Tuberculosis is still one of the major health problems affecting all peoples of the civilized world. It remains the leading cause of death in our most useful and productive age groups. It is a disease which, in mild or severe form, affects at least half of the human race. Tuberculosis is responsible for fully one-seventh of all deaths, and kills about one-third of those who perish between the ages of 15 and 45. It is so ruthless that it causes twice as many deaths as automobile accidents, commonly thought to be the greatest "killer."

Tuberculosis is most insidious in its onset and often relentless in its course. However, it is a disease which may be largely prevented if we merely cease our indifference, our inactivity, and our unholy procrastination. It is true that some few have worked so diligently as to reduce the mortality rate from 200 annual deaths per 100,000 population in 1900, to the present rate of less than 60 deaths per 100,000 population, an average applicable to the general whole age group. Encouraging as this may seem, we have not yet reached our goal of bringing the disease under control, for the morbidity and mortality rates are still first in the economic and productive age groups.

To enumerate all the weapons which must be employed in the control of this disease is beyond the scope of this paper, our desire is rather to bring to attention the pertinent facts concerning control and eradication. The foremost factor of this problem appears to be the simple matter of diagnosis—early diagnosis—followed by prompt and adequate treatment. Proof of this statement is attested by the fact that ninety per cent of the early cases recover and return to their former economic status when diagnosis and treatment are not delayed.

To overcome tuberculosis we must find the patient in a curable stage. The question of early diagnosis and treatment is often made complex by both the patient and the attending physician, because the patient is first seen by the general practitioner or family physician. As a result it is usually weeks and oftentimes months before the patient reaches the sanatorium or takes adequate treatment elsewhere. Thus, the problem of eradicating tuberculosis in a community comes to be the concern of general practitioner and family physician. It would, however, be quite unfair to place the full responsibility of this problem on the physician. Far too many patients delay seeking medical advice and care because the early warning symptoms are usually mild in nature and are hardly noticeable. These symptoms may include cough, loss of weight, fatigue, and gastro-intestinal disturbances. But, in the imperfect estimation of the patient, they are negligible and do not demand medical attention. This delay in diagnosis can be fixed, of course, and can be charged to the ignorance and negligence of the patient. For this we can make a certain allowance. After the patient with one or more subjective symptoms visits the physician there is a division of responsibility as far as the end-result is concerned. The physician must make a definite diagnosis and outline a plan of treatment. The patient must accept the diagnosis and adequately follow the plan of treatment. Courage and persistence are essential.

In reviewing four hundred histories of the Woodmen of the World Hospital it was found that 289, or 71.7 per cent of the patients did not think their symptoms serious enough to warrant a visit to the physician. The time factor from the appearance of symptoms to the first visit to the physician varied from three months to two years or more. Certainly, this delay on the part of the uninformed calls for an intensive campaign in educating the public relative to the common symptoms of tuberculosis and the urgent need for early diagnosis.

In a study by Sedar entitled "The Cost of Tuberculosis with Special Reference to Adequacy of Medical Care and Treatment," it
was found that 261, or 74.7 per cent of the 361 patients were in the advanced stages, and that the cost of institutional treatment for 300 patients in the first, second, and third stages was $523, $873, and $1,113 respectively.

For three hundred patients there was an aggregate expenditure of $261,780. If the patients had been admitted to an institution while in the first stage, the cost would have been $159,690, a saving of $102,180. Such is the price of delay.

Total wage losses for the first, second, and third stages were $596, $979, and $1,251 respectively, while the combined cost of hospitalization and wage loss was $1,128, $1,852, and $2,369 for first, second, and third stages.

The Texas Tuberculosis Sanatorium in its clinical report of 1936-37, shows 2,253 patients admitted. Of these 3.9 per cent were classified as Minimal; 79.6 per cent were Advanced; 16.5 per cent were Non-Tuberculous and Childhood Tuberculosis.

