Classifying the Tuberculous for Isolation in California Mental Institutions

By WALDO R. OECHSLI, M.D., EDWARD KUPKA, M.D., M.P.H., and CHESLEY BUSH, M.D.

TUBERCULOSIS is a well-known scourge among the mentally ill. When a patient with active tuberculosis is admitted to a mental hospital, because of the nature of his mental illness, he may cough or expectorate only infrequently or not at all. He may be afebrile. He is not X-rayed and not diagnosed and thus becomes a focus of infection in the large confined population. Overcrowding in the past has sometimes been so severe that a patient often had to climb over another patient's bed to reach his own.

Such circumstances are ideal for transmittal of the disease; in time, the secondary cases infect others, and the vicious circle continues. This situation is due to a number of factors: lack of knowledge of who are the actively tuberculous individuals being admitted to a greatly overcrowded hospital population; the absence of an easy, practical method of discovering tuberculosis; incomplete segregation; absence of treatment for unrecognized cases; and the tendency of tuberculosis to become reactivated (*1*). The key underlying factor in the problem is the communicability of the disease.

Procedures for Control

Periodic X-ray surveys of the entire hospital population, including personnel, segregation of the tuberculous thus discovered, and instituting an X-ray program at admission have become the basis for the solution of this, one of the most serious remaining problems in the tuberculosis control field. In many States there is increasing evidence that this approach is successful in reducing the number of new cases discovered by annual X-ray surveys and in decreasing the intramural tuberculosis death rate.

A death rate of over 1,000 per 100,000 population among hospitalized mentally ill was not uncommon 20 years ago as compared with a rate of 56.6 per 100,000 among the general population in the United States in 1934. As more diagnosis, segregation, and treatment are effected, the rate in mental institutions is dropping. In 1948, Anderson (*2*) reported that the tuberculosis death rate for 682,251 patients in the mental institutions of this country was 535 per 100,000. Weber (*3*), in Toronto, reported a drop in the intramural death rate from 414 in 1938 to 182 in 1952. Katz and his coworkers (*4, 5*) in New York reported a decrease in death rate from 623.6 per 100,000 in 1935 to 252.4 in 1951, and they attributed this decrease to environmental factors, chiefly early diagnosis and segregation.

In the California hospitals for the mentally ill, the death rate rose substantially until 1946, to a peak of 800 per 100,000 resident population (table 1, fig. 1). Since 1946, when a continuing X-ray survey and segregation program started, the death rate among the mentally ill has dropped 65 percent—to 283 per 100,000. Among the mentally deficient, the death rate, which had generally been lower than among the mentally ill, has dropped to 29 per 100,000.

Dr. Oechsli is roentgenologist, bureau of tuberculosis control, California State Department of Public Health. Dr. Kupka is chief of the bureau, and Dr. Bush was formerly assistant chief.

Tuberculosis Classification for Isolation

Type A. Active and probably active; communicable.

Type B. Probably inactive; greater than minimal extent; potentially communicable; more likely to undergo reactivation than type C.

Type C. Strictly minimal in extent; inactive; presumably not communicable; reactivation considered unlikely.

Type D. Calcified primary lesions, parenchymal or hilar or both. Considered essentially negative.

Type E. Formerly suspected tuberculosis, now negative on film; probable nontuberculous pathology; calcified or thickened pleura only.

This favorable result is due largely to the aggressive case-finding and isolation program in effect.

Satisfactory as this decline may appear, much remains to be accomplished. Continuing persistent effort will be necessary. Instituting an X-ray program at admission and surveying a mental hospital once are not sufficient. Wherever repeated annual X-ray surveys have been carried out, it has been found that a certain number of new cases develop within the institution each year even among the apparently unexposed. In California, the first survey (*6*) revealed a prevalence of a tremendous number of unsuspected cases of tuberculosis. Later an annual survey incidence rate of about 1½ new active cases per 1,000 patients X-rayed was found (*7*). The true incidence rate is unquestionably higher than the survey incidence rate.

