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**WHO EXPERT COMMITTEE**  
**ON LEPROSY**

**Fourth Report**

**WORLD HEALTH ORGANIZATION**

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## WHO EXPERT COMMITTEE ON LEPROSY

Geneva, 9-15 June 1970

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# WHO EXPERT COMMITTEE ON LEPROSY

## Fourth Report

The WHO Expert Committee on Leprosy met in Geneva from 9 to 15 June 1970. The meeting was opened by Dr P. Dorolle, Deputy Director-General, on behalf of the Director-General.

### 1. THE LEPROSY PROBLEM

#### 1.1 Distribution of leprosy in the world

It has been estimated<sup>1</sup> that the number of leprosy cases in the world in 1965 was 10 786 000, of whom 3 872 000 had some disability (including anaesthesia). There were 2 831 775 registered cases and about 1 928 000 treated cases. The latter figure represents some 68% of the registered cases and 18% of the estimated cases. The number of estimated cases by continents was as follows : Africa 3 868 000 ; America 358 000 ; Asia 6 475 000 ; Europe 52 000 ; and Oceania 33 000.

About 2097 million people were estimated to be living in areas with prevalence rates of 0.5 per thousand or higher. In these areas the number of new leprosy cases expected from 1965 to 1970 was 995 000. The data represented an attempt, made with many reservations, to give an indication of the magnitude of the leprosy problem throughout the world, in order to provide a better approach to the leprosy problem from the epidemiological, human and socioeconomic aspects.

In the last five years over 500 000 cases have been detected and registered in 75 countries. Even in areas of very high endemicity, however, it is unlikely that the prevalence rate will exceed 50 per thousand.

In some areas, where long-term programmes are in progress, the rate of newly registered cases seems to remain at the same level or to be declining slightly. It is known, however, that several factors—economic, political and others—may influence the intensity or speed of case-finding. Therefore, great caution is required in interpreting these results. In some countries or areas, the proportion of lepromatous cases seems to be decreasing and only a few are detected even in mass surveys—an indication that case-finding has been efficient.

<sup>1</sup> *Bull. Wld Hlth Org.*, 1966, 34, 811.

The number of cases "out of control"<sup>1</sup> is frequently high even in countries with satisfactory leprosy programmes. This reflects the great difficulty or near impossibility of keeping all patients under treatment and surveillance for many years. In some countries the number of inactive cases and cases released from control has considerably increased.

Taking into account on one hand the estimated number of patients in 1965 and the expected number of cases in the subsequent 5 years, and on the other hand deaths and releases from control, it is probable that the total number of cases in 1970 is not greatly different from the 1965 estimate. In spite of the shortcomings of the data provided, it also appears likely that in most endemic countries the prevalence now remains at approximately the same level.

### 1.2 Human, social and economic implications of leprosy

The seriousness of the endemicity of leprosy in relation to other diseases cannot be evaluated only in terms of prevalence rates; the duration of the disease, the disabilities that it causes, and the human and social consequences to the leprosy patients and their families must also be taken into account.

The long duration of the disease, especially in lepromatous cases, the frequency and persistence of disabilities, the normal life-span of tuberculoid and indeterminate cases, and the high cost of reconstructive surgery give leprosy a special position among diseases. Governments are obliged to establish costly long-term programmes. Other economic implications of leprosy relate to disabilities: disabled patients represent a significant loss of manpower for many countries. To complete the picture of the human and social impact of leprosy the age-old prejudice against the disease must be added; in human and social consequences, perhaps no other disease causes such a reaction in the community and so much distress and unhappiness to patients and their families. This anxiety may follow leprosy patients and relatives throughout their lives and cast a shadow over their families and professional and social activities. Fortunately, the situation is gradually changing. Nevertheless, prejudice still persists to a degree that is not found with any other disease.

## 2. LEPROSY CONTROL

The epidemiology and diagnosis of leprosy, a classification for use in field projects, the chemotherapy and the different control measures were discussed at length in the third report of the WHO Expert Committee on

<sup>1</sup> "Out of control", "absentee" and "lost sight of" are terms that have been used for registered patients who have not been under control for two or more years (*Wld Hlth Org. techn. Rep. Ser.*, 1966, No. 319, p. 11).

Leprosy.<sup>1</sup> The report made recommendations concerning the following: priorities in the treatment and follow-up of leprosy patients and in the surveillance of contacts; medical measures (case-finding, out-patient and in-patient care, protection of the healthy population); training; health education; rehabilitation; social measures; legislation and administrative measures (planning, including collection of data, recording and reporting, and terminology; programming, including objectives, time-tables and organization; evaluation; pilot or demonstration areas for leprosy control); and the role of voluntary bodies in national leprosy programmes.

The Committee considers that the views on the above questions expressed in the third report are still valid and need not be repeated, but a few additions and modifications are suggested below.

### **2.1 Proportion of lepromatous cases to be treated and rendered inactive**

In the third report the tentative proposal was made that, pending the results of epidemiological studies, in order to obtain a significant reduction in incidence leprosy control projects should treat regularly at least 75% of the estimated lepromatous and borderline cases, giving first priority to these and to indeterminate cases.<sup>2</sup> However, taking into account the frequency of reactivation (relapse) of lepromatous cases and the proportion of these cases that are bacteriologically positive, the Committee felt that besides preventing indeterminate cases from progressing to lepromatous leprosy, it was necessary to ensure that at least 75% of the estimated lepromatous and borderline cases should become bacteriologically negative and should remain so, in order to achieve a significant reduction in incidence.

### **2.2 System of priorities**

In view of the impossibility, in many areas, of overcoming the difficulties in controlling leprosy, the third report recommended a system of priorities to be adopted according to local conditions: (a) in relation to the treatment and follow-up of patients and (b) in the surveillance of contacts. During the past 5 years only a few countries have applied these priorities. The present Committee considers it of the utmost importance that the recommended system of priorities should be adopted by countries with limited budgets and facing other serious problems.

### **2.3 Diagnosis in field projects**

In a large number of countries the diagnosis of leprosy is made by paramedical personnel. It is necessary to determine the proportion of under-

<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1966, No. 319.

<sup>2</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1966, No. 319, pp. 10 and 11.

diagnosis, over-diagnosis and misdiagnosis in the findings of each auxiliary worker. Similarly, the proportion of errors in classification must be determined.

## 2.4 Case-finding

### 2.4.1 Contact-tracing

Only a proportion of the total number of cases to be diagnosed will be detected among contacts. This proportion varies according to the degree of endemicity: it will be higher in countries of low endemicity and lower in hyperendemic areas. It therefore follows that besides contact-tracing other methods of case-finding should be adopted in order to detect the maximum proportion of estimated cases.