In the Woodmen of the World Hospital we find that on admission patients were classified as Minimal, 10.6 per cent; Advanced, 76 per cent; Non-tuberculous and other conditions, 13.4 per cent.

The statistics of these two institutions show that the advanced stage predominates, a condition which should not exist, and which could be prevented to a great extent by education of the public and by earlier diagnosis.

We have kept careful records of the 2,798 patients who have come under our observation in the past fifteen years, both during residence and after discharge. In case of death a notice is sent us at San Antonio, from the Home Office at Omaha, giving the cause of death as recorded on the death certificate. This information provides us with genuine knowledge as to whether the patient is living or dead.

The end-results of these 2,798 discharged patients are expressed in terms of "Living" and "Dead," according to the stage of the disease. In the respective stage groups we have living, 91.8 per cent in the first; 70.6 per cent in the second; and 37.9 per cent in the third. These figures confirm the oft repeated statement that "Early Diagnosis means Early Recovery and Lasting Results."

In studying the application diagnoses of 2,550 patients sent to the Woodmen of the World Hospital we have found a wide discrepancy in the diagnoses made by the physicians who signed the applications and those we made after admitting the patients.

The application diagnoses made by physicians showed 664 early cases; 1,564 moderately advanced; and 322 far-advanced. After making a painstaking study of these cases, by employing physical, x-ray, and laboratory examinations, we found that the 664 "early" cases were to be reclassified as 145 minimal, 250 moderately advanced and 143 far-advanced. The reported 1,564 moderately advanced were classified by us as 134 minimal, 608 moderately advanced, and 673 far-advanced. Among the 322 far-advanced cases, as shown by application, we found 12 minimal, 72 moderately advanced, and 222 far-advanced. We also found that 8.8 per cent of the applying diagnoses were either non-tuberculous or else the patient was suffering from some other acute or chronic respiratory disease. Thus, one can see that under-diagnosis of tuberculosis is quite a serious matter.

Unfortunately, we find a similar problem among enthusiastic workers who are prone to over-diagnosis. A few years ago Lewison of Chicago wrote:

"Since the beginning of the anti-tuberculosis campaign about twenty-five years ago, two thoughts have dominated the medical profession in the promotion of this crusade. The first was to diagnose tuberculosis as early as possible; the second was to suspect it in every chronic pulmonary disease. Although the results have been very satisfactory by reducing the mortality of this disease over 50 per cent, this period of over-enthusiasm displayed, especially by those actively interested in this disease, has caused many non-tuberculous conditions to be diagnosed as tuberculosis. Another cause of this is that symptoms of many other diseases simulate those of tuberculosis. Practically all tuberculosis sanatoria have cases of non-tuberculous disease."

Canada's beloved Stewart likewise understood the importance of a balanced diagnosis in pulmonary tuberculosis. In one of his many enlightening articles he wrote:

two flappers discussing their respective medical advisors decided they were of two types familiar to all of us, and, of which, we know many honoured representatives, one a 'pooh-pooh-er,' the other a 'wind-up-er.' In relation to tuberculosis, the 'pooh-pooh-er,' the man who habitually under diagnoses, who has comfortable words of Peace! Peace! when there is no peace, was a tremendous nuisance twenty years ago and still survives. But the man who habitually over-diagnoses, who 'gets his patients' wind up' without sufficient cause is more numerous than he used to be, and something of a nuisance also.

"The 'pooh-pooh-er' has many alibis. He has known the family all his life and there has been no tuberculosis on either side of the house. 'The girl looks as well as she ever did. Her chest is sound as a bell' (upon a half-minute examination with a defective stethoscope, and through underclothing). Blood? Doubtless from the throat. Pain? A little pleurisy, nothing like tuberculosis. Cough? Merely a cold; everybody has colds; or 'flu' hanging on a bit. Spring will clear it up. Fatigue? Not enough exercise; she should get out more.' He will think and talk of everything possible before and besides tuberculosis. He simply wouldn't take the responsibility of suggesting tuberculosis to this frail little woman; the shock would be enough to kill her. Bacilli? Laboratory men make many mistakes. Anyway even if it is tuberculosis, nearly everybody has it. Why worry?

