

THE ENDEMIC TREPONEMATOSES: NOT YET ERADICATED

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At the beginning of this century endemic treponematoses (yaws, bejel, pinta) were rampant in almost all areas of the tropical belt but occurred as well in some communities in the temperate zone. Typically, the endemic treponematoses were confined to underprivileged population groups in remote areas with little or no access to health care and low standards of hygiene.

Disease transmission occurs early in life by direct contact with infectious lesions and, in the case of bejel, also by sharing drinking vessels. The disease persists for years and may lead to gummatous lesions and the destruction of cartilage and bone. Late pinta is less distinctive, but is marked by disfiguring pigmentary changes. The diagnosis is made on clinical grounds but syphilis serological tests are a helpful adjunct. The causative treponemes cannot yet be distinguished from each other or from the treponeme causing venereal syphilis, neither morphologically nor by laboratory tests. During the 1920s and 1930s treatment campaigns against yaws using multiple-dose injections of arsenical preparations and bismuth were launched at hospitals or by mobile units. Results of yaws treatment were spectacular, and a system of rural dispensaries was established to consolidate the results obtained by the mobile teams. In this way, yaws control in Central Africa was the starting point for the system of basic health services (1); the treatment of yaws by injection also firmly established the success of Western-style medicine in tropical countries (2).

However, as treatment was limited to clinical cases only, control was not always achieved and by 1950 it was estimated that there were 50 million cases of yaws worldwide. The acceptance by the Second World Health Assembly in 1949 of an epidemiological approach for the control of the endemic treponematoses set the scene for a global control programme under the technical guidance of the World Health Organization (WHO) and with material support from the United Nations Children's Fund (UNICEF). Long-acting penicillin was the "magic bullet" for treatment of yaws, bejel and pinta in a single intramuscular injection. It is estimated that in the course of the worldwide campaigns against endemic treponematoses, approximately 160 million persons were examined during initial treatment surveys and more than 300 million re-examinations were done during re-surveys. In the course of these activities, approximately 50 million persons with clinical and latent infections were treated (3, 4). The control of the endemic treponematoses thus became a major success and the burden of these diseases was drastically reduced (5, 6). From 1965 onwards, control activities were greatly reduced, while the diseases were not yet eradicated. The static rural

health services were often ineffective in the surveillance of the endemic treponematoses and in the search for and treatment of cases and contacts in the community. As endemic foci remained, the last 20 years have witnessed a resurgence of the endemic treponematoses, in particular in parts of West and Central Africa and in South-East Asia (4, 7, 8).

Renewed control efforts are needed, but the lack of financial and technical resources is a major barrier to effective disease control in the most affected areas. Among other important considerations are the following: (i) because of the success of the mass campaigns in the 1950s, endemic treponematoses are thought to be fully under control; (ii) as the diseases are not fatal and are restricted to poor, remote, rural populations, they are not perceived as high-priority problems by many decision makers; (iii) there is the potential for development of resistance of the treponeme against long-acting penicillin; (iv) in areas where endemic treponematoses still occur, health services are inadequate or non-existent; (v) programmes aiming at a single disease are now frowned upon by the international public health establishment; (vi) the emphasis is now on establishing broad-based primary health care services in currently underserved areas of the world (9).

Therefore innovative approaches are needed for renewed control efforts against the endemic treponematoses (10, 11, 12). These diseases can be lastingly controlled and finally eradicated by active community involvement in control activities integrated with the primary health care (PHC) services. Where PHC is inadequate, yaws control can be used as a catalyst to strengthen PHC and drastically increase the utilization of health services (13).

Detailed data on endemic treponematoses were last published in 1985 (4); more recent information on the epidemiology of these diseases according to WHO region and epidemiological areas is extensively reviewed in this article.

Africa

In *Mauritania*, seroepidemiological studies point to the existence of a large focus of endemic syphilis (bejel) with some persistent transmission in population groups living along the Senegal River (14).

In *Senegal*, Ridet found clinical and serological evidence of continued endemic syphilis (bejel) transmission in populations south of the Senegal River where 2.1% of the children under 15 years of age showed early clinical lesions of the disease and about 14% had serological evidence of treponemal infection — not less than 60% of these were high-titre reactors (>1:16); 70% of adults had serological evidence of past exposure to treponemal infection (15). The endemic area seemed to extend into the

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departments of Linguère and Kédougou in Eastern Senegal where a much lower disease activity was found. According to Graitcer (unpublished report, 1985) the health services identified 1 119 cases of endemic syphilis (1980) primarily in the districts of Longa, Thies and Eastern Senegal. 60% of cases occurred in children under 15 years of age.

Yaws used to be meso- to hypoendemic in the Lower Casamance, an area adjacent to the Gambia and close to the Atlantic Ocean, but disease transmission in this focus may have ceased already (15). The very rare seropositivity in children could be

attributed to congenital syphilis. However, yaws cases continued to be reported (Table 1) from different areas of the country and there is no explanation for the reported presence of yaws in the same area where endemic syphilis is found.

