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TUBERCULOSIS CONTROL (BCG)
MASS VACCINATION CAMPAIGN, SUDAN

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by

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I INTRODUCTION

The Government of Sudan, desiring to conduct a Mass BCG Campaign, approached the World Health Organization for assistance in the matter. WHO proposed that a pilot survey with UNICEF help should precede such a mass campaign, and to this the Government of Sudan agreed.

The Plan of Operation for the survey was signed by WHO on 17 September 1953, by the Sudan Government on 25 September 1953 and by UNICEF on 12 October 1953. An addendum was subsequently signed by the three participants providing for the second phase of the project to start in October 1956.

Accordingly, the pilot survey began in April 1954 and this lasting until April 1955, was conducted in all of the nine provinces of the Sudan, the findings being evaluated by WHO, TRO (Tuberculosis Research Office). As a result, a mass BCG campaign was recommended for the three Southern Provinces: Equatoria, Upper Nile and Bahar El Ghazal, whilst the Blue Nile, Khartoum and Northern Provinces were classified as "border-line" where such a campaign might or might not be considered necessary.

The Mass BCG Campaign Plan of Operation for the Southern Provinces called for the provision by WHO of a senior adviser (doctor) and two BCG nurses; by UNICEF, of equipments, vaccines, tuberculin, and four Land Rovers; by the national Government, of one national counterpart to the WHO senior adviser, eight vaccinators, four clerks, one bilingual secretary, farasheens, drivers and maintenance for the fleet of vehicles.

II THE PROJECT AREA⁽¹⁾

1. Geography and Climate

The project area in the Southern Sudan has an area of 251,295 sq. miles and is situated between latitudes 3° - 13°N; it is bounded on the west by French Equatorial Africa, on the south by the Belgian Congo, Uganda and Kenya, on the north by Kordofan and Blue Nile Provinces of the Sudan, and on the east by Ethiopia.

Equatoria Province has very thick tropical forests and many rolling hills with hard rocky terrain. Bahar El Ghazal Province has, in some areas, hard rocky terrain, whilst the remainder is mainly muddy land. The whole of the Upper Nile Province consists of low lying plains of hard muddy cotton soil.

The river Nile and its tributaries connects with all three Provinces of the project area, a large net-work of small rivers being found in Upper Nile and Bahar El Ghazal. Equatoria has all-season roads to most of its districts and sub-districts, whilst in Bahar El Ghazal, these are limited to only two districts. In Upper Nile, however, all parts of the province are cut off from Malakal headquarters during the rainy season which lasts from the end of April until the end of October.

(1) See Annex I for map giving location of project

The climate of the project area differs greatly from the rest of the Sudan, the hottest months being from January to April and the climate being hot and humid. During the rainy season the major part of the Bahr El Ghazal Province and Upper Nile are submerged, the average rainfall being 60 inches.

2. The Population, its Characteristics and Living Conditions

The population distribution in the Provinces is as follows:

	<u>Area in</u> <u>sq.miles</u>	<u>Density in</u> <u>sq.miles</u>	<u>Adults</u>	<u>Children</u>	<u>Total</u>
Equatoria	76,495	9 sq.miles	392,875	307,266	700,141
Ghazal	82,530	12 sq.miles	605,055	449,903	1054,958
Upper Nile	92,270	8 sq.miles	410,619	351,612	762,231

Most of the population in the project area, Southern Sudan, is divided into literally hundreds of tribes which speak their own languages and dialects and who observe varying tribal customs and taboos. One such tribe consists of only 350 people.

The tribesmen are very sceptical of everyone outside their own tribal confines and this is probably the reason that few have been converted to Christianity. There are some Moslems but these generally have migrated from neighbouring provinces.

The attitude towards outside influences has also retarded social development. Only very recently have some of the tribes taken advantage of the free education for their children, to any significant extent. The Government has provided books, stationery, clothing, food and lodging, gratis, in order to stimulate interest.

The tribes live under chieftains in their communities, but are generally widely scattered and without regular settlements. Some live on the roadsides and others deep in the forests or in the hills. Abodes are never permanent and the people move from place to place, year after year, for cultivation, cattle grazing and fishing purposes, sometimes covering as much as a hundred miles annually. It is thus very difficult to bring them any benefit collectively.

The housing system is almost identical for all the tribes. They live in small round huts called "Tokls" with mud walls, grass roofing, a small door, but without any window to admit sunlight or allow ventilation. They are constructed without any consideration for hygiene or health and at night a fire is built in the centre, around which people sleep in an environment which is both congested and stuffy.

Some tribes have little regard for dress and do not consider it a necessity, although it is very gradually becoming popular.

Food mainly consists of carbohydrates, usually either dura (a type of millet) or bafra (a kind of underground tuber). Proteins and fats are generally absent or form an insignificant part of the diet. Fruits and fresh vegetables are consumed when obtainable, but no attempt is made to make these regularly available as items of food. The cattle owning tribes (Dinkas) drink unboiled and sour milk, but eat the cattle meat only when the animal dies or is reaching

Tobacco smoking and other preparations of the habit forming type are commonly indulged in and locally made liquors are consumed liberally from adolescence by both sexes. Sharing a common pipe for smoking, using the same drinking pot and eating from the same vessel are usual practices and this is never regarded as being harmful. Personal hygiene is not considered by many of these tribal people and defaecation, urination and spitting are practised indiscriminately. Superstitions, prejudices and taboos are very numerous; in some tribes women may not eat eggs, whilst in others, they may not take milk.

Economically, the people are very poor, generally lacking any incentive to work. Most of them have no idea of living standards or of food better than that to which they are used, and appear satisfied with their old ways, not caring to improve their lot. Malnutrition and disease are evident everywhere.

3. Health Conditions and Services

Disease is considered due to "evil eye", and the village "witch doctor", greatly exalted by the community, is called in when illness occurs. Only when the patient is nearing death due to delay and the malpractices of the "witch doctor" is there any thought of calling for the modern doctor.

Prevalent diseases in the area are: Malaria, tuberculosis, bilharziasis, kala-azar, amoebic dysentery, bacillary dysentery, sleeping sickness, onchocerciasis, tropical sore, leprosy, cerebrospinal meningitis, yaws, venereal diseases, hydatid cysts and smallpox.

(a) Tuberculosis

No definite data is available on the mortality and morbidity of tuberculosis in the area, as no survey has yet been made. Figures available from the out-patient departments of the general hospitals in the project area of cases detected by non-routine and incidental examinations, might give some idea of prevalence. Figures for the whole of Sudan were in 1948 - 1873 cases, in 1957 - 4878 cases, in 1958 - 7495 cases. In 1958, the figure for the project area was 1241 cases. The number of cases for the whole country has risen very sharply and deaths amongst such diagnosed cases dropped from 13% in 1948 to 4% in 1958. This is possibly due to the use of modern anti-tubercular drugs and to increased knowledge of the management and treatment of tuberculosis.

The actual number of tuberculosis cases is definitely very much higher than shown above. The bulk of the population is rural and because of the absence of public transport and communications cannot get to the hospitals and often suffer and die at home. Lack of health education or social prejudice often prevent people from going to a hospital even if they live within easy reach of it.

The number of sputum positive cases diagnosed by the out-patient department of the Aweil District Hospital, attended by people within walking distance, is an average of three a week. This is indicative of there being a high number of cases in this community, but exact figures can only be determined by survey.

The Sudan as a whole is very short of doctors and, on an average, ten graduate each year. The number in Government service is 329 and 86 are in private practice. The fact that the population is scattered over vast areas without adequate transport facilities, even more than the shortage of doctors, creates the difficult problem of rendering adequate medical assistance to the people.

Doctors working in the field of tuberculosis prior to the start of this project were: Dr. Mahiyuddin Mahdy, MRCP, Senior Chest Physician in charge of Khartoum River Hospital (TB), Abu Anga (TB), and recently built Khartoum Tuberculosis Hospital; one doctor with TDD (Diploma) who subsequently resigned from Government service; Dr. Zein who received training in modern methods of tuberculosis prevention and control on a WHO fellowship, at present chief of Tuberculosis Division, Ministry of Health, Khartoum.