"The 'wind-up-er,' who is inclined to over-diagnose tuberculosis, is nervous and apprehensive. He heard a rale, or thought he did, somewhere in the chest; or dullness has been defined, or at least suspected; or, there was a speck of blood a little larger than a pinhead; or there has been a cough for a week. Plates show some dirtiness somewhere. There has been a positive Von Pirquet reaction. A few pounds of weight have been lost. The reason must be tuberculosis and the prognosis must be grave.*

Thus, it has been shown that our problem not only involves making the diagnosis early, but also making it accurately. There are non-tuberculous diseases of the chest that simulate pulmonary tuberculosis and have to be differentiated. Between under-diagnosis and over-diagnosis there is a happy medium of right-diagnosis, and if searched for earnestly and sincerely, it will be found.

**Diagnosis of Pulmonary Tuberculosis**

Prompt discovery of tuberculosis is the alpha and omega of attack toward a cure. Early diagnosis does not depend on any one method. In one case a physical examination may be used for the diagnosis. In another case it may be the history, x-ray, or laboratory examination. To establish the diagnosis of tuberculosis, or any other chest disease, a combination of the following factors is necessary:

1. Careful history.
2. X-ray examination.
3. Complete physical examination.
4. Laboratory examination, consisting of sputum, sedimentation rate, and diagnostic tuberculin.
5. Time.

**History**

As Pottenger has said, "The clinical history ... is the foundation on which the diagnostic edifice is to be built." A careful history leads to diagnosis and determination of active disease. Stress is laid on a well developed and well recorded history for the obvious reason that symptoms of pulmonary tuberculosis in the early stages do not vary much from normal, and receive little consideration from the patient. After listening to the patient's complaint, and concluding that it points to lung disease, the physician must then develop the history of symptoms peculiar to tuberculosis.

There are seven common symptoms associated with advancing tuberculosis, and their presence warrants investigation as enumerated. They are:

1—Unreasonable fatigue: A person completely exhausted after ordinary work or play may be suffering with tuberculosis.
2—Cough: An habitual husky throat, a cough which persists for weeks, a "chest cold" or a cold which simply will not clear up—all are common warning symptoms.
3—Indigestion: Persons with failing appetites and those who lose interest in food after a few mouthfuls, or who suffer what

is commonly called "indigestion," certainly should take heed of their symptoms and look to their lungs.

4—Loss of weight: A consistent loss of weight without known cause may be a sign of approaching tuberculosis.

5—Pain in the chest: Especially a dull pain between the shoulder blades needs the attention of a physician.

6—Irritability, (often a complaint, and diagnosed as "neurasthenia" or "nervous breakdown"), should arouse suspicions of tuberculosis.

7—Hemoptysis or Pleurisy: These should be considered due to pulmonary tuberculosis until proven otherwise.

The appearance of one or more of these symptoms should lead the physician to look for tuberculosis.

X-ray Examination

X-ray examination is next in importance to the history, and the examiner should make it a rule to take at least one film of the chest before advising the patient that he does or does not have pulmonary tuberculosis.

Physical Examination

Physical examination is necessary in the diagnosis of tuberculosis, and the physician should never hurry. Inspection, palpation, percussion, and auscultation should be carried out step by step and in the order mentioned.

Physical examination cannot be learned by reading a book or by listening to a paper. Actual practice is necessary before one acquires the requisite skill for examining, and physical examinations are important enough to justify any effort put forth in acquiring such skill.

Laboratory Examination

The value of persistent search of the sputum for tubercle bacilli cannot be over emphasized. It is our practice to make nine sputum examinations including concentrations upon each patient at admission before a negative report is given. These cases also have additional sputum examinations at periodic intervals during their stay at the hospital. An elevated sedimentation rate is indicative of an infectious process and should prompt one to search for pulmonary tuberculosis.