Deficiencies in Control

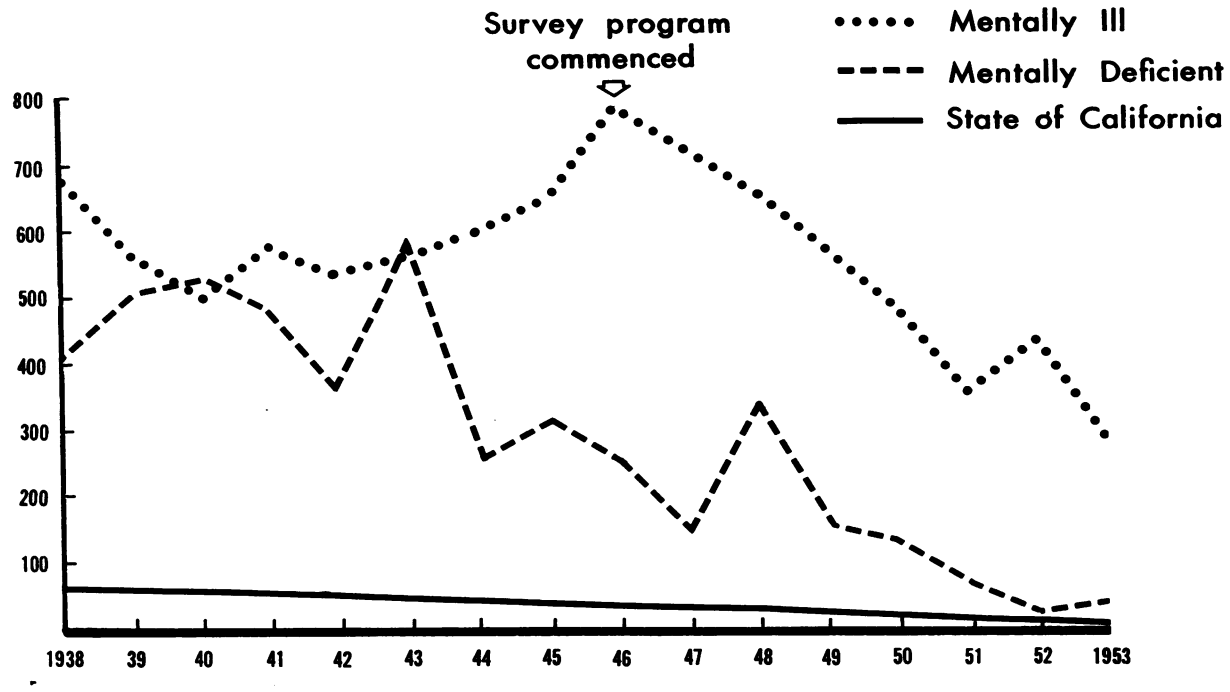
Granting the theoretical possibility of endogenous reinfection as a factor, in our opinion these new cases arise chiefly because of deficiencies in the control system. These deficiencies may be many, depending on the stress laid on the tuberculosis control program and the zeal with which control measures are applied. They include failure to take admission films on all patients; failure to include patients on parole; and the very ill, infirm, or disturbed patients in annual X-ray surveys; delay in discovering reactivation of tuberculosis through failure to X-ray periodically those with supposedly inactive disease; missing the diagnosis of active tuberculosis which is occasionally atypical in its manifestation; and too great dependence on demonstration of tubercle bacilli as a criterion for segregation.

Probably most important among these deficiencies is the occurrence of reactivation of

Table 1. Tuberculosis death rates per 100,000 in California mental institutions and in the State, 1938–53

