
**Report of a global meeting on yaws eradication
surveillance, monitoring and evaluation**

Geneva, 29–30 January 2018



WHO/CDS/NTD/IDM/2018.08

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Abbreviations

DPP	dual path platform (treponemal and non-treponemal) test
IDM	Innovative and Intensified Disease Management
IU	implementation unit
MDA	mass drug administration
NTD	neglected tropical disease
PCR	polymerase chain reaction
RPR	rapid plasma reagin test
RDT	rapid diagnostic test
TCT	total community treatment
TPHA	<i>Treponema pallidum</i> haemagglutination assay
TPPA	<i>Treponema pallidum</i> particle agglutination assay
TTT	total targeted treatment
WHO	World Health Organization

Executive summary

Background

Yaws is a neglected tropical disease (NTD) that affects predominantly children aged under 15 years (peaking at 6–10 years). The disease occurs in remote communities in the African, South-East Asia and Western Pacific regions of the World Health Organization (WHO). There are no recent data from the WHO Region of the Americas, and plans are under way to assess the situation in order to verify interruption of yaws transmission or otherwise.

Yaws is transmitted from person to person. The WHO strategy to eradicate the disease (also known as the Morges Strategy) recommends mass treatment with a single dose of azithromycin to populations living in communities where the disease is endemic. The number of rounds required to interrupt transmission is not yet determined. Rapid syphilis tests (RDT [rapid diagnostic tests] and DPP [dual path platform (treponemal and non-treponemal) tests]) can be used to test symptomatic as well as asymptomatic individuals in order to confirm a clinical diagnosis and the status of yaws endemicity. Polymerase chain reaction (PCR) technology is also available to definitively confirm yaws in swabs taken from lesions and to determine any mutations that confer resistance to azithromycin.

WHO has produced two key documents to guide the eradication of yaws: (i) guidance for programme managers; and (ii) guidelines for the verification of interruption of transmission and certification of countries. WHO and EMS, a pharmaceutical company in Brazil, have signed an agreement to collaborate in the eradication of yaws. EMS has pledged to donate 150 million tablets of azithromycin for the next 5 years, starting 2018.

A two-day meeting was held at WHO headquarters in Geneva, Switzerland focused on surveillance, surveys, and monitoring and evaluation in the context of yaws eradication. The meeting also drew on the vast experiences of WHO's eradication and elimination programmes (dracunculiasis, human African trypanosomiasis, lymphatic filariasis, and trachoma).

Objectives and expected outputs of the meeting

1. To develop protocols for surveys and mapping:
 - confirming the presence of the disease in countries not currently reporting cases;
 - determining the extent of the disease and guiding mass drug administration (MDA) in countries currently reporting cases (or where mapping still confirms cases); and
 - verifying the interruption of transmission.
2. To review recording and reporting forms for routine surveillance.

3. To plan the implementation of mass treatment in endemic countries.

Meeting procedures

The meeting was attended by national yaws programme officers from selected endemic countries, experts on yaws and WHO staff. Annex 1 contains the meeting agenda and Annex 2 lists the participants. The meeting was conducted in English, with presentations and discussions as follows:

- Country experiences in the implementation of the Morges Strategy
- Experiences of other WHO programmes on eradication (dracunculiasis and poliomyelitis) and elimination as a public health problem (human African trypanosomiasis, lymphatic filariasis and trachoma)
- Research findings on yaws epidemiology, mapping and survey methodologies
- Tools and procedures for yaws surveillance in the context of eradication.

Total community treatment issues

The participants discussed the minimum number of rounds of total community treatment (TCT) needed to interrupt transmission. It was noted that the experience of Papua New Guinea in implementing the Morges Strategy seemed to suggest that one round of TCT followed by 6-monthly resurveys and total targeted treatment (TTT) was insufficient to interrupt transmission on Lihir Island,¹ partly due to cases occurring among people who were not treated during TCT. Migration between Lihir Island and elsewhere in Papua New Guinea may also have contributed to ongoing transmission. As a result, the number of rounds of TCT required to interrupt transmission remains a key research question. Robust and responsive ongoing surveillance may also be instrumental in interrupting transmission. As per the TCT reports from Papua New Guinea, the rate of treatment coverage of 84% was less than the minimum threshold of 90% as recommended in the Morges Strategy.

Another pilot study in Ghana suggested that one round of TCT in a sub-district with a population of 16 287 and treatment coverage of 89% had a significant impact on transmission after 12 months, but resurveys or active surveillance were not implemented as was done in Papua New Guinea.

¹ Mitjà O, Godornes C, Houinei W, Kapa A, Paru R, Abel H, et al. Re-emergence of yaws after single mass azithromycin treatment followed by targeted treatment: a longitudinal study. *Lancet*. 2018;391:1599–1607. doi:10.1016/S0140-6736(18)30204-6.

Implementation units, endemicity mapping and criteria for initiating TCT

The Morges Strategy recommends initial TCT of an endemic community with at least one confirmed case of yaws to ensure a minimum treatment coverage of 90%, followed by resurveys and implementation of either TCT or TTT. This recommendation is based on assumptions derived from historical evidence that high coverage of mass treatment with injectable long-acting penicillin during 1950–1960 reduced the prevalence of yaws in some areas from 30% to < 0.05%, and that high treatment coverages everywhere with persistent resurveys would achieve eradication.

The Morges Strategy focuses on the community as one implementation unit (IU). However, this approach can be expensive as all communities have to be surveyed and mapped for TCT and follow-up TTTs and/or TCTs applied to the endemic units. This issue was discussed and the following recommendation was proposed:

- To minimize the cost of and improve the benefits of covering more than one endemic community with TCT, the IU can be redefined as a geographical area with a population ranging between 20 000 and 50 000.

The minimum threshold for the number of confirmed cases that would trigger TCT or TTT was discussed but no agreement on this threshold was reached.

If ongoing clinical surveillance at health facilities indicates the possibility of yaws suspected cases, this should trigger initiation of rapid assessments using point-of-care tests (RDT +/- DPP) to facilitate active case-finding. Other triggers to initiate such assessments could include unusually high rates of sero-positivity among blood donors and antenatal women tested for syphilis at sentinel sites.

- This approach could be especially useful for countries or areas with unknown status of yaws.
- Standard survey protocols are being developed for known endemic countries and countries of unknown endemicity status.

Surveillance indicators and case definitions

Core indicators were discussed and revised according to the surveillance tools presented. It was agreed that countries initiate a central registry and a monthly reporting form indicating suspected, probable (added at this meeting) and confirmed yaws cases.

Case definitions were updated to include a probable case:

- **Suspected case:** a person with a history of residence in an endemic area (past or present) who presents with clinically active yaws-like lesions.
- **Probable case:** a suspected case with a positive rapid treponemal point-of-care test, i.e. both treponemal and control lines visible.
- **Confirmed case:** a suspected or probable case that is both treponemal and non-treponemal positive on rapid DPP test¹ and/or positive PCR.

Laboratory issues

The availability of point-of-care tests and PCR testing facilities remains a critical issue for all countries.

Other cross-cutting issues

Yaws has been earmarked for eradication and should therefore be made a notifiable disease in all countries. The experience of the dracunculiasis eradication programme suggests that countries require ongoing advocacy from WHO and other international community partners both within and outside the countries to ensure compliance.

Commitments to fight NTDs are improving, with some countries increasing domestic support for yaws eradication and control of other NTDs by providing additional resources for logistics and operational costs. However, more advocacy is needed to increase this momentum in countries in order to align with the principles of the United Nations Sustainable Development Goals (SDGs 3 and 6).

Some yaws surveillance activities should be integrated with other skin NTD programmes such as those for leprosy, Buruli ulcer and cutaneous leishmaniasis. These activities can be also integrated

¹ In the absence of DPP, TPHA or TPPA+RPR may be used to serologically confirm yaws cases.

with other programmes such as the Expanded Programme on Immunization, the Global Malaria Programme and other programmes on NTDs amenable to preventive chemotherapy, mainly for case searches, surveillance, training, and information, education and communication

Through an integrated approach to skin NTDs, more international partners and local nongovernmental organizations would be expected to include yaws in their activities for support.

Funding

Gaps in funding were identified by all participating countries and must be addressed in order to fully implement the Morges Strategy.

The donation of azithromycin by pharma EMS of Brazil has been secured, but other resources for diagnostic testing and operational funds to deliver treatment must be mobilized by countries and other partners to ensure full implementation of the Morges Strategy.

Conclusions

The donation of azithromycin by EMS has renewed the urgency of advancing the eradication of yaws. However, countries should make adequate preparations (notably mapping to identify areas that need treatment and implementing effective surveillance systems) before receiving the medicines.

The country presentations indicated that health ministries, with the support of partners, are making their best efforts to assess the status of yaws endemicity and implement the Morges Strategy. Progress in implementation by participating countries indicates increased political and administrative commitment to yaws eradication activities in line with global eradication efforts.

Recommendations

To national yaws eradication programmes

- Strengthen community-based surveillance systems with regular monitoring.
- Galvanize efforts to mobilize resources for full implementation of yaws eradication activities.
- Integrate yaws eradication with other programme activities to enhance surveillance.
- Consolidate data collection and reporting, and, importantly, initiate a central case registry for yaws to assist any request for verification of interruption of transmission and certification.
- Identify national reference laboratories for training of district teams to ensure quality-assured testing when using point-of-care tests and to do PCR for confirmation and drug resistance monitoring.

- Institute strict surveillance (clinical and molecular) to identify treatment failures and emergence of any resistance.
- For logistic reasons, it was agreed that the IU be a geographical area with a population of 20 000–50 000.

To WHO

- Advocate for yaws to be included in the list of notifiable diseases in all countries, since it is targeted for eradication.
- Identify international reference laboratories for PCR and azithromycin resistance testing and external quality assurance of national reference laboratories.
- Continue advocacy for and mobilization of resources to support countries.
- Continue to provide technical support to countries to implement yaws eradication activities.
- Share the revised surveillance tools with countries for local adaptation and adoption.

1. Opening remarks

Dr Daniel Argaw Dagne, Coordinator, Innovative and Intensified Disease Management (IDM) unit, gave opening remarks on behalf of Dr Gautum Biswas, Acting Director, WHO Department of Control of Neglected Tropical Diseases.

He wished that there could have been more frequent meetings to review progress, share experiences from different countries and highlight challenges to progress, but regretted this was not possible due to the lack of resources.

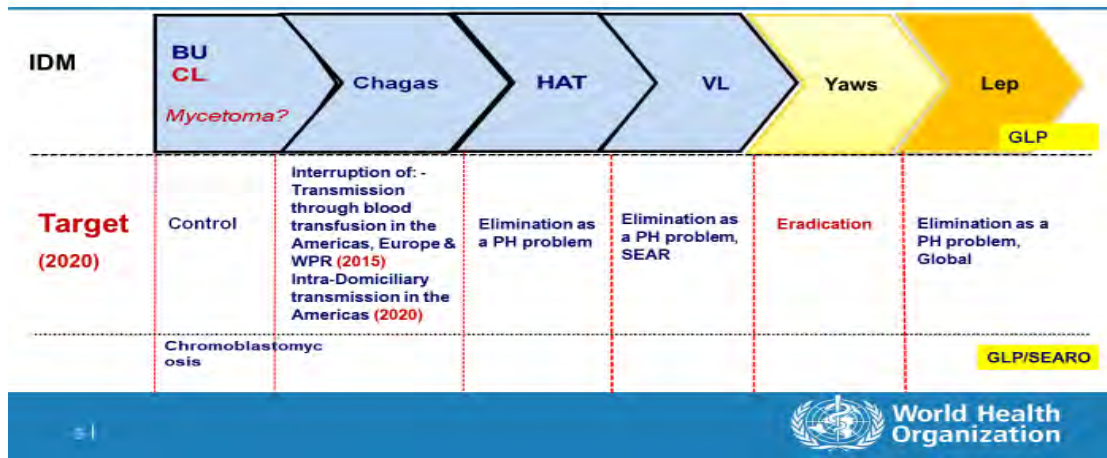
WHO has targeted three diseases for eradication, two of which (dracunculiasis and yaws) are the responsibility of the NTD department; poliomyelitis is in a different cluster. Both the poliomyelitis and the dracunculiasis eradication programmes receive substantial funding from donors; the yaws eradication programme does not. However, we may learn from their experiences to expand eradication interventions.