Since the start of the WHO-assisted Tuberculosis Control Centre at Wad Medani, one doctor trained in tuberculosis work, who was the national counterpart of the WHO senior adviser, unfortunately died; however, three more doctors have now been trained and one of them, who had been on a WHO fellowship for higher studies and training, has just returned from the United Kingdom. This year the Government has decided to recruit doctors, train them in modern methods of tuberculosis control and prevention and allocate at least one to each Province as soon as possible. Initially these doctors will look after the existing tuberculosis beds available in the Province, later on when the proposed Provincial Tuberculosis Control Centres are set up, these will be added to their responsibilities.

Out of 942 beds for tuberculosis cases throughout the Sudan, 145 are in the project area and those are in charge of the general duty doctors. In addition, each district hospital maintains ten beds to meet the pressing needs of local tuberculosis cases, but such beds are not on the regular list of tuberculosis beds.

The new Tuberculosis Hospital in Khartoum, having 100 beds, has been the only one constructed since the start of the project, and only in Khartoum, Omdurman and Wad Medani are the beds for tuberculosis cases looked after by specialists and specially trained personnel. Since the start of the Mass BCG Campaign, one BCG Centre in Khartoum River Hospital, has been opened and is functioning well.

To date there has been no tuberculosis survey of the Sudan as a whole. Although the Wad Medani Centre conducted a survey of part of the Blue Nile Province, this cannot be taken as indicative of the country generally. The area surveyed may be regarded as having better economic and living conditions than those prevailing elsewhere, and great variations are met with.

The establishment of tuberculosis centres in each Province, on the lines of that in Wad Medani, has been accepted by the Government this year as the most practicable way to combat tuberculosis. At the same time, low cost beds will be attached to such centres to meet emergency requirements. In view of the vastness of Provinces and the inadequate public transport and communications, it is considered that static centres cannot fully serve the rural population who greatly predominate. Accordingly, a mobile X-ray unit and laboratory are considered an indispensable part of each centre's set-up for case-finding and treatment.

The main town in each Province of the project area has a fair-sized hospital with some specialized services and in some districts there are hospitals supervised by general duty doctors. Beneath the district level, there are dispensaries having a few beds and being supervised by the medical assistants who have had a course of training in the diagnosis and treatment of simple and prevalent diseases in the area. In the more remote and rural parts, there are dressing stations run by dressers who dispense the mixtures and tablets in common use and administer first-aid. Such dispensaries and dressing stations are under

the supervisor of the doctors in charge of the respective district hospitals who, with the help of the medical assistants and dressers, carry out the preventive vaccinations and make inspections for sleeping sickness; these in certain areas are made every six months.

There is legislation covering these inspections and the people are obliged to comply with this. Tuberculosis is a notifiable disease but the general belief is that medicaments or medical help are only necessary when actual sickness is present.

Environmental sanitation and DDT spraying against mosquitoes and other insects is supervised by Public Health Inspectors who are under the administration of the Provincial Medical Officer of Health, who in turn represents the Director of Medical Services in all matters of health and sanitation.

(b) Other Diseases, etc.

The WHO and UNICEF-assisted Malaria Eradication Team is operating from Sennar (Blue Nile Province), and satisfactory results having been accomplished in this field during the past few years, the scheme may now be extended to cover the whole country.

To explore the possibility of starting a mass smallpox vaccination programme, a pilot survey was carried out by WHO in 1959. Similarly, a treponemal diseases pilot survey was completed by the WHO in 1959 and a plan for mass venereal diseases control campaign with the assistance of WHO and UNICEF is expected to be put into operation soon.

Onchocerciasis survey work was also carried out in the project area by WHO in late 1959 early 1960 to collect data for measures to prevent or arrest blindness which is popularly known as "Jur Blindness", the incidence of which being heavy along the course of the River Jur.

Some nutritional survey work was carried out by the Food and Agriculture Organization with the aim of improving the nutritional standards of the whole country, especially in the South where malnutrition is very common. International assistance in the control of bilharziasis has also been given.

The attitude of the Government officials towards any health project to benefit the tribal people has been one of helpful cooperation, and the assistance received from tribal Chiefs has been praiseworthy. There has also been reasonable aid from professional people, and medical and health personnel have assisted within limits permitted by their other duties.

The vastness of the area, scattered population, difficult communications, constant tribal movements, lack of health education of the vast majority, peculiar modes of living and adherence to tribal prejudices and taboos, all adversely affect any rapid propagation of health measures for the benefit of the masses.

III SUMMARY OF OBJECTIVES

The principal objectives of the project were to give BCG vaccination to negative reactors in the younger age groups in the area with the intention of creating powers of resistance which ultimately would minimize tuberculosis mortality and morbidity, and would also strengthen the national health service tuberculosis control scheme for the whole country, including the Southern

operational area. Functionally, the aims were the creation and development of a well coordinated central Department of Tuberculosis Service specifically for tuberculosis control, but integrated with the General Health Services; also to train personnel in specific technical matters to fill future needs arising with any expansion of the scheme on a national level. BCG vaccination being one of the many measures in tuberculosis control, requires good coordination with and close relation to other services such as tuberculosis hospitals, clinics and sanatoria, also to other non-medical agencies helping towards control in the country.

The general purpose was to introduce the public health aspect of tuberculosis control by imparting to the people a knowledge of how to achieve health generally, with particular reference to the prevention and care of tuberculosis. It was felt that this would lead towards the creation of the necessary control measures and the adoption of legislation to meet local circumstances and needs.

The economic purpose, although a long-term one, was considered to be of great importance, and was that of minimizing the mortality and morbidity of the disease in the area and, consequently, saving man-power loss and the cost of therapeutic medicines and treatment.

IV METHODS

Short WHO documentary films on tuberculosis, and slides prepared by the Health Department for the campaign against the disease, were shown in various places throughout the area in order to give the public an understanding of the benefits and the purposes of BCG vaccination. This was conducted by the mobile cinema van of the Publicity and Information Department of the Government. Pamphlets on the utility of BCG were prepared by the Senior Adviser; these were translated into Arabic and various local tribal languages and circulated by the health and administrative personnel before planning the work in each area. The Ministry of Health circulated memoranda on the subject to their regular staff in the field and to hospitals in the area, and requests were made by the Ministry to render all possible assistance to the BCG campaign work.

Public lectures were given by the Senior Adviser regarding the benefits of BCG and its role in the prevention of tuberculosis, while planning work for any particular area, and these were translated into local dialects by interpreters. Preliminary preparations started long before work actually began, and these laid down the actual programme to be followed.

According to the original plan of operation covering some 2 1/2 million people, 2 million tests and 750,000 vaccinations for non-reactors to 5 T.U. were envisaged, but after a certain period of actual work, this target was found to be impracticable. This was due to the people being very scattered, the difficulty of access to many places, above all, the natural difficulties and hazards of the long rainy season. A revised figure of 521,700 tests and 161,400 vaccinations was agreed to by the three participating agencies and the project was extended until the end of April 1960 to ensure better coverage of the Bahar El Ghazal Province, which had previously been impeded by the rainy season.

Tuberculin testing consisted of 0.1 cc of 5 T.U. (00002 mgm.) PPD injected intradermally in the mid-third of the back of the left forearm, and such tests were read after 72-96 hours. Transverse diameters of induration of 10 mm and above were considered positive reactors, and reactions from 9 mm to zero were considered negative or non-reactor. Since October 1959, PPD Batch XXIII was

used and, because of its six-month potency period, was found to be very convenient in field conditions very often far away from an air strip.

A comparative study between the reactions with 5 T.U. and 1 T.U. with Tween 80 was made by the Senior Adviser, but no difference of pattern in reactions was noticed. Negative reactors were vaccinated with BCG (Liquid BCG 0.07 mgm of moist Bacilli-Calmette-Guerin of two weeks age), 0.1 cc intradermally in the left deltoid region.