The tuberculin skin test is of the utmost importance in diagnosing adult tuberculosis in patients with negative physical, x-ray, and laboratory examinations. Often it will produce an exudative reaction in the lung, thereby definitely establishing the diagnosis at an early stage.

Time

The element of time must be stressed, for the physical signs in early tuberculosis are evanescent, and repeated examinations may be required to establish the diagnosis. A most important feature in the suspected tuberculosis patient is keeping him under close observation to pick up the first definite sign to make its appearance.

Differential Diagnosis

There are many common diseases, both pulmonary and non-pulmonary, that simulate tuberculosis and must be differentiated from it. Lack of space forbids a discussion of these several conditions, but those most often encountered are:

1. Primary carcinoma.
2. Hyperthyroidism.
4. Pulmonary abscess.
5. Fungus diseases.
7. Silicosis.

Case Histories with X-rays

The following cases, with which we have had experience in the Woodmen of the World Hospital, will demonstrate the importance of the various factors in diagnosis and treatment of early tuberculosis. The x-rays emphasize the importance of early diagnosis, while the clinical photographs illustrate the value of early and adequate treatment.
Case 1, Fig. 1, V. R.
EARLY TUBERCULOSIS
Case 1, Fig. 1, V. R., aged 22, female. Good health to September, 1935, when she became highly nervous and irritable. Cried on slight provocation. In October, 1935, she developed pain in the right chest. This was followed by slight cough and expectoration. Physical and sputum examinations were negative for tuberculosis. X-ray shows definite tuberculous infiltration in the right second interspace. The diagnosis was made on history and x-ray.

Case 2, Fig. 2, P. P.
EARLY TUBERCULOSIS
Case 2, Fig. 2, P. P., aged 34, male. On examination for employment the diagnosis was made by x-ray in April, 1938. History of malaise, cough, loss of weight, and night sweats in October, 1937. On admission to the Hospital in June, 1938, there were no symptoms of pulmonary tuberculosis. Physical and sputum examinations were negative. X-ray revealed infiltration in the first interspace of the right lung. Our diagnosis was made on history and x-ray.

Case 3, Fig. 3, B. S.
EARLY TUBERCULOSIS (Negative X-ray)
Case 3, Fig. 3, B. S., aged 30, male. Good health to November, 1937, when he had a pulmonary hemorrhage, followed by productive cough, loss of weight and strength. On admission to the Hospital he had the common symptoms of pulmonary tuberculosis. Physical and x-ray examinations were negative, but the sputum was positive for tubercle bacilli.
Case 4, Fig. 4-a, H. McD.

SUSPECTED TUBERCULOSIS

Case 4, Figs. 4-a, 4-b, 4-c, H. McD., aged 24, male. Was in good health to November, 1937, when he developed pain in the left chest, followed by productive cough, malaise, and loss of weight. When admitted to the Hospital the physical and sputum examinations were negative, but x-ray revealed a suspicious lesion adjacent to the left hilum (Fig. 4-a).

Case 4, Fig. 4-b, H. McD.

EXUDATIVE REACTION AFTER TUBERCULOSIS

An intracutaneous test of tuberculin (P. P. D. .005 mg.) was given. This was followed by physical and x-ray examinations. The x-ray (Fig. 4-b) shows an exudative lesion extending from the left hilum into the second interspace.

Case 4, Fig. 4-c, H. McD.

