treponematosis of the African primate. Primates Med. 3: 113–121, 1969.
49. Hopkins, D. R. After smallpox eradication: yaws? Am. J. Trop. Med. Hyg. 25:860–865, 1976.