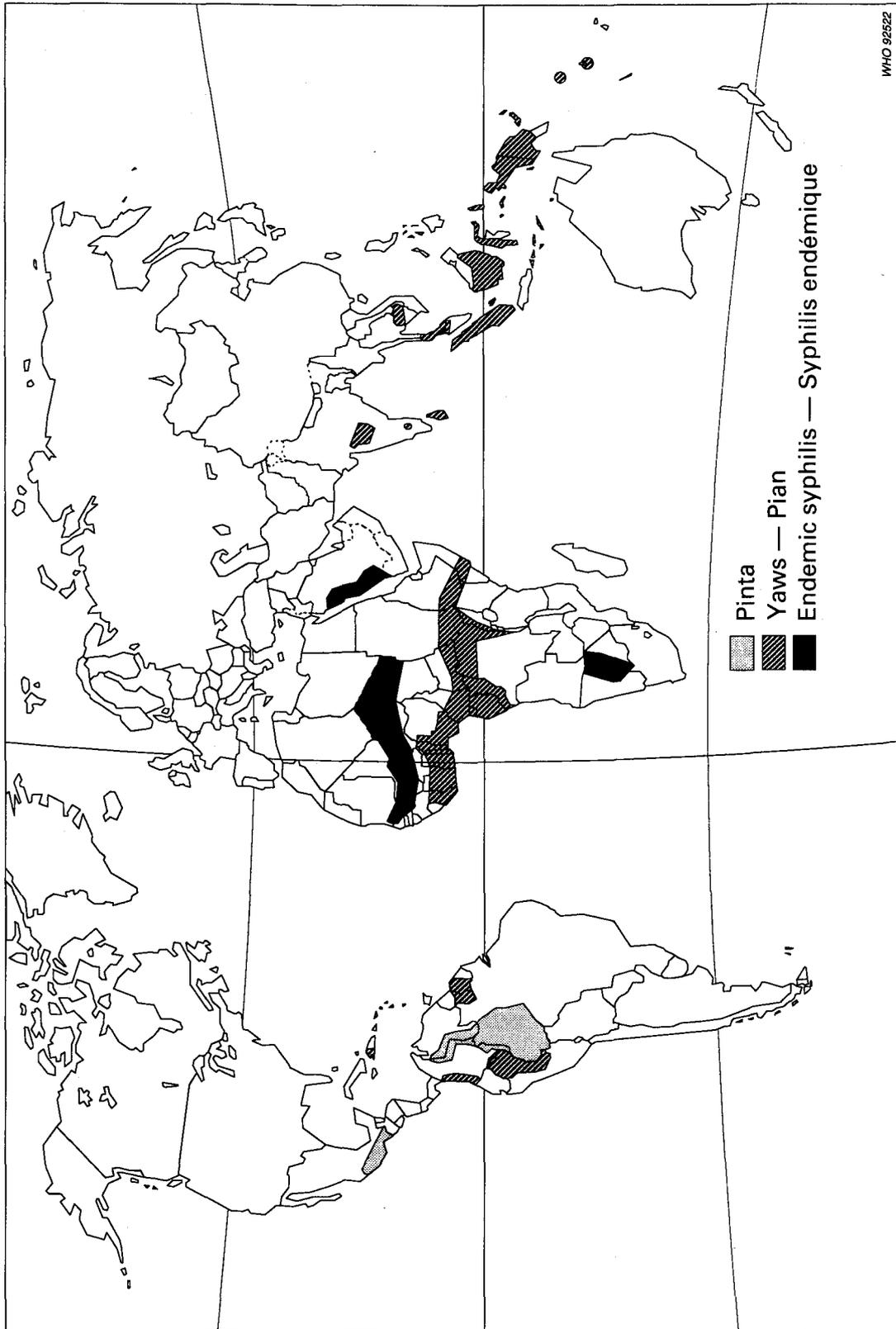
In Guinea hypo- and mesoendemic areas were situated close to the borders with Liberia and Sierra Leone in the humid forest zone. After a mass treatment campaign no cases of yaws were reported until 1983, when a resurgence occurred, during which more than 1 600 active cases were reported. Since then yaws cases have continued to be detected

TABLE 1. REPORTED CASES OF ENDEMIC TREPONEMATOSES, 1983-1990^a
TABLEAU 1. CAS DÉCLARÉS DE TRÉPONÉMATOSES ENDÉMIQUES, 1983-1990^a

| | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|-----------------|--------|--------------------|-------|--------|--------|-----------------|--------|
| Africa — Afrique | | | | | | | | |
| Angola | — | — | — | — | — | 70 | — | — |
| Benin — Bénin | 3 895 | 3 327 | 1 730 | — | 2 428 | — | — | — |
| Burkina Faso | | | | | | | | |
| Yaws — Pian | 781 | 485 | 545 | 580 | — | 583 | — | — |
| Bejel — Béjel | — | — | — | — | — | 1 503 | — | — |
| Burundi | 117 | 102 | 14 | 103 | 89 | 94 | — | — |
| Cameroon — Cameroun | 8 041 | 9 226 | 5 030 | 4 425 | 3 425 | 4 354 | — | — |
| Central African Republic ^b — République centrafricaine ^b | 732 | 674 | 1 025 | 1 236 | 1 553 | — | — | — |
| Chad — Tchad | 1 | 629 | 2 173 | 88 | — | — | — | — |
| Congo ^b | 203 | 1 644 | 161 | 100 | 269 | 48 | — | — |
| Côte d'Ivoire | | | | | | | | |
| Yaws — Pian | 18 235 | 16 109 | 10 468 | 5 166 | 18 790 | 22 234 | 20 476 | 17 738 |
| Bejel — Béjel | — | — | — | 1 404 | 2 064 | — | — | — |
| Equatoria Guinea — Guinée équatoriale | — | 283 | — | — | — | — | — | — |
| Ethiopia — Ethiopie | 585 | 91 | 394 | 533 | 187 | 210 | — | — |
| Gabon ^b | 168 | 246 | 342 | 213 | 614 | 3 534 | — | — |
| Ghana ^b | 5 223 | 9 160 | 4 012 ^c | — | — | — | — | — |
| Guinea — Guinée | 1 652 | 1 174 | 161 | 127 | 208 | 59 | — | — |
| Guinea-Bissau — Guinée-Bissau | 3 | — | 4 | 10 | 2 | — | — | — |
| Mali | 8 | 224 | 95 | 6 594 | — | — | — | — |
| Niger | 9 314 | — | 0 | 415 | 280 | 704 | — | — |
| Nigeria ^b — Nigéria | 525 | 898 | 1 154 | 1 687 | 927 | 875 | — | — |
| Rwanda ^b | 408 | 225 | 19 | 286 | 265 | 189 | 17 ^c | — |
| Senegal — Sénégal | 70 | 31 | 3 | 18 | 380 | 21 | — | — |
| Togo ^b | 4 382 | 2 956 | 5 719 | 2 404 | 5 639 | 5 729 | 2 899 | 4 124 |
| Uganda — Ouganda | 697 | 260 | — | — | — | — | — | — |
| Zaire — Zaïre | 380 | 111 | — | — | — | 117 | — | — |
| Zambia — Zambie | — | — | 25 | — | — | — | — | — |
| South-East Asia — Asie du Sud-Est | | | | | | | | |
| India — Inde | 588 | 422 | 339 ^c | — | — | — | — | — |
| Indonesia — Indonésie | 7 302 | 15 931 | — | — | — | — | — | — |
| Thailand — Thaïlande | — | — | 2 | 1 | 0 | 0 | 0 | 278 |
| Western Pacific — Pacifique occidental | | | | | | | | |
| Fiji — Fidji | 1 | — | — | 2 | 11 | — | 0 | — |
| Papua New Guinea — Papouasie-Nouvelle-Guinée | 33 | 833 | 1 647 | 1 854 | — | 3 063 | 3 421 | — |
| Solomon Islands — Iles Salomon | — | 4 041 | — | — | 2 070 | 4 165 | 6 477 | 9 664 |
| Vanuatu | — | 492 | 411 | 157 | — | 446 | — | 29 |
| Viet Nam | — | — | — | — | — | — | — | 1 927 |
| Americas — Amérique | | | | | | | | |
| Colombia (yaws) — Colombie (pian) | 16 ^c | — | — | 14 | 12 | 23 | 98 | 78 |
| Mexico (pinta) — Mexique (pinta) | 21 | 22 | — | 136 | 92 | 94 | 78 | 70 |

^a In general data are compiled from country reports to WHO, consultant and research surveys — En général, les données sont établies à partir de rapports de pays envoyés à l'OMS, d'enquêtes de consultants et de résultats de recherches.
^b Infectious lesions only — Lésions infectieuses uniquement.
^c Provisional data — Données provisoires.

MAP 1. GEOGRAPHICAL DISTRIBUTION OF THE ENDEMIC TREPONEMATOSES IN THE EARLY 1990s
CARTE 1. RÉPARTITION GÉOGRAPHIQUE DES TRÉPONÉMATOSES ENDÉMIQUES AU DÉBUT DES ANNÉES 90



WHO 92522

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(Table 1) indicating that yaws transmission is still present to some extent in the former endemic areas.

In *Liberia* low-level yaws transmission was suspected to occur in areas close to the border with Côte d'Ivoire, namely Nimba, Grand Bed and Maryland counties; the government considered intensifying anti-yaws activities but was unable to do so owing to lack of financial resources. The present epidemiological situation concerning yaws is unclear and the government is in favour of an epidemiological investigation.

In *Côte d'Ivoire* where active surveillance for the endemic treponematoses is being pursued, large numbers of cases of yaws and endemic syphilis are being reported to the Ministry of Public Health (Table 1) — about one-third are infectious lesions. One-third of the cases are reported from four rural provinces: Adzopé, Gagnoa, Bondoukou and Tissale. In 1991 mass treatment activities were implemented in two regions.

In *Ghana* following the mass penicillin treatment campaign (1955-1965), static health care facilities could not control the spread of yaws in the affected populations. Consequently, active yaws cases increased 21-fold between 1969 and 1976 (16). The three southern regions — Ashanti, Eastern and Central — reported 80% of the yaws cases, with incidence rates between 400 and 500 cases per 100 000 population. The government, in cooperation with the European Economic Community, WHO, UNICEF and USAID launched a yaws/yellow fever programme which also included BCG and tetanus vaccination activities (1981-1983). As a result, yaws was reduced to 62 cases per 100 000 population in the most affected areas. Economic problems in Ghana have limited the continuation of yaws control activities which may result in another resurgence of the disease, particularly in the most remote rural areas. The government is interested in reactivating intensified yaws control activities.

Yaws appears to be still highly endemic in *Togo* (Table 1) where the endemic area is located in the southern region and along the borders with Ghana and Benin. Yaws prevalence rates of 2-3.5% were reported from the 5 most affected prefectures (Lacs, Vo, Yoo, Kloto and Bassar).^c

In *Benin* yaws is endemic in the provinces of Mono, Atlantique and Ouéme in the south of the country. A survey in Ouéme province found 1.7% of children suffering from infectious yaws lesions (17) and seroreactor levels of 19%. About 3 000 yaws cases are detected annually (Table 1) indicating continued yaws transmission in the affected areas. Yaws control is limited to the activities of the fixed health care facilities which are often far away from the remote yaws endemic areas. An endemic syphilis (bejel) focus is suspected to exist in the north of the country.