### 2.4.2 Mass surveys

Mass surveys are expensive and are carried out only in certain areas of the world. They are recommended for hyperendemic foci or pockets. If feasible, multipurpose surveys are preferred and a coverage of at least 90% should be obtained.

### 2.4.3 Urban areas

In urban areas case-finding is particularly difficult. It should be based mainly on contact-tracing and, where the level of endemicity is high, school surveys and examination of certain groups of the population should be undertaken. The co-operation of skin clinics and dermato-venereological units is important, as well as that of general practitioners. In fact, in some countries a high proportion (up to 80%) of cases detected are referred to health services by practitioners.

## 2.5 Therapy

### 2.5.1 Sulfones

Oral administration of dapsone continues to be the most practical current method of therapy for mass campaigns in leprosy. The opinions expressed by the Panel on Therapy at the Eighth International Congress of Leprology<sup>1</sup> and in the third report of the WHO Expert Committee on Leprosy<sup>2</sup> are considered to be still valid. Some leprologists consider that dapsone administered orally in doses much lower than those usually employed is as effective as the conventional doses; the advantages of the lower dosage

<sup>1</sup> In: *Eighth International Congress of Leprology: Final Reports of the Technical Panels Approved by the Plenary Session of September 20th 1963*, Rio de Janeiro, 1963, pp. 18-22.

<sup>2</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1966, No. 319.

are that it is less likely to provoke lepra reaction and causes fewer secondary effects. However, other leprologists maintain that the higher the dose, within the conventional schedule, the better the results. The Committee noted these reports but recommended that properly controlled trials should be carried out to settle the question. It is feared that the use of such small doses may lead to the emergence of strains of *Mycobacterium leprae* resistant to dapsone. The committee therefore felt that it would be premature to recommend these lower doses for general application in leprosy control. The standard dose of dapsone continues to be of the order of 6.0-10 mg per kg body weight per week, both for adults and for children. In some areas of the world, small doses of dapsone (1-5 mg per day) have been recommended as initial doses in the treatment of borderline leprosy and great caution should be exercised in increasing these doses to the limits of tolerance.

Parenteral administration of dapsone is preferred by some because it ensures that the patient receives adequate treatment. However, the long duration of treatment, the pain that the patient may suffer from the injections, and the possibility of abscess formation should be borne in mind. The dose should be regulated to give adequate levels of sulfone in the blood.

#### 2.5.2 *Alternative drugs*

The Committee is of the opinion that at present there is no established alternative drug for the treatment of leprosy when intolerance to dapsone occurs, although a few drugs are at present under study. Until such time as conclusive results are available, it is suggested that thiambutosine might be used as an alternative remedy.

#### 2.5.3 *Lepra reaction*

In general, the Committee endorsed the views expressed in the third report of the WHO Expert Committee on Leprosy regarding treatment of the lepra reaction, but considered it necessary to specify the circumstances under which steroids should be employed for this purpose. Their use should be reserved for a lepra reaction with involvement of nerves and eyes, likely to lead to permanent disabilities, and reactions not controlled by ordinary measures. Care should be exercised in the use of steroids and the treatment tapered off as soon as possible.

### 2.6 **Regularity of treatment**

According to the criterion established at the WHO Inter-regional Leprosy Conference in Tokyo in 1958, a patient taking at least 75% of the prescribed medication is considered to be under "regular" treatment. When dapsone tablets are given to the patient to be taken at home, reports should give figures for "regularity of attendance" instead of for "regularity

of treatment". Furthermore, when determining the proportion in relation to regularity of treatment or attendance, the denominator should be the total number of cases expected to receive dapsons, including those out of control.

### **2.7 BCG vaccination for prevention of leprosy and chemoprophylaxis**

The prevention of leprosy by BCG vaccination and chemoprophylaxis are considered under "Research", sections 3.2.1 and 3.5.2 respectively.

### **2.8 Training**

As already emphasized in the third report of the WHO Expert Committee on Leprosy, no leprosy control programme can be operative if suitably trained personnel are not available. It is necessary to make an assessment of the number of personnel in the various categories who need to be trained. An initial assessment of the magnitude of the problem (requirements for such services) and of the resources (in terms of trained personnel) already available is necessary, so that as many as possible of personnel trained are suitably utilized.

The Committee recognized that while there may be broad common patterns, the details of training have to be worked out to suit the actual requirements of the individual countries or areas. This applies, for example, to the criteria for selection of trainees, the contents of the course and its duration. The Committee suggested that suitable measures should be used to evaluate the efficacy of the teaching and learning processes. This could be in terms of the extent to which the trainees, after training, are able to meet the purpose for which the particular training programme was designed. It was considered that periodic evaluations of this kind would be helpful in pointing to suitable alterations or innovations in the training programme.

Since the learning process is a continuing one, and since knowledge may become outdated, it is suggested that there should be suitable arrangements for continuing education as, for instance, by holding refresher courses.

Leprosy is a serious public health problem in many countries. It is therefore in the interest of the public health service that its personnel should be suitably trained in leprosy. The teaching of leprosy in all its aspects should find a proper place in the curricula designed for the education of the physician and of the public health worker. Since this is not yet the case in several areas of the world, it is recommended that for the present all medical and paramedical personnel likely to be concerned with leprosy should be suitably instructed in this problem. Such instruction is essential for the ultimate integration of leprosy services in the health services.

## 2.9 Health education

Success in the control of a communicable disease such as leprosy depends to a large extent on the co-operation of the community. This is particularly so in situations where, because of a variety of factors, deep prejudices have developed against the disease. Health education is therefore an important part of any leprosy control programme. The proceedings of the Eighth International Congress of Leprology state: "Our educational objective should be to evolve for the public at large, the patients and their families, a reasoned attitude towards leprosy which neither exaggerates the danger nor minimizes it."<sup>1</sup>

The pivot of any leprosy control programme is the patient, actual or potential, within the context of the family and the community. Lack of correct information is often at the root of prejudices that can jeopardize the outcome of any control measure. Health education should aim at correcting this.

The difficulties of health education in leprosy are well-known. Age-old prejudices born out of ignorance, and perpetuated by incorrect and superstitious beliefs have added to the problems of combating a disease that is of very long duration, requiring prolonged treatment, and that may lead to serious disabilities. The social and economic consequences, both to the patient and to his family, are well-known.

The specific objectives of health education in leprosy have already been considered in great detail by previous WHO Expert Committees and by international congresses of leprosy, and the present Committee endorses the views of these bodies. As stated earlier, success in health education is dependent upon the degree of co-operation from the community. A well-planned approach is necessary, with the participation of workers at all levels. Thus, the physician, the medical auxiliary and the social worker are required, each in his own way, to carry the message, in addition to the efforts of the professional health educator. Educators should be convinced of the truth, and be convincing in what they aim to communicate, lest health education be reduced to the level of commercial propaganda. While all available channels and methods of communication can be used, individual situations may require decisions as to the best method or methods suitable for the particular requirements.

