

lowing figures, per thousand strength, for the British army.

Station.	YEAR 1898.			DECADE 1888-97.		
	Ad- missions.	Deaths.	Constantly sick.	Ad- missions.	Deaths.	Constantly sick.
United Kingdom	9.5	0.37	0.37	6.3	0.01	0.23
Gibraltar	4	0.25	0.25	7.2	0.02	0.24
Malta	152.1	0.11	4.17	14.1	0.08	0.66
Canada .....	.....	.....	.....	1.3	.....	0.05
Egypt and Cyprus	58.4	.....	2.19	21.9	0.02	0.85
Bermuda .....	.....	.....	.....	1.9	.....	0.08
West Indies	78.5	3.87	4.13	62.2	0.06	2.58
South Africa	39.2	0.12	1.65	30.2	0.08	1.23
Mauritius	380.3	1.22	15.76	579.2	2.76	25.74
Ceylon	71	2.28	93.0	93.0	0.87	2.77
China	379.2	6.37	16.95	489.6	2.36	14.39
Straits Settlements	829.9	.....	15.17	85.4	0.64	3.15
India	434	0.76	13.26	356.9	0.71	12.01
West Africa	2,027.8	13.89	67.36	1,815.8	52.63	50.26

At certain military stations in India, malaria has at times been so prevalent that all drills and parades have had to be discontinued. In former times the death rate from this disease was often extraordinarily high. Davy mentions an instance in Ceylon where every white soldier sent to a certain station contracted malarial fever; out of a garrison of 254 men there were 205 deaths from this affection.

Next to climate, the influence of season appears to be of the most importance upon the occurrence of malaria; the rates for troops throughout the United States progressively attaining the maximum in September and the minimum in February, as is well shown in the accompanying diagram (see Fig. 1083).

The relationship between malarial disease and marshy and swampy localities has long been recognized; though these fevers have been known to occur in localities not especially marshy, and, on the other hand, to be absent

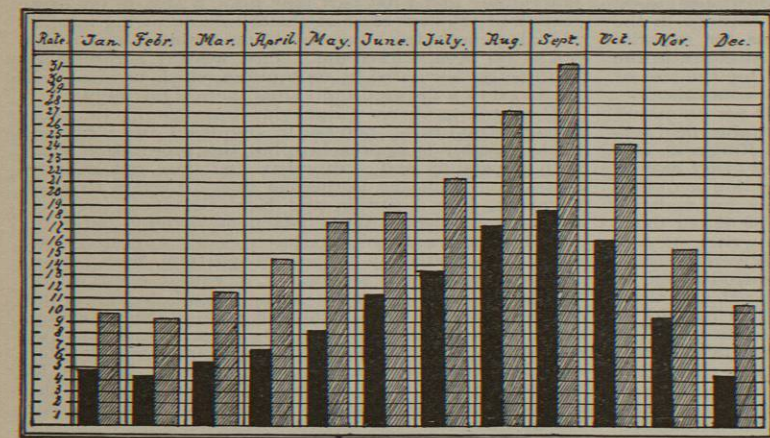


FIG. 1083.—Distribution of Cases of Malarial Fever by Months, per Thousand Strength, Occurring in the United States Army.

from regions wet and swampy. It must be admitted, however, that malarial affections are much more frequent on marshy coasts and low humid plains than on higher ground where drainage of the soil is more complete, and a certain amount of moisture in the soil appears to be essential to the development of the malarial