The yaws control programme in *Nigeria* is part of the federally operated sexually transmitted disease (STD) control programme which is now integrated with the AIDS control programme. Yaws cases continue to be reported from many areas of the country, including from those areas where the disease is

known not to exist, indicating the diminishing competence of medical staff to identify yaws cases. Small-scale epidemics continue to be reported from communities in the south of the country, in Bendel and Cross River States (M. O. Alli, unpublished report, 1986) including a small outbreak close to Lagos (O. Ogunnowo, personal communication, 1988), where active surveillance is required to delineate and control a still simmering yaws endemicity.

A bejel endemic area still exists in the department of Oudalan in the north of *Burkina Faso*; Oudalan is a semi-desert area of about 10 000 km² with a population of approximately 50 000. This area is adjacent to the bejel-endemic area of Gao in Mali (see below). Several studies found about 7% of children between 5 and 14 years of age with early bejel lesions; up to 22% of children and 41% of adults showed serological evidence of treponemal infection. Nomadic and semi-nomadic ethnic groups (e.g. Fulani, Tuaregs, Bellahs) were most affected by bejel. There has been little change in transmission levels over the past years (18).

A yaws-endemic area is located in the south-west of the country, a savannah area with approximately 1.1 million inhabitants. An epidemiological investigation identified the area of Gaoua as the focus of yaws transmission, with 3.9% of children suffering from infectious yaws lesions and 11.6% showing serological evidence of treponemal infection (19).

For most years no separate data are available for endemic syphilis (Table 1) since venereal and endemic syphilis (bejel) are reported as a single disease entity. The government sees the endemic treponematoses as a public health problem but lacks resources for their definite control.

There are three distinct foci of endemic syphilis in the Sahelian zone of *Mali*: a meso-endemic area is situated in the Senegal river basin in the west of the country; it includes 7 districts (1.5 million inhabitants) in the regions of Kays and to the north of Koulikoro, where 19% of children aged 5-9 years were found to be infected by the treponeme. Another focus of infection (0.6 million inhabitants) is associated with the Dogon tribe which lives on the cliffs of Bandiagara in the Mopti region in the centre of Mali (Ministry of public health, unpublished report, 1986).

The most important bejel endemic area extends over 10 districts with 1.1 million inhabitants along the river Niger in the regions of Timbuktu and Gao. In preparation for a mass-treatment campaign, an epidemiological study (20) confirmed bejel to be hyperendemic in this area. More than one-fifth of the children between 5 and 14 years were found to be infected, and in more than half the infection was still active. A mass treatment campaign was implemented (1987-1988) in collaboration with *Médecins sans frontières*. An attempt was made to evaluate different serological parameters for their efficacy in measuring the impact of mass treatment by a standard single-dose penicillin regimen on treponemal endemicity in the child population (5-15 years). A comparison of two serum collections drawn randomly from the same population groups before therapy and 12 months later showed that the demonstration of the disappearance of treponemal IgM (present in active disease) by the solid-phase haemadsorption assay (SPHA) is the most sensitive indicator; but the test is complicated and costly.

^c World Health Organization. *Yaws and other endemic treponematoses*. Report of a regional meeting, Brazzaville, 3-6 February 1986. (Unpublished document AFR/CD/58).

However, a more practical indicator was shown to be a change in seroprevalence of high-titre VDRL reactors (>1.8, or better >1:16) among children who respond to the therapy by converting to a negative serological test (Table 2). Now, the government would like to continue and extend campaign activities.

A yaws-endemic area used to exist in the districts of Bougouni and Sikasso in south-west Mali, an area bordering on Burkina Faso, Côte d'Ivoire and Guinea. The Ministry of Public Health (unpublished report, 1986) believes that yaws transmission has ceased, as no clinical cases of yaws nor any sero-reactor could be detected among children under 10 years of age.

Endemic syphilis (bejel) is found among the Tuareg and Bellah in the north of Niger: there are about 800 000 Tuaregs for whom the government conducts annual treatment clinics in several northern villages at the time the nomads congregate. Over 9 000 bejel cases were reported in 1983; most were from the northern departments of Agadez, Arlit and Tchintabaraden. Financial limitations curtailed these treatment activities and reduced the number of reported bejel cases drastically (Table 1). In 1990 medical authorities resumed treatment activities at one gathering place of the Tuareg and expressed their interest in launching a bejel control programme among the nomadic groups in the desert area.

There are anecdotal reports of numerous bejel cases in the northern part of Chad where war-like conditions have curtailed control activities.

Several thousand yaws cases are reported annually from Cameroon (Table 1). The data were reviewed recently by Louis et al. (21). Most cases occurred in south-west Cameroon which is close to the Cross River State of Nigeria and may form a common yaws-endemic area. Another yaws-endemic area is located close to the border with Gabon, Congo and the Central African Republic where itinerant pygmy populations are heavily infected. Not less than 480 yaws cases were found among 653 pygmies examined (WHO/AFRO, unpublished report, 1992). Pygmy groups represent an important source of infection for the sedentary populations with which they come into contact. The health administration has no specific plan for the control of this infection.