Year	Mentally ill			Mentally deficient			State death rate
	Average daily population	Number of tuberculosis deaths	Death rate	Average daily population	Number of tuberculosis deaths	Death rate	
1938	21, 281	144	677	3, 723	15	403	60. 5
1939	22, 200	125	563	3, 840	20	521	57. 6
1940	22, 853	115	502	3, 950	21	532	56. 3
1941	23, 055	133	576	4, 279	21	491	51. 9
1942	23, 541	128	545	4, 547	17	363	50. 6
1943	23, 961	136	568	4, 738	28	591	45. 7
1944	24, 573	148	607	4, 782	13	272	43. 7
1945	25, 385	169	667	4, 951	16	323	43. 1
1946	26, 101	209	800	5, 078	13	256	41. 6
1947	26, 796	199	743	5, 326	8	152	34. 4
1948	28, 420	190	668	5, 741	19	331	31. 6
1949	29, 675	172	580	6, 205	10	161	26. 3
1950	30, 861	149	482	6, 467	9	139	21. 7
1951	33, 288	122	366	6, 541	4	70	19. 5
1952	32. 808	147	448	6, 600	1	15	15. 5
1953	34, 588	98	283	6, 828	2	29	11. 4

Tuberculosis death rate per 100,000 for mentally ill and mentally deficient in California institutions and for the State, 1938–53



disease in the unsegregated, supposedly inactive tuberculous patients (*8*, *9*). Despite the estimate that the tuberculosis in these patients had been considered as inactive, routine X-rays on 14″ x 17″ films made at the time of annual X-ray surveys showed that unsuspected reactivation had taken place in a certain proportion of such patients. Reactivation was judged by one or more of the following criteria: (*a*) cavitation where none had existed; (*b*) infiltration in a new area; or (*c*) definite increase in density of certain areas of infiltration. Since laboratory aids were often unavailable, it was necessary to make careful comparison of chest X-rays of comparable technical quality before this conclusion was felt to be justified, recognizing that the securing of comparable films on mentally ill persons requires care and patience.

Laboratory confirmation of activity is, of course, more dependable and a more definitive proof of pathological activity. However, such proof was not always available, and conditions had to be dealt with as they were.

It has been said that dealing with the mentally ill, in diagnosis at least, has some of the characteristics of pediatric or veterinary medicine. Often, the patient will not be able to give reliable information regarding his symptoms or cooperate in producing sputum. Add to this the shortage of personnel, especially laboratory technicians, and it becomes necessary to depend heavily upon X-ray findings, even when only a single chest film is available. However, when one has a series of chest X-rays of comparable technical quality, activity of the disease process can often be inferred by changes inter-

Table 2. Reactivation or progression of known tuberculosis among unsegregated mentally ill patients as observed by annual X-ray surveys in California mental institutions, 1947–54

Survey year	Number of patients X-rayed (14″ x 17″ films)	Tuberculosis reactivation or progression	
		Number	Percent
1947–48	261	32	12.3
1948–49	221	19	8.6
1949–50	370	24	6.9
1950–51	410	35	8.5
1951–52	516	26	5.0
1952–53	608	27	4.4
1953–54	597	33	5.5

preted as evidence of progression of disease, as noted above.

As part of the second of the California surveys in 1947–48, 261 unsegregated patients with presumably inactive tuberculosis were X-rayed (table 2). Of these, 32 (12.3 percent) presented X-ray evidence of progression of disease. In subsequent surveys, the percentage of those showing progression dropped to less than half of this ratio. Nevertheless, a ratio of 1 in 20 unsegregated, apparently safe, tuberculosis patients suffering reactiviation each year is surprisingly large, dangerous to nontuberculous patients and personnel, and calls for corrective action.

Resolving the Problem

The most nearly complete solution of the problem would seem to be the segregation of all patients diagnosed as tuberculous, regardless of extent of disease or its activity status. This alternative is open to objections. It is too restrictive for the patients who have had arrestment of their disease for many years, and neither isolation space nor additional personnel are available. Other than a laissez-faire policy, the alternative was to appraise the criteria for segregation.

Two solutions presented themselves. Since the crucial factor in communicability of tuberculosis is the presence of tubercle bacilli, it appears logical to base a decision for segregation on the demonstrated presence of the organism in the sputum or in gastric or tracheal washings. Laboratory investigation certainly should be made regularly and frequently. However, it appeared unwise always to await bacteriological proof before segregating a patient with tuberculosis, since a given patient's findings might be negative today and positive tomorrow. Since examination by culture and guinea pigs takes weeks, the hazard of exposure exists for that period of time. Furthermore, laboratory technicians and other needed personnel were not available, and it often was not possible to carry out even a minimum laboratory investigation. Also, it was difficult, and at times impossible, to intubate some of the patients, and dependence on such clinical findings and symptoms as fever, loss of weight, and cough is notoriously unreliable. In some cases tuberculin testing ruled out tuberculosis; however, the small percentage of the mentally ill who are negative to tuberculin minimizes the value of this test.

