therefore at operation, when possible, of carefully adjusted rubber covered clamps will prevent the soiling of the peritoneum by the escape of any stomachic contents. The hemostatic value of the rubber covered clamp is great.

The improvement in the general condition of the patient following the relief of the obstruction in an hour-glass deformity of the stomach is rapid and very considerable. If the deformity is due to carcinoma the improvement will not, of course, be permanent.

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THE DECREASE IN THE DEATH-RATE OF CONSUMPTION.*

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IN the midst of strenuous endeavor toward the attainment of a well defined object, it is not without profit to occasionally review the work done, take account of stock and estimate the profits. It may be that what has been accomplished so gradually as to seem of small importance may, in the aggregate, assume large proportions. Courage for greater endeavor may be acquired from such a review, and perhaps methods may be improved.

It was with some such idea in mind that I undertook the task of reviewing such literature on the subject of tuberculosis as dealt with the work done toward its extinction. Treatment of any kind not directed toward the decrease or prevention of the disease I did not study. It is the result of my reading that I ask you to consider to-day.

I quote freely from many writers, often without giving their names. The discussion is not intended to be exhaustive, but rather suggestive and to provoke discussion. It is the purpose, then, of this paper to show:

(1) The decrease in the death-rate of consumption as given in the vital statistics of several countries and from other available sources of information.

(2) The significance of the decrease in the death-rate.

(3) The chief causes of this decrease, with a discussion of the more modern investigations into the modes of infection.

The value of vital statistics for purposes of comparison is often questioned. It is well understood that imperfect, ignorant, or even false death returns are made. Some sections of this country give more accurate returns than other sections. The Census Bureau has taken this into account, and has attempted to eliminate mistakes as much as possible, by comparing the returns of their own census takers with the

returns from the cities and towns themselves. For the sake of still greater accuracy they have compiled by themselves the returns from certain states and from a large number of cities, whose systems of reporting vital statistics are the same or nearly the same as that used by the United States. These states and cities taken together are called the registration area. Nearly all the United States statistics I quote are taken from this area. The registration area of 1900 comprised about one third of the total population of the United States.

The total number of deaths reported as due to consumption in the whole United States during 1900 was 109,750, of which 53,626 were males, and 56,124 were females. The ratio of deaths from this disease to 1,000 deaths from all known causes was 109.9. In 1890 the corresponding ratio was 122.3. In 1900, in the registration area, the same ratio was 106.3 to every 1,000 deaths from all known causes. Much more valuable statistics are figured on the death-rate from consumption per 100,000 of population. In 1890 the death-rate from this disease was 245.4 per 100,000 of population; in 1900 the rate was 187.3, a decrease of 58.1 deaths in ten years.¹

It is interesting to compare these figures with those for the same years in England and Prussia. In England the death-rate from consumption has been declining since 1838, when it stood at 380 per 100,000 of population, down to the present time. In 1890 the rate was 238 per 100,000 of population; in 1900 the same ratio was 190. At the present time it is much lower than that, somewhere about 130 per 100,000 of population.² In the tuberculosis death returns of Prussia is included all forms of tuberculosis. Up to 1887 there was little if any diminution in the death-rate from tuberculosis. That, too, in Koch's country, and for six years after the discovery of the tubercle bacillus. But in 1887 the drop in the Prussian death-rate began, and has continued comparatively steadily to the present. In 1890 the death-rate was 280 per 100,000 of population; in 1900 the rate was 210 per 100,000. The drop in the death-rate in Prussia has been much more rapid than in either the United States or England.

In order to bring the subject nearer home I have looked up the statistics for Massachusetts back to 1866. These I have arranged in the form of a chart based on the death-rate per 10,000 of population (see chart). It is instructive to note that our own death-rate began to drop about 1881-82, the year of the discovery of the tubercle bacillus. From then to the present the drop has been steady, from 1880, when the death-rate was 33.2 per 10,000 of population, to 1900 when it was 18.5 per 10,000, a decrease in twenty years of 14.7 for every 10,000 of population.³ That means, if the record could be the same for the next twenty years, the death-rate from consumption would be 3.8 per 10,000 of population in 1920.

A similar chart, prepared by Hillier to show the English and Prussian death-rate, is equally promising. According to that chart the death-rate in Prussia will reach the zero mark in 1927.