WHO has signed an agreement with EMS for donated azithromycin, enabling WHO to supply tablets to yaws endemic countries that may have funds to implement TCT. As speculated, however, WHO may not be in a position to achieve the 2020 target, although this is technically feasible with country commitments and adequate funding.

Integrated management of neglected tropical diseases

Dr Argaw gave an update on integrated disease management and control of the so-called skin NTDs, highlighting their potential as a tracer of progress towards SDG goals 3 and 6. The public health intervention approaches for the two main groups of NTDs (that is, diseases amenable to PCT [preventive chemotherapy and transmission control] and IDM) are not mutually exclusive. Rather, each group of diseases at a certain stage and depending on the availability of control tools may move from one broad intervention strategy to the other or may benefit from comprehensive implementation of both strategies. In addition, addressing the neglected zoonotic diseases, which interface between human and veterinary health, requires intersectoral collaboration among human and animal health systems. Control of NTDs benefits also from expanded, integrated implementation of vector control and the safe water, sanitation and hygiene strategies.

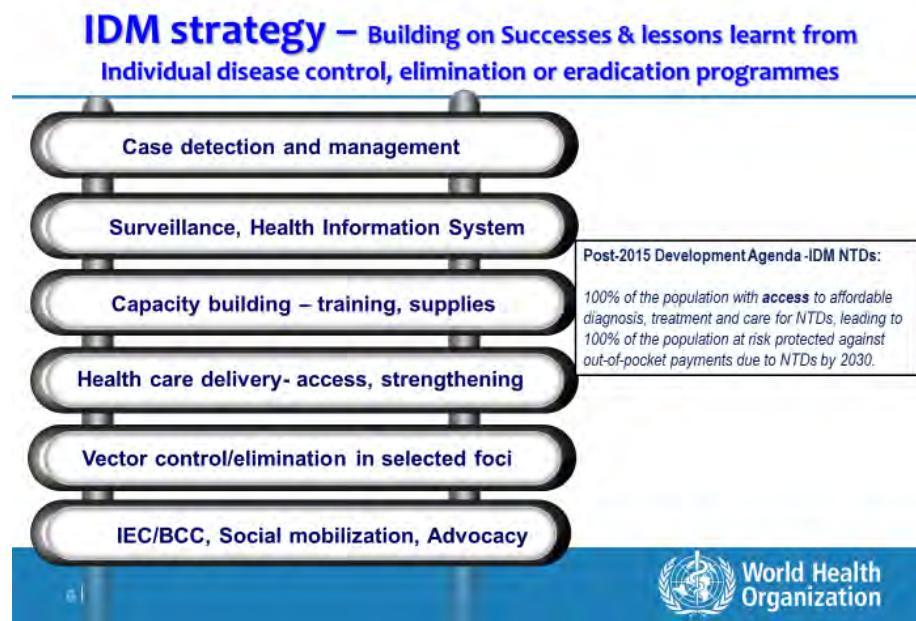
Fig. 1. Integrated disease management and control of skin NTDs



BU, Buruli ulcer; CL, cutaneous leishmaniasis; GLP, Global Leprosy Programme; HAT, human African trypanosomiasis; IDM, innovative and intensified disease management; Lep, leprosy; VL, visceral leishmaniasis; PH, public health, SEAR, WHO South-East Asia Region; WPR, WHO Western Pacific Region

Integrated management of the IDM-NTDs and other NTDs, where possible, is important for efficient use of funds and to rapidly reduce the disease burden in line with the IDM-NTD roadmap targets (**Fig. 1**). The rationale for integration includes geographical overlap (co-endemicity), surveillance strengthening, improved country ownership, better engagement of health services and alignment with universal health coverage (**Fig. 2**). NTDs fit well within WHO’s health system framework of service delivery, human workforce, health information systems, access to essential medicines, financing and leadership/governance. However, yaws must be made a notifiable disease in all countries. The yaws eradication programme will benefit from enhanced implementation of the IDM strategy and the skin NTDs initiative.

Fig. 2. The IDM strategy



IEC/BCC, information, education, communication/behaviour change communication

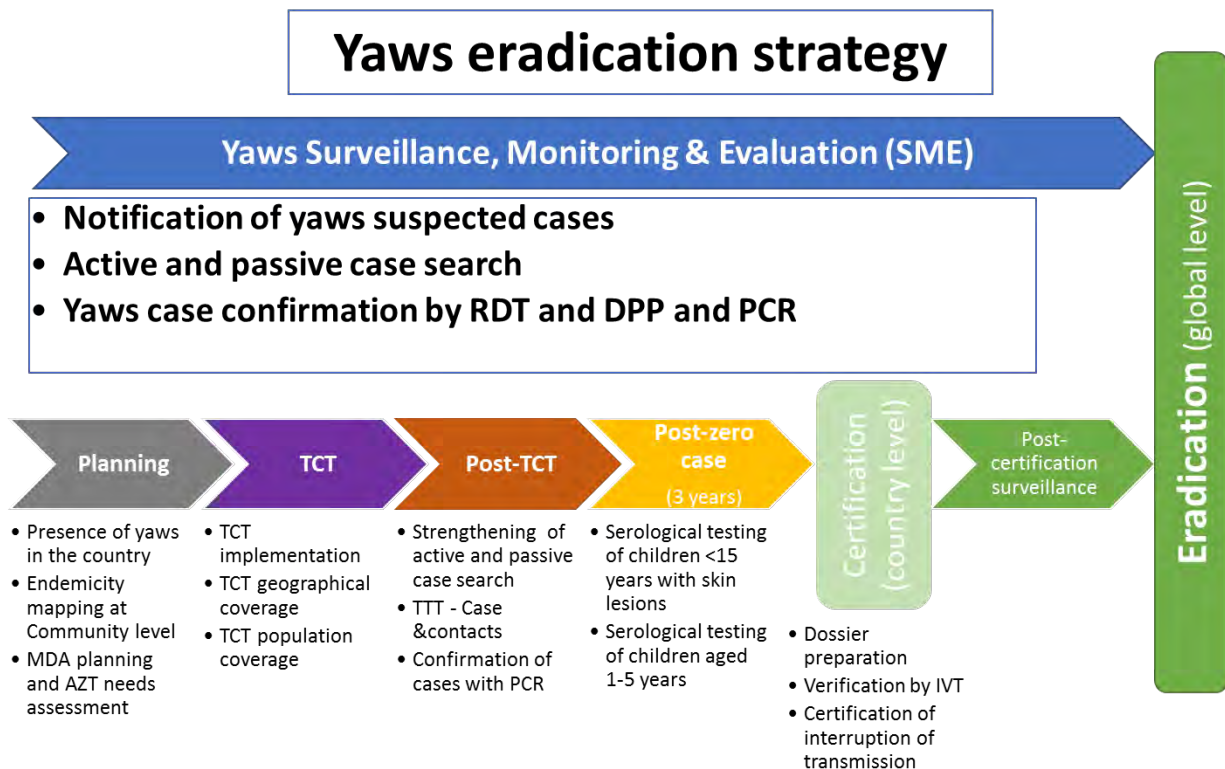
2. Overview of yaws eradication

Dr Kingsley Asiedu, WHO Medical Officer for yaws and Buruli ulcer, summarized clinical aspects, history of yaws, past eradication efforts and possible reasons for not achieving the eradication of yaws originally targeted in 1960. New knowledge on diagnostic tools and mass treatment with oral, single-dose azithromycin as well as renewed interest in eradication following the adoption of resolution WHA66.12 on neglected tropical diseases by the Sixty-sixth World Health Assembly in 2013 have built momentum. The agreement by EMS to donate more than 153 million tablets of azithromycin, signed in January 2018, and increasing commitment from countries in which yaws is endemic and the international community have added impetus towards achieving the global target by 2020 as per the NTD Roadmap of 2012. WHO published the Morges Strategy also in 2012 to eradicate the disease using azithromycin for mass treatment.

3. Surveillance, monitoring and evaluation

Dr Chandrakant Revankar, NTD Consultant, described surveillance, monitoring and evaluation in the context of yaws eradication and the importance of these key components throughout the various phases of the Morges Strategy from planning, TCT, post-TCT, post-zero case to post-certification surveillance.

Fig. 3. Surveillance, monitoring and evaluation in the yaws eradication process*

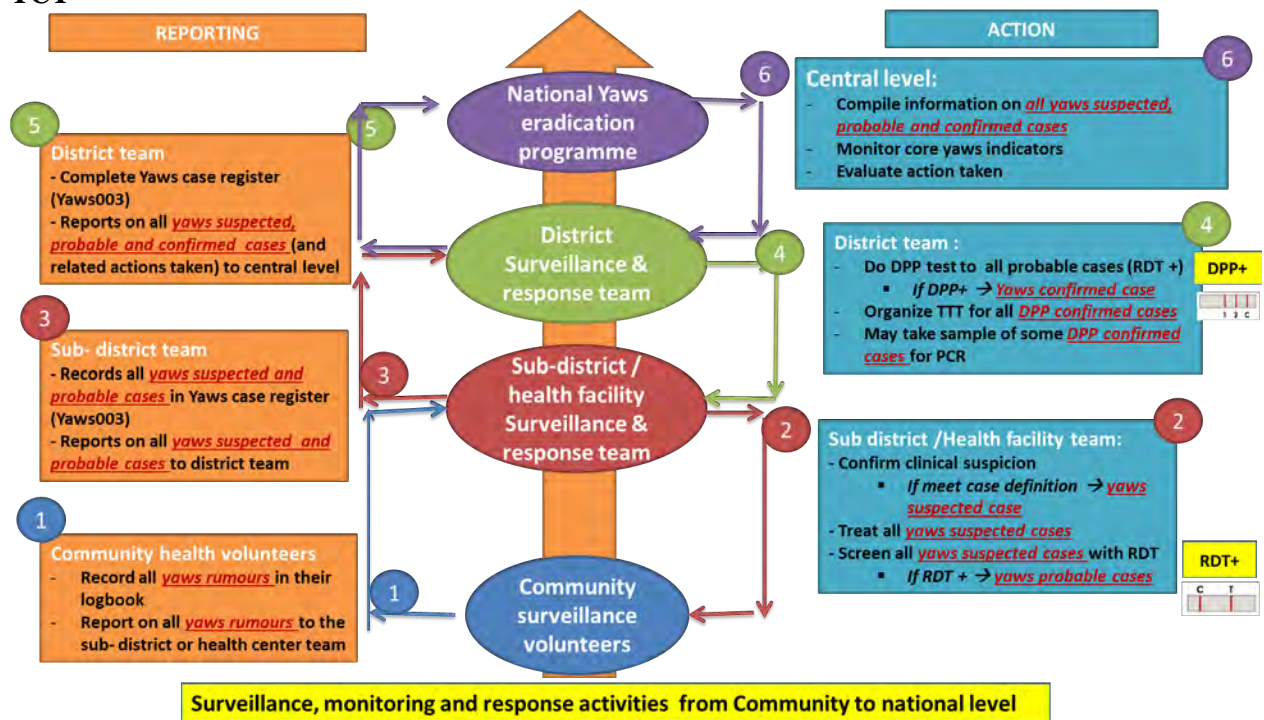


DPP, dual path platform (treponemal and non-treponemal) test; PCR, polymerase chain reaction; RDT, rapid diagnostic test; TCT, total community treatment; TTT, total targeted treatment

*Fig. 3 was revised after the meeting.