Tuberculin was supplied by UNICEF from the Agouza Laboratory (Dilution), Cairo, and BCG vaccine from the Statens Serum Institute, (SSI), Copenhagen, Denmark. Supplies were always regular, except for one occasion, when vaccine did not reach the field in time and a stoppage of work from 24 February to 8 March 1960, resulted.

Initially, UNICEF supplied four Land Rovers for the campaign, but due to very bad road conditions, these became near the end of their useful life by 1958, and due to frequent breakdowns, the programme planned could not be fulfilled. With the arrival of the three new Land Rovers from UNICEF in April 1959, the transport position remained satisfactory almost until the end of the campaign. The only remaining original Land Rover, with re-conditioned engine, used by the teams, was smashed in an accident with a lorry on 27 January 1960, and a pick-up supplied by the Government on loan from the Wau Hospital, gave fairly good service in the field.

The Campaign started in December 1956 with one WHO senior adviser, two BCG nurses and the requisite number of national staff. One of the nurses resigned and left the project in June 1957, and the other did not continue with the teams after October 1957. The original senior adviser resigned and left in January 1958, and the present adviser joined the field project in November 1958. A further BCG nurse joined the team in January 1959, and continued until 6 March the same year.

There had been no designated national counterpart to the WHO Senior Adviser, but Dr. Zein, Chief of the Tuberculosis Division in the Ministry of Health stayed from the beginning for different periods with the teams, working as national counterpart and helping the Senior Adviser in his duties. The bilingual secretary used to help in planning whenever it was necessary and possible for him after doing his regular work.

Two vaccinators, one clerk, and a driver with a car comprised a team and four such teams were formed to work throughout the Campaign. The Campaign started in 1956 in the Upper Nile Province but with the start of the rainy season, no work was possible there, so the teams had to move to Bahar El Ghazal Province in the month of June. Here too, work could not be continued very long as there were not many all-season roads in this Province. After finishing the passable places of this Province in two months' time the teams moved in August 1957 to Tambura sub-district of the Yambio District (Equatoria Province). In November, the teams returned to the Upper Nile Province (Malakal). Here in December a fire burnt all equipment, and work had to be suspended for one month. Some equipment was mustered from Khartoum and Wad Medani during this period for re-starting the work but the original WHO Senior Adviser resigned at this time. The Sudan was having its first election, which occupied all the Administrators and the Chiefs, so the Campaign was stopped. This was done because the active help of Administrators and Chiefs was essential for the Mass Campaign work. BCG staffs were attached to the Wad Medani Tuberculosis Centre for three months.

The Campaign resumed work in Equatoria Province in August 1958 with national staff under the supervision of Dr. Zein. In November, the WHO Senior Adviser joined the teams and remained in the field until the Equatoria Province was finished in August 1959. At this time of the rainy season, no work was possible in any of the residual areas of the South and the staff's annual leave being due, the Government allowed them to take this and return in October to start work in the Bahar El Ghazal Province. The WHO Senior Adviser was temporarily transferred to Sudan 9 project in place of Dr. Beringer who went on leave.

Work in the Bahar El Ghazal Province started on 20 October 1959. Most of the roads were still not passable, so the teams started work in Wau town. Work continued in the province until the end of May 1960, and there is a proposal for a short Campaign in Wadi Halfa later on before the staff are appointed in the permanent (proposed) BCG centres.

Organization and planning in all areas was done by the Senior Adviser, through personal contacts with administrative staff, health authorities, tribal Chiefs and Sub-Chiefs, before the arrival of the teams. Surveying the roads and tracks, fixing possible working centres, arranging accommodation for the staff, were also the regular duty of the Senior Adviser. He was also responsible for the technical supervision of the work in the field, going with one team one day and another the next. But during the stay of the BCG Nurse (Miss Hubert) this work was shared by her for a short period, much to the relief of the Senior Adviser.

Evening refresher training courses for the regular vaccinators and the trainee dressers were arranged by the Adviser himself. The briefing of the team clerks on organizing BCG centres (field), lecturing to the public about tuberculosis, its prevention, BCG vaccination and the importance of the return visit (reading day) were also done periodically.

V ACCOMPLISHMENTS

The evaluation of the accomplishments of the Mass BCG Campaign in Tuberculosis Control measures needs the study of tuberculosis mortality and morbidity in the project area, both before and after the Campaign. The BCG Mass Campaign has no such scope. Such work can better be done subsequently by national teams with short-term WHO consultant assistance. At present, the only means of evaluating the accomplishments of the project are by statistical data on work done and the post-vaccinal allergy, observed by re-testing some of the organized groups of school children in Equatoria and Bahar El Ghazal Provinces.

During the period of the Mass Campaign, a total of 621,962 tests and 219,201 vaccinations were made in the project area.

(For the percentage of return, vaccinations and all other statistical analyses, see annexed tables).

The adult participation has been fairly high and the percentage of negatives in some areas was quite high. Attempts were constantly made to obtain younger age groups and children but these were not very successful because children were not submitted by tribal people unless they had a prior test themselves. It was found several times that when the youngsters were wanted, the parents did not comply with such requests and for these reasons, adult participation although not invited was not discouraged.

In some areas absenteeism as far as the return visit was concerned, was rather high but in others it was not so. Despite all our attempts and efforts through Administrators and Chiefs, such absences could not be satisfactorily reduced in some areas. This is perhaps due mainly to lack of understanding and partly from fear of a second needle. Some of those returning said that others had gone to work in the fields, which they considered to be more important.

Re-test work was done to study the effect of previous vaccination and also to ascertain the allergenic potency of the different batches of vaccines used in the Campaign. The re-test included six batches of vaccines, of which three were used in 1957 and three in 1958; some in Bahar El Ghazal and some in Equatoria Province. The work was done in the Equatoria Province by two teams, one under the supervision of Dr. Zein and the other under the supervision of the Senior Adviser. Re-tests in the Bahar El Ghazal Province were done by the teams without supervision in October 1959, when the teams returned from leave.

Most students, previously in the top classes of the schools, had left after the examination and were consequently not available for re-testing. New entrants to the schools were also given BCG during this period and a total of 3,111 boys were re-tested.

Previous individual cards which had been preserved were distributed to the students concerned a little before the re-test work by arrangement with the headmasters. One technician under the supervision of the doctor measured the size of the previous scar if present, and the results were entered in the appropriate column at the back of the cards. Smooth scar was noted as "S", nodule as "N", no sign of previous vaccination as "O" and Keloid as "K". The tests were read after 72-96 hours under supervision and the negative reactors were again given vaccination at a slightly lower site than the previous scar if it was present.

The positive or negative reactions in the re-testing did not have any relation to the size of the previous vaccination scar or to the presence of a scar or nodule. One thing only was noticed to be a marked feature: that all the boys bearing keloids invariably gave negative reactions on re-testing.

Summary and details of the re-test work results in analytical form appear in the Annexes.

During the period of the Mass Campaign, 13 hospital dressers were fully trained in BCG technique and the services of these trained people will be used in the proposed permanent BCG centres to be established as soon as possible. The 8 regular vaccinators who had been doing the campaign work years are also a good asset and the services of these also are to be used in future permanent centres. All trained staff could conduct short-term campaigns under supervision when these are planned on the Provincial level, in addition to carrying out work in future static centres. Vaccination of new entrants to the schools and the testing of the contact of tuberculous patients in the provinces by these permanent BCG centres will be very valuable tasks.

The social achievements were rather remarkable, in that the tribes of the South, who are the most primitive, and most of whom had no idea whatsoever of preventive medicine let alone the prevention of tuberculosis, are now aware of it. Tuberculosis had been a problem to medical personnel and with the BCG Mass Campaign, the participating public, previously ignorant about the disease, and even those who did not participate, became well aware of tuberculosis in the

project area. The cause of health consciousness has materially gained and this will surely result in successful cooperation from these people in future. During the recent Treponemal Disease Pilot Survey and Onchocerciasis Survey, participation and cooperation has been reported to be good; this and future advancements of schemes for health purposes can be acclaimed in no small degree to be due to the BCG Mass Campaign.

