THE AGE DISTRIBUTION CURVE IN LEPROSY

By Fumio Hayashi
Keiaien National Leprosarium
Kagoshimaken, Japan

Leprosy censuses in Japan.—Every five years a leprosy census is taken in all of the prefectures of Japan, under the direction of the Home Department. The numbers of patients enumerated in the last four censuses are given in Table 1.

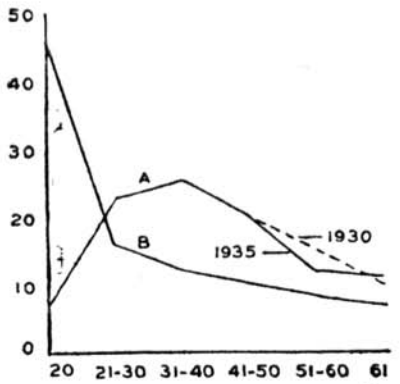
There was an increase in the total number enumerated in 1935 over that of the preceding census, in spite of progressive diminution from 1910 to 1930. This increase is ascribable partly to new patients who had not been registered before but who were admitted into the leprosaria, especially the new ones, as Aiseien, and partly to more careful surveys in some prefectures. The age-distribution curves of the last two censuses are given in Text-fig. 1. They show that there are more patients in the 31–40 year group than in the others.

Table 1.—*Findings of leprosy censuses in Japan.*

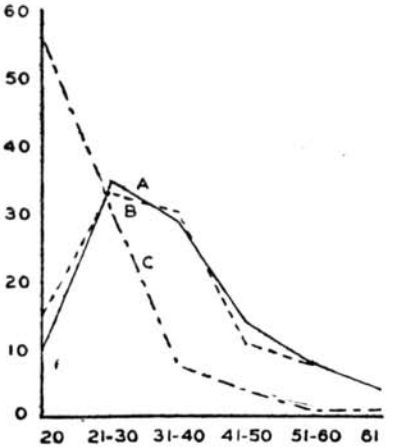
Year of census	Number of lepers	Average age years
1919	16,261	39.3
1925	15,351	39.5
1930	14,261	40.2
1935	15,193	40.0

Age distribution of patients in leprosaria.—The age distribution curves of patients in leprosaria are shown in Text-fig. 2, one curve being that of 2,865 inmates of Aiseien, examined in 1933, the other being that of 413 inmates of Keiaien, examined in 1936. In both curves the largest group is the 21–30 year one. It appears that there are proportionately more young lepers in the institutions than outside. The reasons for this fact are: (*a*) Young early cases are neglected outside; (*b*) Most of the old patients are neural or secondary neural and obstinately avoid hospitalization; (*c*) The younger lepers are less important in the household than the older ones and hence are more readily allowed to go to the leprosaria. (*d*) New cases often arise within the families of inmates and are soon diagnosed and admitted. The curves shown coincide with that of the Culion Leper Colony, from which

fact it appears that this tendency may be seen everywhere in the world.

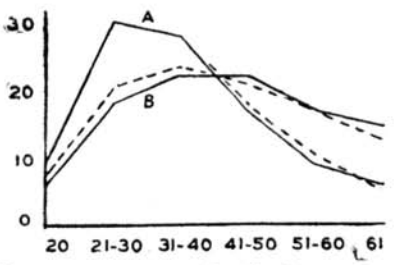


TEXT-FIG. 1. The age distribution curves of the leprosy censuses of 1930 and 1935 (A), compared with that of the whole population (B).

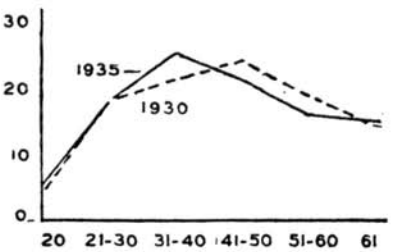


TEXT-FIG. 2. The age distribution of patients in leprosaria—Aiseien, (A) and Keiaien (B)—and that of ages of onset (C).

In Text-fig. 3 are shown the age distribution curves of (*a*) the lepers in the seven prefectures in which there are leprosaria, and (*b*) those in all the other prefectures. They are distinctly different, with higher figures for the young groups in the former. This fact is easily explained by the reasons just given.



TEXT-FIG. 3. Age distribution curve of the seven prefectures with leprosaria (A), and of those without leprosaria (B). Broken lines are of 1930, solid ones of 1935.



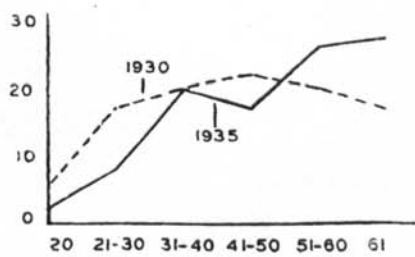
TEXT-FIG. 4. Example of a shift of the age distribution curve to the left; those for Shioku Island. Significance of lines as in Text-fig. 3.