For these reasons, the other possible solution was utilized—serial chest X-ray examinations. As a starting point we again examined the X-rays of every mental institution patient who had ever had a diagnosis of tuberculosis or suspected tuberculosis. Some patients had only one film, most patients had several, and quite a few of long residence had dozens of films each. The serial films were supplemented by any available sputum studies, skin tests, or clinical evidence. On the basis of this film reappraisal, an arbitrary decision was reached in each instance. If the patient was still considered tuberculous, a further decision on segregation had to be made.

Some type of classification was needed to designate those who should or need not be segregated. The requirements were to categorize patients not by extent or activity of disease alone but by actual or potential communicability. The classification of the National Tuberculosis Association was not suitable for this study for two reasons: "Arrested" under certain circumstances permits a positive sputum by the more delicate tests, and "inactive" includes cases which still have a potential of reactivation high enough to be of great importance in mental hospital populations. Hence, a new classification was created to designate three groups—currently communicable, potentially communicable, and probably not communicable (types A, B, C).

Type A. The finding of tubercle bacilli by any method automatically places a patient in this category regardless of the X-ray appearance. In the absence of positive sputum findings, the chest X-rays must present the findings characteristic of recent, active tuberculosis: soft, exudative, caseous pneumonic or soft, miliary infiltration, or cavitation. Reactivation or extension of infiltration or the appearance of cavity in a recent film also calls for a type A classification. All these patients are presumed to have communicable disease and are strictly segregated. They also are as vigorously treated as their cooperation permits.

Type B. Chest X-rays of patients in this

group give an impression of relative or definite inactivity. Cavity must not be present or suspected. Bullous blebs, of course, must be differentiated. The sputum must be negative by any type of investigation; if it has been positive in the past, it must have been negative for at least 1 year. The infiltration is more or less discrete and fibrotic and may be calcific. There may be sharply circumscribed, dense areas usually associated with encapsulated, caseous lesions. If the disease has been active in the fairly recent past or if of longer standing it is more extensive than minimal, these patients are presumed to present a potential communicability hazard. Segregation, however, need not be quite as strict as for type A patients. They may leave the ward, if attended and supervised, for treatments, motion pictures, beauty parlor, or barber shop. Nevertheless, they should be X-rayed every 3 months and, if possible, sputum examinations or gastric lavage performed periodically every 3 months. Their diet should be adequate. They receive whatever psychiatric treatment is indicated, but they need no treatment for tuberculosis.

Type C. This group includes only those in whom reactivation of tuberculosis is considered quite unlikely. The infiltration must be stable, very discrete and fibrotic or fibrocalcific and of small extent, with no evidence of activity for several years. A sharply circumscribed tuberculoma less than 2 cm. in diameter may be present, if not of recent origin. The laboratory findings, of course, must be negative. These patients are not segregated, but care is taken that they are not lost to observation and they are X-rayed every 6 months. Their psychotherapeutic needs are cared for in the same way as the hospital population generally. If they are to be allowed to work, medical permission is required.

Type D. Calcified primary lesions, which are often hard to differentiate from fibrocalcific minimal reinfection tuberculosis, are placed in this category. Although some of these patients had in the past been included in the tuberculosis register in some hospitals, they are considered here as essentially negative and removed from the register. During the annual X-ray surveys, they are filmed along with the rest of the presumably negative patient population.