## 2.10 Classification of disabilities for use in field projects

In a discussion of rehabilitation in the third report of the WHO Expert Committee on Leprosy,<sup>2</sup> attention was drawn to the importance of producing

<sup>1</sup> *Report of the Technical Committee on Educational and Social Aspects. In: Eighth International Congress of Leprology: Final Reports of the Technical Panels Approved by the Plenary Session of September 20th 1963, Rio de Janeiro, 1963, p. 62.*

<sup>2</sup> *Wld Hlth Org. techn. Rep. Ser., 1966, No. 319, p. 18.*

a simple and practical classification of disabilities for use in field projects. Such a classification has since been prepared and published by WHO.<sup>1</sup> It is reproduced in the Annex on page 26.

### **2.11 Social measures**

Many countries that in the past have given special emphasis to the isolation of leprosy patients have been confronted with serious difficulties in reintegrating the patients into the community. Voluntary or charitable organizations should be encouraged to take care of disabled and destitute patients. The savings achieved in this way would enable governments to expand their control activities.

### **2.12 Legal measures**

Any special legal measures that might increase prejudice against leprosy and prevent early cases from presenting themselves for diagnosis and treatment should be abolished. The Committee endorses the view of previous Expert Committees that no special legislation is necessary and that the legal measures applicable to chronic communicable diseases should also be applied to leprosy.

### **2.13 Collection of data, recording and reporting**

Although 5 years have elapsed since the last WHO Expert Committee on Leprosy was convened, a suitable system for collecting, recording and reporting has not yet been developed in many countries. It is of the utmost importance that full attention be given to this problem.

A continuous effort is also required to obtain uniformity in the terminology adopted in leprosy work.

### **2.14 Programme objectives**

When defining objectives in quantitative terms, special attention should be given to the following priorities (1) the treatment and follow-up of infectious and indeterminate cases and (2) the surveillance of contacts of lepromatous and borderline patients.

### **2.15 Inactive cases and release from control of leprosy patients**

At the WHO First Western Pacific Regional Seminar on Leprosy Control<sup>2</sup> (Manila, 1965) and in the third report of the WHO Expert Com-

<sup>1</sup> First published in *Bull. Wld Hlth Org.*, 1969, 40, 609 and reproduced in *Leprosy Rev.*, 1970, 41, 53-56.

<sup>2</sup> *Report on the First Regional Seminar on Leprosy Control, Manila, Philippines, 21-28 April 1965*, Manila, WHO Regional Office for the Western Pacific, 1967.

mittee on Leprosy<sup>1</sup> held in the same year, *operational definitions* of "inactive" cases and "released from control" (*libéré de contrôle*,<sup>2</sup> *alta definitiva*) were proposed for administrative purposes. Taking into account more recent information, mainly concerning lepromatous cases, it is proposed to introduce some modifications in these definitions. The modified criteria are as follows :

A leprosy patient without any sign of clinical activity and with negative bacteriological findings should be considered as an "inactive" case. Once inactivity is achieved, *regular treatment* should be continued for varying periods of time before the patient is "released from control" (r.f.c.). These periods should be 1 ½ years for tuberculoid, 3 years for indeterminate and *at least* 10 years for lepromatous and borderline cases. Since data on relapses after r.f.c. are scarce, it is advisable and important to continue the follow-up of lepromatous cases but without treatment ; some leprologists consider that this should be done for life.

In leprosy projects in which no action has yet been taken to identify treated cases as inactive, tuberculoid patients without any signs of clinical activity and with negative bacteriological findings could be directly released from control provided they have been *regularly* treated for a period of at least 5 years and the decision is taken by a doctor or, where a doctor is not available, by the senior auxiliary staff. In countries that have limited resources and are unable to cope even with the priorities for leprosy control, the same procedure could also be adopted for indeterminate cases.

## 2.16 Integration

The need for integration of leprosy control programmes into the structure of the general health services is widely recognized, as are the difficulties of achieving it.

Full integration will be attained only as a result of a long-drawn-out process, and for this reason countries should be encouraged to take the first step in that direction as early as practicable, not on a country-wide basis but area by area, utilizing methods appropriate to different parts of the same country.

As agreed at the WHO African Regional Office Seminar in Kampala, "the mere fact of integration of leprosy control activities into the basic health services should in no way influence the budgetary provisions necessary for their execution ; on the contrary, the financial allocations should be maintained at the level essential to meet the priority assigned to leprosy within the overall health programme . . . [It is necessary to undertake] continuous evaluation of the process of integration [and there is] advantage in initiating it in a small experimental area to start with."

<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1966, No. 319, p. 20.

<sup>2</sup> This term was approved by the WHO Seminar on Leprosy, Kampala, March 1970, in preference to the term "rayé de contrôle" which was formerly used.

## 2.17 Evaluation

The assessment of a leprosy project should be concerned with *all* the measures applied in the control of the disease—administrative, medical, social and legal—and with health education and the training of personnel. In the interpretation of results, choice of the best strategy to reach the objectives, and action to be taken after evaluation, all the local factors should be taken into account.

In evaluating the medical measures, attention should be directed to the operational aspects of the project (*operational assessment*) and the trend of the disease under the influence of the control measures, often associated with other factors (*epidemiological assessment*).

The Committee examined and approved a general guide to operational and epidemiological assessments on a global basis, useful for adaptation to the actual situation existing in any given country, prepared by the WHO Secretariat.<sup>1</sup> A few countries, with good recording systems, should be able to utilize all the indicators suggested, but each country should choose those indicators that are within its reach.

## 3. RESEARCH

### 3.1 Microbiology

#### 3.1.1 *The mouse foot pad model*

Although the important goal of cultivation of *Myco. leprae* has not yet been achieved, considerable progress has been made in studies of transmission. It has now been confirmed in many parts of the world that the mouse foot pad provides a convenient site for the multiplication of *Myco. leprae*, and the model has been applied to many areas of leprosy research. The infection may be initiated by only a few viable bacilli, and provides consistent and reproducible results. The stability of *Myco. leprae* under wet-ice refrigeration makes it possible to send infectious material by air from endemic areas to laboratories located in other parts of the world. Some of the applications of the foot pad model follow:

(a) Perhaps the greatest use has been in studying the activity of new drugs against *Myco. leprae*. Two experimental systems are available, one of which provides an estimate of the bactericidal properties of a drug. More than 80 drugs have been studied and there has been shown to be a useful correlation between their activity in mice and their activity in man.

