

need further investigation." A wealth of data has been assembled bearing on such subjects as: the physique of women; types of work and conditions of work suitable for them; sick-absenteeism of women as compared with men; accidental injuries and occupational diseases among women; gynecological and obstetrical problems associated with the employment of women; the relation of industrial work to menstruation, the menopause and other gynecological conditions; mortality of women in relation to occupation; and fertility of employed women. Data are not merely presented but are critically evaluated so that their limitations are made clear. On some questions, such as the relative susceptibility of women and men to occupational diseases, the relative frequency of accidents under similar conditions, and the effect of different types of work on the health of women, Dr. Baetjer finds that evidence is lacking or inconclusive. The careful evaluation of the data adds much to the value of this report.

Experience has shown that to obtain maximum health and efficiency of women in industry attention should be given to a number of special problems. These relate chiefly to proper selection and adequate training of women for a particular job, adjustment of machines, etc. to the size and strength of women, hours and conditions of work, and consideration of individual problems by the personnel and medical services. Recommendations for dealing with these problems are discussed fully. For the most part, however, conditions which are conducive to efficient work and a minimum number of accidents and sick-absences by men are also satisfactory for women.

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BCG VACCINATION AGAINST TUBERCULOSIS

STUDIES of the protective effect of the BCG vaccine against tuberculosis have been made with varying methods and varying results since the work was initiated by Calmette in France. Tuberculin-negative infants and children have been inoculated with the bacillus of Calmette and Guerin (BCG), an attenuated strain of the bovine type of tubercle, under the

theory that the infection introduced by the vaccination would build up a resistance to virulent strains of tubercle bacilli. There has been an insufficient amount of experimental data to evaluate the effectiveness of BCG vaccination, but two recent reports of studies being carried on in the United States, a third from Canada, and a fourth on the use of the vaccine in Denmark afford valuable evidence on the subject.

Aronson and Palmer¹ have published a report covering the first six years' results of the use of BCG vaccine among a group of North American Indians living in various communities in the Western part of the United States and in southeastern Alaska. The sample population consisted of 3,007 Indian children and young adults aged 1-20 who failed to react to a dose (0.005 mg.) of standardized tuberculin PPD. "A random portion of the negative reactors was vaccinated intracutaneously with freshly prepared BCG vaccine while the remainder served as controls." The control group was given 0.1 cc. sterile physiological salt solution. The tuberculin tests and vaccinations were begun in December, 1935, and were completed in February, 1938. Comparable follow-up examinations consisting of chest X-rays, tuberculin tests, and histories of exposure to tuberculosis were given to the experimental and to the control group.

Striking differences were found between the vaccinated and the unvaccinated in respect to total mortality, mortality from tuberculosis, and tuberculosis morbidity. The total death rate per 1,000 person-years of experience was 3.8 in the BCG group as compared with 7.2 in the control group. The deaths from tuberculosis numbered twenty-eight for the 1,457 persons in the control group and four for the 1,550 persons in the BCG group. When the cases of tuberculosis were subdivided according to stage and type, the results were more favorable for the BCG group than for the control group for every diagnostic category. During the six years the total annual incidence of cases remained relatively constant for the control group; that for the BCG group declined progressively in successive years after vaccination.

¹ Aronson, Joseph D. and Palmer, Carroll E.: Experience With BCG Vaccine in the Control of Tuberculosis Among North American Indians. *Public Health Reports*, United States Public Health Service, June 7, 1946, 61, No. 23, pp. 802-820.

Attack rates decreased with increasing age in the BCG group but showed relatively little difference with age in the control group.

An analysis of the separate localities represented in the study showed a reduction in the incidence of cases for every Indian reservation, although the amount of the reduction varied somewhat between reservations. Some of the variation was believed to have resulted from differences in the lots of vaccine used. At the reservation where the reduction was least, however, the incidence of cases was twice as great in the control group as in the vaccinated group.

From Canada, Ferguson² reports marked decreases in the incidence of tuberculosis among nurses and attendants of general hospitals and sanatoria following the use of BCG vaccination. Comparisons were made between the vaccinated during a five-year period, 1939–1943, and the unvaccinated during the previous five-year period, 1934–1938.

A study of all nurses entering training in eight Saskatchewan general hospitals revealed a 25 per cent lower incidence of tuberculosis among the 1,005 vaccinated negative reactors than among 759 unvaccinated tuberculin-negative nurses in the earlier period. The incidence of tuberculosis among the BCG group was also found to be significantly lower than that among unvaccinated tuberculin-negative nurses in the Winnipeg General Hospital during the period 1934–1943. The new tuberculosis cases which developed in the general hospitals were distributed throughout the greater part of the nurses' training period.