*Read before The Worcester District Medical Society, Oct. 12, 1904.

In England the zero will not be reached for twenty years more, or about 1947.⁴

In order to bring these statistics more clearly before our minds, let me summarize them. As Hillier says, "compared with the annual death roll from tuberculosis in the British dominions alone the losses in the South African war were a bagatelle." At the present death-rate in the United States in four years 125,000 more persons die of consumption than died from all causes during the four years of our Civil War. It has the largest mortality record of any disease; pneumonia alone approaches it.

able if the parents suffer that the children should be weakened and succumb easily to tubercular infection.

In spite of these two serious drawbacks to a low death-rate, we have decreased our death-rate approximately as fast as they have abroad, and we are fast equalling them in our efforts to stamp out this disease. None the less, I do not anticipate so rapid a decrease in the next twenty years. In the first place the past twenty have been house-cleaning years. We have gradually learned the power of cleanliness to save lives that before were wasted for lack of protection. Fresh

These are the facts which should urge us to every endeavor to stamp out the disease. For our encouragement we have a decrease in the death-rate which is not only large, but with each succeeding decade has been more marked.

As already shown, the decrease in 1900 in the United States was 58 per 100,000 of population; in England it was 48, in Prussia, 70, and in Massachusetts 74 less than in 1890. In the United States two factors must enter into all considerations of the possibility of reducing the death-rate from tuberculosis — first, our large colored population; second, foreigners who make their homes here, and their children either born here or brought here while very young.

The largest death-rate from consumption has always been among the colored people (nearly three times that of whites). The District of Columbia has the largest death-rate, according to population, from this disease of any state, and this is due, without doubt, to the large number of negroes living there.¹

The next largest death-rate is among foreigners or immigrants and the children of foreign-born mothers. The reasons for this are not hard to understand. People from different climates, with different customs, possibly not the best physically of their race, come here and try to live, eat, drink, dress and expose themselves to the weather as they have been accustomed to do at home; add to these poverty, and the result is often disastrous for the individual. It is inevit-

air and food have accomplished much toward cures in incipient cases, and delayed death in other cases. The last twenty years, then, have been a crusade against filth, and because filth abounded the years show a fine record. There is still filth enough to occupy us for some time to come. It does not seem to the reader, however, that the next twenty years can make as good a record in figures, unless something radically new of a curative nature is discovered. But it is not too much to expect that by the latter half of this century the disease will die out as a result of the destruction of infectious material.

CAUSES FOR DECREASE.

We come now to the consideration of the really important part of this subject. It is plainly evident that we have less consumption than twenty years ago. Why?

It seems to the reader the reasons may be summed up in the one word, education. Different observers give various reasons, but when we examine these explanations we find they are practically all a result of a better knowledge of the conditions under which tuberculosis thrives and an attempt to change those conditions.

An observer in England considers the decreased death-rate from tuberculosis there to be the result: (1) Of "generally improved sanitary conditions and food standards among the working classes;" (2) to the "segregation and isolation afforded by chest and general hospitals."

The same observer attributes the phenomenal decrease in the death-rate in Prussia to three causes:

(1) "The discovery of the tubercle bacillus, and the spreading of the knowledge of the infectious character of phthisis."

(2) "The greatly improved general condition of the working classes brought about by the operation of the Workman's State Insurance Laws."

(3) "The establishment of sanatoria," although at the time he wrote this was too recent a movement to have had much effect.⁴

Professor Koch is quoted as stating that the chief factor in his opinion has been the knowledge of the infectious character of phthisis and the precautions gradually brought into practice even among the lower classes in Germany against it. He thinks, however, that from a preventive point of view neither England nor Germany has as yet provided to a sufficient extent "the most essential of all institutions—the institution for advanced cases."⁵ He says further: "Early cases of tuberculosis, where tubercle bacilli occur in the sputum, are a danger, but the danger from them is trifling compared to the danger arising from the advanced and fatal cases." He goes on: "In all other infectious diseases we attack infection at its source. Cases of smallpox, of leprosy, of diphtheria, of plague, are isolated, but cases of tuberculosis in their last stages, the most deadly stage of the most deadly disease of all, are still allowed throughout Europe to spread further infection broadcast in the midst of their already destitute families. This fact does not yet seem to be learned; when it is, and when we have these homes for the hopeless cases adjoining every city, then tuberculosis will pass from the midst of us."