<sup>1</sup> *Bull. Wld Hlth Org.*, 1970, 42, 631. Reprints of this paper are available on application to the World Health Organization, 1211 Geneva 27, Switzerland.

(b) Demonstration of drug resistance. No other method is available for proving that a patient's bacilli are resistant to drugs.

(c) In short-term clinical trials the loss in bacterial viability may be monitored with greater sensitivity and precision than by other methods.

(d) The infection appears to be highly specific in its histological features and in the time-course of its development, so the model may be used to identify *Myco. leprae* in a purported isolate, in a suspected arthropod transmitter, or in the skin or other tissues of clinically normal persons.

(e) A correlation was found between the proportion of solid-staining organisms in suspension and the degree of their infectivity when inoculated into mice.

(f) Studies of experimental vaccines.

### 3.1.2 *Use of thymectomized irradiated mice*

Thymectomized irradiated mice have been reported to provide a host that develops infections with features resembling human lepromatous disease, including frequent nerve invasion, foam cells, and dissemination of the infection. The large yields of bacilli that develop in these infections have valuable uses in other experimental approaches, including cultivation. The pathogenesis of neural damage may be followed temporally from the beginning of the infection, which is impossible in the patient.

It has been reported recently that, very late after the foot pad inoculation, lesions of the sciatic nerve can be observed even in normal mice, and that histological changes with certain features of borderline leprosy can be seen in uninoculated areas, such as the ears, nose and other feet.

### 3.1.3 *Morphological index (solid ratio)*

Considerable evidence has been provided that the morphological index reflects the viability of *Myco. leprae*. It is the most convenient laboratory method available for following the therapeutic response of patients in short-term clinical trials. Because of its limits of sensitivity, however, it is not a suitable procedure for distinguishing the infectious from the non-infectious patient, even when performed under optimal conditions by highly experienced investigators. The measurement is technically more demanding than that of the bacteriological index and, if used in practice, frequent checks would be needed to control its accuracy.

### 3.1.4 *Pharmacology*

Recent findings in the field of pharmacology include :

(a) The minimum inhibitory concentration of dapsone : at the minimum effective dosage of dapsone for *Myco. leprae* in mice, the blood level of

dapsone was found to be about 10 ng/ml.<sup>1</sup> On this basis it has been predicted that dosages of dapsone of the order of 1 mg/day would be active in man. In support of this, intramuscular injections of acedapsone (DADDS) in a dosage of 225 mg every 77 days (which release 2.4 mg/day and give average blood levels of 50 ng/ml), and ingestion of 1 mg/day of dapsone (which gives serum levels of 18 ng/ml) have been reported to be effective in short-term therapeutic trials in lepromatous patients. Long-term studies are in progress.

(b) A spectrophotofluorimetric procedure for determination of sulfones has been developed which is sensitive to about 10 ng/ml (compared to about 200 ng/ml for the colorimetric procedures previously used).

(c) Genetic polymorphism of dapsone acetylation : the ratio of mono-acetylated dapsone to dapsone in serum of man and of rabbits was shown to be determined by the well-known enzyme system that governs the rate of isoniazid and sulfonamide acetylation.

### 3.1.5 *Lines for future investigation*

Leprosy research is in an active stage of development and at a point where it is likely to derive considerable benefit from more active support.

(a) Cultivation remains a crucial, unsolved problem requiring sustained studies. Suggestive results have been reported in tissue-cultures of fibroblast cell lines derived from human and rat embryos and from lepromatous patients. In all such work it is important to prove the viability of the purported growth and to identify it by the methods now available (the inoculation of mouse foot pads, lepromin tests, enzymatic studies of DOPA oxidation, serological identification of nodular extract antigen).

(b) Drugs. Continued exploitation of the mouse infection is needed to discover new and more rapidly acting drugs and to investigate the properties of new drugs before subjecting patients to therapeutic trials. Collaboration between biochemical and clinical pharmacologists is needed here. The experimental findings should then be employed to design trials in humans as final confirmation of their applicability. The essential goal is a rapidly effective treatment that can be administered conveniently and safely in endemic areas.

(c) Pathogenesis. Currently available models can be used to undertake further studies in pathogenesis.

(d) Other experimental models. The experimental animals at present available for leprosy research without immunosuppression do not provide

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<sup>1</sup> 1 nanogram (ng) =  $10^{-9}$  g.

laboratory models in which a progressive macroscopically detectable disease is produced. It is recommended that a centre be established for systematic sustained search for a suitable animal.

(e) Immunology. It is hoped that the rapid developments in cellular immunology will throw light on the mechanisms that make it possible for cellular immunity to be deficient while humoral immunity is intact, a situation that has been especially reported in lepromatous leprosy. Infections in normal and immunologically suppressed mice may provide useful models. It is hoped that clarification of the nature of the deficiency might ultimately permit it to be remedied in the patient.

## 3.2 Immunology

### 3.2.1 Prophylaxis by BCG

Three controlled BCG field trials are in progress, the first initiated in 1960 in Uganda, the second in 1962 in eastern New Guinea, and the third undertaken by WHO in Burma in 1964.

The Uganda BCG trial was conducted in children aged 0-15 years who were contacts and relatives of predominantly tuberculoid cases; 9036 non-reactors and weak tuberculin reactors were vaccinated and 9052 were matching unvaccinated controls; 1081 strong tuberculin reactors, mainly older children, constituted an additional control group. Three follow-up examinations showed that BCG vaccination reduced the incidence of leprosy substantially, by 80% at about 2 years (control 89 cases, BCG 18 cases), by 98% at 4 years (control 54 cases, BCG 1 case), by 64% at 6 years (control 36 cases, BCG 13 cases), or a total reduction of 82% in 6 years (control 179 cases, BCG 32 cases). There thus appeared to be a slight falling-off in efficacy after 6 years. BCG vaccination effectively prevented tuberculoid leprosy in the Uganda children; virtually all cases among the controls were of the early tuberculoid form. Since BCG gave equal protection to Uganda children at *all* ages within two years following vaccination, whether they were 0-4, 5-9 or 10-15 years of age when vaccinated, it seems probable that some pre-existing or incubating leprosy infections among the older children were aborted. BCG vaccination furthermore conferred significantly greater protection than that attributable to actual human tuberculosis infection among the 1081 strong tuberculin reactors.

In spite of the above results, however, the investigators cautiously concluded that although the results indicated a protection rate of about 80% against the early forms of leprosy it was too early to assess protection against lepromatous leprosy. They point out that the pattern of leprosy in Africa appears to be changing, perhaps as a result of chemotherapy,

so that it would be unwise to generalize from the results obtained or to reach a premature conclusion.