HEALING OF EXUDATIVE LESION

Six months after admission to the Hospital the x-ray (Fig. 4-c) shows healing and resolution. The diagnosis in this case was made on tuberculin, x-ray, physical examination, and history.
Case 5, Fig. 5-a, F. C.
SUSPECTED TUBERCULOSIS
Case 5, Figs. 5-a, 5-b, F. C., aged 33, male. Productive cough, pain in chest, loss of weight and strength, following an attack of influenza in October, 1937. On admission to the Hospital he had all of the common symptoms of pulmonary tuberculosis. The sputum examination was negative, but fine crackling rales were heard over all of the right lung. The film (Fig. 5-a) showed suggestive infiltration in the hilum and first interspace. Diagnostic tuberculin (P. P. D. .005 mg.) was given. This was followed by local, focal, and constitutional reactions. The second film (Fig. 5-b) showed an exudative lesion in the apex, first and second interspaces, on the right side. The diagnosis of tuberculosis was made on history, physical examination, and tuberculin reaction.

Case 5, Fig. 5-b, F. C.
EXUDATIVE TUBERCULOSIS—Right Apex.

RESULTS OF SANATORIUM TREATMENT

Case 6, Fig. 6-a, O. N. S.
PHOTOGRAPH ON ADMISSION TO HOSPITAL
Case 6, Figs. 6-a, 6-b., O. N. S., aged 38, male. Entered the Woodmen of the World Hospital May 26, 1939. The chief complaint was productive cough, hemorrhage, and loss of strength. He weighed 150 pounds. Fine crackling rales were heard over the apex of the left lung, and a diagnosis of incipient pulmonary tuberculosis was made. This patient spent twenty months in the Hospital and was discharged arrested. Weight on discharge was 198 pounds. The photographs were made on admission and discharge.

Case 6, Fig. 6-b, O. N. S.
PHOTOGRAPH ON DISCHARGE FROM HOSPITAL
Case 7, Fig. 7-a, T. U.
PHOTOGRAPH ON ADMISSION TO HOSPITAL

Case 7, Figs. 7-a, 7-b, T. U., aged 57, male. On entering the Hospital September 9, 1936, this patient weighed 138 pounds (Fig. 7-a). He complained of productive cough, malaise, loss of appetite and weight. There was an early lesion in the upper lobe of the right lung. After nearly ten months' treatment he was discharged as apparently arrested, and weighed 185 pounds (Fig. 7-b).

RESULT OF ACTIVE TREATMENT

Active treatment implies the use of surgery. The thoracic surgeon of today is a great ally of the chest specialist. During the past decade thoracic surgery has come to the fore-front in the treatment of advanced open cases. Many cases that were formerly considered hopeless are now being restored to health and economic independence by surgery. Passive treatment, or bedrest, is effective in 90 per cent of the early cases, but is insufficient in the advanced stages. The following case illustrates the value of active treatment.

Case 8, Fig. 8-a, A. P. P.
UNRESOLVED TUBERCULOSIS PNEUMONIA—Right

Case 8, Figs. 8-a, 8-b, A. P. P., aged 47, male. Had pneumonia in January, 1938, and failed to recover. On admission to the Hospital March 12, 1938, his chief complaint was productive cough, fever, malaise, loss of appetite and weight. Fine rales were heard over the upper two lobes of the right lung; the sputum contained tubercle bacilli. Pneumothorax was instituted immediately. The second film (Fig. 8-b) shows an excellent collapse, and there has been a gain of 23 pounds.

Case 8, Fig. 8-b, A. P. P.
PNEUMOTHORAX—GOOD COLLAPSE
Artificial pneumothorax is frequently unsuccessful because cavities are held open by adhesions. In selected cases, intrapleural pneumonolysis may be employed to sever the adhesions, with a resultant closure of the cavities.

Case 9, Figs. 9-a, 9-b, 9-c, T. J. V., aged 23, male. Entered the Woodmen of the World Hospital September 15, 1937. There was a total tuberculous involvement of the right lung. Artificial pneumothorax was instituted December 23, 1937. Due to adhesions the cavity remained open and the sputum remained positive (Fig. 9-a). Intrapleural pneumonolysis was done June 11, 1938. The second film (Fig. 9-b) was made shortly afterward, at which time the sputum was still positive.