For reasons mentioned before the Campaign, although started in December 1956, did not run smoothly and continuously; the possible working time proving to be altogether only 33 months. The monthly achievements of tests and vaccinations and the months worked are expressed graphically in the Annexes.

VI COMPARATIVE SUMMARY AND ASSESSMENT OF RESULTS

The specific purpose of the project was achieved in that it reached the target figures for tests and vaccinations. The final target figures fixed were perhaps more reasonable and practical in consideration of the unavoidable natural and other difficulties encountered. A year in the South in reality is only six months in the field because of the long rainy season and the absence of all-season roads in most parts of the project area.

The percentage of convertibility will be clear from the results of re-test work shown in Annex VI. Quite a number of previously vaccinated school children failed to show enough reaction to be grouped as positives and this was rather high in cases of vaccinations done in 1957. The reason for the big difference of convertibility rates between the vaccinations of 1957 and those of 1958 are not known.

Some boys gave negative reactions though having previous vaccination scars, whereas other boys showing no apparent sign of previous vaccination gave positive reaction in the re-test. However, in general, no definite pattern of reactions was noticed in the re-test work. It was also observed that some of the boys who had been vaccinated more than once gave negative reactions. This may perhaps be because some have a very low sensitivity towards tuberculo-protein although they may have developed immunity through vaccination.

Considering the question of coverage, it seems that this was better in Equatoria Province as compared to the other two provinces of the project area. The figures of the work done in the individual provinces may be seen in the Annexes.

Out of 8 regular vaccinators, one was spared for the Wad Medani Tuberculosis Centre's prevalence survey work and a hospital dresser was posted from there in exchange. This dresser is now fully conversant with the BCG techniques whilst the 13 hospital dressers likewise trained have gone back to their respective jobs in the hospitals but can be utilized for future BCG work at any time.

The clerical staff of the project acquired quite a good knowledge of the prevention and control of tuberculosis and of health education through their field duties and periodic stay at Wad Medani Centre. It is hoped that their services may be used in tuberculosis centres to be established in future and with their previous knowledge, these personnel should be of great assistance.

Some of the interested general duty doctors were trained in tuberculin testing and BCG vaccination with apparently good results.

The general outlook on tuberculosis shown by medical and paramedical personnel in the project area had been solely curative, but with this campaign, the public health (mass prevention and control) approach to the problem, though new to many and merely theoretical to some, gave the opportunity of seeing and putting knowledge into practice. This has been an invaluable opportunity to implant the public health approach and control of the tuberculosis problem in the minds of people who will all play individual roles in future activities in this field.

Facts regarding tuberculosis collected through extensive mass contact in the far rural areas covered by the project, which are perhaps more or less the same elsewhere in the Sudan, were very helpful in convincing the Government to draw up a plan for tuberculosis control centres with mobile X-ray and laboratory units to augment static units in each province. This will serve as a better way of extending tuberculosis services in the far rural areas, than the centralized system previously envisaged.

The BCG centre started after the inauguration of the Mass BCG Campaign has been functioning satisfactorily in the Khartoum River Hospital and will continue permanently. This centre in addition to its usual work, does the testing of contacts of tuberculosis cases in the River Hospital and this work is very good for early case finding. One such centre is expected to be started later this year at Wau Hospital and this has already been arranged with the Provincial Medical Officer of Health, Bahar El Ghazal.

Publication of pamphlets in local languages, lectures by the Senior Adviser during planning of the programme, and by team clerks in BCG centres (field), cinema shows on health and BCG by the publicity van, publication of news in the daily newspapers about progress and activities of the Campaign all helped collectively and individually in propagating health and tuberculosis consciousness both in the project area and in other parts of the country. This has been evident from the fact that quite a number of requests were made by the public and medical people for visits of BCG teams to their particular provinces. In short, BCG is now popular in the Sudan and it has created a background for the popularity of future health projects in the country.

VII RECOMMENDATIONS AND PREDICTIONS FOR FUTURE

As the staff have gained considerable experience of the field conditions in the last few years of the Mass Campaign, such a project could continue to do similar work if this were planned in the provinces classified by WHO as "Border Line". Such work always needs supervision by a doctor specially trained in BCG, and there is none available other than Dr. Zein who is busy at the Ministry of Health, and for this reason and because it has already been decided to put the vaccinators in the proposed permanent BCG centres of each province, the Mass Campaign has actually ended with the Bahar El Ghazal Province.

It has, however, been agreed that the teams should conduct a short campaign in Wadi Halfa area before the people there are re-settled due to the inundation of their lands on completion of the Aswan High Dam. These people will encounter much of stress and strain in their new environment and it has been decided that they should be given the chance to have BCG vaccination before they start to move.

The permanent BCG centres in Provincial headquarters will need supervision and planning of work and at present this will be done by the respective Provincial Medical Officers of Health. When the tuberculosis-trained medical officers are available for the provinces, this work and all matters relating to tuberculosis prevention and control, including looking after the tuberculosis beds of the province will be their duty (Provincial Tuberculosis Officers).

In the Provincial headquarters with its rather small population, there may not be enough work for the BCG vaccinator all the year round. Moreover, most of the people are in the rural areas and programmes could be planned for them by the supervising officers in districts, rural areas, and schools wherever and whenever this proves possible. At times a short campaign might also be conducted at the provincial level by pooling all trained (BCG) personnel available in that province.

The monthly results at such centres should be sent to the Tuberculosis Division, for compilation and ready reference, whilst daily records need to be kept on the statistical forms, as envisaged by WHO, for uniformity of the work.

The training of more hospital dressers in BCG technique may be continued at Wad Medani Centre for possible future extension of permanent BCG centres at the district level and these dressers could work part-time, in addition to their usual duties.

The shortage of doctors in the Sudan gives ample scope for them to work in branches of medicine other than tuberculosis. The recruitment of doctors and other staff for tuberculosis seem to be difficult, but it is felt that by improvement of service terms and conditions, the Government can overcome the existing difficulties.

The Tuberculosis Service in the Sudan is in a stage of development. The problem of tuberculosis is a big one, second only to that of malaria, although more complex. It warrants special attention to the establishment of a well coordinated, broad-based tuberculosis control service and the responsibility for planning the necessary expansion could well be given to a regular committee at the Ministry's Tuberculosis Division.

The plan for establishing tuberculosis sub-centres with mobile X-ray units attached in each province is a very correct step, and all such centres should work on the same principle as at Wad Medani, i.e. to serve the maximum number of patients with the minimum of staff and expense.

The other plan of recruiting doctors, at least one for each province and giving them intensive training in modern methods of tuberculosis prevention and control, has been the most important step the Government has so far taken. The training of the medical and the paramedical and other technical staff for tuberculosis centres should be done well ahead of establishing the centre itself, and training facilities for such personnel are available at Wad Medani and Khartoum. In addition to training in all these places, it may be helpful for doctors to see the tuberculosis control methods of other countries having similar conditions. This will need liberal international assistance by way of WHO fellowships, which this country needs, for the speedy training of a sufficient number of doctors.

To combat the tuberculosis problem of the country, it is felt that the rapid establishment of tuberculosis sub-centres, at least at the provincial

level, should now be given top priority by the Health Ministry, and for equipping such centres with mobile X-ray and laboratory units, international assistance will be invaluable.

During work in the Dinka areas, it was noticed that a large percentage of children even in the first age group, i.e. 0-6 years, were positive and that many of them had high positive reactions. The reason for this was thought to be linked with their cattle with which the Dinka life is very closely linked, and the milk is drunk unboiled and sour. Some proof of this assumption was provided by the slaughter houses which showed that 55-60% of the cattle slaughtered were tubercular.