INFECTION.

In spite of careful investigations into the infectiousness of tuberculosis, the study of cases known to have been contracted from relatives, and the more frequent cases which are not so easily traceable to any certain source of infection, but are more or less reasonably considered to be the result of association with tubercular persons, there are writers of note who doubt the wisdom of classing tuberculosis as an infectious or contagious disease. They split hairs over the words, and prefer communicable as more in accord with the facts.

West says: "Being a germ disease, phthisis is in the nature of things infective, *i. e.*, communicable; that it should also be infectious in the common acceptation of the term is also possible, but does not necessarily follow. Whether it really is infectious or not cannot be assumed, but must be settled by evidence and not by presumption."⁷ He believes that the inhalation of particles of dried sputum is the ordinary mode of infection in man. He quotes the experiments made by different investigators to determine the infectiousness of dust, of sputum in a moist state, and of the breath without sputum. Finally he discusses the question of "whether phthisis

is catching—that is to say, whether it is communicable from the sick to the healthy." He says, "The question narrows itself to this. What evidence have we that phthisis may be conveyed to a healthy person by the inhalation of the breath of a phthisical patient? The bacilli have been found, it is true, in the air expelled, but careful observation has shown that they do not exist in the air as such, but in the particles of sputum thrown into it by coughing."⁸

It is rather difficult for one, whose ideas of infection, contagion and communicable are not narrowed down to the inhalation of a patient's breath, to treat these statements of even so eminent a writer as Dr. West, seriously. It seems to the reader that the admission of the possibility of contracting the disease from the dried particles of sputum is sufficient evidence that the disease is infectious, or, if you prefer, communicable.

Because he cannot demonstrate as clearly as might be possible in a case of smallpox, that infection in a given case was due to association with a given person who had the disease, Dr. West concludes:

(1) "That, though a communicable disease, phthisis is either not at all, or else in a very limited sense, contagious, and that the risk of direct infection from the sick to the healthy is very small."

(2) "That inhalation is probably the common mode of infection, and that indirectly through infected dust with which the air is laden."⁹

Flugge and Heyman conducted a series of experiments to determine the mode and danger of infection from consumptive persons. They collected the spray thrown out by coughing from numbers of patients, and found that some of the drops contained tubercle bacilli; that this injected intraperitoneally into guinea pigs gave positive results in many cases. (In one experiment four out of nine pigs were found to be infected.) A more interesting experiment was to "fix Guinea pigs with their heads facing the patients at a distance of 20 to 45 cm. every other day for three hours. Out of twenty-five pigs two died in four weeks, two in seven weeks, one in two months, and one in four months (six in all), all showing symptoms of inhalation tuberculosis."

Flugge, basing his opinion on these and other experiments made with dried sputa, maintains that while tuberculous dust derived from pulverized sputa is a source of infection, the cough-sprayed minute drops of a consumptive patient in an advanced stage are even more so. And this he affirms because experiment has shown that the quantity of sputum dust which under ordinary circumstances is pulverized small enough to float and be capable of inhalation is very small.¹⁴

Professor Koch condemns strongly the placing of other cases side by side with those of advanced consumptives in a general hospital. But considers the danger much greater in a "small confined room where the bacilli, virulent and minute, continue to be sprayed into the atmosphere."

Cornet, in the volume on Tuberculosis, *Nothnagel's Practice*, gives his own experiments on the modes of invasion. It would seem as though he has tested every possible avenue of entrance to the body. He concludes from his experiments that, "Tubercle bacilli, which have invaded the organism, regularly develop at the site of invasion or in the next set of lymph glands (law of localization). . . . Tubercle bacilli are capable of penetrating a macroscopically uninjured mucous membrane, in rare cases even the skin, especially if they are brought into close contact therewith by inoculation. . . . All the organs [he tested] showed tuberculous changes if brought into suitable contact with the organism."