virus. Marshes that are alternately flooded and partially drained of water offer conditions most favorable to the development of malaria. Under such conditions the profusion of rank vegetation, together with decaying organic matter, does much to favor it; though it may occur on barren, sandy soils with high ground water, particularly if the soil be organically contaminated. The broad, alluvial deltas of great rivers and the valleys of smaller streams, in warm climates, are usually malarious. The breaking or cleaning of new lands, in malarious regions, usually results in the appearance of malaria in the immediate vicinity, but by prolonged cultivation the disease becomes less frequent and severe, and may finally disappear altogether. The geological condition of a soil appears to play a somewhat important part in the production of the virus. An impervious surface soil, which does not readily become saturated but favors the rapid shedding of storm water, is not regarded as favorable to the development of the disease. A permeable, shallow surface soil with an underlying impervious stratum may favor the development of malaria under conditions of very moderate rainfall. In general, excessive or prolonged rainfall favors the occurrence of the disease. At high altitudes the disease disappears or becomes infrequent. In the tropics it is said that a height of more than two thousand feet is usually necessary to secure immunity. In the Philippine islands, however, our troops stationed in the upland valleys of the mountain districts suffered more from malaria, and from a more fatal type, than those in garrisons on the low plains of the coast, even the rice-field districts.

While troops may be attacked by malaria when on board ship, this is now rarely the case in practice. During the disastrous expedition of the French in Madagascar, in 1895, it is stated by Lemure that not a single fatal case of malaria occurred on board the thirty vessels constantly maintained off the coast; many other striking instances to the same effect have been recorded. There is a general conviction that the malarial virus may be carried by winds. In malarious regions near the coast the land breezes, especially if they traverse neighboring marshes, appear to favor the disease, while sea breezes do not. Many localities which might otherwise be highly suspicious, but which are continually wind-swept, are often free from the disease. Under ordinary circumstances the virus of malaria does not usually ascend very high above the ground; troops in upper floors of barracks may largely escape the disease where those on the lower floors contract it. There is, however, evidence that the malarial infection may sometimes be carried to high altitudes by strong winds blowing up narrow, unhealthy valleys. The recognition of the mosquito as an agent for the transmission of this disease has done much to explain the influence of air currents in carrying the disease; and the same may also be said with regard to the supposedly baneful influence of night air, since the malarial mosquito is not active during daylight. Davy says of certain British troops in Ceylon that they were largely exempt from malarial fever as long as they were employed by day only; so soon as they were employed more by night than by day, particularly in guarding convoys and the relieving of posts, fever became very prevalent and destructive. Of one company 70 strong, which was forced to sleep out in the jungle for a single night, he states that every man contracted fever and many died. Lemure gives an instance of a garrison of 50 French soldiers in Madagascar, of which at the end of two months

6 were dead, 12 had been invalided home, and all the remainder presented malarial infections. At the same time, the condition as to health was good among a body of marines doing similar duty at the same place, but who returned to their ship at night to sleep.

Experience shows that negroes native to and living in a malarious country possess an undoubted immunity to malarial fevers. This immunity, however, is lost to a considerable extent after long residence in a non-malarious climate, and does not exist to any very great extent among negroes native to regions where this disease does not prevail. The difference in respect to susceptibility between white strangers and native blacks is, however, great. In the British expedition up the Niger, of 145 whites and 158 negroes, there were 130 cases of fever with 40 deaths among the whites, while there occurred among the negroes but 11 mild cases, and these only in individuals who had passed several years in England. In West Africa, Great Britain has found it scarcely possible to retain white soldiers, and the garrisons are composed chiefly of native negroes. For the decade 1888-97 the admission rates for malaria, in West Africa, were 1,815.8 for the whites, in spite of special precautions taken to prevent their infection, and but 990.9 among the native negro troops; the death rates for the whites and negroes were 52.63 among the former and but 5.75 among the latter. In our own service, the rates during time of peace have been invariably higher among the whites than in the colored troops, although the difference was but slight as compared with the figures given above. During the war with Spain, however, the rates for colored troops were much higher than for the whites. This, however, is readily to be explained by the fact that the negro troops were nearly all engaged in the tropics, while many of the white soldiers, especially artillery and cavalry, were not moved from the United States, or in some cases from their usual posts. In our army the native-born white American appears to be slightly more susceptible to malarial infection than are soldiers of foreign birth. For the seven years 1890-96, the admissions for malaria per thousand strength amounted to 84.24 for American-born whites, 81.94 for soldiers of Irish birth, and 74.76 for those of German nativity.