The objective of the Burma trial was to determine the protection conferred by BCG on the general child population, 0-14 years old, in a hyperendemic area with a higher proportion of lepromatous leprosy than in Uganda. The trial started in August 1964; by the end of April 1970, 13 797 children had been included in the BCG group and 13 780 matching children in the unvaccinated control group. A total of 224 cases have been observed so far in the BCG group, as against 264 in the control group. The incidence of leprosy among children with tuberculin reactions 0-9 mm and 10 mm and over for age-groups 0-4, 5-9, 10-14 years at intake is slightly higher in the control group. The differences are, however, not substantial and not of public health importance. A similar incidence is observed when the data are analysed by household contact status. The relative proportions of tuberculoid and indeterminate cases are similar for both trial groups. The preliminary findings, including reactivity to lepromin, suggest that better results with BCG vaccination might be obtained in children 0-4 years old and perhaps even better in the newborn. So far, from the material studied, it appears that under the conditions prevailing in Singu township, no significant effect of BCG can be seen over a period of almost 6 years. The trial will continue until the end of 1974.

A more limited but interesting BCG trial was also started in 1962 in Karimui, eastern New Guinea, in an aboriginal population of about 5000 persons at all ages, with a high prevalence of predominantly tuberculoid leprosy (60 per thousand) but a low incidence of tuberculosis (3.7% Mantoux positive). Leprosy incidence was measured by examinations of the whole population in 1964, 1966 and 1967; 8 leprosy cases were found in 2318 vaccinated subjects (3.5 per thousand) compared with 18 cases in 2295 controls (7.8 per thousand). Although the results were encouraging, it was not possible to reach any definite conclusions. BCG caused a reduction in incidence of leprosy in the age-group 10-29 years, but in persons over 30 years of age and in children under 10 years, no significant differences were noted. The efficacy varied from nil in children under 10 years to 51% in the age-group 10-19 years.

The findings in the Uganda trial are strikingly different from those so far obtained in Burma and in Karimui. The three trials are still in progress and it is hoped that the value of BCG against leprosy, especially the lepromatous form, will ultimately be clearly determined.

In the light of the above, the Committee considered it premature to recommend BCG vaccination for the prevention of leprosy. It would be advisable to extend the trials for at least 10 years, paying special attention to the effect of BCG in the younger age-groups, perhaps most of all in the newborn. A study should be made of the factors that might have been responsible for the differences in findings in the three trials.

### 3.2.2 *Studies related to the standardization of lepromin*

In co-ordinated studies aimed at the standardization of lepromin it was noted that regular lepromins of the Mitsuda-Hayashi-Wade type varied grossly in bacillary and tissue content and in potency, and were often found with bacilli grouped in clumps and with coarse tissue particles. As preliminary requirements for standardization, it was considered that a good lepromin should contain bacilli subjected to minimum trauma, a minimum range of bacterial clump sizes, and no visible or rapidly settling tissue particles.

Studies were carried out to develop an improved antigen. A "blender-type" lepromin was prepared by a process that subjected the bacilli to the minimum of mechanical action and was stated to be less disruptive than mechanical grinding. Methods were also devised for recovering additional bacilli from tissue residues. The micropipette and pinhead methods for microscopic counts of bacilli were developed; comparisons of counts with both methods showed good agreement.

As a result of these studies an antigen containing 160 million bacilli per ml was initially recommended as the "standard" for lepromin by the Eighth International Congress of Leprology<sup>1</sup> and the third WHO Expert Committee on Leprosy.<sup>2</sup>

Studies on diluted lepromins were also carried out, comparing dilutions containing 160, 80, 40 and 10 million bacilli per ml. The results suggested that if a nodule of 3 mm is accepted as the criterion of positivity, a lepromin of 40 million bacilli per ml would be suitable for testing leprosy cases, contacts and non-contacts. Another study comparing lepromins containing 40 and 20 million bacilli per ml also suggested that the latter dilution could be used in place of the former if the 3-mm criterion of positivity is accepted. The net effect would be equivalent to expanding the world supply of lepromin eight times.

General experience has shown a poor correlation between Fernandez and Mitsuda reactions, even with undiluted lepromins. Fernandez reactions have been observed in only a low proportion of persons who gave positive Mitsuda reactions of 3 mm or larger to the 1:4 and 1:8 dilutions of lepromin. The Committee suggested that 48-hour readings need not be made in further investigations on diluted lepromins.

In the light of the above findings, the Committee made the following suggestions:

1. Present standards of lepromin production must be maintained, in order to reduce false positive reactions. The original stocks should be made

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<sup>1</sup> *Eighth International Congress of Leprology: Final Reports of the Technical Panels Approved by the Plenary Session of September 20th 1963, Rio de Janeiro, 1963, p. 62.*

<sup>2</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1966, No. 319, p. 27.

from lepromin yielding 160 million bacilli per ml, when employing 4-5 g of leproma per 100 ml of final suspension, and they should be free of visible tissue particles.

2. Mitsuda reactions in leprosy patients and contacts should be recorded at 4 weeks. Reactions in others should be read at 4 or 5 weeks; in research work or if the reaction is negative or doubtful, further readings should be made at 7 and 9 weeks.

3. Criteria for grouping the results of late lepromin reactions: 0, no reaction;  $\pm$ , induration less than 3 mm; +, nodule of 3 mm to 5 mm; ++, nodule of 6 mm to 10 mm; and +++, nodule larger than 10 mm or with ulceration. The letter "U" should be added to the size to indicate ulcerations.

It was also recommended that the frequency of false positive reactions should be investigated, including histological studies, to determine whether further refinements in lepromin production are necessary.

Further and more intensive comparisons are required between lepromins diluted 1:4 (40 million bacilli per ml) and 1:8 (20 million bacilli per ml) in healthy persons and tuberculoid patients, children and adults. It is desirable to conduct these tests in different areas of the world.

It is hoped that other centres will collaborate in solving problems related to the production of standardized lepromin.

### 3.2.3 *Recent advances in the immunology of leprosy*

The following are some recent findings:

(a) Evidence for a deficiency of cellular immunity in lepromatous leprosy (and perhaps also to a lesser extent in tuberculoid leprosy) has been provided by the demonstration of a relative inability of the patient to develop delayed sensitivity to picryl chloride and dinitrochlorobenzene and of a delayed rejection of skin allografts. Similar deficiencies have been described in the ability of patients' lymphocytes to undergo transformation to blast cells *in vitro* after stimulation with phytohaemagglutinin and streptolysin O (SLO). The formation by lymphocytes of macrophage inhibition factor and lymphotoxin also seems to be frequently depressed in lepromatous patients. The ability of the macrophages of leprosy patients to digest *Myc. leprae* is receiving careful study.