Shifting of the curve.—The curves for all of the 46 prefectures of Japan were investigated to compare those of the 1930 and 1935 censuses, and were classified into three groups: (*a*) those in which the 1935 curves showed a shift of the peak to the left, (*b*) those that were unchanged, and (*c*) those with a shift to the right.

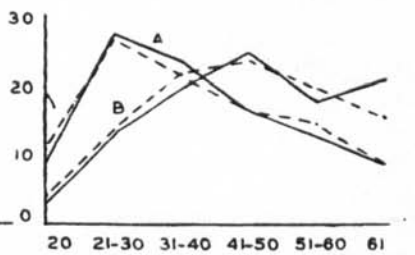
An example of a shift to the left is seen in the curves for Shikoku Island, which comprises four prefectures (Text-fig. 4). In the past there were many Buddhist pilgrim lepers there, and leprosy is prevalent, with 550 cases. The leprosarium in that region is too small to control the disease.

On the contrary, there is a shift to the right in the curve for Yamaguchi prefecture (Text-fig. 5). Antileprosy work is very active in this area and in the five years between the two censuses many patients were sent to institutions, chiefly Aiseien; the number of cases diminished from 328 to 138.

From these data it is clear that a shift of the age distribution curve to the left signifies an active endemic, while a shift to the right means a diminution of the endemic. There are some exceptions, of course. If there is a particularly active survey in one district, and new initial cases are found, the curve will shift to the left on that account, while if the authorities are negligent in the search for new cases there will be a shift to the right. There must, therefore, be caution in the interpretation of the shifting of the curves.



TEXT-FIG. 5. Example of a shift of the age distribution curve to the right; Yamaguchi prefecture.

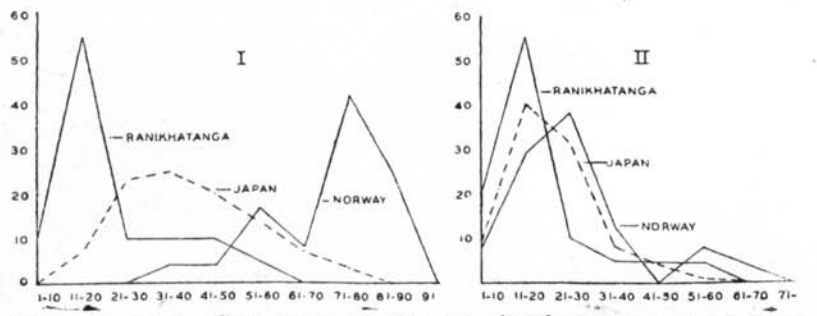


TEXT-FIG. 6. Age distribution curves of lepers in the prefectures of Okinawa (A) and Kagoshima (B).

Kagoshima and Okinawa prefectures.—These two prefectures are notorious for the prevalence of leprosy. In Okinawa the disease is the most dense in all Japan, with 977 patients in a population of 500,000 in 1935 (nearly 2 per thousand). In Kagoshima there are more lepers than in any other prefecture, with 1,081 patients in 1,500,000 population, though the incidence (about 0.7 per thousand) is much lower than in Okinawa. There is, however, an epidemiological difference between the two that was not noticed until after the opening of the Keiaien leprosarium. Entirely unexpectedly, the age distribution curves of the lepers in them are very different (Text-fig. 6). In Okinawa, where the

incidence is lower, the curve shows a higher proportion of young cases, while in Kagoshima there are relatively many old cases, which indicates a late stage of the endemic. The average age of the Okinawa patients is 38.2 years, while that of the Kagoshima patients is 47.1 years. As can be seen from a map of Japan, Kagoshima is the southernmost prefecture in Kyushu, and Okinawa is an archipelago lying between Kagoshima and Formosa. They are neighboring prefectures, and each has about one thousand lepers, but there are big differences between them from the epidemiological viewpoint.

Comparison of Norway and India.—A country which represents the last stage of endemic leprosy is Norway. A place in which the disease has been recently introduced is Ranikhatanga, a small village in the province of Bihar and Orissa, India, where Santra has made a splendid epidemiological survey and where he accompanied the author in 1933. This village of some 500 inhabitants was virgin soil for leprosy until 20 years ago, when a leper priest returned to it from a northern tea plantation. In the following 20 years the disease spread rapidly, numbering 20 patients in 1933.