The Health Ministry has already been informed about this and requested to take up the matter with the Veterinary Department, in order that adequate measures be taken to combat the problem.

The high percentage of positives among the children is an indication of the high incidence of tuberculosis in these areas, and an early survey with a mobile X-ray unit in the Dinka areas would give good scientific data of this aspect.

The small children below 6 years of age with high positive tuberculin reactions may be considered either as potential sufferers or future patients. Such children would have had some treatment with INAH (Iso Nicotinic Acid Hydrazide) pills, at least as chemo-prophylaxis or as regular treatment, had the Tuberculosis Service been extended to the area. The priority needed for such an extension as early as possible needs special emphasis.

EGYPT

22°

* WADI - HALFA

LIBYA

KASSALA
PROVINCE

NORTHERN
PROVINCE

* ATBARA

KHARTOUM PROV.

* KHARTOUM

* KASSALA

BLUE
NILE

DARFUR

KORDOFAN

* WAD MEDANI

* EL FASHER

* EL OBEID

PROVINCE

13°

PROVINCE

PROVINCE

* RENK

* MALAKAL

ETHIOPIA

* NIAMLEIL
* MARIEL BAI

* MADOL

* WUN ROG

* BENTIU

* FANGAK

* NASIR

* WEDWEIL

* GOGRIAL
* TOIC

UPPER NILE
(92,270 sq.miles)

(762,231 population)

* AKOBO

BAHAR EL GHAZAL PROVINCE
(82,530 sq.miles)
FRENCH (1,054,958 population)

* TONJ

PROVINCE

EQUATORIAL

* RUMBEK

* BOR

AFRICA

* YIROL

* YUBO

* AMADI

* MARIDI

EQUATORIA PROVINCE
(760,141 Population)

* NZARA

* JUBA

* TORIT

* KAPOLTA
* NAGISHOT

BELGIAN

(76,495 sq. miles)

KENYA

CONGO

UGANDA

PROJECT AREA IN DOTTED LINES

ANNEX II

The total number of tuberculin testing and BCG vaccinations done so far in the Sudan are as follows:

	<u>Number Tested</u>	<u>Number Vaccinated</u>
BCG Pilot Survey Scheme	65,162	26,602
BCG Mass Campaign	622,962	219,201
BCG Permanent Centre	32,898	13,954
Wad Medani Tuberculosis Centre	29,623	13,091
Total	<u>750,645</u>	<u>271,848</u>

The figures included in this report for analysis have been achieved by the Mass Campaign from the month of December 1956 until the end of May 1960, in 33 working months, as there was no work for nine months for various reasons mentioned before in the body of the report.

Statistical analysis or graphic representations were not possible as no help of statistician or statistical clerk was available for it. The work results of each province and district have been broken down into three groups (age groups), with percentage of return and percentage of vaccinations (negatives) done in each age group for any future statistical work and graphic representation, if EMRO considers necessary. The number of persons negative not vaccinated being low were not included in the report. But in any case, it would bring the percentage of return to a higher one, had it been included.

Though the actual work records had been in four age groups, (0-6, 7-14, 15-19 and 20 years and above), but the records of the work done in 1956 to December 1957 were all burnt in the fire accident. To keep uniformity of the total work of the Campaign, the entire results have been divided into three age groups according to the monthly statistical sheets which were available from the Tuberculosis Division of the Ministry of Health, Khartoum.

ANNEX IIIENTIRE WORK OF THE MASS CAMPAIGN IN AGE GROUPS

Age group	No. tested	No. positive	No. vaccinated	Ret.P.C. %	Neg. and Vaccinated P.C. %
0 - 6 yrs	118,933	15,289	65,888	68%	81%
7 -14 yrs	131,552	37,654	63,316	77%	63%
15 yrs and up	371,477	167,482	89,997	69%	35%
Total	621,962	220,425	219,201	71%	50%

EQUATORIA PROVINCE

0 - 6 yrs		3,686	31,369	64%	89%
7 - 14 yrs	59,366	11,388	32,297	74%	74%
15 yrs and up	199,195	75,315	57,733	67%	43%
Total	313,764	90,389	121,399	67%	57%

BAHR EL GAZAL PROVINCE

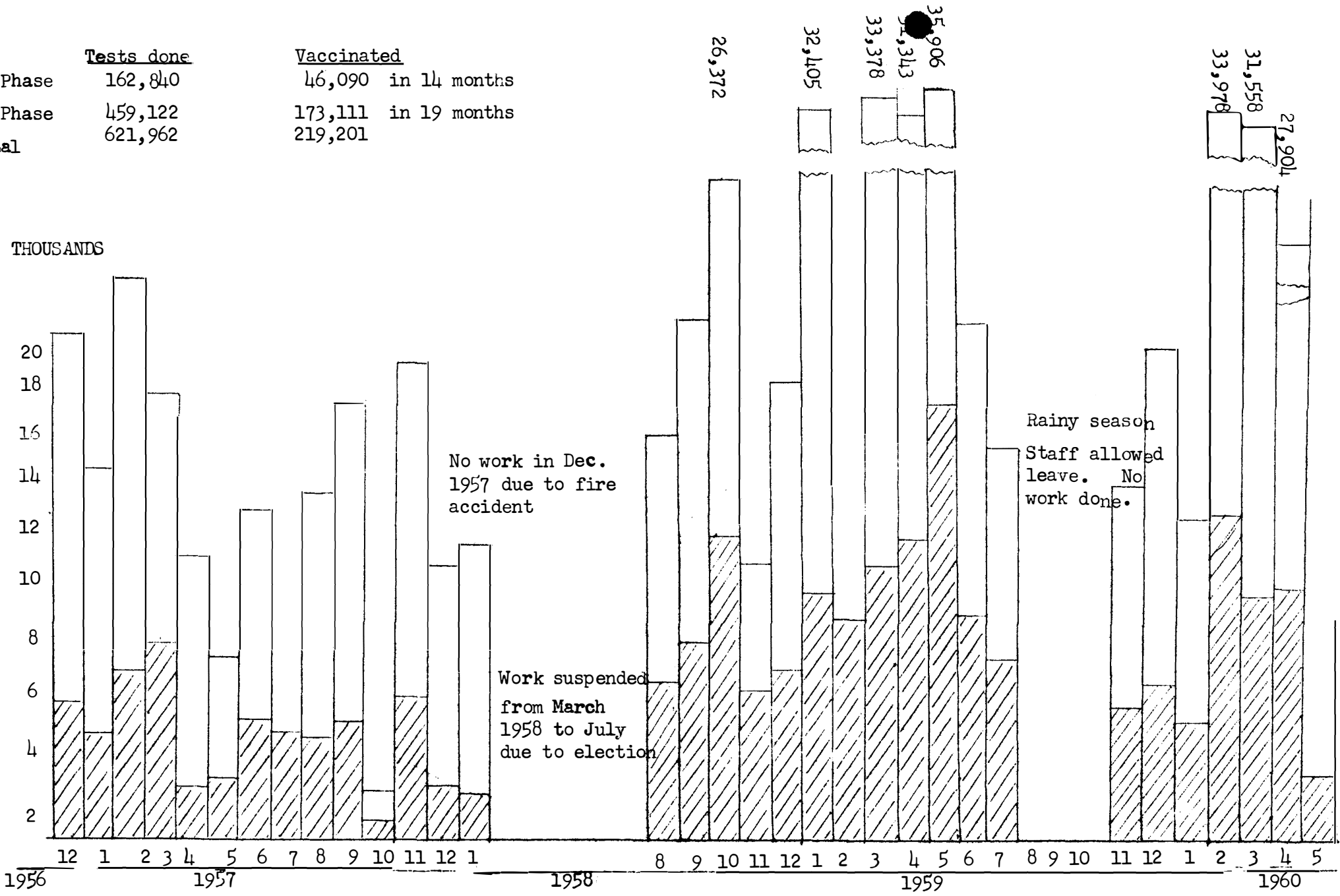
0 - 6 yrs	40,394	7,067	22,079	73%	75%
7 - 14 yrs	49,627	17,247	22,683	82%	45%
15 yrs and up	109,937	58,277	23,379	76%	28%
Total	199,958	82,591	68,141	77%	15%

UPPER NILE PROVINCE

Age group	No. tested	No. positive	No. vaccinated	Ret.P.C. %	Neg. and Vaccinated P.C. %
0 - 6 yrs	23,336	4,536	12,440	72%	73%
7 - 14 yrs	22,559	9,019	8,336	77%	47%
15 yrs and up	62,345	33,890	8,885	69%	21%
Total	108,240	47,445	29,661	71%	38%

	Tests done	Vaccinated
Phase I	162,840	46,090 in 14 months
Phase II	459,122	173,111 in 19 months
Total	621,962	219,201

THOUSANDS



No work in Dec. 1957 due to fire accident

Work suspended from March 1958 to July due to election

Rainy season Staff allowed leave. No work done.

