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TUBERCULOSIS IN INDUSTRY

MARCH 1959

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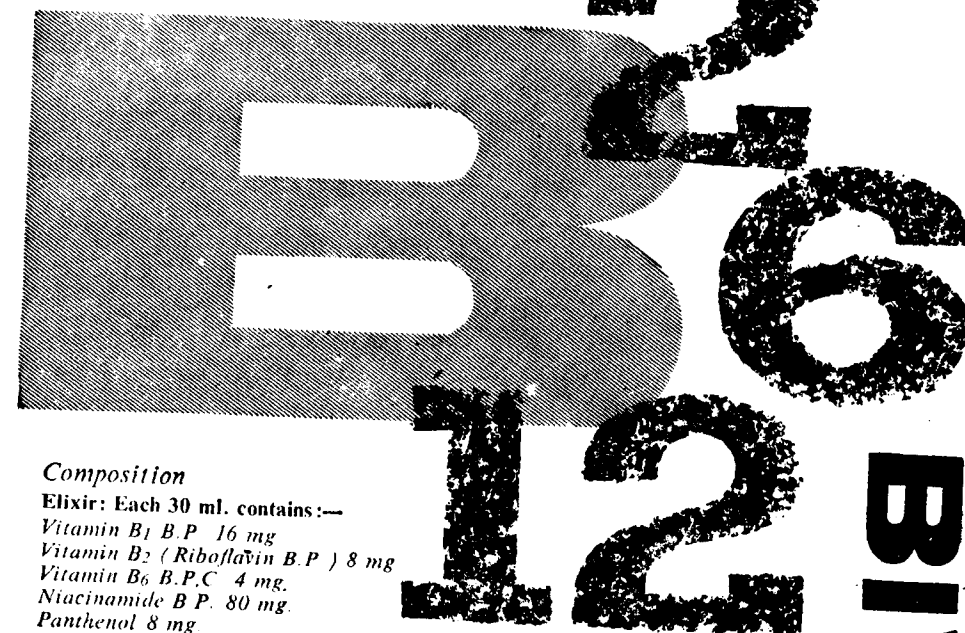
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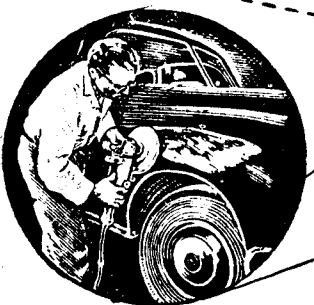
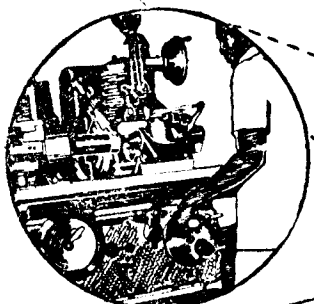
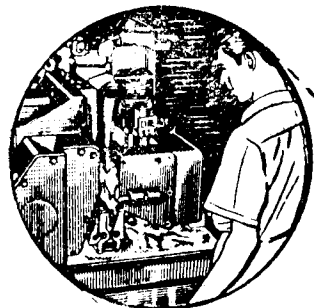
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## Indian Journal of Industrial Medicine 298

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## EDITORIAL:

### TUBERCULOSIS IN INDUSTRY

With the discovery of antibiotics and new chemotherapeutic agents, the long suffering and disability of tuberculosis have been considerably reduced. More and more patients are being restored to full, or to almost full working capacity. Mortality rate has fallen considerably in many countries. The new drugs have reduced the period of bed rest. Ambulatory treatment and chest clinics are assuming an increasingly important role in the treatment and management of these cases.

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According to Bogen (1957), India to-day has a tuberculosis infection rate of nearly 50% in the entire population, a morbidity rate of 5 new cases per thousand persons per annum with more than 1 per cent of the entire population affected with active tuberculosis at any one time, and a death rate of 150 per 100,000 or about one-eighth of all deaths (4 million deaths). The Employees' State Insurance Scheme dealing in a limited field, has found a higher morbidity rate among factory workers viz. 10 new cases per thousand workers per annum. The morbidity rate on X-ray basis in different surveys varied from 0.4 to 2.5% of the population.

How far working conditions in the factory or industry contribute to the development of tuberculosis? The industrial medical officer is often faced with the question. In this issue Dr. Ghosh and Dr. Gupta have discussed this question in detail. Dustiness is not a direct contributory cause, but may be an indirect one—by causing catarrh and lowering resistance it may open up a quiescent focus or make an individual susceptible to infection. Dr. Gupta in his excellent analysis has shown that only silicosis has a direct relationship to this infection. Inhalation of the Silica dust gives rise to silicosis in industry and this condition leads to tuberculosis, a point also stressed by Dr. Ghosh. *Bad hygienic conditions* are worse than heavy work, and their combination is dangerous. Steward and Hughes (1949) found that incidence of tuberculosis increased with *concentration of people*—in boot and shoe industry the incidence of tuberculosis in factories employing 600 workers was 3 times as great as that in factories with fewer than 100 employees.

In the present set up of the country, increasing stress is being laid on ambulatory treatment, as adequate number of hospital beds for treatment of tuberculosis cases is not available. Also, the period of rest necessary for control of tuberculosis toxæmia has been greatly reduced by the use of the new antitubercular drugs. But the period of rest granted to tuberculous workers by the ESI

scheme is inadequate. The period of rest must be sufficient to arrest or cure the disease and prevent quick relapse, to restore the working capacity, ideally to full capacity, or at least to such capacity as will enable the worker to earn an independent living. Dr. Ghosh considers this period to be nine months as minimum, from his experience in the ESI scheme in Calcutta dealing with workers from various industries—Dr. Banerji considers this period to be less than six months from experience in his own industry. Rehabilitation poses a great problem to the industrial medical officer and the industrialist. The ideal is to send the worker with arrested lesion to his original work, and if this is heavy, to gradually rehabilitate him through lighter to heavier jobs. It is unfortunate that many employers do not provide light jobs to these workers—it is either full-time original job or no job at all. Dr. Banerji has rightly pointed out that this rehabilitation through lighter job is not ultimately an economic loss but is rather a gain for the industry. We commend this enlightened view.

Some previous studies have shown that sickness absence rate among rehabilitated workers in industry is very high. Dr. Banerji's study, limited in number of workers and in period of observation, gives a more optimistic outlook. Further observations on this point will be valuable. Rehabilitation of tuberculous workers has always been a big problem—it has become a bigger problem now as the rate of cure is higher. But with the new anti-tubercular drug, not only the period of bed rest of the patient has been greatly reduced, but the necessity of giving alternative lighter jobs has also diminished.

Should X-ray examination of chest be routinely employed during pre-employment examination to all new entrants in the industry? Dr. Ghosh has asked this question. There may be some points against it, but the balance of opinion is in favour of it. Not only pre-employment X-ray examination of chest, but a yearly or a two-yearly X-ray check-up is necessary to detect fresh cases early and treat them early. Dr. Pant has shown that routine physical examination is not sufficient to detect early cases of tuberculosis. Routine radiological survey, both during pre-employment examination and later during periodic check-ups has been recommended.

Lastly the question of *B.C.G. vaccination* as a prophylaxis against tuberculosis. What should be the advice of the industrial medical officer to the families of the workers on this question? *B.C.G.* vaccine produces limited immunity—one vaccination does not give a life-long immunity—it has to be repeated once or twice. Tuberculosis occurs in the vaccinated group in the ratio of 1 to 10 as compared to the non-vaccinated group. *B.C.G.* is a safe vaccine—only two authentic cases of death from *B.C.G.* infection have

been reported among the many millions of *B.C.G.* vaccinated population in various parts of the world. A word of caution is however necessary. *B.C.G.* vaccination should not be given in a tuberculous home—the *B.C.G.* vaccinated child should be carefully segregated from tuberculous infection for a period of at least 2 months. Recent observations suggest that *B.C.G.* vaccination may also act as a prophylaxis against leprosy. This latter observation is interesting, but requires confirmation.

(P.K.G.)

## TUBERCULOSIS IN INDUSTRY

P. K. Ghosh,

C. M. O., Associated Battery Makers (Eastern) Ltd., Calcutta.

During the Second Five-Year Plan period in India emphasis has been laid on the development of heavy industries. As a necessary corollary emphasis has to be laid on the workers' health, as studies have clearly demonstrated that lack of mental and physical well-being of the workers affect performance gravely and adversely.

Tuberculosis is still a major problem in India. The W.H.O. has estimated that at least 5 million people die of tuberculosis in the world each year i.e. 10 die every minute throughout each 24 hours. The death rate and morbidity rate are much higher in underdeveloped countries.

In the absence of notification, no reliable data on an all-India basis on the morbidity and mortality of tuberculosis exist. No morbidity and mortality figures for industries in India have yet been compiled. Here and there, individual studies have been made over years, and we have to piece together such studies in an attempt to get an overall picture. Tuberculosis has attracted all-India attention, and its incidence in some of the industries has been studied. It has been the common belief among medical men in India that tuberculosis flourishes in cities and towns rather than in villages. The criteria commonly used for studying the problem are three-fold: (i) Study of infection rate by Mantoux testing; (ii) of morbidity rate by mass X-ray, and (iii) of mortality rates from available postmortem records. A country-wide tuberculin testing in connection with B.C.G. vaccination campaign has shown that 40 to 60% of those within the age group of 14 years and 75 to 90% of those within the age group of 35 years are infected. Emil Bogen who came to India in 1957 during the XIV International Conference of Tuberculosis summed up the problem as follows:

"India to-day has a tuberculosis infection rate of nearly 50% in the entire population, a morbidity rate of 5 new cases per thousand persons per annum, with more than 1 per cent of the entire population affected with active tuberculosis at any one time, and a death rate of 150 per 100,000 or about one-eighth of all deaths (4 million deaths)." The morbidity rate on X-ray basis in different surveys varied from 0.4 to 2.5% of the population.

In 1945 Aspin reported incidence of pulmonary tuberculosis to be 1% among Gurkha personnel and 3.4% among others after mass X-ray of 6,000 military personnel. In 1949 Lal et al reported 7% morbidity rate and 3% sputum positive cases in a survey of a

jute mill area in Serampore, near Calcutta. In 1952 Philip et al mass X-rayed at Madras 11,612 industrial and transport workers, largely males, and found a morbidity rate of 1.5%—after correction for absentees the figure was 2.5%. Definite morbidity figures are available from two areas, both in Madras—in Saidapet it was 462 per 100,000 and in Madanapalle (town) it was 253 per 100,000.

Though the infection and morbidity rates in urban areas are slightly higher than in rural areas, the National Survey in 1956 showed that the differences in the prevalence of disease in cities, towns and rural areas are perhaps not as marked as had been generally assumed.