Fig. 3 describes the eradication strategy framework.

Fig. 4. Schematic diagram of a possible yaws surveillance and response system, especially after TCT*



* Fig. 4 was revised after the meeting.

Fig. 4 shows the steps of a possible WHO conceptual surveillance and response framework from community level (Step 1) to national level (Step 6). Although this framework may be used at different stages of the eradication process, it is especially critical after TCT. It is based on the sequential testing strategy of using rapid treponemal and non-treponemal tests.¹ The community-based surveillance volunteers first document rumoured cases (Step 1) and inform the nearest health facility or sub-district (where the team investigates the case, confirms whether it meets the definition of a suspected yaws case, tests the person with RDT (SD Bioline Syphilis 3.0 test; only rapid treponemal tests will be available at this level) and treats the patient, preferably with azithromycin. If RDT is positive, the case becomes a probable case (Step 2). The health facility or sub-district team then notifies the district surveillance team where the DPP tests are kept (Step 3). The district team performs DPP testing of the probable yaws case for confirmation (of both treponemal and non-treponemal antibodies). If DPP is dually-positive, the case is considered as a confirmed yaws case (Step 4).

If a case is confirmed to be dually positive for DPP, swabs may be taken for PCR analysis to confirm if the lesion is truly yaws and to determine any mutations that confer resistance to azithromycin. A reactive TTT should be organized to treat at least contacts, and eventually neighbouring households or

¹ Fitzpatrick C, Asiedu K, Sands A, Gonzalez Pena T, Marks M, Mitjà O, et al. The cost and cost-effectiveness of rapid testing strategies for yaws diagnosis and surveillance. *PLoS Negl Trop Dis*. 2018;11:e0005985. doi:10.1371/journal.pntd.0005985.

the whole community of the confirmed case as may be required. The district team sends information to the region or central level on all suspected, probable and confirmed yaws cases (Step 5) as well as actions taken. The central level (national programme) enters the record of the case in the Central Registry, monitors core indicators and evaluates action taken by the surveillance team (Step 6). The Central team sends feedback downwards and advises further action.

4. Country presentations

The country presentations summarized the progress of yaws surveillance, surveys, mapping, and monitoring and evaluation in implementation of the Morges Strategy and identified the main challenges.

Cameroon

Dr Earnest Njih Tabah, Permanent Secretary, National Leprosy, Buruli Ulcer, Yaws and Leishmaniasis Control Programme, Ministry of Public Health

Yaws was thought to have been eliminated from Cameroon by 1970 but re-emerged in 2007 through outbreaks among the autochthonous communities. Lomie district reported the first outbreak where cases were confirmed. Three other health districts around Lomie were also confirmed as endemic. The number of cases reported has increased from 614 in 2010 to 1237 in 2017.

Activities to control yaws have been implemented since 2009 and integrated surveys carried out in 42 of 189 health districts; currently 37 are confirmed as endemic. The remaining districts have yet to be assessed.

Yaws is a notifiable disease, with monthly reporting as a vertical programme to the national programme. The ongoing surveillance system has reported 3550 suspected yaws cases in the past five years. The first national strategic plan on Buruli ulcer, leprosy and yaws for the programme period 2009–2017 is being revised for 2018–2022, in which yaws is targeted for mapping followed by implementation of the Morges Strategy. Some pilot projects to implement the strategy have been planned for 2018 in two health districts (Lomie and Bankim). The current distribution of yaws is shown in **Figs 5 and 6**.

During 2017, outbreaks of yaws were investigated in seven health districts (Abong Mbang, Djoum, Lolodorf, Lomie, Mokolo, Moloundou, Yokadouma). The investigation in Lomie confirmed a yaws

epidemic among both pygmy and Bantu populations; that in Mokolo health district did not confirm a yaws epidemic. All of the 1201 cases with suspected yaws lesions were treated with either azithromycin or benzathine benzylpenicillin, achieving a favourable clinical response of 99%. However, among the 666 suspected cases tested with SD Bioline Syphilis 3.0 RDT, only one was positive, and he was not then negative with Chembio DPP syphilis test.

Several surveys have been conducted. In 2010, integrated case searches with Buruli ulcer and leprosy were carried out in 25 health districts and clinical yaws cases were detected in 17 health districts. In 2013, clinical yaws cases were detected in Lomie district during surveys in schools and communities. In 2017, a yaws–podoconiosis joint survey was carried out in 40 health districts with the support of FAIRMED: 34 out of the 40 health districts surveyed were endemic for yaws and 87 out of 3984 children (2.2%) tested positive for DPP.

The main challenges include mapping of endemic communities, funding, diagnostics, medicines and capacity-building.

Fig. 5. Distribution and trends of yaws in Cameroon (2017 survey and 2010–2017 routine data)

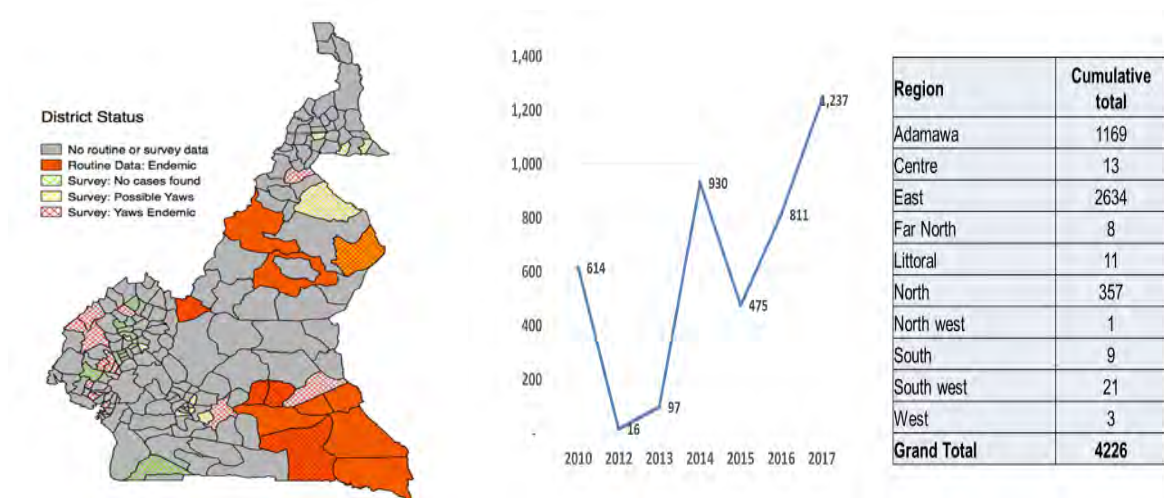
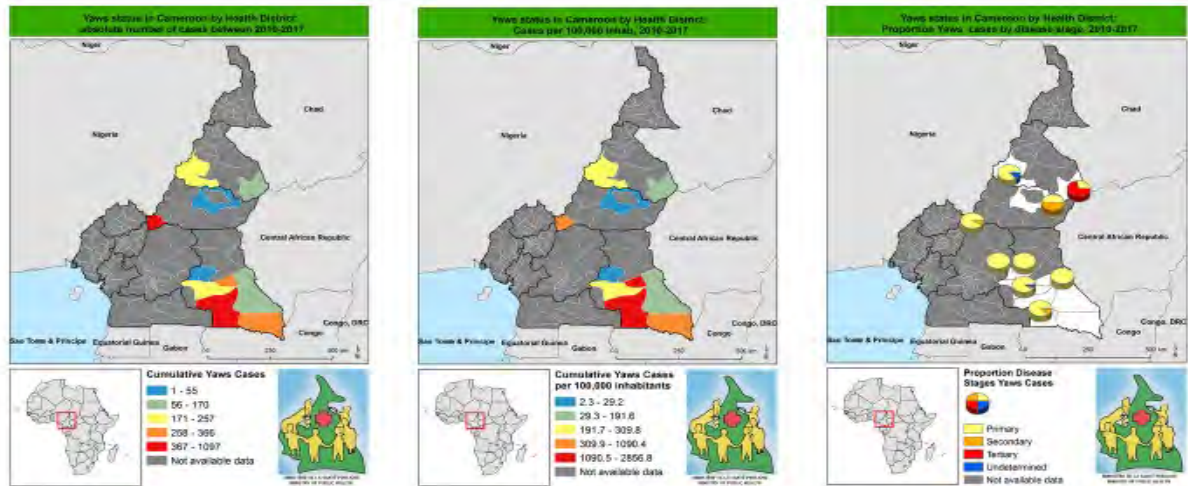


Fig. 6. Distribution of yaws suspected cases using routine surveillance data



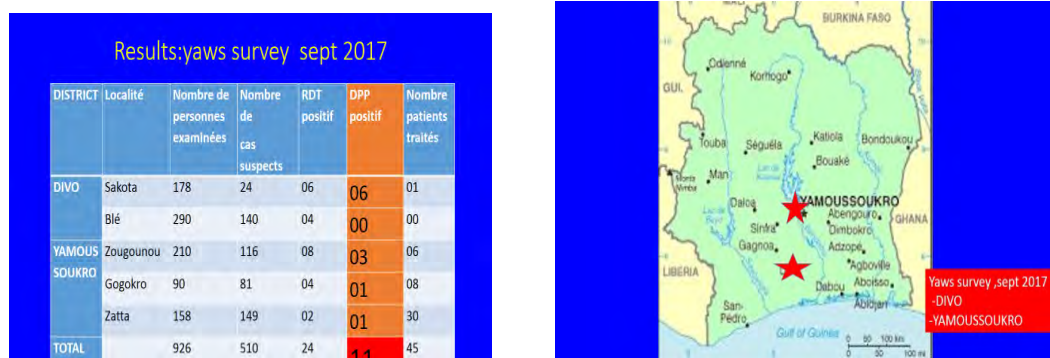
Côte d’Ivoire

Professor Henri Asse, National Programme Manager for Buruli ulcer

Yaws was hyperendemic in the 1950s, but after the first eradication efforts the last cases of yaws were reported in 1970 (30 000 cases). Since then activities to eradicate yaws have stopped. However, yaws cases continued to be identified during case searches for Buruli ulcer and leprosy. A total of 1581 suspected cases were reported in 2016 through the national health information system (DHIMS2).

A survey was carried out in September 2017 in Divo and Yamoussoukro districts and 510 suspected cases were first screened by RDT (syphilis test) (Fig. 7). Of the 24 who were RDT-positive, 11 were confirmed with DPP testing; all were treated with single dose azithromycin (30 mg/kg). During October–November 2017, an integrated survey with Buruli ulcer and leprosy was carried out and nine yaws cases were confirmed. Thus Côte d’Ivoire is endemic for yaws. Mapping is planned but awaiting resources. Government commitment is recent, which is an opportunity.

Fig. 7. Clinical and serological screening for yaws Figure: Yaws survey spots



Ghana

Dr Cynthia Kwakye-Maclean, Yaws Eradication Programme Manager

Ghana established the national yaws eradication programme in 2008 to coordinate all eradication activities. The disease is endemic in almost all 216 districts of the country, but the southern forested part is most affected. Yaws is reported routinely in the electronic DHIMS2, but < 5% of suspected yaws cases are confirmed due to lack of diagnostic test kits (RDT and DPP). All the suspected yaws cases reported from the communities are entered in community registers by the community health surveillance volunteers and reported upwards to the sub-district, district, regional and national levels. Suspected yaws cases are confirmed with DPP testing whenever available.