EM/BCG/27 Annex IV

Graph showing working months and achievements of tests and vaccinations from the start of the Campaign in 1956 up to end of May 1960. Entire column indicates total number of tests done and the striped part indicates number vaccinated.

ANNEX VEQUATORIA PROVINCE IN DISTRICTS

Age Group : No. Tested : No. Positive : No. Vaccinated : Rot. P.C. : Neg. P.C. & %
Vaccinated

YAMBIO DIST.

0 - 6 years:	5,082	:	416	8,450	56%	86%
7 - 14 "	6,996		1,311	3,341	66%	71%
15 yr. & up	58,710		24,822	14,996	68%	38%
Total	70,788		26,549	20,793	66.8%	44%

JUBA DIST.

0 - 6 yrs.	13,431		744	8,616	69%	90%
7 - 14 "	15,024		3,219	8,413	77%	72%
15 yrs & up	38,883		14,788	10,569	65%	41%
Total	67,338		18,751	27,598	68.8%	59.5%

TORIT DIST.

0 - 6 yrs.	12,728		813	7,285	63%	90%
7-14 "	13,898		2,541	8,035	75%	76%
15 yrs & up	30,995		11,128	8,837	63%	43%
Total	57,621		14,482	24,157	67%	53

Age Group	No. tested	No. positive	No.vaccinated	Ret.P.C.	Neg.P.C. & % Vaccinated
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YEI DIST.

0 - 6 yrs.	11,048	1,164	5,510	60%	83%
7 - 14 "	11,201	1,995	5,652	68%	74%
15 yrs & up	29,950	10,169	9,354	65%	48%
Total	52,199	13,328	20,516	65%	61%

MARIDI DIST.

0 - 6 yrs.	3,709	284	2,160	66%	88%
7 - 14 "	6,622	1,533	3,562	77%	70%
15 yrs.& up	25,884	11,105	8,464	76%	43%
Total	36,215	12,922	14,186	75%	52%

KAPOITA DIST.

0 - 6 yrs	9,205	265	5,342	62%	93%
7 - 14 "	5,625	789	3,294	73%	80%
15 yrs.& up	14,773	3,303	5,513	60%	63%
Total	29,603	4,357	14,149	63%	78%

BAHAR EL GHAZAL PROVINCE IN DISTRICTS

Age Groups	No. tested	No. positive	No. Vaccinated	Ret. P.C.	Neg. P.C. & % Vaccinated
<u>WAU DISTRICT (Western)</u>					
0 - 6 yrs	3,251	668	1,637	71%	71%
7 - 14 yrs	6,557	2,206	3,790	91%	63%
15 yrs. & up	18,281	9,227	4,787	76%	34%
Total	28,089	12,101	10,214	79%	46%
<u>LAKE DISTRICT (RUMBEIK)</u>					
0 - 6 yrs.	2,295	425	1,182	70%	74%
7 - 14 "	4,063	1,718	1,510	79%	47%
15 yrs. & up	11,426	6,474	2,658	80%	29%
Total	17,784	8,617	5,350	78%	38%
<u>JUR RIVER DISTRICT (TOWN)</u>					
0 - 6 yrs.	1,386	364	805	84%	69%
7 - 14 "	3,853	1,903	1,819	94%	49%
15 yrs & up	9,477	5,950	2,332	87%	28%
Total	14,716	8,217	4,956	89%	37%

Age group	No. tested	No. positive	No. vaccinated	Ret.P.C.	Neg.P.C. & % Vaccinated
<u>YIROL SUB-DISTRICT</u>					
0 - 6 yrs.	2,240	281	1,315	71%	82%
7 - 14 "	2,686	868	1,145	75%	57%
15 yrs & up.	7,426	3,882	1,407	72%	26%
Total	12,342	5,031	3,867	72%	43%
<u>GOGRIAL SUB-DISTRICT</u>					
0 - 6 yrs.	16,979	3,127	9,769	76%	76%
7 - 14 "	16,205	5,833	7,225	81%	55%
15 yrs. & up	27,548	15,897	4,774	75%	23%
Total	60,732	24,857	21,768	77%	47%
<u>AWEIL DISTRICT</u>					
0 - 6 yrs.	14,243	2,247	7,371	67%	73%
7 - 14 "	16,263	4,719	7,194	70%	56%
15 yrs. & up.	35,779	16,847	4,411	68%	26%
Total	66,285	23,813	18,976	68%	42%

UPPER NILE PROVINCE IN DISTRICTS

Age Group	No. tested	No. positive	No. vaccinated	Ret. P.C.	Neg. P.C. & % Vaccinated
<u>MAIAKAL DISTRICT</u>					
0 - 6 yrs.	15,341	2,652	8,939	76%	78%
7 - 14 "	14,096	5,674	5,660	80%	50%
15 yrs. & up	35,709	18,861	5,069	67%	21%
Total	65,146	27,187	19,668	70%	42%
<u>NASIR DISTRICT</u>					
0 - 6 yrs.	2,333	587	844	61%	59%
7 - 14 "	2,377	935	522	61%	36%
15 yrs. & up	6,898	3,670	499	60%	11%
Total	11,608	5,192	1,865	60%	26%
<u>BENTIEU DISTRICT</u>					
0 - 6 yrs	1,978	544	700	63%	56%
7 - 14 "	2,668	1,288	687	74%	34%
15 yrs. & up	6,321	4,374	474	76%	10%
Total	10,967	6,206	1,861	74%	23%

Age group	No. tested	No. positive	No. vaccinated	Ret. P.C.	Neg. P.C. & % Vaccinated
<u>RENK DISTRICT</u>					
0 - 6 yrs	1,912	338	1,334	87%	80%
7 - 14 "	1,397	399	909	94%	69%
15 yrs. & up	6,300	3,074	2,133	83%	41%
Total	9,609	3,811	4,376	85%	53%
<u>BOR DISTRICT</u>					
0 - 6 yrs	1,359	322	484	60%	60%
7 - 14 "	1,311	450	421	66%	48%
15 yrs. & up	4,777	2,806	560	70%	17%
Total	7,447	3,578	1,465	83%	24%
<u>FANGAK DISTRICT</u>					
0 - 6 yrs.	413	93	139	56%	60%
7 - 14 yrs.	710	273	137	58%	33%
15 yrs. & up	2,340	1,105	150	54%	11%
Total	3,463	1,471	426	55%	22%

SUMMARY FINDINGS OF THE SIX BATCHES OF VACCINES INCLUDED
IN THE RE-TEST

Vaccine Batch No.	Date of Vaccination	Total No. Re-Tested	Total No. Positive	Percent Converted	Mean Negative Induration	Mean Positive Induration	Mean Size of Vaccination Scar
1256	May 1957	684	267	40%	2.4 mm.	13 mm.	6 mm.
1261	June 1957	237	95	40%	1.5 mm.	12.5 mm.	6.6 mm.
1266	July-August 1957	331	158	48%	1.6 mm.	15 mm.	6.3 mm.
1319	July-August 1958	733	460	63%	4 mm.	12 mm.	7 mm.
1323	September 1958	578	379	65.5%	2 mm.	13 mm.	7 mm.
1335	November 1958	548	398	72%	2 mm.	12 mm.	7 mm.