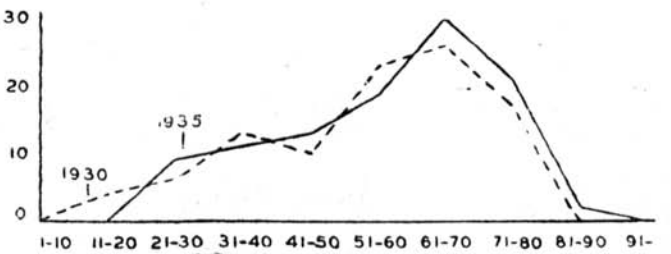
TEXT-FIG. 7. I. Comparison of the age distribution curves of Ranikhatanga (India), Japan and Norway. II. Comparison of the curves of age of onset of the same regions.

In Text-fig. 7, I, are shown the curves for these places and, for comparison, that of Japan as a whole; the last lies between the other two, which are extremely different.[1] In Text-fig. 7, II, are shown the curves of the ages of onset for these three regions. These also show shifting to the left or right in keeping with the curves for ages at the time of examination.

That there may be a continuation of the shift to the right

[1]Data on the actual ages and the ages of onset of the disease of the Indian patients were kindly supplied by Dr. I. Santra. Those for the ages of onset in Norway were obtained from Dr. R. Melsom.

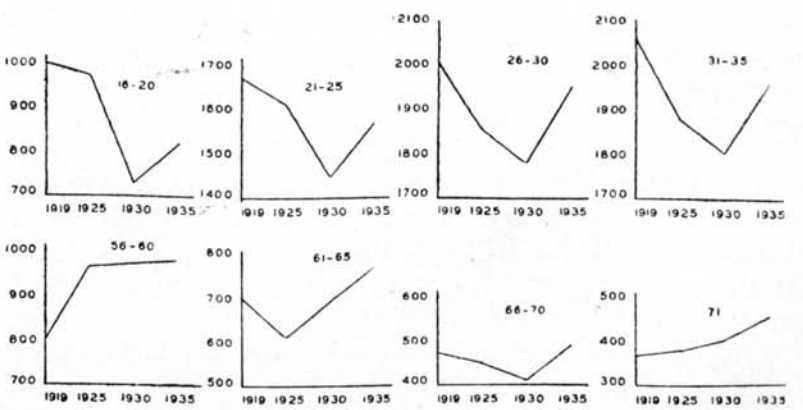
even after the curve has gone far in that direction is shown in Text-fig. 8, which represents the age distribution of Norwegian cases in 1930 and 1935. A decided change took place in that period.



TEXT-FIG. 8. Showing a continuation of shift to the right in Norway between 1930 and 1935.

Is the number of lepers in Japan increasing or decreasing?—It is well known that the medical statistics of military conscripts in Japan indicate that there is a progressive diminution of leprosy in the country. Though there are some mistakes in those statistics, the decrease from 600 cases found among conscripts in 1900 to between 100 and 200 found in 1935 is remarkable. It is a serious question why the numbers of lepers enumerated in the censuses have not decreased in the same way.

To investigate this question curves were made for each age group of the four censuses, and eight of them are shown in Text-fig. 9. These show that while the younger lepers are decreasing, as is indicated by the military statistics, the older ones are increasing. This is at least one reason why the total amount of leprosy in Japan has not decreased as rapidly as among



TEXT-FIG. 9. Curves showing the numbers of cases in several age groups as found in each of the four leprosy censuses.

the military conscripts. It is not a mistake to say that leprosy is decreasing in Japan, as shown in military statistics, but the author prefers to say that it is decreasing as the age distribution curve is gradually shifting to the right, as in Norway.

CONCLUSIONS

(1) The age distribution curves of the lepers enumerated in four recent censuses in Japan, and of others, have been investigated.

(2) In leprosaria the age distribution curve lies to the left, or approaches the curve of the age of onset, as compared with that of patients outside the institutions.

(3) On investigating the age distribution curve of the 46 prefectures in Japan successively in the four censuses it has been found that they can be divided into three groups: (*a*) those that have shifted to the left, (*b*) those remaining unchanged, and (*c*) those shifting to the right.

(4) Shifting of the age distribution curve to the right generally signifies a late stage, or decline, of the disease, while a shift to the left indicates the prevalence of it.

(5) This conclusion is confirmed by a comparison of the age distribution curve of Norway and of Ranikhatanga, in India.

(6) The curve of age of onset also shifts to the right or left in proportion to the shifting of the age distribution curve.

(7) Progressive shift to the right continues in the last stage of an endemic, as in Norway.

(8) Kagoshima and Okinawa prefectures each has about one thousand lepers, according to the official census. But the age distribution curves are absolutely different. That of Kagoshima has shifted to the right, while that of Okinawa has shifted to the left.

(9) The fact that the numbers of lepers enumerated in censuses in Japan do not decrease proportionately to the diminution of the numbers found among military conscripts is explained at least in part by a shift to the right of the age distribution curve for the whole country. There is a diminution of younger cases and an increase in the older ones.

(10) The age distribution curve is important in the epidemiological study in leprosy.