### Tuberculosis and Industry

There is no known industry which predisposes the workers to tuberculosis except perhaps those in which silicosis may develop. Silicosis is notoriously linked up with tuberculosis, and the term silico-tuberculosis indicates this close relationship. Maintenance of adequate hygienic conditions at work places certainly reduces chances of disease and accidents. Adequate ventilation, maintenance of proper temperature and humidity, good lighting and nourishment during working hours are essential. The influence of dust on diseases, especially tuberculosis has engaged the serious attention of both workers and medical men. Generally speaking an excess of dust will cause catarrh of upper respiratory passages. Catarrhal influenzal colds have been found to be more common in places where more dustiness prevails. It also induces coughing and sneezing and thereby causes spread of diseases by droplet infection. Heaf (1946) however, failed to trace any direct relationship between incidence of tuberculosis and the degree of dustiness in work places. Very recently my opinion was sought in a tea industry, whether tea dust predisposes to tuberculosis. There was no data to show that it did. Dust may have an indirect effect on tuberculosis—by causing catarrh and lowering resistance it may open up a quiescent focus or may infect a fresh individual with germ insufficient to cause disease in a normal healthy person. The Registrar-General's return (1931–32) of the U.K., showing percentage mortality from tuberculosis in males in various occupations, however shows a generally higher mortality in the dusty trades; the peak of the curve falling in the 50–55 age group in these and in the 40–45 age group in the non-dusty and heavy occupations.

Again, light work under bad hygienic conditions is more harmful than heavy work under good hygienic conditions. More barmen die of tuberculosis than compositors and boot-repairers. But heavy work under bad conditions is a serious combi-

nation—more dockers die of tuberculosis than smiths and stone quarrymen. Stewart and Hughes (1949) investigating increased incidence of tuberculosis in the boot and shoe industry found that the overall incidence of pulmonary tuberculosis in factories employing more than 600 workers was over 3 times as great as in factories with fewer than 100 employees. In the former case, there were more than 60 operatives per room, the latter had fewer than 20 operatives per room, so that size of working unit was an important factor in determining disease incidence in any occupation.

### Present Study

The age distribution of 35,729 diagnosed tuberculosis cases under Bengal Tuberculosis Association during the five year period 1944/45—1952 (Chart I) shows the highest incidence of disease in the age group of 21–30 years, and next highest in the two decades just preceding and following it. Chart I also shows the population distribution in Calcutta according to age group on the basis of the census report 1950. It will be observed from a study of these two tables that the highest incidence of tuberculosis in the age group 21–30 years cannot be equated by corresponding population distribution according to age group. The mortality figures of 22,334 deaths from pulmonary tuberculosis from Calcutta Corporation during the same period are shown in Chart II. The female mortality rate during child bearing period is 4 and 3 times the male mortality rate (Chart III). This is a very different pattern from the mortality rate in Europe and America.

During the period 15-8-'55 to 25-1-'58, 1,411 persons visited the Chest Specialist's centre at the Mayo Hospital, Calcutta. Of them the distribution of respiratory diseases was as follows:

Tuberculosis—22%; Asthma—11%; Tropical Eosinophilia 4% and pleural thickening 2%.

The number of cases of tuberculosis of lungs was 310. Though the number of pulmonary tuberculosis cases is statistically small, the age distribution follows the same pattern as in the general population that is, highest in the age group 21–30 years, and next highest in 31–40 years.

With a few exceptions the treatment was ambulatory with Streptomycin and INH, and after 3–4 months with PAS and INH. SM was administered  $\frac{1}{2}$  gm. daily for 6 days, then 1 gm. daily for 10 days, then 1 gm. 3 times a week till 50–60 gm. INH was given in 200–300 mg. daily doses. PAS was given in 10 gm. daily doses. Of 310 tuberculous cases, 146 returned to work—the great majority after 9 months of treatment, a few cases of minimal

CHART I

PERCENTAGE OF  
TUBERCULOSIS MORBIDITY  
IN RELATION TO POPULATION  
ACCORDING TO AGE GROUP

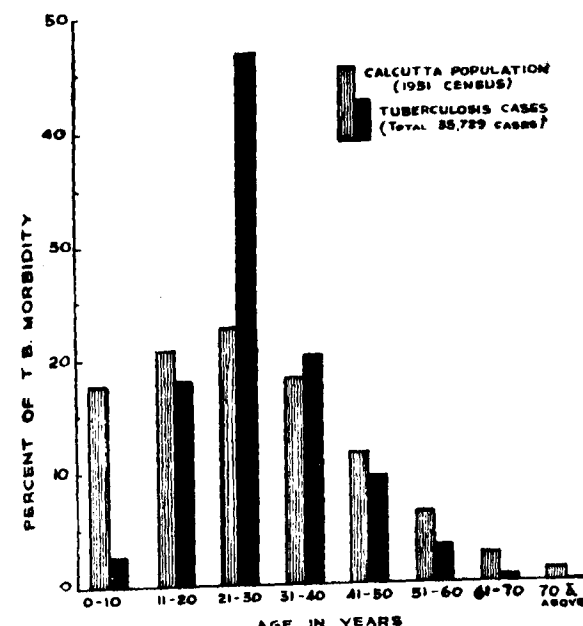


CHART II

MORTALITY FIGURES OF  
LUNG TUBERCULOSIS  
CALCUTTA  
AVERAGE FOR 9 YEARS  
(1944-45 TO 1952-53)  
TOTAL No. 22,334 CASES

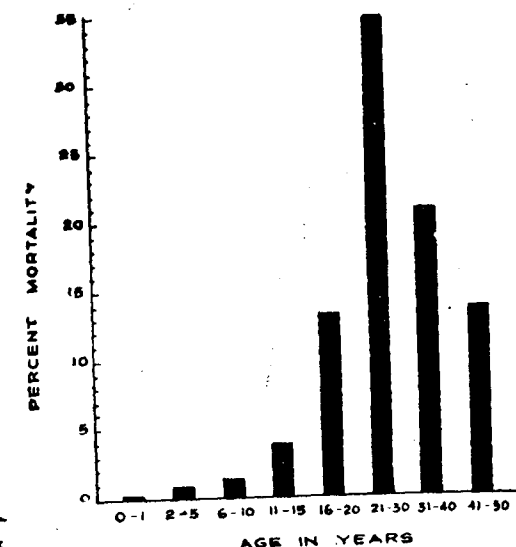
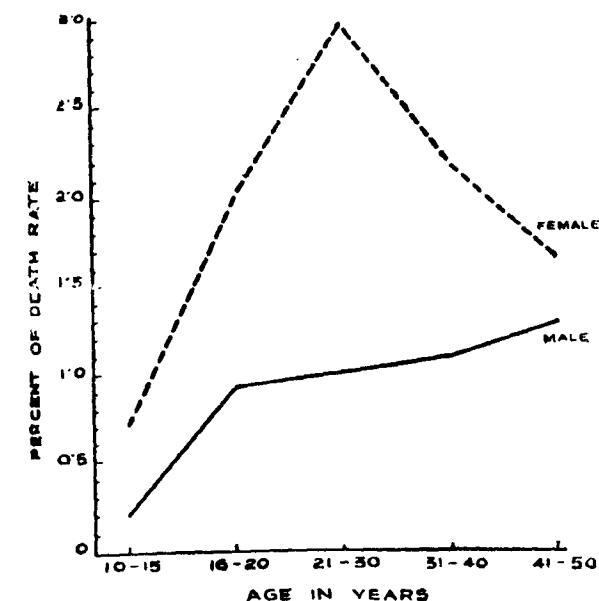


CHART III

DEATH RATE PER MILLE  
(CALCUTTA)  
ACCORDING TO AGE AND SEX  
1952-55



tuberculosis (Stage I) after 4-6 months of treatment. The criteria of returning to work were three-fold: (i) asymptomatic—fever and cough controlled and patient stabilised; (ii) X-ray examination shows complete clearance, or, absorption of exudates with scarry shadows, and (iii) laboratory examinations—sputum negative on smear examination (concentration method) and E.S.R. 10 mm. or slightly above it. After return to work, medicine is continued orally for a period from 1 to 2 years. Clinical and radiological check up and laboratory examination of sputum and E.S.R. are continued every three months during the first eighteen months and then every 6 months. Amongst 146 cases returned to work, there had been 4 cases of relapse.

### Problems

During the first two years of the E.S.I. Scheme's working, the number of new cases of lung tuberculosis was many—in the ensuing period the rate of new cases per annum will be lower. The E.S.I. Scheme has provided two advantages—(1) free diagnosis and treatment and (2) financial assistance. The latter is meagre and should be considerably increased. The period of leave allowed is 56 days and 72 days—but it is not enough. I am trying to assess the minimum period of rest from work, after which a worker can return to his duty. In my series it has been 9 months on an average—it needs further study. The period of rest and of financial assistance should be linked up.

During the febrile period, or during the first month of treatment, strict bed rest should be enjoined and the attending doctor should visit the worker at his residence. It is not being done at present. The febrile patient has to go to his doctor for injection and advice.

Usually the doctor, while signing a patient fit to resume work recommends light work for him. The management cannot find a light work. If the worker is given a light job, he will get less salary—and he will resent it. Should the worker refrain from joining duty till his working capacity is restored fully? There are two sides to this problem: Given a lighter job a worker can return to work earlier. On the other hand, is the management not going to disturb labour relationship by introducing special privileges and conditions for a few selected employees? There will also be the inherent danger if this facility be offered that the ex-tuberculous worker will tend to be slack and shirk his share of work on the plea that he has tuberculosis. In U.S.A. the tuberculous worker will compete in the open market, and claim no special privileges. Russia has modified employment, prophylactic work-

shop, night sanatorium—adequate food and rest—but a lower wage scale.

Should a sputum positive case, if he is otherwise stabilised, be allowed to return to work? He is a source of danger to his co-workers—he is more liable to relapses. Such a case should not go back to normal industry, but should be provided with a job in special workshops.

A sputum negative case when stabilised, will return to his own work. But periodic check-ups are necessary. Even when he returns to normal duty, he is more liable to sickness than a non-tuberculous worker—he is also liable to relapse, though to a less degree than the sputum positive one. He may even be a slacker or a shirker.

In a small number of cases the question of rehabilitation to other jobs crops up. Even after full treatment and rest the working capacity may remain impaired. He has then to be trained in a different job within his working capacity. Formerly, it was usual to recommend outdoor job, but such jobs are arduous and poorly paid. So sedentary, supervisory or technical jobs are more useful for tuberculous workers.