As is the case with nearly all other diseases, age is a factor of great importance in predisposing to malarial infection, as is shown by the accompanying diagram. The desirability of detailing old soldiers for duty in malarious stations is obvious.

During time of peace, for the seven years 1890-96, the admission rates for malarial disease, according to the branch of service, were distributed as follows:

Branch of Service	Per 1,000 strength.
Artillery	163.24
Engineers	130.66
Cavalry	110.79
Ordnance	60.91
Medical Department	55.31
Infantry	46.28

Malarial fevers are much more common among soldiers than among officers. For the seven years 1890-96, the admissions in our army per thousand strength were 81.74 for enlisted men and 40.30 for officers.

Common experience shows that a considerable number of individuals, exposed to the malarial poison, escape infection. While this may be due to a racial immunity, as already mentioned, the strongest predisposing element in the development of infectious disease, to which malaria is no exception, is a lowering of vital resistance through unsanitary surroundings, bad food, exhaustion, or expos-

ure. Among these factors physical exhaustion is not of the least importance, and in this connection Coustan calls attention to the fact that in the late Madagascar expedition the proportion of deaths among the French officers was 1:16.6, while among the soldiers, who were exhausted by the carrying of heavy burdens and long marching, the proportion was 3:5. Under-fed or fasting



FIG. 1084.—Admissions for Malarial Fevers in the United States Army, Arranged According to Age, per Thousand of Each Class, During the Seven Years 1890-96.

troops are very susceptible to malarial influences, and early morning drills before breakfast, or late guard duty, are especially favoring factors. Exposure to heat undoubtedly exerts an influence favorable to malarial infection, and the same is commonly believed to be the case with respect to alcoholic excesses.

The acclimation of troops in a malarious country cannot be counted upon—military experience showing that the mortality increases with the length of the sojourn. One attack of malaria, unlike the eruptive fevers, predisposes to another; and it is an invariable rule in the French service to select for expeditions in the tropics only such as have not previously been affected with the disease.

After residence in a malarious country, with or without symptoms denoting malarial infection, the disease often appears in a persistent form after removal to a region in which there is no malaria. This has commonly been observed in recruits sent from malarious stations to healthful districts in the west, and was particularly evident among our troops returned from Santiago.

Prophylaxis.—This depends upon the application of both special and general measures of prevention, and of these the former are probably of the most importance. In the avoidance of malarial infection by inoculation it is evident that troops should be shielded against the attacks of insects; further, that the insects should be destroyed. From the nature of military service it is obvious that soldiers cannot always avoid being bitten by mosquitoes, especially in the field. Much may, however, be accomplished to this end, and the less the number of bites the smaller are the chances of infection. In garrison all doors and windows should be provided with screens, and mosquito bars should be attached to all beds. The nets should be square, should be hung inside a framework, tucked carefully under the mattress all around and stretched tightly better to allow the passage of air. The mesh may be fairly large, but should be free from rents. Care should be taken to destroy all mosquitoes within the netting after entering. This is best accomplished by holding a light at one corner outside the net, toward which the insects fly and are readily despatched. In the field, in malarious districts, soldiers should be furnished with squares of mosquito net or head nets for use at night. The weight need not be more than a couple of ounces, and such a protection would conduce much to comfort and health and amply repay its carriage. In camps, smudges made of green boughs lighted to windward, so that the smoke blows over the men, are often of great value. For this purpose the eucalyptus boughs,

where they can be obtained, are said to be particularly valuable, the mosquito having an especial antipathy to this tree. Oil of pennyroyal, or oil of cloves, smeared in small quantity over the exposed surface or dropped on the pillow, may keep off these insects, but being volatile, these substances require to be frequently renewed. In Italy, pieces of onion are often used for the same purpose. Mosquitoes which have gained access to barracks may be destroyed mechanically, or by the fumes from burning pyrethrum powder, tobacco, or even from green wood. The vapor of kerosene oil or turpentine also kills them. Leggings are an excellent protection for the ankles against these insects, but gloves or head nets can rarely be worn on the march. Still, except during night marches, malarial infections are probably rarely acquired under such conditions. Since patients suffering from malaria are capable of directly infecting others through the agency of mosquitoes, they should always be treated under mosquito netting; and this precaution should be continued for weeks after the actual fever has disappeared.