"The theory of a special predilection on the part of the lung for tuberculous poison finds no experimental confirmation. . . . The degree of frequency depends not upon an inherent peculiarity of the organ, as the expression predisposition would seem to indicate, but upon external conditions; it is controlled by the distance of the organ from the site of infection, and upon the mode of infection."¹⁰

The writer explains the difficulty of demonstrating the source of infection in most cases when the infection occurs naturally. This is due to the long period of time which elapses after the infection before the disease manifests itself. "It is this circumstance which makes plain why the infectious nature of tuberculosis was so long a matter of dispute."¹¹

Cornet, while emphasizing the infectiousness of pulmonary tuberculosis under favorable circumstances, and the need for preventive measures, just as clearly shows how slight the danger of infection may be, provided proper precautions are taken. He says, "that the statement every man lives to some extent in a community of the tuberculous is without foundation." He also declares that statements concerning the number of persons infected at some time by tubercle bacilli which conclude that at least a third of the race is tuberculous are fallacious, founded upon erroneous deductions from statistics.¹²

"The chances of association with the tuberculous vary according to age — the child from one to five years evidently comes into direct contact only with its parents, its relatives, and the domestics. If these are healthy the child itself runs no risk of infection."

"From the sixth to the fifteenth year during which the child goes to school, the circle becomes widened so as to embrace the other children of the same class, numbering 30 to 40, and the teacher. . . . There is only one tuberculous individual in nearly 1,000 living children of the age of five to fifteen years, and this one individual imperils only his immediate environment, i. e., 6 to 8 children."

"From the twentieth to the thirtieth years the extent of an individual's acquaintanceship will vary enormously according to the occupation and sex; but as a rule the number of persons with whom we come into close and continuous contact

will hardly be found to exceed 8 or 10. . . . According to one table there is on the average one tuberculous individual among about 85 males and 109 females, ranging in age from twenty to sixty years; but this one case is a source of great danger only to his immediate neighbors."

"The exposure to infection is, therefore, less general than is ordinarily supposed; it is false to premise, as is done in almost every debate upon tuberculosis, that every person comes into frequent contact with the tuberculous, and would long since have been infected if the disease were really so transmissible."¹³

This question of infectiousness has naturally claimed the attention of the boards of health of our large cities.

Dr. Biggs believes in boards of health exercising supervision over, not only the ordinarily accepted infectious diseases, but over such diseases as are to a greater or less extent preventable; this supervision to be of such a character as not to annoy the patient or his friends. He gives the rules of the new code of the New York Board of Health relating to the infectious diseases. This subdivides infectious diseases into three classes:

(A) "Contagious (very readily communicable), — Measles, rubella (rotheln), scarlet fever, variola (smallpox), varicella (chicken pox), typhus fever, relapsing fever.

(B) "Communicable, — Diphtheria (croup), typhoid fever, Asiatic cholera, *tuberculosis* (of any organ), plague, tetanus, anthrax, glanders, epidemic cerebrospinal meningitis, leprosy, infectious diseases of the eye, puerperal septicemia, erysipelas, whooping cough.

(C) "Indirectly communicable (through intermediary host), — Yellow fever, malaria."¹⁴

This classification gives the board such authority as it needs to properly supervise the diseases named. In this classification, however, there is no splitting of hairs over the words, infectious, contagious and communicable. All the diseases are infectious, all are communicable, varying only in the degree.

SUMMARY.

(1) Statistics of tuberculosis show conclusively a marked decrease in the death-rate during the last twenty years. For the countries whose statistics were available, it is not too much to expect that tuberculosis will die out in this century.

(2) The most careful investigators are agreed that tuberculosis is directly communicable from one person to another. They consider the dried sputum a source of danger, but the spray from a coughing, sneezing patient in the last stages of consumption they consider a much greater source of danger. They consider a hospital for the consumptive poor when in the last stage to be a necessity if we are to prevent the spread of the disease most effectively.

(3) With proper precautions the danger of infection from a consumptive may be reduced to almost nothing.

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PULMONARY CONGESTION AS A CAUSE OF SUDDEN DEATH.*

BY W. W. MINER, M.D., WARE, MASS.

I HAVE met with severe and extensive congestion of the lungs in post-mortem examinations of three persons who died suddenly. They were not considered, by those associated with them, to be in any danger of the approach of death. One of them was a young man in vigorous health, one an elderly man in fair condition, and one a strong man who had a severe cold but was walking about as usual. Three hours later his dead body was found at the foot of a stairway where he had fallen. There were no ante-mortem symptoms noticed in two of these cases that attracted any particular attention. The strong young man, however, said he did not feel well after felling some small oak trees, and he dropped dead while leading his horse homeward with the fuel he had cut down and loaded on his wagon. I certified that in these cases the cause of death was congestion of the lungs, not being able to find any other sufficient cause, and the autopsies in each case showed to me ample cause of death in the remarkably congested condition of the lungs, which had been of very short duration.