In Gabon yaws is endemic in the north (Woleu-Ntem Province) and is said to be primarily confined to itinerant pygmy groups which move freely across the border with Equatorial Guinea, Cameroon and

the Congo. Reports on a recent increase of yaws in Ngounie Province have been investigated and results are awaited.

Also in the Central African Republic yaws infections are predominantly found among the pygmies of the rain-forest area in the south of the country. In the course of treatment surveys carried out among pygmies in Sangha and Lobaye provinces, R. Widy-Wirski (unpublished report, 1986) identified active yaws lesions in 41% of 1 005 pygmies and more than 75% had serological evidence of active disease. An increase of reported yaws cases has been noted in recent years (Table 1). A health education campaign is currently being undertaken among pygmies.

In Congo most yaws cases occur among the pygmies and are reported from the provinces of Likouala and Sangha; and from the southern part of the country, Lékoumou and Kouilou. The first two areas are adjacent to the yaws-endemic areas in Cameroon, Gabon and the Central African Republic (Ministry of Public Health, unpublished report, 1985). Several surveys carried out in Likouala confirm very high rates of clinical yaws among pygmies (22). Plans have been drawn up for a yaws control programme in the north of the country.

Yaws was thought to have been eliminated from Zaire since the early 1960s. However, the disruption of health care services and economic deprivation have made it difficult for the population to maintain personal hygiene and have led to an environment favourable to the transmission of the endemic treponematoses. Two recent surveys identified yaws-endemic foci in Ubangi in the north-west of the country, not far from Bangui, Central African Republic, and in the Ituri forest area in the north-east of Zaire (23, 24). In the former, focus cases with infectious yaws lesions were seen in 11% of the children under 15 years of age in this sedentary population. In Ituri, yaws was found at a high rate among pygmies. WHO received a request to collaborate in the training of laboratory and other health personnel to be involved in planned yaws control activities.

More than 200 yaws cases are reported annually from Rwanda (Table 1). Health authorities believe that the disease problem can be controlled by routine health service activities.

In Sudan yaws is suspected to be still endemic in the southern regions of Equatoria, Bahr-el-Ghazal and Upper Nile; but this area cannot be surveyed because of civil unrest. Some low-level endemicity

TABLE 2. VALUE OF DIFFERENT SEROLOGICAL TESTS IN EVALUATING THE IMPACT OF A MASS TREATMENT CAMPAIGN AGAINST ENDEMIC TREPONEMATOSES, IMBUKTU REGION, MALI

TABLEAU 2. RÉSULTATS DE DIFFÉRENTS TESTS SÉROLOGIQUES UTILISÉS POUR ÉVALUER L'IMPACT D'UNE CAMPAGNE DE TRAITEMENT DE MASSE CONTRE LES TRÉPONÉMATOSES ENDÉMIQUES, RÉGION D'IMBUKTU, MALI

| | 1987 % | 1988 % | Ratio — Rapport 1987 1988 | P |
|--|-----------|-----------|---------------------------------|---------|
| SPHA-IgM | 11.5 | 2.7 | 4.3 | <0.0001 |
| Qualitative VDRL — VDRL qualitatif | 20.1 | 16.6 | 1.2 | NS |
| Quantitative VDRL — VDRL quantitatif (Titre ≥ 1:8) | 16.0 | 5.7 | 2.8 | <0.001 |
| Quantitative VDRL — VDRL quantitatif (Titre ≥ 1:16) | 14.1 | 3.1 | 4.5 | <0.001 |
| Quantitative TPHA — TPHA quantitatif (Titre ≥ 1:1280) | 18.7 | 18.0 | 1.0 | NS |
| Quantitative TPHA — TPHA quantitatif (Titre ≥ 1:10240) | 8.2 | 4.1 | 2.0 | 0.035 |

of endemic syphilis exists in the Northern Region (Nuba mountains).^d

In *Ethiopia* an organized yaws campaign took place in the south and south-west of the country in the 1950s. No subsequent information on the epidemiological situation became available until a small survey of some villages in the Wellaga and Illubabor administrative regions in the south-west of the country was carried out in 1986 as part of a viral survey programme. Not less than 68% of 227 children tested showed serological evidence of treponemal infection, and infectious yaws lesions could be observed in 10 of 200 children in one area (25). This focus may well be a part of the yaws-endemic area in Sudan.

Although *Angola* was assumed to be free from yaws, it reported 70 cases of the disease in 1988 (Table 1).^c

A recent observation (26) of an unexplained positive syphilis serology in sera collected from 1 575 healthy black primary school children in Bloemfontein *South Africa* led the investigators to reflect on the possible existence of endemic syphilis in the population of the black township. Similar observations of what was believed to be endemic treponematosi s had been made in black communities in Bloemfontein and the Cape Province.

Two treponemal diseases which are similar to or identical with endemic syphilis and bejel existed in Bantu populations of *Botswana* (dichuchwa) and *Zimbabwe* (njovera). Dichuchwa may still be prevalent among the bushmen of the Kalahari desert, but njovera is no longer encountered (Latif, personal communication, 1992).

Eastern Mediterranean ^d

Yaws was reported (1955) from the lowlands between the Juba and Shabelle rivers in the south of *Somalia*, but no studies were undertaken to confirm the existence and extent of the disease. Bejel is suspected to occur among the Bedouin in the North.