Pre-employment radiographic examination is being increasingly employed. It is the routine now in railway employment. But this throws a serious responsibility on the employer, for if the worker develops tuberculosis any time subsequently, his disease may be attributed to work conditions. The private employer will not take such responsibility.

Employers in our country are unwilling to employ tuberculous workers, and the reasons have been discussed above. If there is full employment, employers can be forced by law such as Disabled Persons Employment Act to employ a quota of such persons. Is India ripe yet for such an enactment?

### Conclusions

1. Tuberculosis is not peculiar to any industry except where silicosis also exists.
2. Bad hygienic conditions in work places e.g. dust, overcrowding, under-nourishment etc. may predispose to tuberculosis.
3. The E.S.I. Scheme has provided some amenities to the workers in the shape of free diagnosis and treatment and financial assistance. But for tuberculosis the periods of leave and financial assistance have to be considerably augmented.
4. Employment of tuberculous workers have been discussed.

5. 310 cases were diagnosed as tuberculous in an E.S.I. Chest Specialist centre in Calcutta during a two-and-a-half years period. 146 were returned to work after an average of 9 months period of rest from work and ambulatory treatment. Ambulatory treatment is continued 1-2 years after re-joining work and a three monthly check-up is maintained. 4 cases of relapse were reported. The period of observation is too short and the numbers statistically small. Yet a hopeful pattern of treatment for the arrest of the disease and return of the worker to work emerges.

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## DUST INHALATION AND PULMONARY TUBERCULOSIS IN INDUSTRY

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### Introduction

The relationship between industrial dust inhalation and pulmonary tuberculosis has not been completely understood.

The workers inhale numerous kinds of the so-called "inert" dusts which do not cause irritation in the bronchial tubes, or impairment of lung function, or emphysema or fibrosis and do not predispose the workers to tuberculosis or other infections. Yet, their storage is not harmless. They cause mechanical interference with respiration and get deposited in the lymphatics to cast nodular shadows on X-ray films, if they are radio-opaque. Their deposition results in "benign pneumoconiosis" (siderosis, baritosis, stanosis etc.) and causes confusion in film interpretation. Carbon dust, calcium dust, and most of the artificial abrasives have also no material influence on tuberculous infection, which if present in these cases is purely a coincidental disease.

Studies, however, in industries with silica risk have shown a material increase in the incidence of pulmonary tuberculosis among those so exposed. We have found that tuberculosis morbidity and mortality increase approximately in direct proportion to the free silica content of industrial dusts. The true nature of this relationship, between silicosis and tuberculosis, is a matter where some difference of opinion still exists. Some have stated that silicotic tissue does not stimulate the multiplication of tubercle bacilli; others are emphatic that silicosis can develop only in the presence of tuberculosis. Clinical and experimental evidence, however, confirms the view that pre-existing tuberculosis foci are adversely affected by silicotic tissue which furnishes a medium for rapid and increased growth of tubercle bacilli. As such, silicosis activates tubercle bacilli. The fibrosing effect of silica however helps to localise tuberculosis and to hide clinical evidence of the activity of the tuberculous focus for many years. That is the reason why sputum in such chronic silico-tuberculosis cases remains negative for long periods. It is only in later decades of life that clinical activity develops and a higher incidence of active tuberculosis is noticed in the group as compared to the incidence of tuberculosis in those who do not have silicosis.

### Results

Some of the results, in support of the above observations, from our studies carried out amongst 1,612 workers in the various dusty industries with silica risk, are presented below:—

Table I  
Incidence of tuberculosis in silicotics and  
non-silicotics

| Occupations and industries.                   | Workers examined. | Cases of silicosis. |      | Cases of tuberculosis |      |                |      |                    |      |
|-----------------------------------------------|-------------------|---------------------|------|-----------------------|------|----------------|------|--------------------|------|
|                                               |                   |                     |      | Total.                |      | in silicotics. |      | in non-silicotics. |      |
|                                               |                   | No.                 | %    | No.                   | %    | No.            | %    | No.                | %    |
| Supervisory staff in Mica Mines (1) ...       | 42                | 19                  | 45.2 | 8                     | 19.0 | 8              | 42.0 | ...                | ...  |
| Mica Mining (2) ...                           | 329               | 112                 | 34.1 | 61                    | 18.6 | 39             | 34.8 | 22                 | 10.1 |
| Hand drillers in Mica Mining (3) ...          | 62                | 17                  | 27.4 | 4                     | 6.6  | 2              | 11.7 | 2                  | 4.4  |
| Metal Grinding (4) ...                        | 44                | 12                  | 27.2 | 4                     | 9.0  | 2              | 16.5 | 2                  | 6.2  |
| Fireclay and silica brick manufacture (7) ... | 327               | 69                  | 21.1 | 24                    | 7.3  | 10             | 14.5 | 14                 | 5.4  |
| Pottery and ceramics (5) ...                  | 808               | 127                 | 15.7 | 51                    | 6.3  | 30             | 23.6 | 21                 | 3.0  |
| Total ...                                     | 1612              | 356                 | 22.0 | 152                   | 9.4  | 91             | 25.5 | 61                 | 4.8  |

It will be seen from the preceding table that 25.5 per cent of those having silicosis had tuberculosis while only 4.8 per cent of the non-silicotic workers had the disease. This relationship of a higher incidence of tuberculosis in silicotics in comparison to those who do not have silicosis is to be found in all the industries and occupations listed above.

### The extent of silica hazard

To be able to appreciate the extent of the silica risk in these industries, the following data were obtained on chemical analysis of the rock and dust and by dust counts of the air breathed during the manufacturing or mining carried out in these industries.

Table II

Free silica content of dusts met with in industries.

|                                            | Per cent.            |
|--------------------------------------------|----------------------|
| In Mica mines .. ..                        | 11—67<br>(median 42) |
| In fire-clay and silica brick manufacture: |                      |
| Non-plastic clay .. ..                     | 30                   |
| Plastic .. ..                              | 38                   |
| Semi-plastic .. ..                         | 32                   |
| Feldspar .. ..                             | 26                   |
| Grog .. ..                                 | 18                   |
| In cutlery grinding .. ..                  | 29                   |
| In pottery and ceramics:                   |                      |
| Quartz .. ..                               | 100                  |
| White sandstone .. ..                      | 98                   |
| Jubbulpore clay .. ..                      | 39                   |
| Himatnagar clay .. ..                      | 52                   |
| Talcum .. ..                               | 6                    |
| Pipe body .. ..                            | 36                   |
| Electric goods body .. ..                  | 34                   |
| Tile body .. ..                            | 28                   |
| Porcelain glaze .. ..                      | 24                   |
| Earthenware glaze .. ..                    | 7                    |

It will be seen that in all these industries the free-silica content of dusts breathed is quite high to cause development of fibrotic changes in the lungs.

Likewise, the following table gives dust concentrations met with by workers in these industries in various operations:—

Table III

Dust concentrations encountered in industries.

|                                   | mppcf*                     |
|-----------------------------------|----------------------------|
| Pneumatic drilling in mica mines. | 600—1,000<br>(average 800) |
| Hand drilling and scaling .. ..   | 60                         |
| Mucking .. ..                     | 40                         |
| Silica Brick manufacture .. ..    | 9—192                      |
| Fire clay brick manufacture .. .. | 4—1,700                    |
| Cutlery grinding .. ..            | 36—110                     |
| Ceramics and pottery .. ..        | 4—429                      |

\* mppcf — million particles per cubic foot of air.

## Dust exposure and incidence of tuberculosis

It has been shown that there is a statistically valid correlation between dust exposure and the incidence of pulmonary fibrosis (1, 2, 3, 4, 5, 6 and 7) in these industries.

The development of the various degrees of radiologically diagnosed fibrosis is directly associated with the degree of dustiness of the occupations as well as the duration of time these cases of silicosis had worked at those occupations. A correlation is also found between degrees of pulmonary fibrosis and incidence of pulmonary tuberculosis. This relationship is shown in the table below:

Table IV

Incidence of tuberculosis in relation to degree of radiologically diagnosed fibrosis.

| Industry.                                        | Cases of  |      | Cases of fibrosis with Tuberculosis. |      |          |      |                    |      | Non-silicotics with T.B. |
|--------------------------------------------------|-----------|------|--------------------------------------|------|----------|------|--------------------|------|--------------------------|
|                                                  | Silicosis | T.B. | Nodular.                             |      | Nodular. |      | Conglome-<br>rate. |      |                          |
|                                                  |           |      | I                                    | T.B. | II       | T.B. |                    | T.B. |                          |
| Mica Mining ...                                  | 112       | 61   | 78                                   | 14   | 20       | 11   | 14                 | 14   | 22                       |
| Hand drillers ...                                | 17        | 4    | 10                                   | ...  | 5        | 1    | 2                  | 1    | 2                        |
| Supervisors in mine ...                          | 19        | 8    | 12                                   | 4    | 3        | 2    | 4                  | 2    | ...                      |
| Brick manu-<br>facture ...                       | 69        | 24   | 60                                   | 6    | 9        | 4    | ...                | ...  | 14                       |
| Metal Grind-<br>ing ...                          | 12        | 4    | 9                                    | ...  | 2        | 1    | 1                  | 1    | 2                        |
| Pottery and Ce-<br>ramics ...                    | 127       | 51   | 107                                  | 16   | 13       | 7    | 7                  | 7    | 21                       |
|                                                  | 356       | 152  | 276                                  | 40   | 52       | 26   | 28                 | 25   | 61                       |
| % cases of T.B.<br>in each fibrosis<br>group ... |           |      |                                      | 14.5 |          | 50.0 |                    | 89.3 |                          |

The relationship of the incidence of tuberculosis with the degree of fibrosis is very significant. In the earlier stages (Nodular I) incidence is only 14.5 per cent but this increases to 50 per cent in Nodular Stage II and about 90 per cent cases of conglomerate type shows evidence of tuberculosis.

This relationship also holds good between dust exposure and the frequency rates of pulmonary tuberculosis.

The dust exposure of the workers has been expressed in the following table as the "Time Intensity factor," calculated for each worker, by multiplying the average daily exposure to dust of his occupation by the number of years that he had spent in the occupation. This "Time Intensity factor" is most important in relating dustiness to pulmonary disease, for the disease (silicosis) develops as a cumulative effect, generally taking many years to appear.