Type E. Various miscellaneous patients who sometime in the past were put on the tuberculosis register, but who in all probability were not tuberculous, were also reviewed and placed in this category. They included:

1. Those in whom tuberculosis had been tentatively diagnosed, or in whom infiltration of the lung fields had been observed, but in whom current chest films show completely clear lung fields.
2. Those with infiltration of the lungs once tentatively believed tuberculous. By location or progress, the infiltration seems more characteristic of some nontuberculous condition, particularly suppuration of the lung or bronchiectasis, or coccidioidomycosis.
3. Those with infiltration of the lungs which do not seem typical of tuberculosis, though this cause has not been absolutely ruled out. Great caution should be used in evaluating this group.
4. Those with thickening or calcification of the pleura of undetermined origin, in whom no parenchymal lesions are demonstrable.

Those in categories E-1 and E-4 require no further attention other than inclusion in annual X-ray surveys. Those in categories E-2 and E-3 require continuing clinical and laboratory study until a diagnosis is reached.

Using the Classification Scheme

In the course of this review, we studied over 3,000 sets of chest X-ray films in 11 California State mental institutions in collaboration with the staff physicians in the hospitals. Each case was reviewed; the chest X-rays were carefully studied; and clinical data and available laboratory data were weighed. Decision as to classification rested largely on the serial X-ray films, however, because of the sparseness of clinical and laboratory data.

In 2,915 (85 percent of the 3,443 cases studied) the original diagnosis of tuberculosis seemed valid (table 3). Of the 2,915, 32 percent, or 923, were classified as type A. These constituted the most important group of patients needing strict segregation and active treatment. An additional 832, 28 percent, were classified as type B. This group of patients is considered almost as important as the type A patients. Be-

Table 3. Classification and disposition of mentally ill and mentally deficient patients with known or suspected tuberculosis in California institutions, 1953

Category	Type A		Type B		Type C		Type D		Type E		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Mentally ill	841	28	777	25	1,024	33	87	3	351	11	3,080	100
Male	572	30	446	23	638	33	54	3	220	11	1,930	62
Female	269	23	331	29	386	34	33	3	131	11	1,150	38
Mentally deficient	82	23	55	15	136	37	23	6	67	19	363	100
Male	41	21	29	15	78	40	11	6	34	18	193	53
Female	41	25	26	15	58	34	12	7	33	19	170	47
Grand total	923	27	832	24	1,160	34	110	3	418	12	3,443	100
Total diagnosed as tuberculous	923	32	832	28	1,160	40	------	-----	------	-----	2,915	100
Total recommended for segregation	923	53	832	47	------	-----	------	-----	------	-----	1,755	100
Total tuberculous but not segregated	------	-----	------	-----	1,160	100	------	-----	------	-----	1,160	100
Total removed from register	------	-----	------	-----	------	-----	110	21	418	79	528	100

cause they have fewer symptoms, negative sputum, and an unchanging X-ray appearance, there is a strong tendency to consider these patients as inactive and, therefore, innocuous. The danger lies in the fact that reactivation (table 2), often unnoticed in the mentally ill, occurs distressingly often in this group of patients. If reactivation does take place, it is usually not discovered until the patient is X-rayed again. If he is not segregated during this period, many nontuberculous patients are exposed to infection. It is important, therefore, that the patients classified as type B should be segregated. Psychiatric treatment is given, of course, as needed.

The remaining 1,160, 40 percent, were classified as type C. This group was restricted, by definition, to those whose tuberculosis appeared very unlikely to reactivate because of its slight extent and fibriotic-appearing character over a long period of time. These patients were not segregated. However, since the estimate of the stability of disease could be in error, these patients should be X-rayed every 6 months instead of annually. Laboratory check is not needed unless the character of the disease changes.

Three percent, 110, of the 3,443 patients studied had findings which were judged as probably due to calcified primary lesions, hilar or parenchymal, or both (type D). Little or no skin testing was done on these patients. The lesions may have been due to coccidioidomycosis or histoplasmosis. These patients were considered as essentially negative and were, therefore, removed from the register.

Twelve percent, 418, of the 3,443 were placed in one or another of the categories under type E. Some of these cases still presented diagnostic problems; others could be considered as nontuberculous.