(b) Studies are in progress on the autoimmune mechanisms and on serum protein changes. The presence of anti-gammaglobulin factors has been reported in lepromatous patients. Thyroglobulin antibodies have also been detected with a certain frequency in the serum of leprosy patients. Anti-nuclear factors, characteristic of systemic lupus erythematosus, have also been demonstrated, and typical LE cells, rosettes and

free nuclei have been detected in a certain proportion of lepromatous patients. In view of the findings so far reported, leprosy has been considered as a model of immunopathological disease.

(c) A protein antigen (nodular extract or NE antigen) has been reported to be specific for *Myc. leprae*.

The Committee was informed that the present status of the experimental research in this field would be reviewed by a WHO Meeting of Investigators on Immunological Problems in Leprosy Research in the light of new knowledge of specific cell-mediated immunity, circulating antibodies, and the relationship of these two systems to mechanisms by which macrophages handle leprosy organisms.<sup>1</sup>

### 3.3 Pathology

The role of histopathology in the support of clinical research and drug trial programmes is well-known. Histopathology is useful in the diagnosis of early forms of leprosy, as an aid to classification in the detailed study of the biology of the disease, in the recognition and evaluation of unusual clinical forms, and in determining the progress of the disease under therapy. In addition, histopathological methods are essential in the study of the manifestation of leprosy in nerves, muscles, liver, and other viscera, as well as in the evaluation of transmission experiments.

In many geographical areas where leprosy is endemic the curricula of medical schools do not give sufficient emphasis to the teaching of leprology. Pathologists and dermatopathologists have therefore had little opportunity for formal training in the pathology of leprosy. In general, pathologists and dermatopathologists who are interested in leprosy have to develop their competence through personal experience.

It is recommended that, in order to promote the standardization of the criteria for the histopathological identification of forms of leprosy, an international reference centre should be established for the histological identification and classification of leprosy. Such a centre should have a great impact on the teaching and practice of histopathology in leprosy.

### 3.4 Diagnosis

The Committee emphasized the continuing need for improved methods for the detection of infection or of the disease in its pre-clinical phase.

The development of a laboratory technique and/or skin-test for diagnostic purposes would greatly contribute towards disease control and to better epidemiological knowledge.

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<sup>1</sup> *Bull. Wld Hlth Org.*, 1971, **44**, in press.

An indirect fluorescent antibody technique employing smears of *Myco. lepraemurium* as antigen has been used to study the sera from leprosy patients and persons suspected of having the disease. This technique has been reported to be useful in the diagnosis of human leprosy.

The use of immunological techniques for the diagnosis of leprosy has been limited mainly by the lack of suitable antigens. The availability of such antigens will probably come when more is known about the antigenic structure of *Myco. leprae* and related organisms.

### 3.5 Chemotherapy and chemoprophylaxis

#### 3.5.1 Therapy

From a review of the relevant literature it would appear that there is room for improvement in trials planned for evaluation of antileprosy drugs so that results may reflect the real effectiveness of these drugs. Research on antileprosy drugs should be based on controlled clinical trials of sufficient duration. Pilot trials of short duration may, however, be carried out without a control group, in order to obtain an indication of the value of these drugs and also of possible early secondary effects.

*Sulfones.* It has already been mentioned that dapsone in smaller doses than those employed conventionally has been reported to be effective in the therapy of leprosy. The Committee believed that these claims should be validated by controlled therapeutic trials.

A review of the literature indicates that, though effective, dapsone is not the ideal drug against *Myco. leprae* as it takes more than 5 years of continuous therapy to render most of the patients with lepromatous leprosy bacteriologically negative. Furthermore, relapses are known to occur. The search for better drugs, including those for the treatment of the lepra reaction, continues to be one of the major objectives in leprosy research.

*Long-acting sulfonamides.* The drugs of this group that have been used in the therapy of leprosy are: sulfadimethoxine, sulfalene, sulfamonomethoxine, and sulformetoxine.<sup>1</sup> There are varying reports regarding the efficacy of these drugs in leprosy. In view of this and the fact that serious secondary effects have occasionally been known to accompany their use in other diseases, it is recommended that suitable long-term trials be conducted to test out the usefulness of these drugs in the therapy of leprosy. From some findings it would appear that patients not responding to dapsone do not benefit from such long-acting sulfonamides.

<sup>1</sup> Proposed International Nonproprietary Names for *N*'-(2,6-dimethoxy-4-pyrimidinyl) sulfanilamide, *N*'-(3-methoxy-2-pyrazinyl) sulfanilamide, *N*'-(6-methoxy-4-pyrimidinyl) sulfanilamide, and *N*'-(5,6-dimethoxy-4-pyrimidinyl) sulfanilamide respectively.

*Clofazimine*.<sup>1</sup> Certain authors have reported that clofazimine is active in the treatment of lepromatous leprosy in doses varying from 200 mg weekly to 600 mg daily. There are reports that the drug prevents the onset of a reaction, and that in adequate doses it may control severe reactions in corticosteroid-dependent patients. One important drawback of this drug is that it imparts a reddish hue to the skin of the patients, most evident in light-skinned persons. It would be desirable to obtain more information on the use of this drug in patients resistant to sulfones and on its value in controlling lepra-reactions of long duration, which are apparently aggravated by dapsone treatment.

*Acedapson*.<sup>2</sup> There are indications that acedapson, which is a repository drug, may be effective in leprosy. However, insufficient information is available on this remedy.

*Thalidomide* has been reported to be effective in cases of recurrent lepra reaction not responding to antimonials or antimalarial drugs. There are, however, reports of possible toxic effects on the central and peripheral nervous systems. In view of this and of the well-known teratogenic effects of thalidomide, it is recommended that for the present this remedy be used only for strictly investigative purposes under proper conditions of observation and control.

### 3.5.2 Chemoprophylaxis

The Committee noted the results of the double-blind chemoprophylaxis trial carried out in Chingleput, India. The subjects studied were children under 15 years of age who were contacts of lepromatous and other bacteriologically positive index cases. The prophylactic doses of dapsone were large, almost reaching conventional therapeutic levels; treatment was given to each child while the index case remained bacteriologically positive and was continued for a further period of 3 years. During the 5½ years that the trial lasted, 23 cases of leprosy developed among 358 children in the dapsone group compared with 48 cases in 360 placebo group children—an estimated reduction of 52.5% attributable to chemoprophylaxis. None of the 71 cases detected was lepromatous.

The Committee also noted with interest the interim results of another controlled chemoprophylaxis trial in child contacts under 10 years of age living in Cullion Sanitarium, Philippines. The prophylactic doses of dapsone used in this trial are about ½ to ⅔ of those used in Chingleput. At the end of 3 years, 15 cases of leprosy were detected among 259 children in

<sup>1</sup> Proposed International Nonproprietary Name for 3-(*p*-chloroanilino)-10-(*p*-chlorophenyl)-2,10-dihydro-2-(isopropylimino) phenazine.