Table V

Incidence of tuberculosis in relation to "Time Intensity factor" of cases of silicosis in

(a) Pottery and ceramics (127 cases of silicosis).

| Time Intensity Range. | No. of workers. | Cases of Tuberculosis |      |
|-----------------------|-----------------|-----------------------|------|
|                       |                 | No.                   | %    |
| 100 and below         | 425             | 19                    | 4.4  |
| 101 — 1000            | 352             | 28                    | 8.0  |
| 1001 — 4000           | 27              | 3                     | 11.0 |
| 4001 — 8000           | 4               | 1                     | 25.0 |
|                       | 808             | 51                    | 6.3  |

(b) Mica mining (112 cases of silicosis).

| Time Intensity Range. | No. of workers. | Cases of Tuberculosis |      |
|-----------------------|-----------------|-----------------------|------|
|                       |                 | No.                   | %    |
| 200 and below         | 99              | 18                    | 18.0 |
| 201 — 800             | 105             | 17                    | 16.2 |
| 801 — 3200            | 119             | 22                    | 18.5 |
| above 3200            | 6               | 4                     | 66.6 |
|                       | 329             | 61                    | 18.6 |

It is apparent from the preceding table that morbidity from tuberculosis increases with the increase in the amount of free silica inhaled by these workers.

### Discussion

Such periodic surveys in dusty trades on workers with or without silicosis or silico-tuberculosis bring out the following facts:

1. Only those having silicosis recognizable by chest X-ray appear to have more tuberculosis than the general population.

2. Silico-tuberculosis, rather than tuberculosis, appears to be the only occupational form of tuberculosis in the dusty trades.

3. Workers who show no radiological evidence of silicosis in spite of known exposure to silica dust, but who develop tuberculosis and show post-mortem evidence of silicotic nodules should be considered as having died of occupational tuberculosis. This view is expressed because 4.8% workers (in Table I) show evidence of tuberculosis which is about three times more than the incidence in the general population. Also, a large percentage of these workers show evidence of increased trunk and linear markings in both lungs with increased hilar shadows and ground glass appearances. It is always essential in such cases to have a precise knowledge of the kind and amount of dust exposure to call these shadows and markings as being the result of silica dust inhalation.

### Other dusty trades

As for other dusts it can be stated categorically, on the basis of our experience presented below, that none other is known to adversely affect the worker making him susceptible to tuberculosis.

Table VI

Incidence of pneumoconiosis in magnesite and chromite ore workers(6)

| Data.                         | Industry                               |                   |
|-------------------------------|----------------------------------------|-------------------|
|                               | Chromite ore mining and concentration. | Magnesite Mining. |
| Number of workers examined    | 99                                     | 59                |
| X-ray finding :               |                                        |                   |
| Linear markings increased     | 67 (67.7)*                             | 50 (84.7)         |
| Ground glass                  | 32 (32.3)                              | 9 (15.3)          |
| Dust concentrations (mppcf.)  | 1.7 — 114.2                            | 1.2               |
| Free silica content of dust % | 1.7 — 5.3                              |                   |
| Cases of :                    |                                        |                   |
| Silicosis                     | Nil                                    | Nil               |
| Tuberculosis                  | Nil                                    | Nil               |

\*Note :—Figures in brackets show percentages.

In this small group of workers, where silica dust is either absent (as in magnesite mining) or very little (chromite mining) to cause any silicosis, no case of tuberculosis was found. All that can be said regarding chromite workers is that chromite dust has an adverse effect on the lungs and tends to induce increased pulmonary markings apparent in chest X-rays. The pulmonary markings, however, were not associated with symptoms of the respiratory tract.

#### The source of tubercle bacilli

It has been said earlier that silicosis makes the lungs more susceptible to tuberculosis. That probably is true, but silicosis or no silicosis the tubercle bacillus is still necessary to cause tuberculosis. The source of tubercle bacilli is other persons with tuberculosis. If the uninfected silicotic has no chance of exposure to tubercle bacilli there could be no possibility of superimposed tuberculosis.

This appears to be the crux of the whole problem of tuberculosis in industry, both from the point of view of epidemiology and prevention and treatment.

The number of men exposed to silica dust hazard in various types of mining and factory industries in India may be said to be:— (1955)

|           |    |    |    |          |
|-----------|----|----|----|----------|
| Mining    | .. | .. | .. | 4,08,162 |
| Factories | .. | .. | .. | 1,52,720 |
|           |    |    |    | <hr/>    |
|           |    |    |    | 5,60,882 |
|           |    |    |    | <hr/>    |

In view of the increasing industrialisation and mining one can safely add another 1,00,000 workers to this number, who run the risk of contact exposure.

The incidence of tuberculosis in the community at large is still very high as revealed by National tuberculosis surveys.

We have as yet no data on the incidence of tuberculosis in the home contacts of our silicotic workers. This is a possible source and it is recommended that proper steps be taken to prevent our silicotic cases in various industries from acquiring tubercle bacilli through home contacts.

#### Acknowledgement

I am grateful to Shri N. S. Mankiker, Chief Adviser, Factories, for permission to publish this article.

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## TUBERCULOSIS IN INDUSTRY IN BOMBAY CITY

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The problem of tuberculosis amongst industrial workers in our city is vast but information based on actual data is not available. Such information is essential for a correct measurement of the problem. That would help us to make a beginning with the all important function of industrial medicine in our setting, namely, reduction of T.B. morbidity and mortality and later perhaps eradication or complete control of the disease. Records of incidence, count of cases treated etc., are however so meagre that no comprehensive idea regarding the prevalence of the disease can be made. This experience points out to the state we are in, compared to societies which are now closing down sanatoria and hospitals that were opened only a few decades ago to control the disease. While they have been so successful in their fight against tuberculosis, we seem to be proceeding on an almost fatalistic delusion that tuberculosis will be automatically controlled with betterment of socio-economic conditions and better housing about which we, as medical men, can do very little. I do not believe that if medical men especially those working on the preventive medical section, sit with folded hands then even with improvements in social and economic conditions and raising of standards of living of our masses, tuberculosis will be automatically controlled. The need for measurement of the problem, devising of a regular plan of attack and adoption of measures to isolate and break the chain of infection in our community should be emphasised.

I like to consider the steps that industries should take for controlling tuberculosis but before actually going to that aspect, I wish to state a few convictions on my part. The first of these is that there is certainly enough basic knowledge and vast experience accumulated in other countries which we can easily adopt and apply in the matter of eradication of tuberculosis. This means that we cannot evade the issue with the usual excuse that we have not developed efficient methods even if we wanted to apply them. It is mainly a question of attitudes and the will to do something about the problem. Secondly, wherever the disease has been effectively checked, it has been achieved by the application of classic epidemiological and preventive medical principles rather than by treatment of every single case of tuberculosis. In other words, breaking the chain of infection at its earliest levels of prevention has been a more potent factor in the disappearance of the disease

than curative treatment, important as it may be in individual cases. Thus, case finding and prompt measures to make the case non-infectious seem to be the royal road to success. Early diagnosis most certainly simplifies the problem and keeps costs low. For a country like ours, this is very important. Lastly, I am almost convinced that in industry at least, the will to face the problem and do something tangible about it is still to come. It just does not exist today. Tuberculosis is being shunned by management as well as by our own group, the industrial medical men, as a governmental responsibility and the belief seems to be that all we can do to help is in getting dying cases admitted to hospitals and sanatoria. While I agree that tuberculosis in industry needs to be tackled on a broader front than the factory environment, I think that there is not the determination on our part, even in many much publicised industrial health departments, to face the problem as responsible communities have done and tackled the issue. This, I believe, is the greatest deterrent to any advance in the field. Only when this complacent attitude changes to one of determination and far-sighted vigour, can we expect action that will stop the tide of the highly potent tubercle bacillus in our midst and turn the flood-gates against it. Assuming that stage has arrived, let us see what is to be done.

First of all, our understanding of the disease has to be widened and clarified. It is no longer sufficient only to know that tuberculosis is caused by the tubercle bacilli and the manner of controlling it is by administering some drugs to the patient found to be suffering from it. Such fixed thinking and faith in unitary causation of the disease do not take us very far. Tuberculosis is to be understood as a dynamic process of interaction between a human organism or group of human organisms with tubercle bacilli of different quality in a vastly complex environment. Each one of the factors entering into the dynamic process continually alters and has wide fluctuations within itself. Thus, the human host has a vastly complex internal milieu with varying degrees of resistance and susceptibility at different ages and with different diets and surrounding influences. The environment is also subject to enormous variations, physical, economical, even biological. A worker in industry is thus subjected to enormous influences not only within himself due to his vital processes, but also he is greatly influenced by the working conditions of his factory environment as well as his home or 'chawl' life. Tubercle bacilli, of differing types and quality, are yet another variable in the complex combination that ultimately decides whether the host comes down with the disease or is able to withstand the attack. Every one of us, particularly in a city and during our life time, is continually

having a complex interaction dynamically influenced by a very large number of factors. In such an interaction, a balance of the forces of the triad, of host, agent and environment signifies freedom from the disease while a tilting of the balance in favour of the bacillus indicates tubercular disease. We, as industrial physicians, should have the understanding of the various influences of the above-mentioned triad in our particular setting, if we are to help in keeping the balance in favour of the human host. Such understanding of the many factors in the causation and spread of the disease in our specific environment is the object of modern epidemiological science, which stands in the same relationship to public health practice as diagnosis stands in relation to therapy in clinical medicine. While the clinician applies his clinical methodology and clinical investigation in making a diagnosis of his individual case in order that he may chalk out specific therapy, the epidemiologist has to apply suitable epidemiologic methodology and proper epidemiologic investigation of the disease before specific public health methods can be applied to bring down the incidence of the disease. Without going too deep into such epidemiologic methodology, one can say that methods of field surveys and field reviews are indicated in our specific groups at the present time. When one looks around for any base line figures on which reasonable hypothesis and a pattern of action can be developed, one is struck by the vast hollowness and unreliability of statistical data that is collected. I am told that lack of reliable statistical information is universal in India and when it comes to health statistics I guess that the limit has been reached. Under those conditions none of the recognised statistical analysis or epidemiologic methods that have been useful in correcting communicable illnesses is possible.