Routine data have been mapped (**Fig. 8**), but active case searches are planned for 2018 (as part of the skin NTDs project) to identify, map and treat endemic communities in 15 districts. This project is supported by the Anesvad Foundation, an international nongovernmental organization based in Spain.

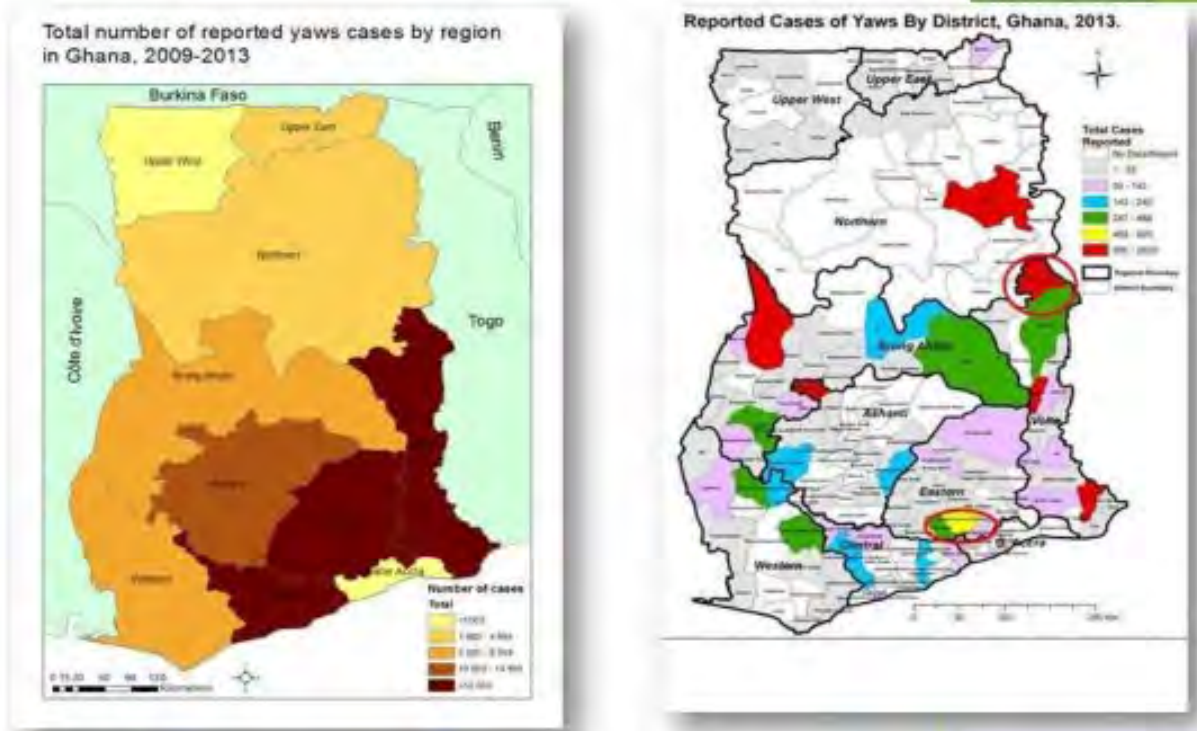
Surveys were carried out in 2008 and 2009 in collaboration with the Expanded Programme on Immunization as well as clinical trials comparing azithromycin and benzathine benzylpenicillin. In 2015, a clinical trial comparing azithromycin (20 mg/kg versus 30mg/kg) for treatment of yaws started in four districts.

A pilot MDA study was carried out in the Abamkrom sub-district of Upper West Akyem District in Eastern Region from 2013 to 2014. Serological testing was done using RDT (SD Biotec Syphilis 3.0 test) and DPP to confirm RDT-positive cases. All the serologically positive cases were subjected to PCR testing for azithromycin resistance and *Haemophilus ducreyi* and *Mycobacterium ulcerans*. Strict trial monitoring was carried out regularly through surveillance and meetings. This trial also showed that case notifications per 100 000 population fell from 241 in 2002 to 8 in 2016 in the pilot area.

Country capacity was built by the United States Centers for Disease Control and Prevention with the support of WHO. Laboratory staff from the Noguchi Memorial Institute for Medical Research in Accra and the Kumasi Centre for Collaborative Research in Kumasi were trained in serological testing and multiplex-PCR testing.

The main challenges include inadequate supply of azithromycin tablets, laboratory logistics and operational funds.

Fig. 8. Distribution of yaws in Ghana, 2009–2013



Indonesia

Dr Nani Rizkiyati, Sub-Directorate for Leprosy and Yaws

Indonesia, an island country located in the WHO South-East Asia Region, has a population of 255 million spread over 514 districts in 34 provinces. The health care system is decentralized. Some 79 districts are endemic for yaws in 18 provinces (**Fig. 9**). Yaws endemicity mapping was done using routine surveillance data and serological tests. One district is labelled as one implementation unit.

Fig. 9. Mapping of yaws endemicity in Indonesia

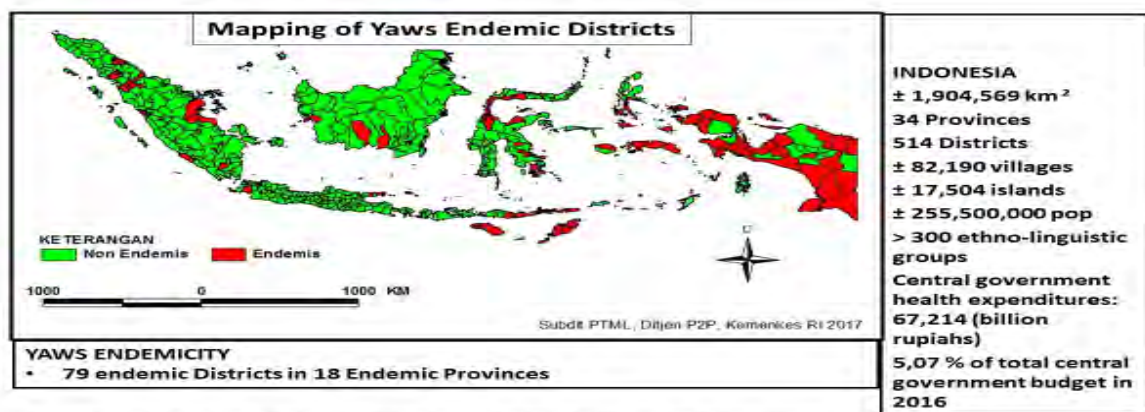
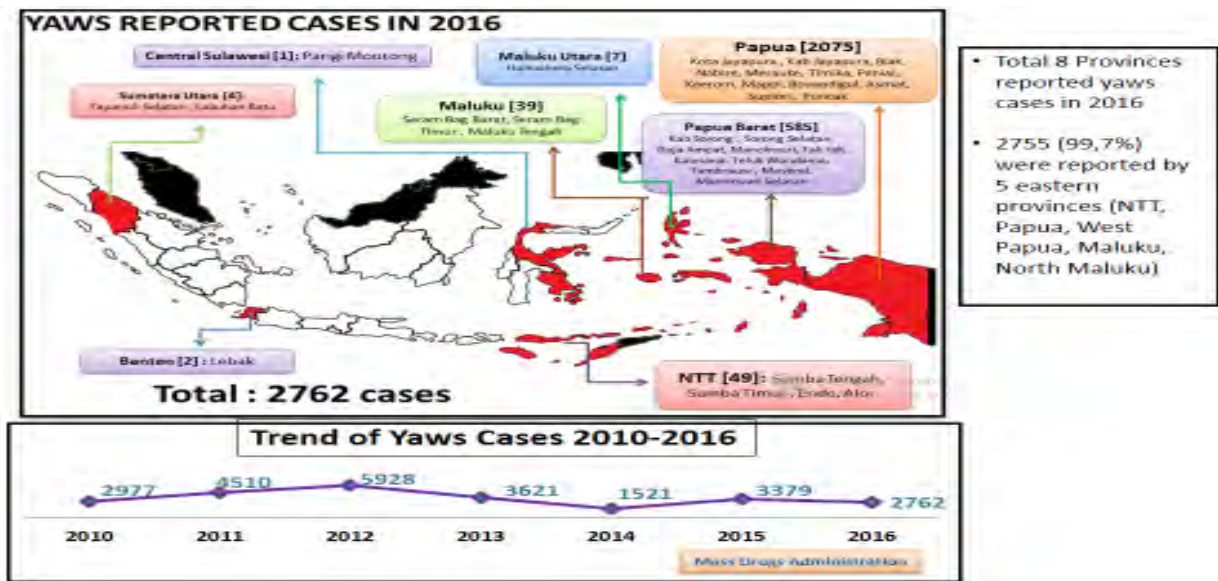
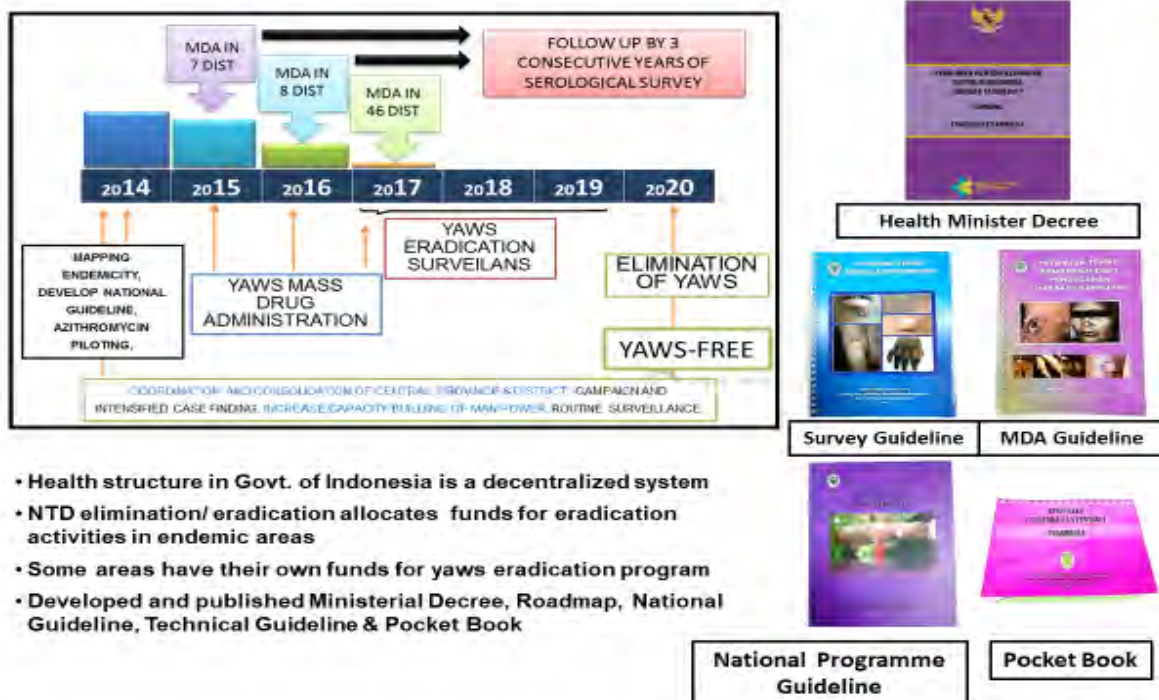


Fig. 10. Reporting of yaws cases from different provinces in 2016



During 2016, eight provinces reported yaws cases, five of which (Papua, West Papua, Maluku, North Maluku and NTT) from the eastern part of Indonesia reported 99.7% of the total 2762 cases (**Fig. 10**).