In the arid areas of Hijaz and Asir in *Saudi Arabia*, bejel was endemic among the nomadic and semi-nomadic Bedouin. Two recent studies (27, 28) found clinical and serological evidence of possibly no longer active foci of a nonvenereal treponematosi s (bejel) in the north-west and south-west of the country.

In the *Syrian Arab Republic* the disease has virtually disappeared after an eradication campaign in the 1950s in bejel-endemic north-eastern provinces of Deir-Ezzor, Hassaka and Ragga, and surveillance activities which continued for 8 years.

A seroepidemiological survey carried out in *Iraq* on 102 children aged 7-14 years in the Amara region demonstrated that bejel transmission has ceased in this area for some time. Moreover, information on the situation regarding bejel in the western Euphrates valley and Mosul indicates that no bejel case had been seen for the last 20-30 years.

A focus of endemic syphilis was discovered recently in a remote area in the north-western part of

Pakistan; 43 cases of infectious lesions were detected among 2 000 persons. Cases tested by VDRL were found to be reactive.

South-East Asia

The present yaws situation in *India* is not entirely clear. An enquiry made into the extent of the yaws problem in Central India in 1985 showed that in at least 10 districts of 3 states (Andhra Pradesh, Orissa and Medhya Pradesh), low-level disease transmission was continuing. 1 349 yaws cases were reported from this area over a 2½-year period (1983 to June 1985). Yaws endemicity appears to be associated with certain tribal groups and some degrees of inaccessibility. There may be some additional pockets of endemic treponematosi s in Tamil Nadu, the North-East Frontier States and Gujarat (29).

In *Sri Lanka* few yaws cases (2 cases in 1982; 9 cases in 1983) are reported from two areas of low socioeconomic status; the north-central plains and the adjacent lower part of the hill country and an area in the south of the country (30). The disease is being kept under surveillance by anti-malaria teams which are active in this area.

Yaws appears to have been eliminated from *Thailand*, except for the occasional small outbreaks in the border area with Malaysia. Owing to rapid mop-up operations, these epidemics could be contained within a short period of time.

By the early 1950s the estimated total number of yaws cases was about 12 million (i.e. mean prevalence 15%), making *Indonesia* the second largest focus of yaws in the world (after Africa). A WHO/UNICEF-sponsored national yaws control programme did not rely on a vertical approach and the use of mobile field teams but established 2 500 district teams to cover all 26 yaws-endemic provinces. Since its implementation yaws control activities were continued with varying intensity and changing control approaches. Yaws could be reduced to negligible levels indeed in 12 provinces including Java, Bali, major parts of Kalimantan and Sulawesi, but is still of considerable prevalence in the rural areas in the eastern and western parts of Kalimantan, the island of Sumatra, the Moluccas, Timor and in particular in Irian Jaya. In the latter area, yaws transmission is still quite intensive in the remote tribal areas, while among the new settlers originating from other parts of the country yaws is rarely observed. It may be estimated that since the onset of organized yaws control activities, the population living in yaws-endemic areas and therefore being exposed to yaws infection declined from 92 million to 35 million. The latest data available refer to 1984 when 15 931 infectious yaws cases were reported from 22 of the 27 provinces (31). There is little doubt that yaws still constitutes a major health problem in large parts of the population living in remote and economically depressed areas. A yaws control campaign was launched in 1991 in East Timor with support from UNICEF (Meheus, unpublished report, 1991).

Western Pacific

After a vertical treatment campaign in the early 1960s, yaws was considered eradicated from

^d World Health Organization. *Regional meeting on endemic treponematoses, Amman, Jordan 20-23 October 1986*. (Unpublished document EM/CD/36-E).

Cambodia. Subsequently there were anecdotal reports of skin lesions believed to be yaws being seen among Cambodian refugees arriving in Thailand. In 1986 Cambodia reported 4 858 cases of clinical yaws. Considering the inadequacy of the health service infrastructure at that time and the limited diagnostic capabilities for this "end-of-the-road disease" it may be reasonably assumed that the number of reported cases does not reflect the true extent of the disease problem. During a consultation, R. Widy-Wirski (unpublished report, 1987) observed several villages with children having active yaws lesions. He also found high seroreactor rates in both children and adults, indicating a recent resurgence of yaws transmission in certain communities. Anti-yaws activities were implemented in military secure areas of Kampong Speu, Kampong Chhang, and Siem Reap province between 1987 and 1991. During this period 1 935 yaws cases were treated.

In *Papua New Guinea* yaws was deemed to be under control as a result of the nationwide total mass treatment campaign in the late 1950s and limited regional efforts in the late 1970s. However, various investigations since 1978 confirmed a resurgence of yaws infection in the North of the country (East & West Sepik, Karkar Island) and Papua (East New Britain, New Ireland, North Solomon) with isolated pockets of high clinical and serological prevalence being encountered often. 833 yaws cases were reported in 1984 (32). By 1989 the number of reported cases had quadrupled (Table 1). Of serious concern are observations from Papua New Guinea and the Solomon Islands of diminished response to treatment with repository penicillin and the persistence of yaws transmission despite intensive treatment of cases and contacts. The possible emergence of *Treponema pertenuis* strains with reduced susceptibility to penicillin needs to be investigated.