The firm that we have worked with for over two years has an Industrial Health Department for the last ten years. Over these years some figures have been collected about the morbidity of this disease, but I am afraid no statistical conclusions can be drawn from them. This has not been due to lack of interest on the part of the physicians, but due to various other circumstances, the data collected cannot be accepted as statistically valid for calculating the rates of incidence and prevalence of the disease. I shall, however, give you whatever data we have got to give you some idea about the extent of the disease in our firm. The number of cases of tuberculosis varies between 75 and 100 in our two factories in Bombay employing 12,000 workers. The incidence rate works out to 6.8 cases per 1,000 per year over the past six years. If we analyse the figures of only one textile mill, we find that the rates have been rising gradually from 3.8 per 1,000 to a figure of 14.5 per 1,000 in the course of five years. No definite trends or conclusions can

be arrived at from these figures as we know that the sample is biased in the sense that those who were quite sick came under medical surveillance and early cases either did not report for examination or went outside. Since the Employees' State Insurance Scheme has come into effect we have only the records of the T. B. Wing of our medical clinic at the Headquarters Office to give us any idea of the incidence of tuberculosis. Recently, we made an attempt to survey the whole groups of workers functioning together in a department or canteen in these mills and were able to get early cases of Pulmonary Tuberculosis spotted and isolated by means of fluoroscopy survey. This programme, however, has to be pursued with zeal and against many road-blocks which take the patience and stability out of even the best amongst us. Three early cases were detected out of 64 screened in one week, which would not have been possible by the usual clinical examinations. During the last International Tuberculosis Conference held at New Delhi, the glaring lack of statistics of morbidity and mortality of tuberculosis in India was pointedly referred and the early results of a continuing survey in seven regions of India on a planned basis were discussed. Unfortunately, in this survey, the western part of India was not covered at all and further, even in the eastern, northern and southern areas, there was no study on the industrial groups. This leaves us again practically where we are and unless the industries in Bombay make some firm efforts to carry out a survey we shall never know what is the size of our problem here todate. If we have to get this information, certain industry-wide surveys as detailed below have to be undertaken which will be particularly meaningful to us.

1. The tuberculin reactivity survey can give a rough idea of the extent of infection and its distribution but is influenced by other nonspecific infections in tropical regions.

2. Clinical tuberculosis detection drive. This has been done before the widespread use of chest X-ray. Frankly it is a waste of time and effort and yields only grossly inaccurate data. Early cases are missed and various other chest diseases are wrongly labelled tuberculosis.

3. Postmortem surveys are possible but not probable in our society where the practice is greatly resisted.

4. Mortality surveys: Reported deaths in a representative section of the community are investigated from histories and reports of attending physicians and relative incidence of tuberculosis mortality to total mortality worked out. From this figure in one unit, an idea of the total tuberculosis mortality of the whole community can be calculated.

5. Fluoroscopy surveys: These are less expensive but only small groups can be handled. The radiologist is exposed to much radiation. A few cases may be missed due to fatigue and personal error of the radiologist, and full size films have to be taken on suspected cases.

6. Full size X-ray film survey: This is, of course, the ideal but the cost is prohibitive and only small and special groups like medical or nursing students, new entrants to factory or office work can be surveyed by this method.

7. Mass Miniature Radiography surveys: These are a boon to the modern case-finding programme and field surveys for tuberculosis. The cost is low, technical efficiency is high and they have really given most satisfactory results in the advanced countries which have tackled the disease.

Lastly, I should mention the sputum surveys and combination of different surveys described above. Out of these, my own preference would be to carry out a mass miniature X-ray examination using 10 mm. X-ray film on a sampled or whole factory population and then to pick out the suspicious cases for a full chest plate X-ray picture and bacteriological examination if found positive in the larger plate also. I believe that this is the method adopted in the Indian tuberculosis survey in progress now. Case-finding by this method is the epitome of an effective Tuberculosis control programme. It has to be followed by medical care and isolation till the case is sputum-free of tubercle bacilli and then after-care and rehabilitation should be arranged. If cases are detected at early stages, there are effective antimicrobial agents today which were not available 5 years ago, and which help to rehabilitate individuals afflicted with the dread disease in short periods of weeks rather than months. A programme which adopts the above-mentioned public health measures, supported by active and well-planned health education is bound to show its effect within a few years.

Before concluding, I wish to quote a famous authority who spoke thus more than 20 years ago in a different setting and referring to a different epidemiologic situation: "The eradication of tuberculosis is now an expectation sufficiently well-grounded to justify shaping our tuberculosis control programme towards this definite end. We have reached the stage at which the biological balance is against the survival of the tubercle bacillus and, as demonstrated by the steadily falling morbidity and mortality rates, each existing case has for some time been giving rise to less than one new case of the disease. If this balance can be maintained and the sources of infection further reduced, the control of tuberculosis is within our grasp."

These words were spoken by Dr. Wade Hampton Frost, the first Professor of Epidemiology in America in 1935 at the fiftieth anniversary of the Saranac Lake T. B. Sanatorium. The closing down of the Saranac Lake T. B. Sanatorium in 1953 marks the correctness of his prediction and his deep understanding of the disease. Frost enunciated the basic principles and objectives of prevention of tuberculosis when he emphasized that the rate at which infectious cases develop in a population should be maintained permanently below the rate at which infectious cases are isolated and treated. Only then can we hope to relax our efforts and struggle, having played our due role in society, without passing the buck to the economists and social reformers. The alternative to this is a disastrously expensive evasion of the real problem, which will soon be the number one disease of our nation.

## MASS—MINIATURE RADIOGRAPHY IN INDUSTRY

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For effective promotion and maintenance of workers' health in our factories, emphasis is paid by our Medical Service on a preventive programme of health which consists of a series of physical examinations, study of working conditions and rehabilitation of the disabled.

Physical examination of the employees includes—

- (a) Pre-employment examination of the new entrants.
- (b) Periodic Health examination of the employees once every 12 to 18 months.
- (c) Occupational examination of people working on potentially hazardous jobs or on jobs in which the health status of employees concerned is of more than usual importance particularly from the point of view of effect on others viz., canteen workers, workers engaged in the manufacture of food products.
- (d) Re-entrance examination of the people returning after sickness.
- (e) Transfer examination—when a worker is transferred from one job to another he is examined to make sure that he is physically fit for the new job.

Except periodic health examination all these examinations are compulsory. As a result of these physical examinations we are able to assess the health of approximately 60% of our employees each year. During these examinations, as well as during our day to day clinical work, we refer cases to outside specialists for special examination whenever we feel the need of assistance. Radiological examination of the chest is done when we suspect Pulmonary Tuberculosis or any allied condition. For detection of tuberculosis cases we depend on the physical examination mainly and radiological examination is done only when we suspect a lesion.

At the beginning of our preventive programme (1951), the morbidity rate of Pulmonary Tuberculosis in our factory population was 10 per 1,000. After a determined effort for six years to control the disease by—

- (i) early detection of cases
- (ii) their isolation and treatment, and

- (iii) their rehabilitation, the morbidity rate came down to 6 per 1,000. By the middle of 1957, we had fairly consolidated our activities. The E.S.I. scheme was working smoothly and helping the tuberculous by giving treatment. We felt that we were in a position to carry out a radiological survey and take care of tuberculosis cases even if they were detected in larger numbers. We therefore approached the Bombay State Anti-Tuberculosis Association (organised home treatment clinic) for Mass Miniature 'X' ray facilities. They readily agreed to offer us all possible help.

## Material and Method

We decided to carry out a random sample survey of 77% of our people consisting of males and females of all ages, employed in various occupations. Employees who had definite suggestive signs or those who were known to be tuberculars were not included in this group.

The examination was absolutely voluntary. But we ensured that there were no hardships of any kind to those who went for the 'X' ray examination. We explained the purpose and usefulness of the survey to create interest and co-operation. We are pleased to report that the response was excellent and there was no case of refusal.

A careful study of the 'X' ray reports was done in every case and a follow up of all positives, suspects and healed lesions was done. Laboratory investigations in the form of total and differential blood counts, sputum examination, sedimentation rate determination etc. were carried out wherever necessary.

## Results

The results of the Mass-Miniature examination were as follows:—

Table I

| Detected by Physical Examination<br>Confirmed by X-Ray |                                                              |                                | Detected by Mass-Miniature<br>Radiography               |                                         |                                |
|--------------------------------------------------------|--------------------------------------------------------------|--------------------------------|---------------------------------------------------------|-----------------------------------------|--------------------------------|
| No. of<br>employees<br>examined.                       | No. of T.B.<br>Cases detected<br>by Physical<br>Examination. | Morbidity<br>rate per<br>1000. | No. of<br>employees<br>examined<br>by M.M.R.<br>Survey. | No. of<br>Cases of<br>T.B.<br>detected. | Morbidity<br>rate per<br>1000. |
| 3069                                                   | 18                                                           | 6                              | 2373                                                    | 43                                      | 18                             |

Table No. I shows that out of those radiologically examined, 18 active cases of Pulmonary Tuberculosis were detected per 1,000. As

the known cases of tuberculosis were not included in the group of 2,373 who were examined by M.M.R., the actual Morbidity Rate amongst the workers will be in fact 18 plus 6 or 24 per 1,000. Morbidity figures of Tuberculosis cases amongst other industrial workers, published by the same M.M.R. Clinic, have been as high as 68 per 1,000. We are not in a position to explain why their figures are as high as that. But a possible explanation could be that only suspected cases were referred by their doctors for the M. M. R. examination.

Can our result, based on examination of 77% population (2,373 out of 3,069), be considered statistically significant? Bradbury (1948) in his analysis of Surveys has stated that in order to detect half the tuberculous cases in any group, at least 70% of that group should be examined. Our survey on this random sample therefore should be statistically significant.

Table II

## Incidence Amongst Males—Age Groups

Total No. Examined: 2090

| Years.                      | Upto 24 | 25—34 | 35—44 | 45—55 |
|-----------------------------|---------|-------|-------|-------|
| No. of Males Examined       | 343     | 1014  | 610   | 123   |
| No. of positive cases       | 2       | 19    | 14    | 5     |
| Incidence per 1000 examined | 6       | 19    | 23    | 4.1   |

Table No. II shows that the highest number of T.B. cases per 1,000 employees was found between the ages of 35 and 44 in males. Table No. II-A shows the incidence in female workers. It shows the number of active cases per 1,000 female employees; all were in the age group of 25-34 years.

Table II-A

Total No. Examined: 283

| Years.                      | Upto 24 | 25—34 | 35—44 | 45—55 |
|-----------------------------|---------|-------|-------|-------|
| No. of Females examined     | 46      | 177   | 49    | 11    |
| No. of cases of T.B.        | ...     | 3     | ...   | ...   |
| Incidence per 1000 examined | ...     | 17    | ...   | ...   |

Table III

| No. of people Examined.          | New Cases Detected. | People need to be observed as suspects. | Healed T.B. Lesion. |
|----------------------------------|---------------------|-----------------------------------------|---------------------|
| 2373                             | 43                  | 18                                      | 51                  |
| Percentage of the total examined | 1.8                 | 0.8                                     | 2.1                 |

Table III gives some valuable information about other problems of Tuberculosis. It will be noticed from the figures that 2.1% of the people had healed lesions and another 0.8% were suspects and needed observation. These figures go to show how widespread is the tuberculous infection and unless we have radiological examinations carried out fairly frequently a large number of cases will go undetected. Both these groups can become active and become the source of spreading infection in a community and therefore should be kept under close observation.