When mosquitoes are present in barracks, suitable conditions for their development are usually found close by. In the case of the malaria-carrying variety, these are small stagnant pools. Where these cannot be filled up or drained, recourse should habitually be had to culicides for the destruction of the larvæ and pupæ. For this purpose the substance most available for military use is kerosene or mineral oil. This should be sprinkled over the surface of the water, as with a broom, until a fine film is produced, which destroys the larvæ by cutting off the supply of air and choking their air tubes. The adult insects, which alight on the surface to deposit their eggs, are also destroyed. This film must spread over the entire surface of the water, and should last at least two days, to kill the larvæ as they are hatched from the eggs already laid. The quantity of oil required naturally varies with the conditions met with. For small, still pools probably one ounce of kerosene to each fifteen square feet of water surface is quite sufficient. Surface vegetation, sometimes very abundant, may often obstruct the mechanical action of the oil, and in waters even very slightly running the supply of the oil must be frequently or continuously renewed. Petroleum, also, has the disadvantage of evaporating somewhat rapidly in warm weather. Potassium permanganate will destroy the larvæ, but only in solutions having a strength of five parts to the thousand. Strong infusions of tobacco are fatal to the larvæ; and they are destroyed by powdered chrysanthemum flowers, as now found in commercial insect powders, in the proportion of three parts to the million. Recently, Celli and Casagrandi have shown that gallol, in the proportion of seven parts to the million, is the most certain and effective agent in destroying the larvæ and possesses the advantage of great permanency. Whatever be the method employed, the life history of the mosquito shows that it should be repeated at intervals of from seven to ten days. The introduction of small fish or minnows into fishless breeding-places of the mosquito is of great importance, as these feed greedily upon the larvæ and soon exterminate them.

General measures of prophylaxis have been shown by experience to be of much value in the prevention of malaria. It is not advisable to take an army into a malarious country during the fever season, and in localities where fevers prevail to great extent it is well to retire to high ground during the malarial period, as is done by the English in India and Jamaica and by the French in Guadeloupe. In locating a camp or post in a malarious district, special care should be taken in the selection of the site. In general, the appearance of the natives will give some knowledge as to the prevalence of this disease among them.

The abandonment of a highly malarious post, in time of peace, is much to be desired and can usually be accomplished. The retention of unhealthful posts is at the expense of unnecessary suffering, and in the past many thousands of lives have been uselessly sacrificed to tenacity of position. With marching troops, zones of malarious country should be avoided or passed over as quickly

as possible. The abolition of marshes by flooding or drainage, and the removal of adjacent shrubbery and rank vegetation are great prophylactic measures in reducing the amount of malaria in a garrison. Plants of rapid growth should be cultivated for the assistance which they give in removing moisture from the soil. For this purpose the eucalyptus, castor-oil plant and sunflower appear to be most satisfactory, not only drying the ground but being shunned by mosquitoes. Subsoil drainage is often of great value, but this can rarely be thoroughly carried out in the military service. Barracks should be raised on piers, be cemented underneath and be of two stories in height. All water used for drinking purposes should be sterilized by heat. Food should be abundant and nutritious. Distributions of hot coffee for those on guard at night, or engaged in arduous labor, are often of value. The use of quinine as a prophylactic, where troops are temporarily exposed to marked malarial influences, is of great importance, as has been repeatedly demonstrated. Not only are the cases of malarial infection greatly decreased in number by its use, but the character of the cases which occur is favorably modified. In general, a dose of gr. v. once daily will be sufficient, preferably taken shortly before any unusual exposure is anticipated. In a malarious country the general issue of a small dose of quinine, after anything lowering the resistive power, as a forced march, wetting, or lack of food, has much to commend it. In the Italian army, arsenious acid has been tried in the prevention of malaria, but with little satisfaction. Exposure, particularly to heat and night air, and over-exertion should be avoided. The soil should be disturbed as little as possible. If this should be necessary, as little as possible should be disturbed at one time and the work should not be begun too early in the day. The minimum number of men should be employed in the work, and only such as have not had a previous malarial infection.