<sup>2</sup> Proposed International Nonproprietary Name for 4', 4'''-sulfonylbis-[acetanilide]. Also known as DADDS.

the dapsone group compared with 26 cases among 251 untreated controls—an estimated reduction of 44.1% likewise attributable to chemoprophylaxis. There were no lepromatous cases among the children. This study is still in progress.

In neither of the above trials could the value of chemoprophylaxis in lepromatous leprosy be definitely determined. It is recommended, however, that the results be taken into consideration when planning future trials, which are needed to determine the optimum dose and the length of time that preventive treatment should be continued.

### 3.6 Epidemiology and genetics

Some unexplained features of leprosy require further epidemiological investigation in different parts of the world.

In countries where leprosy has disappeared or is disappearing, studies could be made of the factors that may have contributed to this occurrence.

Tuberculoid cases become bacteriologically positive during periods of reaction. Comparative studies should be made, in different geographical areas, of the occurrence of such reactional episodes in order to assess the role of tuberculoid cases in the spread of the disease. Changes in the morphological and bacteriological indices and in reactivity to lepromin before, during and after reactions should also be investigated.

Mouse foot pad inoculation, in combination with field studies, should be used to identify acid-fast bacilli found in the skin of apparently healthy individuals, particularly contacts.

It is suggested that field and laboratory studies be undertaken using mouse inoculation to investigate arthropod transmission in leprosy.

The nature and causes of natural reactivity to lepromin may be further clarified by a study of the reactivity of different groups of children comparable in sex and age, living in endemic and non-endemic areas. Such a study should include the testing of their reactivity to other antigens.

Susceptibility and resistance to leprosy may have a significant genetic component. Studies comparing lepromatous cases, tuberculoid cases, and controls for possible differences in the frequency of a wide range of genetically controlled determinants, such as blood groups, enzymes, serum proteins, G6PD deficiency, or taste sensitivity to phenylthiourea, have so far given controversial or even negative results.

Twin studies may be an important tool for the indication of genetic susceptibility. Limited data so far indicate a high degree of concordance of leprosy in identical twins, which is not the case in unidentical twins. More data on the occurrence, clinical type, and course of leprosy in monozygotic and dizygotic twins should be collected.

Some authors have reported a non-random distribution of lepromatous or tuberculoid leprosy in families or in sibships, which suggests a familial

aggregation. Recent advances in the techniques of segregation analysis now increase the chances of identification of genetic factors determining susceptibility.

Reactivity to lepromin should be studied on a familial basis, especially with a view to establishing the existence of individuals who may be constitutionally incapable of becoming lepromin-positive, and who may develop lepromatous leprosy upon infection. The advice of geneticists should be obtained regarding other studies that could help in solving the question of genetic susceptibility to leprosy.

The Committee noted that increasing attention is being paid to the development of epidemiological models to describe the natural history of many diseases (e.g., tuberculosis) and the way in which they spread in communities. The availability of computer facilities has contributed to progress in this direction. If an epidemiological model could be developed for leprosy it would be of great value for a better understanding of the evolution of the disease. Further, the outcome, over a period of time, of different control measures can be predicted from these models, thus providing an objective basis for planning.

### 3.7 Control

Operational research is essential for planning and programming, as well as for the execution and evaluation of leprosy control projects. As recommended in the third report of the WHO Expert Committee on Leprosy,<sup>1</sup> demonstration areas should be established in different parts of the world to carry out operational research on the fundamental aspects of the leprosy control programme.

The distribution of leprosy in a number of countries is changing, owing to industrialization and related population movements. The operational methodology of urban leprosy control, in the light of these developments, requires close study and attention.

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<sup>1</sup> *Wld Hlth Org. techn. Rep. Ser.*, 1966, No. 319, p. 23.

## Annex

**CLASSIFICATION OF DISABILITIES RESULTING FROM  
LEPROSY, FOR USE IN CONTROL PROJECTS \***

Among leprologists there has been an increasing interest in the prevention of disabilities as a part of each leprosy control project. This may be due in part to a recognition that, in addition to any direct benefit to the patient, the attention to disabilities has a favourable influence on attendance at treatment clinics and thus on the control of leprosy.

Both the International Leprosy Association in its congress reports and the WHO Expert Committee on Leprosy have emphasized the importance of including a programme of disability prevention in leprosy-control projects and to this end the WHO Expert Committee on Leprosy<sup>1</sup> called for a simple and practical classification of disabilities which would be easy to understand and to apply under field conditions.

The WHO classification of disabilities which had been adopted by the WHO Expert Committee on Leprosy<sup>2</sup> has been used by a number of groups in an attempt to assess the size and the nature of the problem. The WHO Leprosy Epidemiological Team (1960-67), for example, applied the classification in all its studies and collected a great deal of interesting data relating the development of disabilities to many variables in leprosy. The work of this team supported by other workers has made it possible to compare the frequency of different types of disability in various parts of the world, and has given some idea of the magnitude of the problem and of the burden which leprosy disability places on the countries where leprosy is common.

It is from this background of existing surveys on a limited scale that WHO has set itself the task of preparing a simplified classification that may be more widely applied.

The medico-legal definition of a disability is "loss of function or earning power" and is graded only by the extent to which it interferes with a person's ability to earn his living or to enjoy a normal life. The WHO classification of disabilities mentioned above was not an attempt to identify

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\* Reproduced from *Bull. Wld Hlth Org.*, 1969, 40, 609.

<sup>1</sup> WHO Expert Committee on Leprosy (1966) *Wld Hlth Org. techn. Rep. Ser.*, No. 319.

<sup>2</sup> WHO Expert Committee on Leprosy (1960) *Wld Hlth Org. techn. Rep. Ser.*, No. 189.

the type of disability but was only a method of grading the severity of disability. Because it involved the summation of various types of disablement, the classification was not suitable for detailed record-keeping. For the same reason it was found to be rather complicated for use by those who were not trained to assess disabilities.

In preparing this new classification the following requirements were taken into account :

- (1) To have a classification so simple and practical that it could be used by auxiliary health workers.
- (2) To have a classification that would also be a guide to the auxiliary health worker and to the doctor with regard to the need for special preventive measures or treatment.
- (3) To have a classification that would also be useful for collecting and classifying information concerning disabilities in the field, so that data from different countries could be compared.