Table IV

## Distribution of Types of Cases—Total No. of Cases: 43.

| Sent for M.M.R. During.                 | Minimal Lesion. | Intermediate Lesion. | Extensive Lesion. | No. of People Examined. |
|-----------------------------------------|-----------------|----------------------|-------------------|-------------------------|
| Periodic Health Examined                | 15              | 7                    | ...               | 1661                    |
| Transfer Exam.                          | 4               | ...                  | ...               | 200                     |
| Re-entrance Exam.                       | 6               | 2                    | ...               | 205                     |
| Occupational Exam.                      | 2               | ...                  | ...               | 307                     |
| Total                                   | 27              | 9                    | ...               | 2373                    |
| Percentage of total.                    | 1.1             | 0.4                  | ...               | ...                     |
| Suspects confirmed on investigations... | 7               | ...                  | ...               | ...                     |

Table No. IV shows that 16.3% of the positive cases found by M.M.R. had an intermediate type of lesion. None of the cases detected had any symptoms which aroused suspicion of tuberculosis. They were referred to us for some medical examination or the other and not even one of them had felt the need to seek any medical advice about his health from us. Also, during medical examination except in the cases of 7, none of them had any clinically detectable signs of T.B. but were sent for M.M.R.

examination as a part of this routine survey. All this shows that a large percentage of active cases, some with fairly advanced lesions, can easily go undiscovered and unnoticed if there is no routine radiological examination of the chest.

Table V

| Total No. of people examined. | Thick-ened Pleura. | Calci-fied spot. | Hilar Calci-feration. | Hilar Flare. | Bron-chitis. | Bron-chiectasis. | Medi-astinal glands. | Cer-vical Rib. | Promi-nent Aorta. |
|-------------------------------|--------------------|------------------|-----------------------|--------------|--------------|------------------|----------------------|----------------|-------------------|
| 2373                          | 5                  | 18               | 754                   | 63           | 2            | 2                | 170                  | 3              | 5                 |
| Percentage of total examined. | 0.2                | 0.8              | 31.8                  | 2.7          | 0.1          | 0.1              | 7.2                  | 0.1            | 0.2               |

Table No. V shows other findings during M.M.R. examination of the group. Although none of these indicate any active tubercular infection the findings are interesting and shows what a variety of conditions may remain 'silent'. Prior knowledge of such conditions helps us to take steps, where necessary, for correction.

#### Details of positive cases

The analysis of the physical findings of all the positive cases found by M.M.R. were very interesting. The medical history and findings of the cases during previous physical check-ups were examined in every case. Except in the case of seven workers, none of the positive cases aroused any suspicion of tubercular infection clinically. Radiologically, however, they were found active cases of tuberculosis. All of them had been medically examined a year or two before the present medical examination and some of the positive cases had actually shown an improvement in their general health.

#### Conclusion

Periodic physical examination of people helps us in early detection of tuberculosis. But from our experience, clinical examination alone is not sufficient as it may fail to detect early cases without symptoms, or even those who have the disease in an advanced stage but who appear normal and maintain normal health. No programme can succeed in controlling the disease in a community unless it can fully ensure isolation of all sources of infection. To achieve this, routine radiological or M.M.R. examination of the community is essential. Physical examination alone is not sufficient. Our experience shows that we have been missing a large number of cases by depending on physical examination alone. Routine radiological survey is expensive but M.M.R. is comparatively inexpensive and is a practical proposition in industry.

A valuable secondary benefit of the Mass-Miniature Radiography is the discovery of non-tuberculous abnormalities such as cardio-vascular diseases, and some of the common lung conditions which normally may not come to light.

While planning M.M.R. surveys provision should be made for adequate staff to carry out the follow up work. Health education prior to the starting of the survey, necessary facilities for the examination and co-operation from the people themselves are some of the pre-requisites to make an M.M.R. survey successful.

#### Acknowledgement

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## REHABILITATION OF THE TUBERCULOUS

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Occupational resettlement of the individual patient is the final stage in the management of the tubercular. It tests the degree of health achieved by the labours of the physician and surgeon and it is a measure of the patient's ability to combat the effects of prolonged and unnatural inactivity.

Even with the provision of a clinic, a hospital and a sanatorium, the campaign against tuberculosis is not complete. Increasing consideration should be given to the economic status of the patient, the unit of his family, the question of after-care and rehabilitation with the assurance of a livelihood without which this problem of tuberculosis cannot be dealt with successfully and satisfactorily. Few people realize that a patient with a cavity in the lung is as incapacitated as a man with an amputated limb. The victim is permanently sub-standard and measures have to be taken to provide suitable work to enable him to earn a reasonable livelihood without which he is liable to become a burden on the society. Such existence is not a satisfactory solution of the problem. Hence, it is essential that as much care must be bestowed on the rehabilitation as is bestowed on the treatment of the tubercular patients.

The problem of rehabilitation has been in the fore-front for the last ten years. People suffering from other incapacitating diseases have also to be rehabilitated, but the problem of rehabilitation of the tuberculous patients is very important in civil life. Greater attention has of recent years been devoted to this aspect.

Experience has shown that this problem is not confined to medicine alone. In combination with medicine, we have to get co-operation of psychology, sociology and economics for any tangible results to be obtained.

Sir Pendrill Varriar Jones was the first to draw attention to this problem. As a practising physician of renown he had very great doubts in the truth of the commonly accepted methods of dealing with tuberculosis patients after their discharge from a sanatorium. Various attempts were made by him to get his patients employed in some industry or other in suitable jobs and in practically every case he was disappointed, as sooner or later, many of them returned with relapse. By experience he came to the conclusion that unless he could in fact rehabilitate his patient in

the true dictionary sense, he was wasting his time and at the same time sacrificing the life of the ex-patients. The actual words used by him in this connection were "*to restore him to his former status*".

After these painful experiences he reversed the order of the dictum and instead of sending patients to work, he brought work to the patient. Experience has shown that the reversal of the dictum has had a salutary effect and is now recognised as the main method of rehabilitation.

It must be realised that the case of tuberculous patient does not end with his discharge from the hospital. As much care must be bestowed on him after discharge as is bestowed when in an institution. It is observed that a large number of patients who have been discharged from a sanatorium or hospital return to their homes which are in very poor surroundings with hardly any sanitary arrangements and a poor environmental hygiene. The result is that many of the ex-patients return back to the sanatorium with a relapse. The most vulnerable period during which relapses occur are the first two years after discharge. Hence it is suggested that all patients discharged from institutions should be looked after for a further period of 2 or 3 years, but at the same time the patients should be made to feel that they are being trained in some occupation or other.

Colonisation or establishment of settlements for the ex-patients would serve the purpose of looking after the patients and at the same time teach them useful occupations.

Many of the patients who are discharged from a sanatorium are below par in strength and health and cannot stand any competition with healthy individuals in any trade or occupation. Employers prefer to have healthy individuals rather than those below par in health, with the result that the ex-patients have very little or no chance of employment. Even if by any chance some of the patients get employment, they have to work harder to keep pace with the healthy employees. Coupled with this hard work, if the patients have to do long journeys to workspots, the effects on the patients are very detrimental. To get over this, it has been recognised that rehabilitation of ex-patients is as important as the curing of the patients and in practically all countries colonies for such individuals have been started and in Madras a scheme for colonisation is well on progress.

Colonisation has certain advantages. Each individual ex-patient is given work according to his capacity. The type of work and duration of work are regulated by periodical examination by the resident doctor in such a way that no harm could result

to the ex-patient. The doctor in charge always keeps a watch on these workers and at the earliest signs of breakdown, gets them admitted to the attached sanatorium and repair work is started at once. This is very important as the detection of relapse at the early stage would facilitate the repair work and shorten the duration of stay in the sanatorium.

In many cases, the ex-patients may not be able to return to their original trade or occupation which involves heavy manual labour. The colonies or settlements teach these patients alternate occupations which will not involve heavy manual labour and at the same time provide living wages.

By looking after the patients during the period of work and during the period of first two years, the chances of relapse get very much reduced, with the result that a large number of beds in an institution can be made available for fresh cases. The colony provides facilities for the workers to live with their families in model houses built on a fairly decent scale. The sanitary arrangement and hygiene of the surroundings are well looked after and the children born to them are also cared for. In the course of some years, it may be necessary to start schools for the children.

Rehabilitation should start from the time that the patient is admitted into the institution for treatment of his condition and continued till the patient is provided permanent employment. During the early part of the patient's stay in the institution, the greatest amount of care must be bestowed to overcome certain difficulties such as initial shock of the diagnosis, the fear of treatment, doubts and lowering of self-esteem, the strain placed on personal relationship by separation and fear of infection. These can to a large extent be overcome by the Welfare Officer or Social worker undertaking this work. The Officer can help to lessen the initial dismay by engaging the interest of the patient in plans for treatment, thus removing to some extent the fear and assist him to face the situation. At the same time, a useful discussion of the possibilities of employment and of the future could be of considerable help. Occasionally the process of easing certain problems such as claims, pensions, correspondence eases the mental condition of the patient.

There is an atmosphere of hopefulness created by the constant progression from hospital to sanatorium and on to settlement. The families of the patients have to get themselves to reorient their lives, often making certain sacrifices, if necessary. Material assistance is necessary for the families and this mainly depends on the Liaison Officer and Social worker or on the after-care Committee.

In rehabilitation after discharge various factors have to be taken into consideration. The two main factors are:—

- (i) General principles with regard to the patient; and
- (ii) General principles with regard to the industries.

#### General Principles with regard to the Patient.

As soon as a patient comes to the settlement from a sanatorium, he is no more called an ex-patient but termed *Trainee*. He is made to feel that he is coming to a settlement of his own and the industry is his. This idea is the important pivot around which rehabilitation work revolves. The trainee should not feel that he is commencing another course of dead-end of occupational therapy or as the Americans call it a "*Toe Cover Factory*". In inculcating this aspect the interviewing person, having himself gone through the same process, will be in a better position to understand the feelings of a trainee. During the period of first few days the trainee is made to feel that his future is secure and he has to depend mainly on the industry for his permanent occupation.

In the words of the present Director of the Papworth Colony, the trainee is given an opportunity "*to be listened to with regard to his story at least once*". By this method, the management will get very real knowledge of the industrial back-ground and the trainee's psychological re-action to it.

After these preliminary steps have been taken, the trainee is given time to go round and acquaint himself with various types of work available in the settlement. The trainee thereafter is allowed to choose the job within the bounds of his physical capacity.

After having been hospitalised for a long period, the association of the trainee in any industry produces a mental condition which brings back a high degree of self-confidence. He must be made to feel that without him the industry cannot go on. Throughout the period of training, regular reports of the trainee are submitted to the management by the head of each department. If the reports are satisfactory the trainee is allowed to continue. Where even after a sufficient lapse of time the report is unsatisfactory, the trainee is given another opportunity of choosing a fresh or different job.