Note: As no statistician's help is available at hand, the results of the Re-Test works are all put as such in the Work-Sheet form as Annex. (Please see next pages of annex).

WORK-SHEET OF RE-TESTINGVaccine Lot No. 1256Date of Vaccination: May 1957

Age in Years	Induration in mm.																						Total No. Tested	Total No. Positive	Percent Converted	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21				22
1 - 5 years	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	Nil	0%
6 "	7	-	3	1	1	2	-	-	-	-	5	2	1	-	-	-	-	1	-	-	1	-	-	24	10	42%
7 "	23	-	13	3	4	12	6	1	1	-	5	2	4	2	2	2	1	-	1	1	-	-	1	84	21	25%
8 "	23	2	1	8	3	7	4	1	-	-	5	2	2	1	-	-	-	-	1	1	1	1	2	63	14	22%
9 "	35	2	7	3	7	8	3	-	-	-	11	1	2	3	2	-	-	-	1	-	1	2	-	88	23	26%
10 "	21	-	4	4	4	3	7	1	-	-	6	3	3	3	1	1	2	2	1	0	-	-	-	66	22	33%
11 "	13	-	3	1	1	2	-	-	0	1	9	4	2	1	1	-	2	-	-	-	-	1	-	41	20	49%
12 "	22	-	-	5	2	2	1	2	2	-	7	11	1	3	2	2	3	-	-	-	2	1	-	68	32	47%
13 "	11	-	-	3	2	8	4	-	3	1	8	2	8	2	4	5	3	1	-	1	-	-	-	69	37	54%
14 "	8	-	1	4	2	2	5	-	-	-	3	3	2	-	0	3	1	-	1	-	-	-	-	35	13	37%
15 "	5	-	4	1	5	2	2	2	-	-	4	1	4	1	2	1	3	1	3	-	-	-	-	40	19	48%
16 "	3	-	2	1	-	3	-	1	-	-	6	5	1	1	2	5	-	1	2	1	-	-	-	34	24	70%
17 "	2	-	1	-	2	6	2	-	-	-	2	1	-	1	2	-	1	-	1	-	-	-	-	21	8	38%
18 "	5	-	1	-	2	2	-	-	-	-	3	-	-	-	-	-	3	2	-	-	-	-	-	18	8	44%
19 "	1	-	0	1	-	2	1	1	-	-	3	2	3	-	2	1	1	1	-	2	-	-	-	21	15	71%
20 "	3	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	4	1	25%
21 and above	3	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	Nil	0%
Total	185	4	40	36	35	62	36	11	6	2	77	40	33	19	18	22	21	9	12	5	6	5	3	684	267	40%
<u>Average Negative Induration 2.4mm.</u>		<u>Average Positive Induration 13mm.</u>										<u>Mean Vaccination scar size 6mm.</u>														

WORK-SHEET OF RE-TESTING

Vaccine Lot No. 1261

Date of Vaccination: June 1957

Age in Years	Induration in mm.																				Total No. Tested	Total No. Positive	Percent Converted	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19				20
1 - 5 years	2	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	4	1	25%
6 "	1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	3	2	67%
7 "	7	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	9	1	11%
8 "	5	-	1	3	-	-	1	-	-	-	5	1	-	-	-	-	-	-	-	-	-	16	6	37%
9 "	4	-	1	1	1	-	1	-	-	-	3	3	-	-	-	-	-	-	-	-	-	14	6	43%
10 "	15	1	1	-	-	-	-	-	-	-	3	3	1	1	-	-	-	-	-	-	-	25	8	32%
11 "	8	-	-	2	2	3	1	1	-	-	6	2	3	1	-	-	-	1	-	-	-	31	14	45%
12 "	22	-	1	1	1	2	-	-	-	-	7	8	1	2	-	1	-	-	1	-	-	47	20	43%
13 "	9	-	1	-	-	5	-	-	-	-	3	4	2	-	1	2	-	-	1	-	-	28	13	46%
14 "	5	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	6	1	17%
15 "	2	-	-	-	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	5	1	20%
16 "	9	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	1	9%
17 "	1	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	3	1	33%
18 "	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-	-	-	-	3	3	100%
19 "	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2	1	50%
20 "	2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	3	1	33%
21 and above	10	-	-	1	1	-	-	-	-	-	8	1	1	2	-	-	-	-	-	2	1	27	15	56%
Total	102	2	5	10	8	11	3	1	0	0	41	24	9	7	3	5	0	1	2	2	1	237	95	40%

Average Negative Induration 1 1/2mm.

Average Positive Induration 12.5mm.

Average Vaccination scar 6.6mm.

Total No. of Keloid. 9

WORK-SHEET OF RE-TESTING

Vaccine Lot No. 1266

Date of Vaccination: July-August 1957

Age in Years	Induration in mm.																					Total No. Tested	Total No. Positive	Percent Converted
	0	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21			
1 - 5 years	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1	100%
6 "	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0	0%
7 "	17	2	3	2	1	1	-	1	1	-	2	1	-	-	-	3	-	1	-	-	1	37	9	24%
8 "	24	1	2	-	1	1	-	1	-	1	-	1	1	1	1	2	-	-	1	-	-	39	9	23%
9 "	5	1	-	-	5	2	1	1	-	2	2	3	-	1	3	1	1	-	1	3	-	33	18	55%
10 "	2	-	1	2	-	2	1	-	-	-	-	1	3	2	1	-	3	1	2	-	-	21	13	62%
11 "	3	-	1	1	-	-	-	-	-	-	1	1	-	-	-	-	-	1	-	1	3	12	7	58%
12 "	10	-	1	-	1	1	1	-	-	-	1	2	-	2	2	5	1	3	2	-	1	33	19	60%
13 "	8	-	1	-	-	2	-	-	-	2	1	4	3	-	4	-	2	3	1	1	2	34	23	68%
14 "	6	-	-	-	1	-	1	1	-	1	-	-	1	2	2	1	-	2	-	-	1	19	10	53%
15 "	10	-	-	-	1	1	-	-	1	1	1	-	1	2	-	-	2	-	1	1	1	23	10	43%
16 "	8	1	-	-	-	1	-	-	1	3	1	-	1	2	-	3	1	2	1	-	-	25	14	57%
17 "	7	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	9	2	22%
18 "	4	-	-	-	-	1	-	-	-	1	2	-	1	-	1	1	-	1	-	1	-	13	8	62%
19 "	6	-	-	-	1	-	-	-	-	2	-	-	1	1	-	-	-	-	-	-	-	11	4	36%
20 "	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1	100%
21 and above	6	1	-	-	1	-	-	-	-	2	1	3	1	1	-	1	-	-	-	-	1	18	10	56%
Total	118	6	9	5	12	12	4	4	3	15	14	18	13	15	15	16	12	14	8	8	10	331	158	48%

Average Negative Induration 1.6mm.

Average Positive Induration 15mm.

Mean Vaccination scar size 6.3mm.