On the other hand, there are many factors that should be investigated and for which precise information on a world-wide basis is needed, but which would be difficult for an auxiliary medical worker to assess in the field. It is recognized that many workers will certainly use more detailed records both for research work and for follow-up of cases under treatment. Therefore, the proposed standard WHO field classification must emphasize simplicity and functional value with the hope that it will also be useful for comparisons of the frequency of disability in various parts of the world.

In the preparation of this proposed classification, the opinions of a large number of leprologists were sought and their suggestions are gratefully acknowledged. The suggested new classification owes much to the scheme proposed by Dr P. Laviron who has used a similar pattern in his work in Africa.

It is proposed to record separately the various factors that were summated together in the previous WHO classification, but to simplify the final grading system to 3 grades instead of 5. This grading will apply only to hands, feet and eyes. Each grade is related both to severity of disability and also to the possibility of useful action, by the staff in the field. The grades are as follows :

- (1) Mild disability ; warning of possible trouble in the future ; need for education.
- (2) Moderate disability ; therapeutic action needed to prevent severe disability.
- (3) Severe disability ; may be too far advanced for effective treatment under field conditions.

The new classification is then as follows :

*Hand*

- 1 = Insensitive hand.<sup>1</sup>
- 2 = Ulcers and injuries and/or mobile claw hand and/or slight absorption.
- 3 = Wrist drop or fingers clawed and joints stiff and/or severe absorption <sup>1</sup> of fingers.

*Foot*

- 1 = Insensitive foot.<sup>1</sup>
- 2 = With trophic ulcer and/or clawed toes or foot drop and/or slight absorption.
- 3 = Contracture and/or severe absorption.<sup>1</sup>

*Eyes*

- 1 = Redness of conjunctiva.
- 2 = Lagophthalmos and/or blurring of vision and/or inflammation of globe.
- 3 = Severe loss of vision or blindness.

It will be noted that in each of the categories hands, feet and eyes, it is the grade 2 that is the most important for therapeutic action. This is the patient who most needs advice and attention or referral to the doctor or supervisor, and in each case there is some action that the field auxiliary can take. Each limb and each eye should be assessed separately and disabilities may be classified as in the following examples :

<i>Hands</i>		<i>Feet</i>		<i>Eyes</i>	
L	R	L	R	L	R
2	1	2	2	1	3

USE OF CLASSIFICATION OR OF FORMS OR BOTH

It is suggested that field auxiliaries should be provided with standard forms on which they can record details of each of their patients. The form, which should be part of the leprosy patient card, provides a simple and minimal record of the level of disability, by noting each of the factors that make for disability.

Alternatively, in those programmes in which it is felt that the task of entering details on such a form could not be carried out by the auxiliary, the grading may still be used without any record of the details of the disability. In such cases, absorption of the fingers will immediately be allocated to grade 3 without the need to consider either paralysis or insensitivity. It is hoped that by this simplification, every control project may at least begin to assess and record the frequency of disabilities, as a part of a programme of prevention. The use of record forms will provide better opportunities for observers to follow the progress of efforts to improve the situation.

Finally, it should be pointed out that the usefulness of the same basic form may be extended by those who have definitive programmes for the

<sup>1</sup> See notes on insensitivity, absorption and stiffness.

study of disability. This may be done by keeping the same sequence of factors (insensitivity, paralysis, etc.) but making a finer anatomical subdivision of the hands and feet and recording separate digits, different parts of the foot and so on.

To use the form, each square in the section on hand, foot and eye should be marked if the disability is present, or left blank if it is absent. At the bottom of each column the grade (1, 2 or 3) should be noted, the most severe disability of that limb or eye being recorded.

In the last section, involvement of the larynx, collapse of the nose and facial paralysis, there is no grading, only a check-mark is entered for the presence of the disability.

It may seem strange to classify a hand as grade 3 if only 1 finger is absorbed. However, in this simplified system only a qualitative estimation is possible. For those who wish to collect more precise information, the same form may be used with the inclusion of additional vertical columns to subdivide, for example, each hand into ulnar and median parts or into individual digits.

#### NOTE ON INSENSITIVITY

The purpose of this assessment is to find out if the patient has lost *protective* sensation. The loss of light touch is not really a disability, but if a patient cannot localize a firm touch, he is liable to suffer frequent injury. Therefore, to test for insensitivity, the examiner may use the point of a pencil. The pressure should be firm enough to dimple the skin but not enough to move the patient's finger or hand; the patient's hand must be supported while it is tested. The blindfolded patient should point to the place where he believes he has been touched; pointing to the wrong place that may be as little as 2 cm from where he is touched is a sign of insensitivity. It has been shown that failure to localize firm touch is a useful sign that the patient is now in danger from mechanical injuries and burns.

#### NOTE ON ULCERS AND INJURIES

Haematomas, blisters and wounds are all signs of misuse of an insensitive hand. They indicate the need for education and the presence of any of them demands a grade 2 classification.

#### NOTE ON ABSORPTION

Absorption refers to a significant or manifest absorption. If only the tips of fingers are absorbed, a hand may still be classified as grade 2. In the foot, if as much as one-fifth of the sole area is lost, this would be considered as grade 3.



## NOTE ON STIFFNESS

The auxiliary worker should attempt to move the flexed fingers. If the fingers have a good range of passive movement, even though not quite 100%, they may still be regarded as mobile but if they have lost 25% of their passive range they are classified as stiff.

## NOTE ON INFLAMMATION OF EYE

The auxiliary worker should be taught to distinguish between the generalized redness of the conjunctiva in conjunctivitis and the circumcorneal redness indicating inflammation that involves the iris and the visual area of the eye. The latter is a grade 2 disability and demands urgent action. Photophobia or pain in the eye may also indicate iritis, while haziness or ulceration of the cornea should be marked as keratitis and also classified as a grade 2 disability.

## NOTE ON VISION

It is recognized that the testing of vision is time-consuming under field conditions. However, commencing blurring of vision in lepromatous leprosy may be a vital sign of a reversible iritis.

It is suggested that the auxiliary worker should carry a card on which is drawn a split circle or C drawn to the dimensions of a letter on the 6/6 row of Snellen's Test Type. The card may be about 10 cm by 10 cm and the split circle drawn in the centre. The circle is 9 mm in diameter, consisting of a black band 2 mm wide with a 2-mm gap on one side :



A normal eye can see the gap in the circle when the card is held at a distance of 6 m. A medical auxiliary may hold the card 3 paces from the patient and ask him to point to the side of the circle in which there is a gap. Failure to see the gap at a distance of 3 m is recorded as blurring of vision. By turning the card in various ways, patients may be rapidly screened for poor vision in a very short time. Each eye is covered while the other is tested.

In this grading, the eye may be recorded as "severe loss of vision, grade 3," if the patient cannot see the gap in the circle, even when the card is held directly in front of his face. The eye is recorded as blind if there is no perception of light.

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