From the point of view of the trainee, there is nothing which produces a greater amount of psychological fear than the insecurity of the job. Hence, the cure for this psychological defect is to keep before the trainee the ultimate goal of permanent employment on full wages.

### General Principles with regard to the Industry

(1) Any industry that is started for the ex-patient should be such that it produces no deleterious effect on the health of the ex-patient. Occupations like weaving and working in cotton, or factories which produce dust or occupations where irritant gases are produced are forbidden. The most useful occupations and at the same time profit earning in a short time are printing, carpentry, leather working, poultry farming, gardening, basket and mat making, paper making, lace work, embroidery, cloth printing, painting etc. At the outset, I would like to point out that there is absolutely no danger in buying these articles from these colonies, because they are not infected. No patient is taken into the colony unless he is free from infection. Hence buying of articles or the location of such colony is no danger to society.

In the early years it is not possible to establish industries that are self-supporting or paying. But there is no reason why in the course of a dozen of years, the industry should not be self-supporting. At the Papworth Colony, in 1948, 1,200 people were employed; £50,000 was a saving to the State in maintenance charges, £7,000 was contributed to the State, £9,500 was contributed to the National Health Insurance and £60,000 as Purchase Tax. The purchasing power of the community was increased by £160,000, paying wages on a turnover of £500,000. In the first few years it is bound to be a losing concern, but gradually it has to flourish.

2. The industries provided for should manufacture such products as are readily in demand in the market. No useful purpose is served if products which are not in heavy demand in market are manufactured. In this connection, I would like to repeat what I said before that there is no danger of infection spreading as a result of purchasing articles made in the settlement. No case with positive sputum is entertained as a trainee or workman.

3. The industry should have recourse to the use of machinery to the fullest extent. By using machinery a great amount of manual labour is reduced and the time saving factor is very important. Industries like carpentry can also be undertaken, because practically every part is made with the use of machinery and the assemblage is left to be done by the workers. The product thus produced has a better finish and can extract a better sale than others made by manual labour, at the same time the cost is also reduced.

4. Every position in the colony is open to the members of the colony and industry should be built around a worker rather than the worker be shoved into an irksome job. When the industry is built

around a person, the chances of progress are much greater than otherwise.

5. The intellectual capacity of the patient should be utilised to the fullest possible extent and it is no exaggeration to say that some of the ex-patients are capable of very high standard of work and their intellectual capacity is far above the average.

6. In the establishment of industries, care must be taken to see that those industries provide fairly permanent jobs enabling good wages to be earned and normal family life to be resumed, so that the ex-patients may have no psychological drawbacks.

7. The dignity of labour should be upheld everywhere and the management should see that no element of charity enters the settlement. Everyone should be paid according to work done and at the same time enough to live.

8. The trainees being ex-patients of tuberculosis, the possibility of relapses should always be borne in mind and provision should always be made for periodical thorough examination to detect at its earliest stage any relapse that may occur.

9. The settlement should take into consideration not only the patients, but their family also should be kept in mind.

In this organised fight for the control of tuberculosis and for their complete rehabilitation the help of legislature has to be sought for. In the United Kingdom, recently a legislation has been passed giving powerful weapons in the hands of tuberculosis workers. The scheme has been developed by the Ministry of Labour in accordance with the provisions of Disabled Persons Employment Act. The main provisions of the Scheme are—

- (i) the appointment of Disabled Resettlement Officer.
- (ii) training Schemes
- (iii) rehabilitation Centres.
- (iv) re-employ Factories.

These weapons are excellent in themselves as far as disabled persons from other diseases are concerned, but with reference to tuberculosis, they fail to meet the needs for two reasons, firstly, they do not take sputum positive cases and secondly, they do not provide for the patients who are not fit for full day's work.

The problem of rehabilitation of sputum positive case has yet to be tackled and certain sections of the settlements are now being opened for these positive cases, but watch is kept over them.

A large amount of criticism has also been levelled at settlements and colonies. They are—

1. Is it possible to employ permanently every discharged patient in any settlement or colony? Permanency is one of the essential things, and therefore the criticism is to some extent correct, but this difficulty can be got over by transferring the sufficiently experienced people to jobs outside the colony after a lapse of 5 to 6 years, by which time they would have stabilised their strength. In this connexion, the establishment of Employment Bureaus has been advocated, so that every trainee who has had an unbroken period of 3 to 4 years experience in the colony is registered with this Bureau for employment elsewhere. By this method, the settlement may be kept within reasonable number.

2. The second criticism is that since attempts are made to employ as many people as possible, full advantage is not taken of the available machinery. As pointed above this is a wrong conception, as one of the main objects is to utilise machinery to the fullest extent. Even when machinery is employed to the fullest extent, there may be odds and ends to which trainees may be posted for work.

3. These settlements being situated in far off places may not be utilised to the fullest extent by patients. They would like to go back to their homes as soon as they are declared fit by the sanatorium doctor. This question appears to be rather important in India. When settlements or colonies begin to function and demonstrate the efficiency of rehabilitation and thus educate the public, I am almost certain that this lack of enthusiasm to remain in the settlement will fast disappear.

## REHABILITATION OF THE TUBERCULOUS IN INDUSTRY

B. Banerji, N. M. Pant & K. S. Basu

Medical Service, Hindustan Lever Ltd., Bombay.

There has been a revolutionary change during the last 10 years in the management and treatment of tuberculosis cases. The antibiotics and chemotherapeutic agents have reduced suffering and disability of the disease considerably. Ten years back the medical officer in industry could do very little after a diagnosis of tuberculosis was made amongst one of the employees. But today there is much that he can do when any industrial worker gets an attack of tuberculosis. Proper arrangement for treatment is looked after by the E.S.I. Scheme and the industrial medical officer has mainly to face the problem of rehabilitating cases after the arrest of the disease. More and more such cases with arrested lesions are coming back after treatment. Rehabilitation of these workers is becoming a bigger problem every year.

During the last 7 years, we have had 232 cases of tuberculosis in one of our factories and we are pleased to report that we have been able to rehabilitate 170 of them in the same factory. We propose to discuss a few points that we have had to face while arranging rehabilitation of these cases. Table I gives details about the number of cases detected and rehabilitated. In 1958 we examined the workers by M.M.R. and that explains the rise in the morbidity rate during the year.

Table I

|                                                                                | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | Total. |
|--------------------------------------------------------------------------------|------|------|------|------|------|------|------|--------|
| No. of employees ...                                                           | 3010 | 3150 | 3142 | 3200 | 3200 | 3145 | 3069 | ...    |
| No. of cases detected ...                                                      | 31   | 32   | 32   | 28   | 26   | 22   | 61   | 232    |
| Morbidity rate per 1000 ...                                                    | 10   | 10.5 | 10   | 9    | 8    | 7    | 24   | ...    |
| No. rehabilitated ...                                                          | 20   | 28   | 29   | 24   | 20   | 21   | 38*  | 180    |
| Average No. of week's rest necessary per case for treatment before resumption. | 36   | 36   | 26   | 25   | 21   | 19   | 14   | ...    |

\*20 patients are still under treatment.

Workers often have a fear that the presence of the tuberculous amongst them will expose them to infection. The management often fears that keeping these handicapped persons in employment will prove a liability and if this is allowed to continue for years together the burden will eventually prove too much for the capacity

of the industry. There is the feeling that a tuberculous worker remains disabled for the rest of his life. Health education and reassurance prove sufficient to remove the fear of the workers. But it is not easy to solve the problem that faces the management. The number of handicapped persons in industry may be many. Tuberculosis is not the only disabling disease. There is the problem of the injured, the problem of the cardiac etc. and all these add up to make the burden a heavy one to carry. Our experience with respect to tuberculous workers does not justify the fear that the tuberculous is a permanently disabled person and we feel that if a humane approach at the first few months of rehabilitation—during the awkward phase—is made then most of the cases can come back to useful working life.

Before allowing the patient to start work we make sure from the specialist who has been treating the patient that it would be all right to put him to work. As a double check we ensure from a sputum examination that the case is a closed non-infectious case and we take a chest X-ray to ensure that the lesion is in the healing stage. A record of his E.S.R., weight, temperature and pulse rate is kept for future comparison. As a rule every case is put to light work to start with. The patient is usually sent to his own department with our recommendation about the type of job in which he can be placed for the present. Instead of specifying the exact job we generally advise the type of job in the department that would be suitable or unsuitable for the patients. Generally they are forbidden to do such jobs which entail too much of moving about, standing most of the time or doing too much of physical exertion. In consultation with the time and motion study department, a much slower pace of work is prescribed for them in those jobs which have some standard quota of performance. Table II will serve as an example for the type of jobs that we would recommend or forbid in the soap-wrapping department. Similar classifications for other department can be easily made.

Table II

| <i>Jobs suitable at the beginning.</i>        | <i>Jobs forbidden.</i>                                     |
|-----------------------------------------------|------------------------------------------------------------|
| Unwrapping of soap tablets ...                | Lifting of Weights.                                        |
| Inspection of soap tablets ...                | Rolling of drums.                                          |
| Packing of tablets in boxes ...               | Carrying Weights.                                          |
| Wrapping of soap tablets ...                  | Shift work or overtime work.                               |
| Cleaning working table, stamping machine etc. | Working in a dusty or moist atmosphere.                    |
| Tally Work ...                                | Jobs which have to be done in a constant standing posture. |
| Operating switch of the wrapping machines.    |                                                            |

During the first week after resumption we ask every patient to see us every 3 days so that we can test their tolerance to efforts. From the second week the patient is given a weekly periodic check up to ensure that the job is not proving too strenuous for his health. The patient is interviewed regarding his symptom and his pulse-rate at rest, weight, temperature and other physical signs, if any, are compared with his previous records. After three months a more complete investigation with X-ray, E.S.R., Sputum examination is done and compared with the previous record. If an allround improvement is noticed the patient is put to a slightly more strenuous job or his pace of work is slightly increased in the same job. After the first three months, instead of a weekly check up a fortnightly check up is made in most of the cases for the next three months, when another complete investigation with X-ray, E.S.R., Sputum examination etc., is done and if an improvement is noticed the patient is put to a more strenuous job. In this graded manner the patient is put gradually to more strenuous jobs until he goes back to his own former job. The time taken to go back to one's normal job after resumption varies, but in an average case in our series, the time taken was 27 weeks after resumption of duties. Such graded strain does not seem to affect the health and the rate of relapse is 5%. Table III gives the relevant figures.