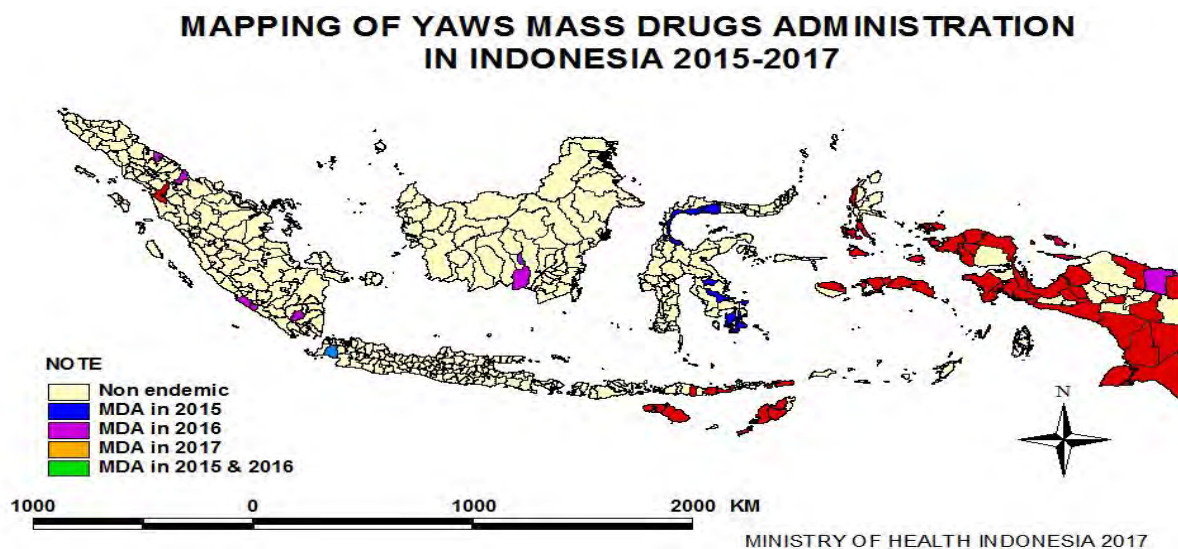
Fig. 11. The national plan to eliminate yaws in Indonesia, 2014–2020



- Health structure in Govt. of Indonesia is a decentralized system
- NTD elimination/ eradication allocates funds for eradication activities in endemic areas
- Some areas have their own funds for yaws eradication program
- Developed and published Ministerial Decree, Roadmap, National Guideline, Technical Guideline & Pocket Book

Following a decree by the Health Minister in 2017, the yaws programme received priority and support. Subsequently, the mid-term evaluation of leprosy and yaws (December 2016) and the Jakarta Call for Action ministerial meeting (April 2017) increased political and administrative support for yaws eradication in Indonesia (**Fig. 11**).

Fig. 12. Total community treatment in Indonesia, 2015–2017



Highlights of progress, 2015–2017

- The programme successfully completed TCT (MDA) in 62 endemic districts (**Fig. 12**).
- Administrative treatment coverage rates of MDA ranged from 80% to 100% in 21 districts, from 60% to < 80% in 10 districts, and to < 60% in six districts. The remaining 18 districts have not yet submitted reports on TCT implementation and coverage.
- The reasons for low coverage of TCT were difficulties in reaching the endemic communities, rejection of treatment by the community due to occurrence of adverse events and incorrect calculation of the number of targeted population.

Serological survey for assessing transmission of yaws infection

- A serological survey was carried out for 3 consecutive years to confirm the interruption of ongoing yaws transmission in the population.
- A sample of more than 2000 children aged 1–5 years per district was selected for the serological survey with RDT.
- In 2017, a total of 44 districts conducted serological surveys and 4 positive cases were found in three districts.

Challenges include hard-to-reach areas making distribution of logistics difficult, poor commitment by some local government authorities, and weak surveillance and case-finding. Additionally, laboratory facilities are inadequate in many districts.

The Philippines

Dr Belen Dofitas, University of the Philippines College of Medicine, Philippine General Hospital, and President of the Philippine Leprosy Mission

The Philippines was a previously known endemic country where yaws was thought to have been eradicated after the campaign in the 1950s. The status of endemicity has not been known since the eradication campaign ended in 1961 and no yaws cases had been officially reported since then. In 2000, a community skin survey in Maguindanao province, Mindanao region, revealed that 82 (11.7%) out of 698 people had yaws skin lesions (Dofitas, 2000). In 2012, of the 1301 women and household members from Maguindanao and North Cotabato provinces screened by Dr Sherjan Kalim, 13.2% tested positive for *Treponema pallidum* with a specific RDT (SD Bioline Syphilis 3.0 test). Dr Kalim attributed the high seroreactivity to yaws more than to syphilis.

A study was therefore commissioned by the Department of Health and carried out in 2017 (Dofitas, 2017) to assess the status of yaws in the Philippines. A clinical seroprevalence survey was conducted in Liguasan Marsh, Central Mindanao, covering nine selected municipalities in three provinces (Maguindanao, North Cotabato and Sultan Kudarat). The survey was school-based, but persons with lesions resembling those shown on posters were also asked to report for screening.

Among the 2779 schoolchildren and community members screened for yaws-like skin lesions, 150 yaws suspects had serological tests (DPP and TPPA). Four children (aged 5–10 years) with yaws skin lesions were serologically confirmed. The prevalence of active yaws among children aged ≤ 15 years was 1.6 per 1000 screened for skin diseases (N=2554). Eight adults were probable latent yaws cases (i.e. reactive DPP tests but no active yaws lesions) of whom three were family contacts of confirmed yaws cases. Five of the nine municipalities studied had active and latent yaws cases. No tertiary cases were found. There were no cases reported outside the three provinces included in the study. Qualitative interviews with household contacts of yaws cases and local health personnel revealed that yaws is a stigmatizing disease with negative socioeconomic effects. Persons who test positive for treponemal antibodies are being refused employment outside the Philippines (i.e. denied overseas work).

An exploratory survey of government physicians and dermatologists in the whole country was also conducted by Dr Dofitas. Physicians were sent online questionnaires (Google Form) to determine if they had ever encountered any yaws cases and were requested to report any yaws suspects. Among the 131 respondents, only three dermatologists had reported personally seeing yaws cases in the past. The majority of physician respondents were not knowledgeable about yaws, making yaws recognition and reporting unlikely.

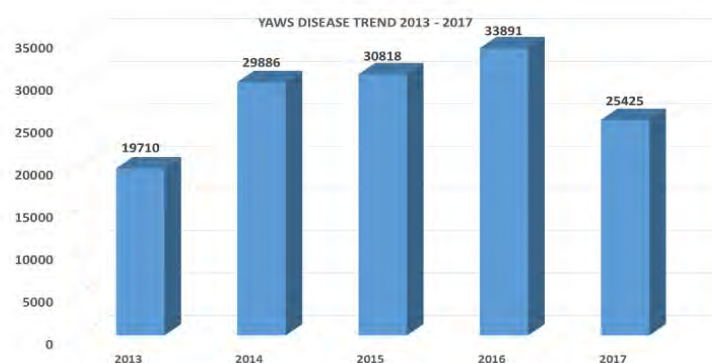
The confirmed yaws cases detected in Mindanao makes the Philippines the 14th endemic country. However, yaws is not included in the disease surveillance system and is not a notifiable disease. There is no electronic health information management system. The Department of Health of the Philippines asked the meeting whether it could start a yaws programme based on the data. Dr Asiedu advised to continue with case-finding and surveillance, especially in endemic communities and adjacent villages.

Papua New Guinea

Ms Wendy Houinei and Dr Lucy John, Department of Health

The burden of yaws is high in Papua New Guinea. The national yaws programme reported 15 000 cases in 2007 and 29 000 in 2015. **Fig. 13** shows the trend in the numbers of cases reported during 2013–2017. With support from WHO and IS Global, the programme conducted a trial with single-dose azithromycin in one island, which led to the formation of a new treatment strategy for yaws eradication by WHO in 2012 (i.e. the Morges Strategy). In addition, the programme completed a multicentre comparative clinical trial of azithromycin (20 mg/kg versus 30 mg/kg) in Karkar island. Six monthly rounds of TTT were completed in Lihir Island during 2013–2016 with a six-monthly assessment. MDA in Namatanai district is planned for 2018. The supply of point-of-care tests and azithromycin for programmatic use is inadequate. PCR is available at the Papua New Guinea Institute of Medical Research but it is not often used as this is a research institute. Yaws is reported in the national surveillance system but tally sheets are the only tool available for collecting data on yaws. Mapping has not been done with routine case searches or survey data.

Fig. 13. Trend in yaws case reporting in Papua New Guinea, 2013–2017



Vanuatu

Ms Fasihah Taleo, National Professional Officer

Vanuatu has 83 islands with a population of 289 115. In July 2012, the Ministry of Health launched the NTD–yaws elimination programme. In April 2013, a yaws baseline survey was carried out in Tafea province, with prevalence of 16.1% (n=997). In August 2013, TCT or MDA with azithromycin was started in Tafea province (**Fig. 14a**), achieving 95% treatment coverage (> 45 000 people treated). In 2014, a yaws school seroprevalence survey also in Tafea province showed 7.2% seropositivity (n=1553). Surveillance of yaws was established in all provinces in 2014, and in 2015 health information system monitoring and confirmation of cases was implemented. Information, education and communication as well as training and soap distribution programmes have started. In 2016, trachoma TCT or MDA was conducted nationwide, achieving 95% treatment coverage (> 262 000 people were treated with azithromycin [20 mg/kg body weight doses]). In 2017, Vanuatu was still reporting confirmed yaws cases including in Tafea province despite the two rounds of TCT conducted there (**Fig. 15**).

The main challenges include lack of azithromycin and rapid tests, ageing staff and very hard to reach areas of yaws.