Yaws prevalence in the *Solomon Islands* was the highest among the Pacific Islands. Following the WHO/UNICEF-supported national yaws treatment campaign and subsequent surveillance activities (1956-1970), yaws was thought to have been eliminated and transmission interrupted. In 1981 many cases of skin lesions were observed in the Western Province. A serological investigation confirmed these lesions to be due to yaws. It was speculated that yaws had been reintroduced from a yaws-endemic area in Papua New Guinea. In 1984 a mass treatment campaign was launched which examined 29 135 people and identified 4 041 active yaws cases, predominantly in children. Subsequent to this campaign, yaws reappeared in the same area and led to a further yaws treatment campaign with the assistance of the New Zealand Army in 1987. 2 070 active yaws cases were detected among the 24 216 inhabitants of the yaws-endemic area (33). In response to a renewed yaws epidemic, another treatment campaign was carried out in 1991.

Vanuatu (the former New Hebrides) continued to report yaws cases (495 cases in 1985); most were from Tanna Islands and some from Espiritu Santo. With the help of the New Zealand Army, a mass examination and treatment programme was carried out on Tanna Island in 1989. Among 18 223 people examined 464 suspected yaws cases were found, of which 23% could be serologically confirmed, bringing the prevalence of clinical yaws cases to less than 1% (34). Two years later a considerable number of yaws cases were again reported from Tanna Island from villages which had refused to participate in the recent control programme (W.I. van der Meijden,

unpublished report, 1992) — the infection may spread again from there to the rest of the population.

Americas

Until the first half of this century, yaws and pinta represented an important public health problem in several countries of Latin America and the Caribbean. In most of the endemic areas, yaws and pinta were eradicated through national mass treatment campaigns. Unfortunately, pockets of these two endemic treponematoses still exist in remote areas of some countries (S. Talhari, unpublished report, 1988).

In *Suriname* yaws appears to be still endemic among the black populations living in the interior of the country, where over 10% of rural schoolchildren had a positive syphilis test in 1980. Few clinical yaws cases from the interior seek care in the capital city, and civil unrest in the interior prevented the implementation of control activities.

Low-level yaws transmission persists in *Guyana* where between 1979 and 1984 the leprosy service identified 36 yaws cases.

In *Venezuela* no yaws cases have been identified for the last 15 years. The disease is regarded as being eradicated. However, between 1983 and 1985, 24 pinta cases were reported, and pinta transmission is going on among Indian populations close to the border with Colombia.

In *Panama* yaws cases have not been observed since 1980 and the disease can be regarded as having been eradicated, but the eradication of pinta is less certain.

As recently as 1988 some foci of yaws were detected by R. Widy-Wirski (unpublished report, 1988) in the course of surveys for HIV infection among rural populations in *Haiti*.

Two cases of early yaws reported in pregnant women in *Martinique* (35) give evidence of continued low-level endemicity of this treponematoses.

In *Mexico* pinta was endemic predominantly in the states of Guerrero, Michoacan, Chiapas and Oaxaca. In the course of a national pinta campaign, which was deactivated in 1983, over 250 000 pinta cases were traced and treated. In the state of Michoacan the disease is thought to have been eradicated. Active pinta surveillance is maintained in the state of Oaxaca only. While pinta does not represent a public health problem now, low-level disease transmission is continuing (Table 1) in the remote pinta-endemic areas which may offset some of the gains achieved by the control programme.

Yaws is still endemic in communities along the Pacific coastal area of *Colombia* where an integrated active surveillance programme is operational. A disturbing increase in reported yaws cases has been noted in recent years (Table 1). In addition, yaws cases are reported from other endemic areas of the country.

In *Brazil* no new yaws infections have been seen for several years. Pinta is now rarely seen among Indians in the Western Amazonas region and along the tributaries of the Rio Negro.

Europe

The last foci of endemic syphilis were located in rural *Bosnia* and among Moslem Turkish farmers in *Bulgaria*. With the advent of penicillin therapy a mass treatment campaign was implemented in *Bosnia* in 1948. This campaign was the model for the epidemiological approaches applied in subsequent mass treatment campaigns against the endemic treponematoses all over the world. In surveys and resurveys 35 238 cases of endemic syphilis were treated. The campaign resulted in the eradication of the disease in 1951 (36).

The little known focus in *Bulgaria* was also successfully controlled by a case-treatment campaign (1958-1962). A follow-up study confirmed that complete interruption of treponemal transmission has been achieved (37).

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SUMMARY

The endemic treponematoses which comprise yaws, endemic syphilis (bejel) and pinta constitute a group of potentially disabling and disfiguring infections which primarily afflict children in tropical and subtropical areas. Foci where these diseases are now endemic have a patchy distribution and are typically confined to underprivileged communities living in remote rural areas, with little or no access to health services and removed from the mainstream of socio-economic development.

A drastic decline in the prevalence of these infections was brought about by the implementation of mass treatment campaigns with penicillin under the technical guidance of WHO and with material support from UNICEF in the 1950s and 1960s. These worldwide campaigns against the endemic treponematoses halted disease transmission in many areas and held the promise of complete eradication if intensive surveillance could be continued for some time with the increasing involvement of the basic health services. National campaigns were so successful that relatively low priority was given to the preparation of the rural health services for this new task. The failure of many countries to integrate active control measures into the functions of the rural health services led to the gradual build-up and extension of treponemal reservoirs and the resurgence of foci of increased disease transmission particularly in communities where standards of hygiene and health care had remained low. In a number of former endemic foci only low-level transmission persisted; in a few areas disease prevalence increased dramatically to reach pre-campaign levels. The lack of technical and financial resources limited the success of renewed national control activities in the most affected areas.