When the third film (Fig. 9-c) was made, the cavity had closed and the sputum was negative. When the patient was discharged all symptoms had disappeared and the physical condition was excellent.
Case 10, Figs. 10-a, 10-b, T. O., aged 18, male. First consulted a physician in June, 1936, for productive cough and loss of appetite. A diagnosis of tuberculosis was made then, but he continued to work until March, 1939. On admission to the Hospital his symptoms were severe. Rales were heard over both lung fields, the sputum was highly positive, and the sedimentation rate was far above normal. Within a month of admission pneumothorax was instituted bilaterally. Due to adhesions a cavity in the left apex was held open (Fig. 10-a). The adhesions at the left apex were released by intrapleural pneumonolysis (Fig. 10-b), and the sputum has now been negative for several months.

Case 11, Figs. 11-a, 11-b, B. H. M., aged 37, male. Began to cough and lose weight in March, 1937. Consulted a physician for the first time in August, 1937, because of "cold in the chest." Without physical or x-ray examination a diagnosis of influenza was made. After a week in bed he felt better and returned to work. In January, 1938, there was a recurrence of the "chest cold," accompanied by pain in the left chest. The patient was sent to a teaching hospital for diagnosis and treatment. While there the sputum was examined and was negative for tubercle bacilli. A final diagnosis of "unresolved pneumonia, left upper lobe," was made before discharge on February 7, 1938.

After leaving the hospital a chest specialist was consulted, and a diagnosis of tuberculosis was made after physical, x-ray, and sputum examinations. Artificial pneumothorax was instituted immediately, and the patient entered the Woodmen of the World Hospital March 24, 1938 (Fig. 11-a). Pneumothorax was continued until it was apparent that adhesions were preventing closure of an apical cavity (Fig. 11-b).
Case 11, Fig. 11-c, B. H. M.

FIRST STAGE THORACOPLASTY—Left

Case 11, Figs. 11-c, 11-d, B. H. M., aged 37, male. Intrapleural pneumonolysis was attempted June 11, 1938, but was unsuccessful because of the density of the adhesions and their close proximity to the subclavian artery. Thoracoplasty was then decided upon, and this was done in two stages (Figs. 11-c, 11-d). The patient was discharged in good condition, and, for the past nine months has worked at his former occupation.

This case emphasizes the importance of early diagnosis and illustrates the value of thoracic surgery in advanced cases that were formerly considered hopeless.

Conclusions

1—Patient and physician must share alike the responsibility for delayed diagnosis, and for the large number of advanced cases.

2—Tuberculosis can be unmasked by modern methods.

3—Early discovery of tuberculosis, with efficient and adequate care, means 90 per cent recovery on passive treatment.

4—The percentage of advanced cases is still too high.

5—Tuberculosis ranks first as cause of death between the ages of 15 and 45.

6—Right diagnosis of chest disease is better than over or under diagnosis.

7—Thoracic surgery has no place in early tuberculosis, but is of prime importance in advanced cases.

TUBERCULOSIS ASSOCIATIONS HELP DISTRIBUTE JOURNALS

Twenty-five Tuberculosis Associations in Ohio and West Virginia placed orders for 727 copies of the OHIO and WEST VIRGINIA STATES ISSUE of Diseases of the Chest, which was published as a special issue in December, 1940.

These copies have been distributed, with the compliments of the associations to physicians in Ohio and West Virginia. Complimentary remarks, which have already been received from physicians getting these copies, is ample proof that the journal is a welcome visitor in the offices of physicians who do not specialize in chest diseases, but, who are nevertheless interested in learning more about chest conditions.

The Editorial Board of Diseases of the Chest, takes this opportunity to express its appreciation to these Tuberculosis Associations in Ohio and West Virginia for their support of the Journal, and is ever ready to cooperate with recognized organizations in the furtherance of education in the fight against tuberculosis.