Total No. of Keloid 16

WORK-SHEET OF RE-TESTING

Vaccine Lot No. 1319

Date of Vaccination: July-August 1958

Age in Years	Induration in mm.																					Total No. Tested	Total No. Positive	Percent Converted	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20				21
1 - 5 years	1	-	-	1	1	3	4	3	-	-	14	3	-	3	-	-	-	-	-	-	-	-	33	20	60%
6 "	1	-	2	1	1	2	-	1	1	-	5	3	2	1	1	-	-	2	-	-	-	-	23	14	65.2%
7 "	5	-	6	6	6	6	3	4	2	-	24	4	9	4	2	-	1	-	1	-	2	-	85	47	55.2%
8 "	6	-	3	3	6	18	12	15	6	1	61	6	9	8	3	3	2	1	-	-	-	-	163	93	57%
9 "	10	1	4	10	1	10	10	7	5	-	23	5	3	4	-	1	1	1	-	-	-	-	96	38	39.6%
10 "	2	-	4	1	4	6	7	6	-	-	25	6	4	-	3	3	-	1	1	-	-	-	73	43	57.5%
11 "	2	-	3	2	1	5	1	1	1	-	16	2	2	2	1	1	-	1	2	-	1	-	44	28	63.6%
12 "	1	-	-	-	1	2	3	1	-	-	11	3	3	3	4	2	-	2	1	-	-	-	37	29	78.4%
13 "	4	-	-	-	-	1	1	2	1	-	3	3	5	6	-	6	3	-	1	-	-	-	36	27	75%
14 "	2	-	-	2	-	5	-	-	-	-	1	10	6	2	2	2	-	-	-	1	-	1	34	25	73.5%
15 "	1	-	1	-	-	1	-	-	-	-	3	4	2	-	4	2	1	1	-	-	-	-	20	17	85%
16 "	1	-	-	1	-	1	-	2	-	-	4	2	2	1	4	-	3	1	1	1	1	-	25	20	80%
17 "	-	-	-	-	-	-	-	-	-	-	3	4	2	-	-	2	1	-	-	1	-	-	14	13	92.8%
18 "	1	-	-	-	-	-	1	-	-	-	1	-	3	-	2	4	-	-	-	-	-	-	12	10	83.3%
19 "	1	-	-	-	-	-	-	-	-	-	2	1	1	1	2	3	2	-	-	-	1	-	14	13	92.8%
20 "	-	-	-	-	-	-	-	1	-	-	2	-	1	1	2	2	-	-	-	-	-	-	9	8	88.8%
21 and above	-	-	-	-	-	-	-	-	-	-	2	1	2	2	2	4	-	-	1	1	-	-	15	15	100%
Total	38	1	23	27	21	60	42	43	17	1	200	57	56	38	32	35	14	10	8	4	5	1	733	460	63%

Average Negative Induration (mm.) Average Positive Induration (2mm.) Average Size of Vaccine (mm.)
Total No. of Keloid 10

WORK-SHEET OF RE-TESTING

Vaccine Lot No. 1323

Date of Vaccination: September 1958

Age in Years	Induration in mm.																											Total No. Tested	Total No. Positive	Percent Converted
	0	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23	25	27						
1 - 5 years	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	nil	0%		
6 "	9	1	1	-	-	1	-	-	-	4	1	4	-	-	7	1	2	-	-	-	-	-	1	-	33	20	61%			
7 "	9	-	1	1	4	1	-	-	-	8	1	6	1	-	6	2	-	-	-	-	-	-	-	-	40	24	60%			
8 "	10	-	3	-	4	-	2	-	-	7	1	3	-	1	1	-	1	-	-	-	-	-	1	-	34	15	44%			
9 "	9	1	-	-	1	2	-	5	1	7	1	3	1	3	6	-	1	-	4	1	1	1	-	-	48	29	60%			
10 "	5	1	3	-	1	3	1	1	1	11	6	5	5	2	7	1	2	-	2	2	2	-	1	1	63	47	75%			
11 "	12	1	2	-	1	1	-	-	-	10	5	5	8	2	1	-	-	-	-	-	-	-	-	-	56	39	70%			
12 "	14	2	-	1	3	1	2	2	2	8	6	3	1	5	13	4	3	-	1	1	-	-	-	-	72	45	63%			
13 "	11	-	-	-	6	1	1	-	-	18	5	5	3	-	4	2	-	2	4	4	-	-	-	-	62	43	69%			
14 "	7	1	-	1	-	1	-	-	-	5	3	8	1	2	13	2	-	3	-	-	-	-	-	-	47	37	80%			
15 "	8	-	-	-	-	-	-	-	-	8	2	2	-	-	3	-	-	1	-	1	-	-	-	-	25	17	68%			
16 "	5	-	2	-	-	-	-	-	-	11	2	4	4	-	4	2	-	1	-	1	-	-	1	-	37	30	80%			
17 "	3	-	-	-	1	-	1	-	-	2	-	3	-	1	1	1	-	-	-	-	-	-	-	-	13	8	61%			
18 "	3	-	-	-	-	-	-	1	1	3	-	2	2	-	1	-	-	-	-	-	-	-	-	-	12	7	60%			
19 "	4	-	-	-	1	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	4	44%			
20 "	1	-	1	-	-	1	-	-	-	2	-	1	2	-	-	-	-	-	-	-	-	-	-	-	8	5	56%			
21 & above	3	-	1	-	3	-	1	-	-	3	-	4	-	-	-	1	-	-	-	1	-	-	-	-	17	9	53%			
Total	114	7	14	3	26	12	8	10	5	111	33	57	28	16	72	18	10	7	11	11	3	1	4	1	573	379	65.5%			
<u>Average Negative Induration 2mm.</u>											<u>Average Positive Induration 13mm.</u>											<u>Average Size of Vaccination Scar 7mm.</u>								
<u>Total No. of Keloid 7</u>																														

WORK-SHEET OF RE-TESTING

Vaccine Lot No. 1335

Date of Vaccination: November 1958

Age in Years	Induration in mm.																									Total No. Tested	Total No. Positive	Percent Converted
	0	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	25					
1 - 5 years	2	-	-	-	1	-	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	6	3	50%		
6 "	7	1	-	-	-	-	1	-	-	4	-	2	-	-	2	-	-	-	-	-	-	-	1	18	9	50%		
7 "	9	-	-	-	4	1	-	1	-	13	2	3	1	1	4	-	-	-	-	-	1	-	1	41	26	63%		
8 "	10	-	1	-	3	-	-	-	-	12	1	4	1	-	4	-	1	-	-	2	-	-	-	39	25	64%		
9 "	16	1	-	1	1	1	-	-	-	14	3	15	2	-	3	2	2	1	-	-	-	-	-	62	42	70%		
10 "	8	-	-	4	1	2	-	2	1	17	8	11	4	-	12	1	4	1	-	3	-	-	-	79	61	78%		
11 "	10	-	1	1	3	-	2	1	-	20	6	10	2	-	4	1	-	1	-	-	-	1	-	63	45	71%		
12 "	10	-	1	2	1	1	1	2	1	25	6	9	6	-	7	4	2	-	-	1	-	-	-	80	61	76%		
13 "	4	-	1	1	1	3	1	2	-	17	6	3	-	-	7	-	-	-	-	2	-	-	-	48	35	73%		
14 "	3	-	-	-	2	-	-	1	-	4	2	7	3	-	3	-	-	-	-	2	-	-	1	28	22	89%		
15 "	5	-	-	-	-	-	-	-	-	4	2	5	-	1	2	-	-	-	-	2	-	-	-	21	16	76%		
16 "	1	-	-	-	-	-	-	-	-	6	3	4	1	-	2	1	-	-	-	1	-	-	-	19	18	95%		
17 "	-	-	-	-	-	-	2	1	1	4	1	2	1	-	2	1	-	-	-	-	-	-	-	14	10	71%		
18 "	-	-	-	-	1	-	1	1	-	5	1	1	2	-	1	-	-	-	-	-	-	-	-	13	10	77%		
19 "	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2	-	-	-	-	-	-	-	-	4	4	100%		
20 "	-	-	-	-	-	-	-	-	-	2	-	1	1	-	-	-	-	-	-	-	-	-	-	4	4	100%		
21 and above	2	-	-	-	-	-	-	-	-	1	-	4	-	-	1	-	-	-	-	1	-	-	-	9	7	78%		
Total	87	2	4	9	18	8	8	11	3	151	42	82	24	2	56	9	9	3	-	14	1	1	3	548	398	72%		
<u>Average Negative Induration 2mm.</u>											<u>Average Positive Induration 12mm.</u>											<u>Average size of vaccine scar 7mm.</u>						
<u>Total No. of Keloid 8</u>																												