Fig. 14a. TCT in Tafea province

Fig. 14b. Yaws status by province

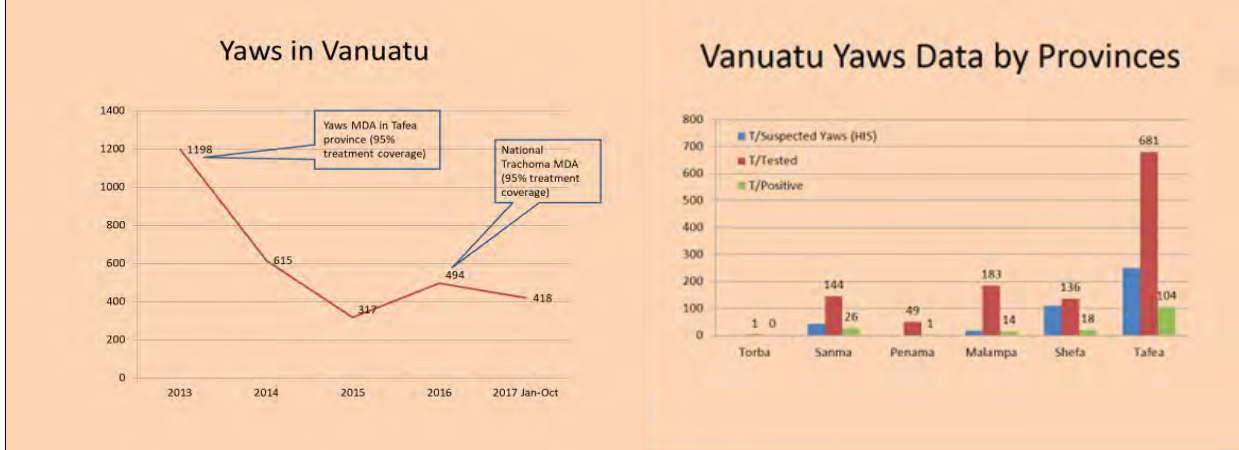
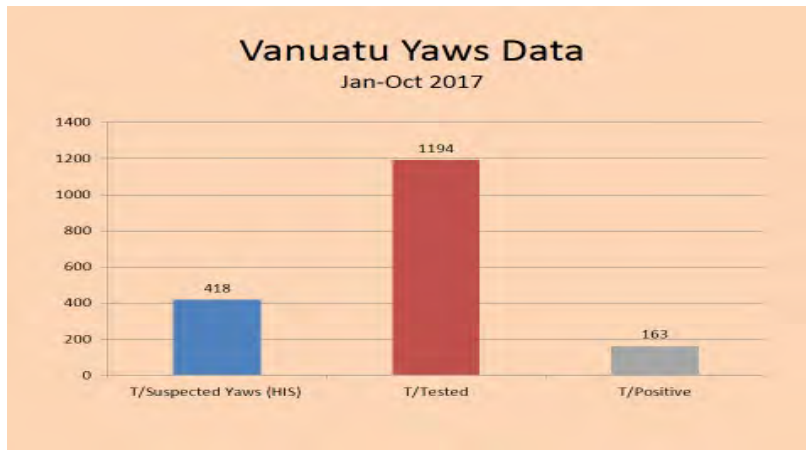


Fig. 15. Data on yaws in Vanuatu, January–October 2017



5. Experience from other eradication and elimination programmes

The participants discussed the status of other global programmes for eradication (dracunculiasis and poliomyelitis) or elimination as a public health problem (human African trypanosomiasis, lymphatic filariasis and trachoma). The following presentations were made by the representatives of the various global programmes at WHO headquarters in Geneva, Switzerland.

Polio eradication: surveillance

Dr Harish Verma, Global Polio Eradication programme

Dr Verma stated that the basis for polio eradication is:

- limited period of infectiousness;
- clinical surveillance;
- no natural reservoir;
- efficacious vaccine, easy to administer; and
- feasibility of eradication proven.

The core components are detection of poliovirus transmission through surveillance, namely, acute flaccid paralysis, environmental and other surveillance including targeted supplemental surveillance, contact sampling, healthy children sampling, ad hoc environmental sampling and laboratory components. There were also some innovations for environmental sample collection, such as bag-mediated filter systems and laboratory technology (real-time PCR, direct testing).

Eradication relies on an extensive, highly sensitive surveillance system as the poliovirus penetrates areas with ongoing conflict or facing major security challenges. Timely detection helps end poliovirus circulation in areas with ongoing transmission and also ensures rapid response to outbreaks in polio-free areas.

A framework for case detection and handling was given. Critical to this are a well-sensitized reporting network and frontline action. Guidelines are necessary for case investigation (case recording, sample taking and handling, case classification and necessary interventions). The polio surveillance system is now well established thanks to hard work and the detailed guidelines. The disease remains endemic in three countries: Afghanistan, Nigeria and Pakistan.

Dracunculiasis eradication: surveillance

Dr Dieudonné Sankara, Guinea worm eradication programme

The main basis for defining the eradication strategies is the life cycle of the disease. The criteria for eradication are that endemic countries provide evidence of interruption of transmission, that optimal surveillance is in place to detect any occurrence of the disease and that all countries are certified free of dracunculiasis transmission. These criteria informed the roadmap to eradication, from intervention to transmission interruption to individual country certification to all countries certified free of dracunculiasis transmission.

Countries are grouped into three for surveillance purposes:

1. Group A are known endemic countries;
2. Group B are countries reporting zero cases for < 3 consecutive years (pre-certification stage);
and
3. Group C are other countries, areas and territories reporting zero cases for > 3 consecutive years (certification stage) and requiring verification (Somalia was one such country) or not requiring verification, or where transmission has never existed.

Following the recommendations of the International Commission for the Certification of Dracunculiasis Eradication, WHO has certified a total of 198 countries, territories and areas, including 186 WHO Member States, as free from dracunculiasis transmission. Eight Member States remain to be certified: four countries (Chad, Ethiopia, Mali and South Sudan) in which the disease is endemic; two countries (Kenya and Sudan) in which the disease was previously endemic and that are in the pre-certification stage; and two countries (Angola and the Democratic Republic of the Congo) in which no history of the disease has been reported since the 1980s but that need to provide further evidence of the absence of transmission.

The level of intensity of surveillance in endemic countries is based on the risk of transmission. In endemic villages, active surveillance is done through multiple weekly searches, household by household. There is monthly reporting and at least monthly supervision. In formerly endemic and/or at-risk areas, active surveillance is done. In non-endemic areas at risk, ≥ 1 searches are conducted per month. Monthly reporting and monthly supervision are also done. In non-endemic, low-risk countries, passive surveillance or integrated disease surveillance and response is done with monthly reporting and integrated supervision.

Cross-border surveillance and notification are carried out to minimize the risk of spread and/or reintroduction of the disease in already freed countries and areas. Surveillance data are shared with WHO by countries. WHO maintains an up-to-date database, which is accessible online for evidence-based analysis and decision-making.

Lymphatic filariasis elimination: transmission assessment surveys

Dr Jonathan King, WHO Global Programme to Eliminate Lymphatic Filariasis

The Global Programme to Eliminate Lymphatic Filariasis has two objectives: (i) to stop transmission through MDA; and (ii) to reduce suffering and improve quality of life through morbidity management and disability prevention.

Activities are guided by a strategic framework outlining requirements, from starting interventions to achieving criteria for elimination as a public health problem. Epidemiological mapping is used to identify endemic areas requiring MDA. WHO recommends that endemic IUs (usually a district) conduct MDA once a year for at least 5 years until transmission is interrupted. After at least five MDA rounds achieving > 65% coverage of the total population in each round, impact is assessed in epidemiological surveys of sentinel and spot-check communities suspected to be the most endemic. Where the proportion of persons who test positive for microfilaraemia or antigenaemia in each surveyed community is below target thresholds (< 1% Mf or < 2% Ag), then the area proceeds with measuring incident infection through the transmission assessment survey (TAS).

WHO recommends TAS as the decision-making tool to determine when to stop MDA. TAS is a standardized survey that determines whether incident infection is below a certain level at which transmission is assumed no longer sustainable. These target thresholds are shown in **Table 1**. TAS follows a lot quality assurance sampling methodology using a critical cut-off value for decision-making, yet also provides a prevalence estimate. The outcome of the TAS and the interpretation are shown in **Table 2**. Once an area passes TAS, WHO recommends repeating the TAS twice at intervals of 2–3 years during post-MDA surveillance to ensure that infection levels remain below target thresholds.

Training modules and sampling tools developed by WHO are available for capacity-building of programmes. TAS relies on the use of point-of-care rapid diagnostic tests: the Alere Filariasis Test Strip (FTS) for *Wuchereria bancrofti* and the Brugia Rapid Test for *Brugia* spp. The FTS is available free of charge to countries through a WHO donation programme. Once a country passes a TAS no sooner than 4 years after stopping MDA in all endemic areas and meets the criteria for morbidity

management, it may submit a dossier for validation. Surveillance activities are required even after validation and should be opportunistic and sustainable. WHO has yet to provide standardized guidance for post-validation surveillance.

Table 1. TAS critical cut-off thresholds

<i>W. bancrofti</i>	< 2% Ag (ICT/FTS) <i>Anopheles / Culex</i> < 1% Ag (ICT/FTS) <i>Aedes</i>
<i>Brugia spp.</i>	< 2% Ab (Brugia Rapid Test)

Table 2. TAS outcome and interpretation

Result	Interpretation	Recommended action
Positive children ≤ critical cut-off	PASS Incident infection below threshold.	Interventions no longer required – Stop MDA Post-MDA surveillance phase
Positive children > critical cut-off	FAIL Incident infection not below threshold.	Interventions still required – 2 more years of MDA

Human African trypanosomiasis: epidemiological surveillance

Dr Gerardo Priotto, Medical Officer, human African trypanosomiasis elimination programme

Human African trypanosomiasis (HAT or sleeping sickness) is transmitted by tsetse flies, but its distribution is much more focalized than the area infested by tsetse, which is vast. Different methods of surveillance are followed depending on the level of endemicity, including **active screening** and **passive screening** of the population living in the endemic area. Mapping of all cases at the village level is key for proper targeting of surveillance activities. Individual rapid serological tests (RDTs) and multiple serological tests (CATTs [card agglutination tests]) are used for screening, as a first-line selector of suspected infection, but confirmatory diagnosis requires parasitological tests, which are resource-demanding and time-consuming. Trypanolysis laboratory tests are done on samples collected on filter paper and sent to remote reference laboratories, and used to raise the level of suspicion in patients in areas where there is no capacity for HAT parasitology.

Active surveillance is carried out by active screening either by classic teams (by car) or light teams (by motorbike). One modality is visiting house to house for serological tests and carrying out confirmatory testing during a second visit to the village.

Once the case prevalence declines, **passive screening** is established in the health centres by serological tests done on patients with a compatible clinical profile. Whenever a case is confirmed, a reactive active screening is done in the village of origin. As every detected case is treated with effective trypanocidals, this strategy depletes the reservoir of trypanosomes, which is mainly humans (gambiense HAT), and transmission of the disease declines. The continued application of this strategy has reduced the annual number of cases by 90% in the past 15 years, and the disease is targeted for elimination as a public health problem by 2020.

Trachoma elimination: mapping and elimination criteria

Dr Anthony Solomon, Medical Officer, Global Programme for Trachoma Elimination

Trachoma is an eye disease transmitted by flies, fingers and fomites from person to person within impoverished communities. Since there is no effective vaccine against the causative organism, public health approaches focus on reducing transmission and limiting the effect of infection, using the SAFE (surgery, antibiotics, facial cleanliness and environmental improvement) strategy. The disease is targeted for elimination as a public health problem by 2020.

The criteria for elimination of trachoma as a public health problem are: (i) prevalence of TT [trachomatous trichiasis] < 0.2% in ≥ 15 year-olds; and (ii) prevalence of TF [trachomatous inflammation–follicular] < 5% in 1–9 year-olds, in each formerly-endemic district; plus (iii) a system to identify and manage cases of incident TT, using defined strategies, with evidence of appropriate financial resources to implement those strategies. The need for interventions (at baseline survey), the timing of their discontinuation (at impact survey) and determination of whether the disease has been sustainably eliminated (at surveillance survey) are assessed using appropriately-powered population-based prevalence surveys, for which robust systems for country support and implementation have been developed in recent years.

5. Costs of yaws eradication to achieve the 2020 target

Mr Christopher Fitzpatrick, Health Economist

Recent developments, including the donation of 153 million azithromycin tablets (worth US\$ 31 million) and the adoption of a sequential testing strategy, warranted a revision to the first cost estimate published in 2014. Now it is estimated that the total financial cost (excluding Indonesia) would be US\$ 175 million over 5 years. If the drug donation is extended to cover all drug needs, the cost would be US\$ 111 million. This costing may change depending on post-treatment surveillance and the certification process. It is important to get better **country-level** estimates of eligible or at-risk populations, and plans for expansion (what percentage per year and number of TCT rounds).

7. Yaws endemicity mapping

Timor-Leste school survey methodology – a process discussion

Dr C.R. Revankar described the process of yaws endemicity mapping in Timor-Leste in 2017.