A group of nurses, hospital attendants, and other employes exposed to tuberculosis in sanatoria were given BCG vaccine. In contrast to the general hospitals where the average percentage of nonvaccinated negative nurses becoming positive to tuberculin in the first year of training was 12 per year, the percentage of nonvaccinated tuberculin-negative employes who became positive to tuberculin during the first year of exposure in the sanatoria was 60. The findings, even in this area of high infection, were decidedly in favor of BCG. The incidence of

² Ferguson, R. G.: BCG Vaccination in Hospitals and Sanatoria of Saskatchewan. *Canadian Journal of Public Health*, November, 1946, 37, No. 11, pp. 435–451.

tuberculous cases was reduced one-fifth among the vaccinated in the sanatoria as compared with the unvaccinated during the preceding period. Most of the new tuberculosis cases occurring in the sanatoria developed in the early months of employment.

The experience of the graduate nurses and nurses' assistants in the sanatoria was studied separately because of the excessive risk to which this group was subjected. The percentage of unvaccinated tuberculin-negative nurses who became positive to tuberculin after one year's exposure was 71.8. During a period of slightly more than one year 2.46 per cent of the 203 vaccinated nurses developed manifest tuberculosis; 15.9 per cent of the 113 nonvaccinated negative nurses developed tuberculosis. Since vaccination of tuberculin-negative nurses was begun in September, 1938, the serious situation with regard to the excessive incidence of tuberculosis among nurses and sanatoria employes no longer exists in Saskatchewan.

In contrast to these positive findings for BCG vaccine as a protective measure against tuberculosis, Levine and Sackett³ found no reduction in tuberculosis mortality during the first five years of life among a group of BCG vaccinated infants from tuberculous homes in New York City as compared with a similar control group. The only criterion used for determining the effectiveness of vaccination in this study was tuberculosis mortality.

The New York City sample population consisted of children, almost entirely under age 1, from tuberculous families referred from tuberculosis clinics and hospitals. Those aged 1 month and over must have been negative to 1.0 mg. tuberculin and must have had negative chest X-rays and negative physical examinations.

The study was divided into two periods: (1) 1927–January 1, 1933, when the selection of children to be vaccinated was made by the physician; and (2) January 1, 1933–January 1, 1944, when alternate children were routinely vaccinated. Prior to the change in method, the tendency was to vaccinate the children of the more intelligent and more cooperative parents.

³ Levine, Milton I. and Sackett, Margaret F.: Results of BCG Immunization in New York City. *The American Review of Tuberculosis*, June, 1946, LIII, No. 6, pp. 517–532.

In the earlier period, 0.68 per cent of the 445 vaccinated children died of tuberculosis as compared with 3.38 per cent of the control children. In the later period, 1.41 per cent of the 566 children in the BCG group and 1.51 per cent of the 528 children in the control group died of tuberculosis.

To try to explain the change in the mortality rates in the second period the authors examined the following factors:

1. Exposure to positive sputum cases
2. Racial distribution
3. Economic conditions
4. Proportion of lost cases
5. Number of autopsies performed
6. Variations in the activity of the BCG vaccine

No important differences between the two groups with respect to any of the above variables were found.

The only factor which the authors could find to explain the shift in mortality was the weighting of the earlier control group with children of uncooperative parents. As criteria of the degree of cooperation of the family, (1) the average number of clinic visits made during the first year, and (2) a rating by the visiting nurses as to the type of care received by the child were compared for the vaccinated cases and the controls in each period. The two groups differed markedly before January 1, 1933, and were relatively similar after that date in regard both to the average number of visits and the nurses' rating. No information was given as to what "type of care" included. It would have been desirable to describe briefly the criteria used in rating the families.

The question as to whether or not the deaths among the BCG vaccinated children result from a tuberculous infection received prior to vaccination or to a massive infection before the effects of the vaccine could exert itself, arises in any study of this kind. Levine and Sackett attempted to study the problem by comparing the tuberculous mortality for a special group of vaccinated cases with a similar control group, both of whom had been separated from their homes for three months before and three months after vaccination. They concluded that, although such separation was impractical and inadvisable, the inoculation

might be of some protection if the children could be separated from exposure to tuberculosis for a sufficient period of time before and after vaccination.

The writers finally conclude that "as a public health measure the routine vaccination with BCG of children from tuberculous homes is probably of less advantage than removing the tuberculous case from the home."

It is evident that more data needs to be accumulated, particularly with reference to the importance of age in vaccination and to duration of the resistance. The study among the Indians suggested that vaccination was more effective in older than in younger children and that protection might be greater in the later than in the earlier years after vaccination.