CASE I. Francis K., seventy years of age, on Nov. 30, 1900, was found dead lying on a sofa in a sitting room at the house of an acquaintance when the family arose in the early Sunday forenoon. He had passed the night on the sofa with some covering over him in a cold room. Together with the man and woman in whose house he was found, he had been indulging in intoxicating liquors on the previous evening. The woman had a badly bruised and swollen face and was in a semi-stupid condition. An autopsy was held. He had contused places on the right side of his forehead, also a contused spot over nasal bones of triangular shape, one third of an inch in diameter, with dried blood on it. The skin was dried and stiff on bridge of nose. There was another contused spot on skin of nose, one-third inch in diameter. There was no blood in the interior of the nostrils.

His pericardium contained one-half an ounce of fluid of normal quality and the pericardial cavity was normal. The heart was normal and each cavity contained a very little dark blood; the valves and coronary arteries were normal.

The pulmonary pleural membrane was very firmly adherent to the costal pleura on both sides of the thorax at the upper portion and had whitish patches of thick

fibrous character. The upper lobes of the lungs on both sides were extensively and firmly adherent to the walls of the chest and were of a grayish color and contained several calcareous nodules, giving evidence of some former chronic inflammatory or tubercular disease. There were no suppurating foci in the lungs and no accumulation of grayish gelatinous material or yellowish mucus, so that it was not considered that there was an active tubercular or destructive process going on in the lungs. The greater part of the lungs were uniformly dark and congested and the tissues and air passages of the lungs were thoroughly occupied by darkish fluid blood, giving evidence of acute pulmonary congestion which was considered by those present to be the cause of death.

The spleen was small. The venous system of the small intestines was congested. The liver was of normal size, but showed fatty degeneration. His right kidney was smaller than normal and had a cyst at its apex containing one and one half ounces of fluid and showed fatty degeneration. The left kidney appeared normal. The bladder was thickened and held about six ounces of urine.

CASE II. Michael P., twenty-three years of age, on Sept. 18, 1903, dropped dead in the road while leading a horse which was drawing a load of four-foot long pieces of oak wood fuel from the region where it had just been felled and cut into lengths by this young man. He was of Polish birth, strong and vigorous, and no suspicion of previous disease or disability was entertained by his brother with whom he was boarding. He had been discharged from employment in a factory a day or two before for some slight misconduct and was apparently quite anxious to earn his board and offered to go to his brother's lot and procure some fuel which was then a scarce article. His axe, judging from the cut surface of the wood, was not in the best condition of sharpness for the work of cutting green oak trees. Two young men joined him where he was cutting, and after a while he said he was not feeling well and would go home. They assisted him to some extent but did not realize in the least that his death was impending.

At the autopsy nothing abnormal was found in the condition of his brain and its blood vessels or in the pericardium or heart. The cavities of the heart were nearly empty. Both lungs were throughout very deeply congested and of dark bluish red color externally and presented the character of severe congestion on section of different portions. No other lesion of the lungs was present. His face did not show any lividity or his surface generally. His bladder was contracted. His kidneys were congested, otherwise normal, and the weight of both was fourteen ounces.

His stomach contained about eight ounces of partly digested food and was largely liquid in character. There were streaks of congestion and hemorrhagic effusion in the walls of the stomach but the general appearance of the lining of the stomach was normal. The spleen and liver were found normal. There was nothing in the character of the stomach contents that excited any degree of suspicion. His mouth and fauces were in normal condition. There was nothing in his general appearance that justified any idea of poisoning or of any pre-existing disease. The congested condition of his lungs was considered the cause of his death and was thought to be the result of his anxiety to earn his board by the amount of fuel he could bring home. The physical effort required, with the poor condition of his axe, made such an amount of over-exertion as to cause pulmonary congestion and death.

CASE III. Eugene B., thirty-seven years of age, was found dead at the foot of a cellar in May, 1904. His head was bent forward on his body which had apparently

* Read at the annual meeting of the Massachusetts Medico-Legal Society, June 7, 1904.