During and after this review of all tuberculosis patients in the mental institutions, the centralization of tuberculosis patients into a few institutions went on as rapidly as possible. A 500-bed tuberculosis hospital was completed at Patton State Hospital to care for tuberculosis patients from the southern part of California. At Napa State Hospital, a tuberculosis unit houses 240 patients. A 460-bed addition is being constructed there for tuberculosis patients from the central and northern part of the State. Until this addition is completed, tuberculous patients are being cared for at DeWitt State Hospital also. The tuberculous mentally deficient patients have been centralized at Sonoma State Hospital where a 120-bed tuberculosis hospital was built 3 years ago. The numbers of mental patients from which these tuberculous are drawn, in the above regional and type categories, were: mentally ill patients, southern California—13,000; mentally ill pa-

tients, central and northern California—22,000; mentally deficient patients, 7,400.

All patients classified as type A or type B were segregated and transferred to these tuberculosis centers. Type C or type D patients were not segregated nor moved from their wards or institutions. Patients classified as type E were studied further if a diagnostic problem existed. Otherwise, they remained in the general mental hospital population.

Summary and Conclusions

Tuberculosis is still a serious problem of frequent occurrence among the mentally ill and mentally deficient. A program of X-ray of all admissions and periodic X-ray surveys plus segregation are the first requirements in control. However, segregation of patients with active tuberculosis does not entirely meet the problem. Tuberculosis often undergoes reactivation, and, in the mentally ill patient, this fact often goes unnoticed until revealed by X-ray. Segregation of all patients diagnosed as tuberculous, regardless of extent or status of disease, appears impracticable.

The classification of the National Tuberculosis Association is not suited to the needs of mental hospital populations. A new classification has been created, based on the appearance of X-rays plus available laboratory or clinical data. This classification designates three groups, currently communicable (type A), potentially communicable (type B), and unlikely to reactivate (type C). Two additional groups were designated: those with only calcified "primary" lesions (type D) and those once designated as suspects with probable nontuberculous pulmonary disease (type E).

In a review of the case histories and films of 3,443 mentally ill and mentally deficient patients with tuberculosis or suspected tuberculosis in California mental institutions, 27 percent were considered as communicable and were classed as type A; these patients were segregated and treated. Another 25 percent of the patients were considered as potentially communicable and were classed as type B; these patients were segregated but not treated. Thirty-three percent were considered as noncommunicable and not likely to suffer reactivation and were classed as type C; these patients were neither segregated nor treated. A few patients (3 percent) were diagnosed as having only calcified "primary" lesions, and were considered, in effect, as nontuberculous and were classed as type D; these patients were removed from the tuberculosis register and were handled as other nontuberculous mentally ill patients. Eleven percent of the patients reviewed had X-ray evidence of pulmonary pathology which was considered as probably nontuberculous; these were classed as type E and only a few undiagnosed problem cases in this group are still being segregated.

REFERENCES

(1) Kupka, E.: Problem of tuberculosis in California State hospitals. California & West. Med. 61: 96–98, August 1944.

(2) Anderson, R. J.: Tuberculosis problems in mental hospitals. Ment. Hosp. 3: 4–5, March 1952.

(3) Weber, J. J.: Tuberculosis control in Ontario mental hospitals. *In* Medical papers of the Canadian Tuberculosis Association. Ottawa, The Association, 1953.

(4) Katz, J., Kunofsky, S., and Locke, B. S.: Tuberculosis morbidity and mortality among mental patients as compared with the general population. Am. Rev. Tuberc. 70: 32–48, July 1954.

(5) Katz, J., Plunkett, R. E., and Brill, H.: The control of tuberculosis among patients in mental institutions—A 10-year report. Psychiatric Quart. 28: 1–8, July 1954.

(6) Oechsli, W. R.: Tuberculosis control program of nine California mental institutions. Pub. Health Rep. 64: 4–16, January 1949.

(7) Oechsli, W. R.: Tuberculosis resurveys of patients in California mental institutions. Pub. Health Rep. 69: 560–568, June 1954.

(8) Crawfis, E. H., Kupka, E., and Oechsli, W. R.: Tuberculosis control in California mental hospitals. California Med. 79: 390–393, November 1953.

(9) Oechsli, W. R.: Significance of tuberculosis among the mentally ill. Med. Times 83: 24–28, January 1955.