MEASLES.—Occurrence.—Among troops, this disease is of frequent occurrence. Under certain conditions, when developed under conditions of want, hardship, exposure, and bad sanitation—and especially when associated with a scorbutic taint—the disease may assume an extremely severe and fatal character. Formerly the occurrence of the hæmorrhagic form of measles was not infrequent among troops, and was much dreaded. The exposure, often unavoidable, in the treatment of the sick in tent hospitals does much to develop secondary diphtheria and pneumonia; and to these latter causes are to be attributed also much of the gravity which the disease has assumed when prevailing among troops during the existence of hostilities. In garrison, the mortality from this disease is small; for the period of peace, 1885-94, in our army, the death rate was but one one-hundred-and-tenth of the rate given by the Registrar-General for the total population of England and Wales during the same period. From 1832 to 1859, according to Rosse, measles was the cause of 2.7 per cent. of deaths from all causes occurring in the garrison of Paris. During the Civil War there were, in the Union forces, 75,177 cases with 5,174 deaths, the admissions per thousand strength during this period amounting to 31.72 and the deaths to 2.02. Among the Confederate troops, Eve states that measles prevailed to such an extent that whole companies, battalions and regiments, under organization, had to be disbanded and the men sent home. During the siege of Metz, measles was extremely prevalent and fatal in the garrison. In our army, for the period 1868-98, there occurred a total of 3,733 cases with 15 deaths, giving an admission rate per thousand strength of 4.50 and a death rate of .017.

The disease appears to be more prevalent now than formerly among our troops, the rates being as follows:

Period.	Admissions per thousand.	Deaths per thousand.
1868-84	1.88	0.004
1885-94	4.85	.004
1895-98	13.72	.090

The expansion of our army with a large number of susceptible recruits at the outbreak of the war with Spain, and their aggregation in large camps where the dissemination of the disease was favored, did much to raise the rates for both admissions and mortality during the last period given above, the admissions for the year 1898 being 25.09 per thousand strength and the deaths from this cause amounting to 0.26 per thousand; while for the previous year of peace, 1897, the admission rate was only .82 per thousand, with no deaths. In the German army the rates of admission for measles, for varying periods, were uniformly low, as follows:

Period.	Admissions per 1,000 strength.
1881-82 to 1885-86	1.4
1886-87 to 1890-91	1.5
1891-92 to 1895-96	.83
Year 1896-97	1.1

For the French army the rates of admission per thousand strength, for the five years 1890-94, was 9.71. Coustan believes that the system prevailing in the French army, of turning into a common magazine for storage certain articles worn by the men only during the period of the field manoeuvres, greatly favors the dissemination of the infection of measles, and hence partially explains the high rates given by that army. In the Austrian army, for the year 1897, the admission rate was only .8 per thousand, but the proportionate mortality was high, .02.

Colored troops appear to be less susceptible to measles than are white, but certain mild cases are more liable to escape recognition in the former class; the rates of admission in our army for measles, in 1898, were 25.91 per thousand whites and 14.42 for colored troops. During the Civil War the rates were 30.41 for white and 46.65 for colored troops, this excess as regards the negroes being apparently due to lessened efforts for the control of the disease among them. The disease occurs far more frequently among recruits than among old soldiers; in the Civil War the number of cases depending upon the proportion of susceptible individuals and occurring particularly among country-bred recruits. For the French army Coustan gives the following figures, as illustrating the effects of age and length of service on the occurrence of this disease:

Year.	Less than one year service, admissions per 1,000 strength.	More than one year service, admissions per 1,000 strength.
1891	23.63	12.69
1892	99.62	4.04
1893	11.98	6.08
1894	14.80	7.91

In our own service, measles prevails to by far the greatest extent at the recruiting depots; in 1892, the recruits at Columbus Barracks furnishing more than half the cases occurring in the entire army. The disease ordinarily occurs in time of peace most frequently during cold weather, when ventilation is comparatively restricted and the opportunity of infection is most favorable. During the year of war 1898, when the number of recruits was great, the rate of admission was by far the greatest during June and July, thus showing the greater importance of length of service as compared with season in influencing the occurrence of this disease. During the same year the admission rate was 19.82 per thousand among soldiers stationed in the United States, while there was a total rate of 48.25 for the troops serving in the West Indies and the islands of the Pacific. The case mortality of measles, as already noted, is capable of varying within very wide limits, ranging from as little as 1 or 2 per cent. in some outbreaks to 40 or 50 per cent. in others. "In Paris, during the siege (January, 1871), out of 215 of the Garde Mobile who took measles, 86, or 40 per cent., died; and the mortality reached very nearly the same figures among the French troops who returned to Paris after the Italian

war, 40 out of 129 cases dying in one hospital whose sanitary condition was bad." As in typhus fever, the concentration of a large number of measles cases, with deficient ventilation, appears unfavorably to affect the course of the disease through an intensification of the virulence of the infection.

From analogy, it may be assumed that the cause of measles is a specific micro-organism, but as yet its special nature has not been determined. The infection is presumably given off by the breath and mucus from the catarrhal surfaces, also by exfoliated epidermis. The poison undoubtedly is capable of being air-borne and tends to cling to fomites and remain in ily ventilated spaces. The materies morbi is very tenacious of life; and where it once fairly establishes itself, as has been apparently the case at Columbus Barracks, annual epidemics are the rule. There is no evidence that the disease is transmissible by water or food; infection probably always occurs through inhalation. In a garrison, the disease is not infrequently introduced by children. The incubation period varies from eight to twenty days, the usual limit being about eleven days. The infective period begins with the earliest symptoms; it is greatest while the catarrh and rash are present, and probably extends well into convalescence. As a general rule, infection is over by the end of the fourth week, provided that cough and desquamation have ceased. One attack of measles usually confers an immunity to future attacks.

Prophylaxis.—In civil life, vigorous efforts are rarely made to prevent the spread of measles. In the military service the opposite should be the case, bearing in mind that this disease is never devoid of danger, and, particularly in the field, may assume a grave character. Further, it causes the loss of a considerable amount of service by troops to which the state is entitled. In view of the fact that measles was mild under favorable conditions and was often extremely fatal when the patients were exposed to inclemencies, it was seriously urged, during the Civil War, to infect all susceptible recruits with this disease, and only after recovery to send them to join their regiments. The prevention includes the isolation of the sick and the disinfection of all clothing, bedding, and surroundings. The discharges should be disinfected, particularly those from the mouth and eyes. For the latter purpose soft rags should be employed, and these burned after use. As far as the patient is concerned, Cameron concludes that "so far as figures are of value, ample air space, free draught, freedom from overcrowding and from effluvium nuisances, conduce most to recovery."

In the spring of 1898 the writer carried out some investigations with regard to the production of an artificial immunity against measles. The experiments were abruptly interrupted by field service, but appeared to be distinctly favorable so far as carried out. The method employed consisted in the subcutaneous injection of blood serum obtained from convalescents from measles by means of cantharidal blisters. The injections were made in children living in an infected garrison, 5 to 10 c.c. being administered in three doses at intervals of about forty-eight hours. None of the cases so inoculated contracted the disease, while a considerable proportion of the susceptible and uninoculated children became infected.