Timor-Leste is one of the two known countries endemic for yaws in the WHO South-East Asia Region. Since the country does not report yaws cases routinely, decisions about implementing the Morges Strategy are difficult. Two survey reports in 2010 (skin survey) and 2016 (serological screening) are available as evidence of the existence of pockets of yaws. The 2010 skin survey indicated a yaws prevalence of 0.4%. The 2016 serological survey indicated that the treponemal infection rate was 5.2%.

As per these two surveys, it is assumed that the prevalence may be $\geq 5\%$. Since community-based surveys are resource demanding and time consuming, it was decided to plan school-based clinical and serological surveys since children aged 6–10 years are likely to suffer more than older children.

Timor-Leste has a population of 1.2 million (2015 census) and a child population (aged 0–14 years) of 39%. In 2015, more than 80% of children were registered in 1336 schools, of whom 250 000 were registered in 1169 primary schools. This information was used to select the sample for the school-based survey. The country is divided into 13 districts and 65 sub-districts. One sub-district is labelled as one IU or treatment unit for yaws TCT implementation. The average population of one IU is 18 210 spread over 5–7 villages.

The selected schoolchildren were screened clinically for skin diseases resembling yaws (suspected yaws) and subjected to RDT (SD Bioline Syphilis 3.0 test). Those who tested positive for treponemal antibodies were further tested for treponemal and non-treponemal antibodies using DPP kits. Those found positive for both antibodies were considered as active yaws cases for treatment with single-dose azithromycin.

A non-probability sampling methodology was followed to select schools and schoolchildren. The criteria for sampling were: (i) public primary schools located in remote underdeveloped areas of the sub-district (IU); (ii) a school located 400 m from the main road and within 4 km of a health facility (community health centre) using QGIS (Quantum Geographic Information System) methodology; and

(iii) from each selected school, a minimum 200 and maximum 800 students from one primary school were screened.

A total of 360 primary schools from 50 sub-districts in 10 districts were selected for screening during October and November 2017 (remaining 15 sub-districts from three districts will be taken up in early 2018). A total of 113 health centre doctors and nurses and 100 laboratory technicians were trained in yaws disease, screening process and records. The laboratory technicians were trained in RDT and DPP tests and skin lesion sample collection.

Yaws mapping

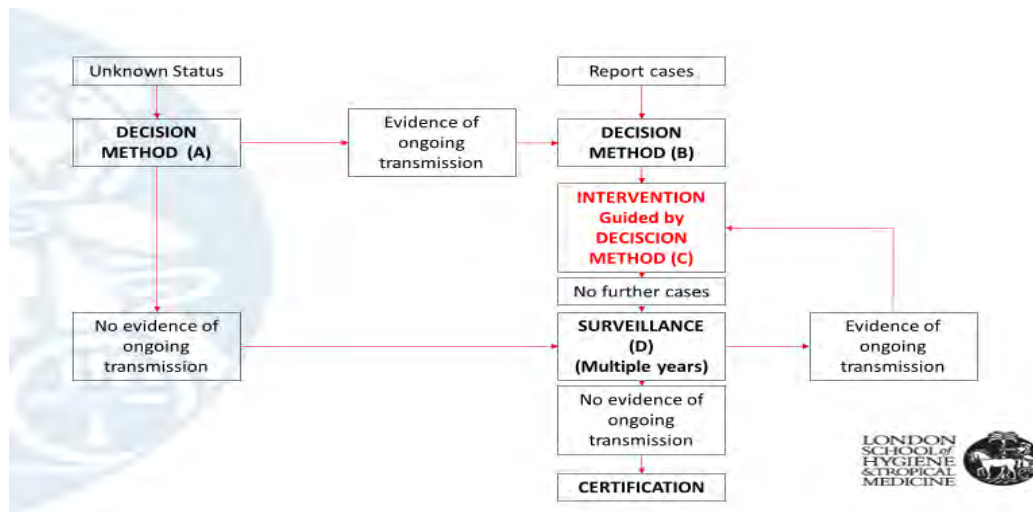
Dr Michael Marks, with input from Dr Emma Harding-Esch and Mr Eric Mooring, London School of Hygiene & Tropical Medicine, discussed issues relating to endemicity mapping and decisions for TCT or TTT based on the number of new yaws cases reported annually.

Significant gaps in our current knowledge of yaws epidemiology were identified, including:

- the appropriate design effect to use for sample size calculations;
- the appropriate age range to include in sero-surveys; and
- the effect of spatial heterogeneity on mapping strategies.

It was noted that similar issues had been raised at a yaws strategy development meeting (Atlanta, GA, USA, 27–28 October 2014), but limitations of funding prevented these issues from being addressed. The absence of data on these points makes the accurate design of surveys to support yaws eradication extremely challenging.

Fig. 16. Decision-making in implementing the yaws eradication strategy



The need for stage-specific decision-making tools was discussed (Fig. 16). If the status of yaws endemicity is unknown in a given country, decision method A could be based on either no evidence of ongoing transmission or evidence of ongoing transmission and decision B followed. If a country is reporting yaws cases, take decision C and decide about interventions. If there are no yaws cases after the intervention, follow decision D, (surveillance for many years). If no yaws cases are reported during the process of surveillance, decide about certification of interruption of transmission.

Some elements of surveillance are likely to be based on high-quality, epidemiologically driven active case-finding (for example identification of suspected cases in countries of unknown status, or to monitor post-interruption of transmission). Other elements of surveillance (disease mapping) are likely to require surveys. It is important to note the seasonality of yaws, which is more prevalent during the rainy season or immediately afterwards. However, this is also the period when villages are least accessible.

Funding is required to undertake the appropriate operational research to inform the design of these tools.

8. Data collection tools and case definitions

Dr Lise Grout, Epidemiologist, WHO/IDM unit/NTD, discussed data collection tools in the yaws eradication programme. The core monitoring indicators and the WHO standard surveillance forms (001–010) were presented and discussed (summarized below).

Form	Name	Purpose
001	Yaws TCT tally sheet	To help counting the number of people treated during TCT
002	Yaws TCT daily summary sheet	To aggregate data after total community treatment activities each day
003	Yaws case register	To capture individual information for each yaws suspected and confirmed case detected at health facility, during active case search in the community or in schools, or during TCT
004	Monthly reporting forms	To monthly report on core aggregated data on yaws activities, at health facility, during active case search or during TCT
005	Community registers for volunteers	To keep track of all yaws “rumors” notified by community health worker to district officers
006	Case investigation form	To capture more detailed information on yaws suspected case and their contacts after TCT phase
007	Lab request form	To request PCR analysis to confirm yaws cases and for yaws cases that do not respond to treatment or appear after treatments
008	Village endemicity assessment	To capture endemicity and number of cases at community level
009	Active case search register	To document the effort of active yaws case search in the community
010	Yaws survey record form	

Yaws surveillance, M&E, in the context of eradication - Geneva, 29-30/01/2018

These tools will be ready soon for field testing and are all available electronically.

Fig. 17. WHO yaws surveillance data collection tools for different phases of eradication

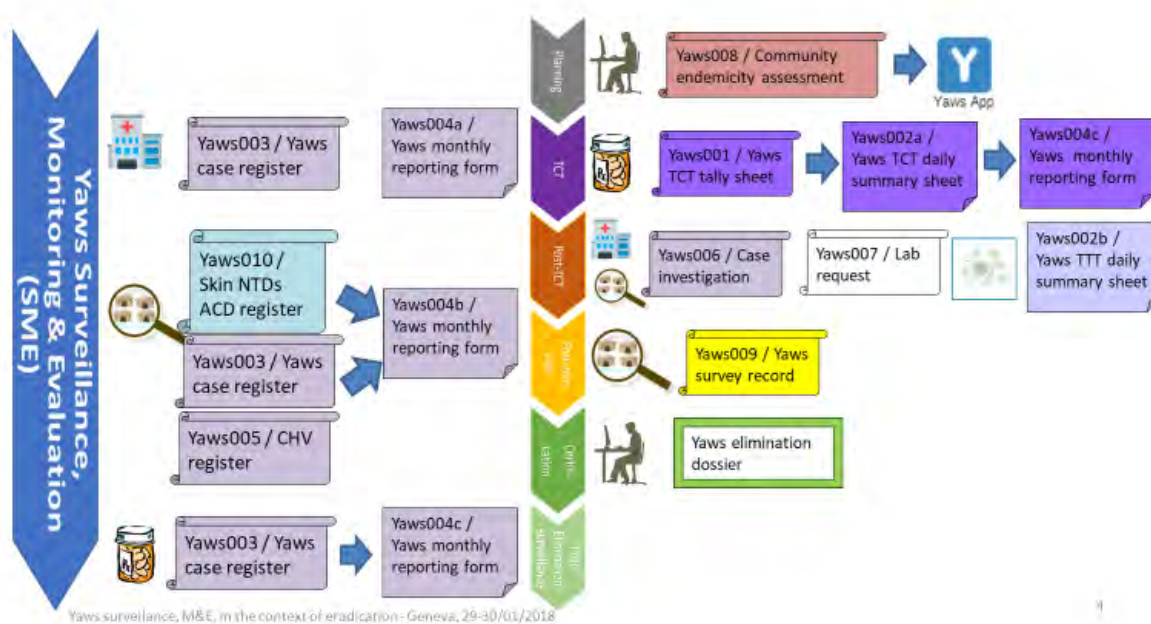
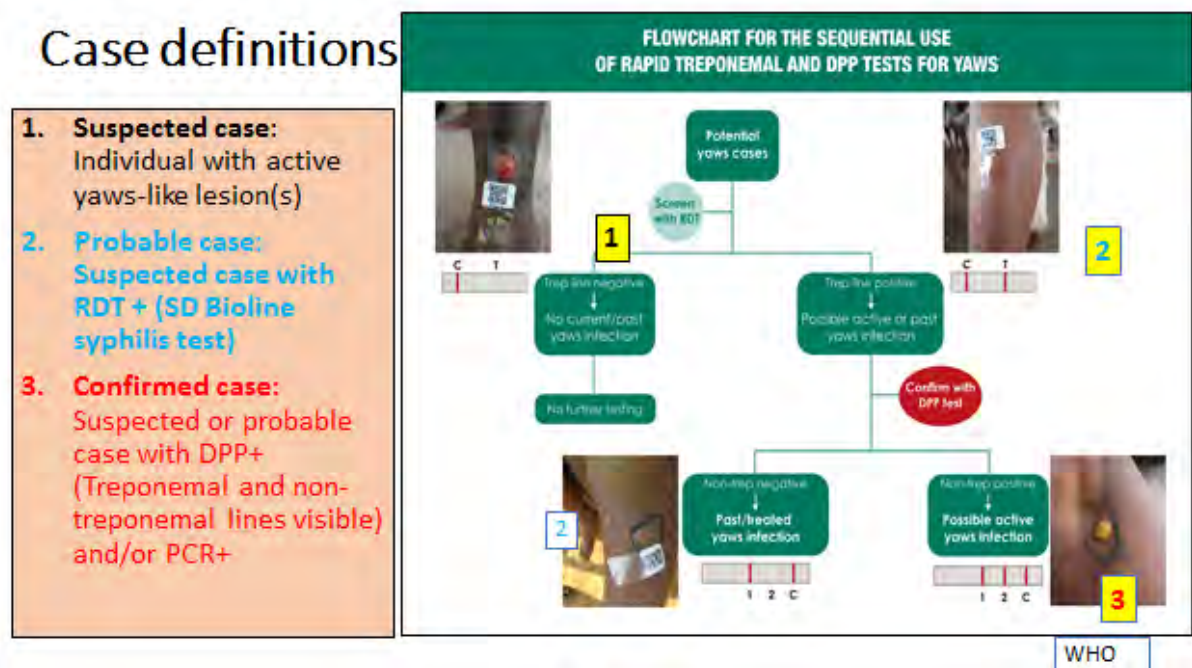


Fig. 17 shows the various tools used at different levels (community, health centre, sub-district, district, region and central) and phases of implementation of the yaws eradication strategy, from planning to post-certification surveillance.