Table III

|                                                       | <i>Average.</i> |
|-------------------------------------------------------|-----------------|
| Average period of disability ...                      | 21 weeks.       |
| Average period for which light job was necessary ...  | 27 "            |
| % of people who could be put to their former jobs ... | 84%             |
| Rate of relapse ...                                   | 5%              |

Table III gives the average period of disability, the average time for which light job was necessary. Twenty-seven weeks is not all that long time that the industry, with a humane approach to the problem, will find it difficult to bear. 84% of the cases actually went back to their normal work. It has always been our attempt to encourage the patient to gradually go back to his former occupation. Apart from the psychological effect this saves the bother of learning an altogether new job. We have received good co-operation from the patients, they are generally willing to go back to their former job, amidst their former colleagues although they get full pay even when they are on light jobs. It is necessary to create a suitable psychological atmosphere conducive to their return to their old job. Their colleagues have to be assured that it is perfectly safe to work with them at this stage. The depart-

mental supervisors and managers should be requested to keep an eye on them so that in an excessive zeal to prove their fitness they do not over exert at the beginning. Younger people took lesser time than their older colleagues to go back to previous work.

Table IV gives an idea of the number of physical check ups that were necessary per case. For the first three months we give a weekly physical check up to these patients and after three months X-ray, E.S.R., sputum examinations are done. After the third month if the condition is favourable, physical check ups are done every fortnight and X-ray, Sputum and E.S.R. examinations are done every three months until the first year. From the second year onwards we make physical check ups once every quarter and X-ray, Sputum and E.S.R. are done twice during the second year.

Table IV

|                                                                                                   | 1st 6 months. | 7th month to 12th month. | 2nd year. | 3rd year. |
|---------------------------------------------------------------------------------------------------|---------------|--------------------------|-----------|-----------|
| Physical check up mainly clinical interview, check up of pulse-rate, weight, temperature etc. ... | 18            | 11                       | 4         | 4         |
| X-ray, E.S.R. Sputum examination ...                                                              | 3             | 1                        | 2         | 1         |

On an average we have had to make 4 physical check ups and take 1 X-ray for follow up of a case per year after the first year. All those examinations except X-ray examination were done in our laboratory attached to the medical service. For X-ray on an average we have spent Rs. 10 per case per year. This certainly cannot be considered to be a very heavy expenditure. This expenditure even has gone down now, we have now the facilities of a mass miniature radiograph unit in the locality and we are getting free service for the radiographic check up from this unit. We like to emphasize in this connection the importance of periodic check ups of these people. With modern treatment the disease is arrested—the drugs are merely bacteriostatic—and there is a constant need for such check ups, to ensure that the lesions are not flaring up with the strain of work.

It is thus evident from our experience that the tubercular has to be given a light job only for a short time—within 6 to 7 months majority of them can come back to their former jobs without any harm to themselves or to others. Secondly the expenses incurred for their periodic health check up is not high. From the point of view of the industry, we think, this experience is of very great importance. The industry in fact does not have to bear any burden—

after a short initial period it gets full return from the tubercular as from any other healthy employee, also hardly any extra expenditure has to be incurred for maintenance of health of the tubercular. In our series, on an average, a case needs continuation of specific treatment after resumption for only 3 to 4 weeks.

The next fear that the industry has about these people is, that the tuberculars have an increased susceptibility to illness, the sickness rate of the tubercular, it is assumed, is so high that he eventually proves to be a liability. Our experience does not substantiate this assumption also. The sickness absence rate and sickness experience of these workers compare favourably with those of the general group. Table V gives the sickness absence rate of 100 general factory workers taken at random as compared with those of 100 tubercular workers with arrested lesions for one year.

Table V  
Reported Sickness

|                                              | No. of people having no sickness. | No. of people having sickness 1 to 5 times during the year. | No. of people having sickness between 6 and 19 times during the year. |
|----------------------------------------------|-----------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------|
| Workers with arrested Tubercular lesions ... | 21%                               | 69%                                                         | 10%                                                                   |
| General factory workers.                     | 16.45%                            | 66.5%                                                       | 18%                                                                   |

Table VI  
Lost time sickness

|                                              | No. of people having no sickness absence. | No. of people having sickness 1 to 5 times during the year. | No. of people having sickness between 6 and 10 times during the year. |
|----------------------------------------------|-------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------|
| Workers with arrested Tubercular lesions ... | 39%                                       | 61%                                                         | Nil.                                                                  |
| General factory workers.                     | 41.1%                                     | 58.9%                                                       | Nil.                                                                  |

It will be evident from the above that the industry does not have to suffer due to a higher sickness absence of these workers.

## NEWS :

**PERMANENT COMMITTEE AND INTERNATIONAL  
ASSOCIATION ON OCCUPATIONAL HEALTH  
XIII INTERNATIONAL CONGRESS ON OCCUPATIONAL  
HEALTH.**

The 13th International Congress on Occupational Health—first to be held in the Western Hemisphere—will meet in New York City, July 25 to 29, 1960, according to an announcement by Dr. Leo Wade, of New York, who is chairman of the Organizing Committee.

Several thousand physicians, nurses, industrial hygienists and other delegates from more than forty countries will attend. Dr. Wade is medical director for Esso Standard Oil Company.

"With experts from all over the world gathered in New York to discuss and share important knowledge in the fields of occupational injury and disease," he said, "the 13th Congress will emphasize the fact that the science of health knows no national boundaries."

Theme of the New York meeting will be prevention, rather than cure. Programme participants from the many countries will report on their experiences, the findings of both clinical and laboratory research, and on methods for control of occupational health hazards. Plans already are under way to provide meeting facilities, and for translation services, accommodation for the visitors, and other arrangements.

The congresses are sponsored by the Permanent Committee and International Association on Occupational Health, of which Dr. Sven Forssman, of Stockholm, is president and Dr. Enrico Vigliana, of Milan, is secretary.

All previous meetings have been held in Europe, beginning with the first one in Milan in 1906. The 12th Congress was in Helsinki in 1957.

Dr. Wade said the international meetings on occupational health are one means of implementing an objective outlined by the U.S. President in his latest State of the Union message.

"A programme of science for peace," President Eisenhower said, "might provide a means of funneling into one place the results of research from scientists everywhere, and from there making it available to all parts of the world. There is almost no limit to the human betterment that could result from such co-operation."

As modern industry continuously expands its uses of materials and technological techniques throughout the world, new occupational hazards come into being to take their places beside such old and well-known ones as arsenic, mercury, and lead.

Radioactive materials, for example, are being used to an increasing extent in industry. Findings of research now in being which will be reported at the 13th International Congress on Occupational Health will supplement present knowledge on the control and effects on health of exposures to radiation in industry.

Dr. Wade pointed out that such man-made hazards among industrial workers can and, in most instances, are being controlled—with resulting benefits in health, increased productivity and economic well-being for vast segments of the world's population.

#### Invitation to Present Papers

The 13th International Congress on Occupational Health will be held in New York City at the Waldorf Astoria Hotel, July 25–29, 1960. The Scientific Programme Committee invites submission of papers for presentation at the Congress. The programme will be devoted to the discussion of the following aspects of Occupational Health.

1. Administrative Practices
2. Medical Practices
3. Surgical Practices
4. Education and Training
5. Social and Legal Aspects
6. Environmental Hygiene
7. Influence of Environmental Factors in Health
8. Work Physiology and Psychology
9. Specific Industries
10. General

#### Official Languages

The official languages of the Congress will be English, French, German, and Spanish. However, papers may be read at the Congress in the language desired by the author.

## Submission of Papers for the Programme

## Papers and Abstracts

1. Those desiring to present papers must submit abstracts before January 1, 1960 to Dr. Irving R. Tabershaw, Chairman of the Scientific Programme Committee, International Congress on Occupational Health, 375 Park Avenue, New York City.
2. Abstracts of papers should not contain more than 200 words, typed double-space. Original contributions rather than a review of previously published material will be given priority. Three copies in English are required for use by the Programme Committee and one copy in another official language of the Congress.
3. All abstracts will be reviewed by the Scientific Programme Committee. Selection will be based on the areas of interest as listed and the programme space allotted to each section. Authors will be notified before March 1, 1960 whether their papers have been accepted for presentation.
4. The names, academic degrees, titles, and complete addresses of author and co-author must be included in each abstract. The author who is to present the paper should be the first author listed in the abstract.
5. At the time the abstract is submitted the author must indicate that the paper will be presented at the Congress.
6. Complete texts of the papers in any one of the official languages of the Congress must be submitted not later than April 1, 1960.
7. The time allotted for each paper will be limited strictly to fifteen minutes including slides.
8. The abstract will be published in the Proceedings which will be issued at the time of the Congress.

## Proceedings of the Congress

Complete papers will be published in the *Proceedings* of the Congress following the meetings.

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## FORM IV

(See Rule 8)

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I, V. Ramchandran, hereby declare that the particulars given above are true to the best of my knowledge and belief.

V. RAMCHANDRAN,

*Publisher.*

*Dated the 25th March, 1959.*

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(Tyre Rubber) and other Tyre Repair Materials

**RUBBER ROLLER**  
for printing presses, Textile Mills and Tanneries

**RUBBER GLOVES**  
Acid and Alkali Resistant

**LATEX FOAM**  
Cushions & Mattresses

**CAB TYRE**  
for Rikshaws, Jutkas etc.

**CHAPPAL SOLES**  
Shoe heels & half soles



## MADRAS RUBBER FACTORY

Head Office :  
2, ERRABALU CHETTY STREET,  
MADRAS-I.

| Branches   | Phone No. |
|------------|-----------|
| BOMBAY     | 26-3122   |
| BANGALORE  | 2829      |
| CALCUTTA   | 24-3806   |
| DELHI      |           |
| KOTTAYAM   | 2373      |
| KOZHICODE  |           |
| TRICHUR    | 258       |
| MANGALORE  | 151-A     |
| NAGPUR     |           |
| VIJAYAWADA |           |
| OLAVAKKOT  |           |
| COIMBATORE |           |



### He's never colour blind about vitamins!

Yes, vitamins *do* produce colours! And this expert can tell the exact strength of a vitamin by the colour reading on his photo-electric equipment.

Why all this precision? Because we know that you expect *unvarying* high quality when you buy Hindustan Lever products.

To ensure that these standards are maintained, we test at every stage. From the buying of raw materials, to the manufacturing process, to the performance of the finished product...experts, technicians, scientists are checking and double-checking. This *quality control* also helps conserve precious national resources and vital production time.

In this way, we are providing you with *quality products you can trust*, at economical prices.



### HINDUSTAN LEVER SERVES THE HOME

HLL 17-X52



PROFIT BY EXPERIENCE

"IT PAYS  
TO FIT **Perkins** P6V  
ENGINES

They give you far more FOR far less."

Say Experienced Transport Operators  
All Over the Globe.

These World-Famous Engines are now  
Manufactured in India

by