More data on the changes in the tuberculin reactions would be of interest. Among the unvaccinated negative reactors the proportion becoming positive after exposure to tuberculosis furnishes an index to the infectivity of the environment. The vaccination induces a positive reaction to tuberculin in the great majority of persons. It would be of interest, however, to know what proportion of persons continue to give a positive reaction to tuberculin in successive periods after vaccination.

The study of Aronson and Palmer and that of Ferguson both suggest that BCG vaccination may have definite value in areas of high infection. The results indicate that the protection given by BCG is considerable although not absolute; cases of pulmonary tuberculosis do occur among the BCG vaccinated. The New York City study still leaves room for further analysis of the problem, since the study was limited to persons vaccinated in infancy and followed only for the first five years of life. It has been demonstrated that the vaccination has advantages for certain populations unavoidably exposed to tuberculosis.

Although emphasis has been placed on the use of BCG for areas of high infection, in Denmark it has been employed particularly for populations in areas of low infection. BCG vaccination has been used extensively in Denmark since 1940 according to Holm.⁴ Denmark has a large number of tuberculin-negative young adults. Approximately two-thirds of the population

⁴ Holm, Johannes: BCG Vaccination in Denmark. *Public Health Reports*, United States Public Health Service, September 6, 1946, 61, No. 36, pp. 1298-1323.

at age 14 are negative reactors and at ages 20–23 one-third still give a negative reaction to tuberculin. The amount of infection in the population as measured by the tuberculin test varies in different localities of Denmark and is dependent largely on the amount of infection in the cattle. The negative reactors have been found to be at special risk of developing severe cases of primary infection in adult life and also to be at greater risk than are the positive reactors of developing reinfection tuberculosis subsequently. BCG is used extensively and very successfully in Denmark to prevent these dangerous primary infections in adults.

Experience in Denmark has indicated that BCG also helps to prevent the development of reinfection pulmonary tuberculosis, although according to Holm the protection given is not absolute. Holm cites figures for the Island of Bornholm, a low-infection area, showing that the new cases of pulmonary tuberculosis were substantially reduced after vaccination as compared with a prior period. Among students at the University of Copenhagen a greater incidence of tuberculosis cases was noted among students who had been negative to tuberculin than among the positive reactors; no cases were noted in the BCG vaccinated group. An epidemic of tuberculous infection which occurred in a State School in 1942 was also cited to demonstrate the effectiveness of BCG vaccination.

The report on BCG in Denmark is not the analysis of one particular study but a brief review of the history of the use of BCG in that country and an outline of the policies in practice there today. Special attention is paid to the variations found in the virulence of the BCG strain, the preparation of the vaccine, and the complications occurring in vaccination. In Denmark a person must have been free from exposure to tuberculosis six weeks before the vaccination is performed. Children from tuberculous families who have been vaccinated are not permitted to associate with the source of infection at home until after they show a positive reaction. The details as to how the separation of these children from their homes is accomplished in Denmark are not given in this report.

The duration of the protection induced by the vaccination is considered in Denmark to coincide with the duration of the

positive tuberculin reaction. In that country, tuberculin testing is carried out extensively and uniformly. In recent years, BCG vaccination was applied to all tuberculin-negative soldiers in the Danish Army. The tendency now is to vaccinate all tuberculin-negative school children. In Denmark, BCG vaccination has apparently been accepted widely as a public health measure in tuberculosis prevention.

The data reported upon here indicate that BCG vaccination may be a valuable adjunct to other protective measures in tuberculosis work, especially for certain population groups. Also indicated is the need for continued research and for careful observation and evaluation of any BCG vaccination program.

SALLY PREAS

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INDIA'S POPULATION: FACT AND POLICY¹

IN our troubled world no people are more tragically ravaged by poverty, famine, and disease than are those of India. It is of these people that Dr. Chandrasekhar writes in his book *INDIA'S POPULATION: FACT AND POLICY*. The author introduces India's population problem as an example of too many births, too many deaths, and too many people subsisting at shockingly low levels of living. He focuses attention upon the underlying economic and social maladjustments of his native country, and offers a nontechnical description for the general reader.

The mean density of population for all India is not abnormal. Although parts of east Bengal have over 1,000 persons per square mile, India as a whole has a mean density of only 246 persons per square mile. This is five and one-half times the density of our United States but it is less than that of Germany, Japan, or England. The rate of growth of India's population likewise is not abnormal, but because of her giant population a modest 15 per cent rate of increase during 1931-1941 added fifty millions to her numbers within that time (p. 16).

The steady rate of growth and high birth rate of India during the last two decades are the results of social, religious, economic,

¹ Chandrasekhar, S.: *INDIA'S POPULATION: FACT AND POLICY*. New York, The John Day Company, 1946, 117 pp. \$2.00.