Surveillance begins at the community level (suspecting yaws cases by community surveillance volunteers). Further testing and reporting start from this grass-roots level upwards until the central level receives the list of all yaws cases (suspected, probable and confirmed).

The importance of distinguishing suspected, probable and confirmed yaws cases was highlighted, and **case definitions** were agreed upon (**Fig. 18**).

Fig. 18. Yaws case definitions*



* Fig. 18 was revised after the meeting.

The **yaws surveillance and response system** will aim at strengthening adequate testing and reporting of cases and appropriate response to detected cases. The yaws case registry should be implemented after the TCT campaigns in order to collect core information for each yaws suspected case. This information will be aggregated and summarized in the yaws monthly reporting form.

Active case searches will have to be organized in the communities in order to identify yaws suspected cases and, ideally, be integrated with case searches for other skin NTDs. An active case search register was presented and discussed.

It is to be noted that the monitoring exercise is an integral component of the surveillance system since all the surveillance data are processed and activities are monitored. Monitoring will rely for example on population and geographical TCT coverage. Tally sheets, daily summary sheets and monthly reporting forms will be useful to calculate these indicators.

Finally, the evaluation is an end process (assessing the impact of interventions).

Annex 1. Agenda

Day 1 – Monday 29 January 2018 (Chairman: Nsiire Patrick Agana)

Time	Item	Presenter
09:00–10:15	Self-introduction	All
	Opening remarks	Gautam Biswas
	Innovative disease management of selected NTDs	Daniel Argaw Dagne
	Rationale and objectives of the meeting	Kingsley Asiedu
	Overview of yaws surveillance, monitoring and evaluation in the context of yaws eradication	Chandrakant Revankar
10:45–12:30	Country updates on yaws surveillance, surveys, mapping, monitoring and evaluation activities	
	Vanuatu	Fasihah Taleo
	Ghana	Cynthia Kwakye
	Cameroon	Earnest Njih Tabah
	Indonesia	Nani Rizkiyati
	Côte d'Ivoire	Henri Assé
	Papua New Guinea	Lucy John
	Philippines	Belen Dofitas
14:00–15:30	Surveillance, surveys, mapping, monitoring and evaluation: experiences of other programmes	
	Polio eradication (surveillance)	Harish Verma
	Dracunculiasis eradication (surveillance)	Dieudonné Sankara
	Lymphatic filariasis elimination (transmission assessment surveys) ¹	Jonathan King
	Trachoma elimination (Global Mapping Project)	Anthony Solomon
	Human African Trypanosomiasis elimination (population screening)	Gerardo Priotto
	<i>Discussion</i>	All
16:00–16:30	Estimating the cost of yaws eradication	Christopher Fitzpatrick
	<i>Discussion</i>	All
16:30–18:00	Yaws surveillance	All
	Discussion and finalization of yaws surveillances forms	All
	Yaws surveillance tools and DHIS2	Lise Grout

¹ See: Training in monitoring and epidemiological assessment of mass drug administration for eliminating lymphatic filariasis [facilitator's guide and learner's guide]. Geneva: World Health Organization; 2013 (http://www.who.int/neglected_diseases/resources/9789241505444/en/).

Day 2 – Tuesday 30 January 2018 (Chairman: Lasse Vestergaard)

Time	Item	Presenter
09:00–11:00	Yaws surveys endemicity assessment, mapping and verification of interruption of transmission	
	Yaws endemicity mapping survey in Timor-Leste	Chandrakant Revankar
	Yaws endemicity mapping using DHIS2 : results of the questionnaire sent to countries and experience at district level in Ghana	Lise Grout
	Discussion	All
	Programmatic requirements and current knowledge to inform yaws surveys	Michael Marks
	Discussion	All
	Knowledge gaps in designing yaws surveys	Michael Marks
	Discussion	All
11:30–12:30	Proposals for operational research and interim approaches to survey design	Michael Marks
	Discussion	All
14:00–14:45	Mass treatment	
	Azithromycin needs assessment (tools: Excel, DHIS2 App)	Lise Grout
	TCT forms and indicators	Lise Grout
	Discussion	All
14:45-15:30	Tools final validation and any other issue	All
15:30–16:30	Conclusions and recommendations	Rapporteur
	Closure	Daniel Argaw Dagne

Annex 2. List of participants

Nsiire Patrick Agana

National Yaws Eradication Programme
Ghana Health Service
Korle-Bu, Accra
Ghana

Tel:+233 244 292170

Email:agana.nsiire@gmail.com

Henri Assé

Programme national de lutte contre l'ulcère de Buruli
Ministère de la Santé et de l'Hygiène Publique
22 BP 688
Abidjan 22
Côte d'Ivoire

Tel:+225 05 60 36 01

Email:pr.assehenri@gmail.com

Ron Ballard

1765 Florahome Way
The Villages, FL 32163
United States of America

Email:ronjoanballard@bellsouth.net

Belen Dofitas

Section of Dermatology, Department of Medicine
Philippine General Hospital
Taft Avenue Ermita
Brgy 670 Zone 72
Manila, 1000 Metro Manila
Philippines

Email:belendofitas@gmail.com

Emma Harding-Esch

Clinical Research Department
London School of Hygiene & Tropical Medicine
Keppel Street
London WC1E 7HT
United Kingdom of Great Britain and Northern Ireland

Tel:+44 (0)20 7612 7982 - Ext: 7982

Email:emma.harding-esch@lshtm.ac.uk

Wendy Houinei

Health Department
Ministry of Health
Level 3, AOPI Centre
PO Box 807
Wagani, 131, National Capital District
Port Moresby
Papua New Guinea

Tel:+675 301 3732

Email:wendy_houinei@health.gov.pg,
whounei7@gmail.com

Lucy John

National Department of Health
Ministry of Health
Level 3, AOPI Centre
PO Box 807
Waigani, 131, National Capital District
Port Moresby
Papua New Guinea

Tel:+675 3013759

Email:lucyninmongojohn@gmail.com

Irma Surya Kusuma

Sub Directorate Direct Transmitted Tropical Diseases
(Leprosy and Yaws)
Director of DTDC Directorate General of CDC & EH,
Ministry of Health RI
Jln. Percetakan Negara 29
Jakarta
Indonesia

Tel:+62896-6556-4022

Email:irma.sk07@gmail.com

Cynthia Kwakye

National Yaws Eradication Programme
Ghana Health Service
PMP Ministries
Box 493
Korle-Bu, Accra
Ghana

Tel:+233 24 412 1272

Email:ckwakye83@yahoo.com

Michael Marks

Department of Clinical Research
London School of Hygiene & Tropical Medicine
Keppel Street
London WC1E 7HT
United Kingdom of Great Britain and Northern Ireland

Email:Michael.Marks@lshtm.ac.uk

Eric Mooring

Department of Epidemiology
Harvard T.H. Chan School of Public Health
677 Huntington Avenue
Boston, MA 02115
United States of America

Email:eqm183@mail.harvard.edu

Earnest Njih Tabah

National Leprosy, Buruli Ulcer,
Yaws and Leishmaniasis Control Programme
Disease, Epidemics and Pandemics Control, Ministry of
Public Health
Centre Jamot, Mballa 2
Yaoundé
Cameroon

Tel:+237 674 05 68 74

Email:enjih2000@gmail.com

Chandrakant Revankar
4305 Birchwood CT
North Brunswick, NJ 08902
United States of America

Tel:+1-732-348-8373
Email:revankarcr@gmail.com

Nani Rizkiyati
Sub Directorate Direct Transmitted Tropical
Diseases (Leprosy and Yaws)
Director of DTDC Directorate General of CDC &
EH, Ministry of Health RI
Jln. Percetakan Negara 29
Jakarta
Indonesia

Tel:+62816-1852-900
Email:nani.rizkiyati@gmail.com

Ade Erma Supriyatin
Directorate Direct Transmitted Tropical Diseases
(Leprosy and Yaws)
Director of DTDC Directorate General of CDC & EH,
Ministry of Health RI
Jln. Percetakan Negara 29
Jakarta
Indonesia

Tel:+628119843558
Email:erma.ade@gmail.com

Alphonse Um Boock
Direction générale
Fondation Fairmed
Avenue Valéry Giscard d'Estaing
Yaoundé BP 5807
Cameroon

Tel:+237 22 22 22 378
Email:umboock@yahoo.fr,
alphonse.umboock@fairmed.ch

Lasse Vestergaard
Department of Infectious Disease Epidemiology
and Prevention
Statens Serum Institut
5 Artillerivej
2300 Copenhagen S
Denmark

Tel: +45 3268 3268
Email : LAV@ssi.dk

WHO Secretariat

Kingsley Asiedu

Global Yaws Eradication Programme
Innovative & Intensified Disease Management unit
Department of Control of Neglected Tropical Diseases
Communicable Diseases
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 2498

Email:asieduk@who.int

Gautam Biswas

Department of Control of Neglected Tropical Diseases
Communicable Diseases
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 3850

Email:biswasg@who.int

Daniel Argaw Dagne

Innovative & Intensified Disease Management unit
Department of Control of Neglected Tropical Diseases
Communicable Diseases
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 4532

Email:biswasg@who.int

Christopher Fitzpatrick

Strategy Development and Implementation Coordination
Department of Control of Neglected Tropical Diseases
Communicable Diseases
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 1331

Email:fitzpatrickc@who.int

Lise Grout

Innovative & Intensified Disease Management unit
Department of Control of Neglected Tropical Diseases
Communicable Diseases
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 2341

Email:groutl@who.int

Saraubh Jain

Leishmaniasis Programme
Innovative & Intensified Disease Management unit
Department of Control of Neglected Tropical Diseases
Communicable Diseases
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 3849

Email:jainsau@who.int

Jonathan King

Global Programme to Eliminate Lymphatic Filariasis
Preventive Chemotherapy and Transmission Control unit
Department of Control of Neglected Tropical Diseases
Communicable Diseases
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 1423

Email:kingj@who.int

Pamela Mbabazi

Preventive Chemotherapy and Transmission Control unit
Department of Control of Neglected Tropical Diseases
Communicable Diseases
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 4588

Email:mbabazip@who.int

Sally-Ann Ohene

Technical Units
World Health Organization – Africa
AF_GHA Ghana
N° 29 Volta Street
Accra PO Box M.B.142
Ghana

Tel:233 21 763918-9

Email:ohenes@who.int

Dieudonné Sankara

Guinea Worm Eradication Programme
Preventive Chemotherapy and Transmission Control unit
Department of Control of Neglected Tropical Diseases
Communicable Diseases
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 2164
Email:sankarad@who.int

Anthony Solomon

Trachoma Elimination Programme
Preventive Chemotherapy and Transmission Control unit
Department of Control of Neglected Tropical Diseases
Communicable Diseases
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 2823
Email:solomona@who.int

Fasihah Taleo

WHO Country Office in
Vanuatu
WHO Country Liaison Office
PO Box 177
Port Mila
Vanuatu

Email:taleof@who.int

Alexandre Tiendrebéogo

Regional Programme of Control of Neglected Tropical
Diseases
African Regional Office
World Health Organization
BP6 Cité du Djoue
Brazzaville
Congo

Tel: +242 010 328 347
Email: tiendrebeogoa@who.int

Harish Verma

Clinical Trials and Research
Polio Eradication
World Health Organization
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: +41 (0)22 791 3567
Email:vermah@who.int