Today, with waning interest in these diseases confined to remote, and thus silent, population groups,

and a decreasing ability of health staff to identify cases, data collected by countries need to be supplemented by information from other sources in order to arrive at a more valid assessment of the situation concerning the endemic treponematoses.

Central and West Africa are most severely affected by the resurgence of the endemic treponematoses. In recent years a number of countries (e.g. Ghana, Côte d'Ivoire and Mali) have launched renewed control efforts, often combining yaws or endemic syphilis control with other public health programmes. In Central Africa itinerant pygmy groups are still highly affected by yaws and are an important source of infection for the sedentary population with which they come into contact. In Chad, Sudan and Ethiopia, there is some evidence of persistent foci of endemic treponematoses; the epidemiological situation in Southern Africa is not well established. In the Eastern Mediterranean, bejel has been eliminated from most areas, but foci of infection have been reported in remote villages in Pakistan, and some endemic syphilis transmission might still prevail in nomadic people of the Arabian peninsula.

Health officials in South-East Asia and the Pacific Islands have documented remaining foci of yaws in at least 7 Member States, including several outbreaks in the Solomon Islands. Indonesia has made dramatic progress in yaws control but widely dispersed foci of infection still persist, particularly in Irian Jaya, the Moluccas, Sumatra and Kalimantan.

In the Americas, yaws incidence is very low with very small foci remaining in Suriname, Guyana, Colombia and some islands of the Caribbean. Pinta cases are still detected in Indian tribes of Mexico and the Amazon basin.

RÉSUMÉ

Les tréponématoses endémiques: pas encore d'éradication

Les tréponématoses endémiques qui comprennent le pian, le bétel (syphilis endémique) et la pinta constituent un groupe d'infections potentiellement invali-

dantes ou défigurantes qui frappent avant tout l'enfant dans les régions tropicales et subtropicales. Les foyers actuels d'endémie sont répartis irrégulière-

ment et se limitent généralement aux communautés défavorisées vivant dans des zones rurales reculées à l'écart du développement socio-économique et dans lesquelles l'accès aux services de santé est difficile ou inexistant.

Les campagnes de traitement de masse menées au moyen de la pénicilline avec l'appui matériel de l'UNICEF au cours des années 50 et 60 ont entraîné un déclin spectaculaire de la prévalence de ces infections. Les campagnes mondiales contre les tréponématoses endémiques ont permis d'interrompre la transmission dans de nombreuses régions et laissé entrevoir la possibilité d'une éradication complète si une surveillance intensive pouvait être maintenue assez longtemps avec la participation croissante des services de santé de base. Les campagnes nationales ont connu un tel succès que la préparation des services de santé ruraux à cette nouvelle tâche est apparue comme moins prioritaire. Beaucoup de pays n'ayant pas intégré de mesures de lutte actives aux services de santé ruraux, on a assisté à une extension et à un renforcement progressifs des réservoirs à tréponèmes ainsi qu'à la résurgence de foyers de transmission accrue, notamment dans les communautés où les normes d'hygiène et de soins de santé restent peu développées. Dans plusieurs anciens foyers d'endémie, on n'observe qu'une persistance de la transmission à un faible niveau, mais parfois la prévalence a augmenté de façon spectaculaire pour se retrouver au niveau d'avant les campagnes. Le manque de ressources techniques et financières a limité le succès des nouvelles activités nationales de lutte dans la plupart des régions touchées.

Aujourd'hui, ces maladies qui se limitent à des zones reculées et à des groupes incapables de faire entendre leur voix suscitent moins d'intérêt et les agents de santé savent de moins en moins les reconnaître. Les données réunies par les pays doivent donc être complétées par des informations

émanant d'autres sources pour permettre une évaluation plus précise de la situation des tréponématoses endémiques.

Les régions les plus touchées par la résurgence sont l'Afrique centrale et occidentale. Ces dernières années, plusieurs pays, par exemple le Ghana, la Côte d'Ivoire et le Mali, ont lancé de nouveaux efforts de lutte en rattachant souvent la lutte contre le pian ou la syphilis endémique à d'autres programmes de santé publique. En Afrique centrale, les groupes itinérants de pygmées sont encore très touchés par le pian et constituent une importante source d'infection pour la population sédentaire avec laquelle ils entrent en contact. Au Tchad, au Soudan et en Ethiopie, certaines indications témoignent de la persistance de foyers de tréponématoses endémiques; la situation épidémiologique en Afrique australe n'est pas connue avec précision. En Méditerranée orientale, le bégel a été éliminé dans la plupart des zones, mais des foyers d'infection ont été signalés dans des villages reculés du Pakistan, et il est possible que la transmission de la syphilis endémique subsiste chez les nomades de la péninsule arabique.

Les responsables de la santé en Asie du Sud-Est et dans les îles du Pacifique ont fait état de foyers de pian qui se maintiennent dans 7 Etats Membres au moins, plusieurs poussées ayant été notamment observées aux Iles Salomon. L'Indonésie a fait des progrès spectaculaires dans la lutte contre le pian, mais des foyers d'infection très dispersés subsistent notamment en Irian Jaya, dans les Moluques, à Sumatra et à Kalimantan.

Dans les Amériques, l'incidence du pian est très faible et seuls des foyers réduits subsistent au Suriname, en Guyana, en Colombie et dans certaines îles des Caraïbes. On observe encore des cas de pinta chez des populations indiennes du Mexique et d'Amazonie.

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