Mumps.—Mumps occurs very frequently among troops, especially in young soldiers, but its mortality is practically nil, and, like some other affections, it becomes of importance merely from the temporary disability for military service which it causes. In a total of 3,122 cases of mumps occurring in the United States army for the thirty-one years 1868-98 inclusive, there was not a single death which could be attributed to this affection. The admission rate for this disease for the period 1868-84 was 2.99 per thousand; for 1885-94, it was 5.08, and for 1895-98, it was 4.05. The rate of admissions for the entire period, 1868-98 inclusive, was 3.76 per thousand.

In the military service, mumps usually prevails in well-defined epidemics. A large proportion of the cases occur in recruits. The aggregation of such young men at certain stations for purposes of instruction is very favorable to the occurrence of this disease; and in 1894, out of 337 cases of mumps occurring in the army, there were 119 cases at the two recruiting depots of Columbus Barracks and Jefferson Barracks. In the previous year, out of a total of 149 cases, 43 cases occurred at the first-named station. Orchitis and atrophy of the testicle are very common among soldiers affected with mumps, being present in about one-third of the cases. Coustan states that in an epidemic among French soldiers in 1891, every man attacked developed orchitis. Laveran found it 211 times in 699 cases.

The infection is supposed to be given off by the breath and the secretions of the mouth, but as yet no specific organism has been isolated. It is not conspicuously disseminated by means of fomites; in garrison, it frequently appears to be introduced from outside by children. The period of incubation is reckoned as from fourteen to twenty-five days. The patient is regarded as infectious while there is any inflammation or tenderness of the salivary glands. Sanitary precautions consist in the isolation of the patient and the disinfection of his clothing and equipment. Beyond the cleansing and disinfection of the cuspidors in the squad room, no further preventive measures, in view of the comparative triviality of the affection, will usually be necessary. Among soldiers mumps not infrequently occurs in close association with measles, but this apparent relationship is probably to be regarded as accidental. The disease is most common during the colder weather.

ACUTE CROUPOUS PNEUMONIA.—Occurrence.—Pneumonia is a disease which, as might be expected, considering the conditions of military life, though not one of the most common to which the soldier is exposed on service, is yet not of infrequent occurrence nor unproductive of considerable mortality. Though ordinarily the disease occurs only sporadically, at times it appears to take on a distinctly contagious character; and well-defined epidemics of pneumonia among soldiers, either in garrison or in the field, are by no means infrequent. Under such conditions it is reasonable to assume the existence of some common depressing influence, by which a number of individuals are predisposed to an infection, to which, under ordinary circumstances, they would be largely unsusceptible. In considering the prevalence of this disease in the military service, it should not be forgotten that pneumonia may either occur primarily or be consequent to some other disease, particularly influenza and measles; and it is particularly during epidemics of the latter affections that the rates for pneumonia attain their maximum. While the disease occurs to some extent among troops in garrison, it is considerably favored by the exposure incident to field service.

The rates in our army for pneumonia, since the Civil War, have steadily decreased as a result of the greater care given to the comfort and welfare of the soldier, as shown by the following figures:

Period.	Admissions per 1,000 strength.	Deaths per 1,000 strength.
1861-66 (Civil War).....	32.45	7.79
1868-94	6.55	1.01
1885-94	4.28	.76
1895-98	3.66	.51
Year 1898 (war with Spain).....	4.84	.83
Year 1897	2.96	.21

The case mortality of the disease has also greatly diminished, but this is probably due to a more rational line of treatment than to any decrease in the virulence of the infection. As compared with the rates for foreign services, those for our army are extremely low. In the German army the admissions and deaths from pneumonia have been as follows:

Period.	Admissions per 1,000 strength.	Deaths per 1,000 strength.
1881-82 to 1885-86	11.0	0.19
1886-87 to 1890-91	10.5	.43
1891-92 to 1895-96	9.3	.36
Year 1896-97	6.7	.25

It is seen that in the German army the death rate has latterly increased while the proportion of cases has diminished, a fact which can be explained only on the supposition of an increase in the gravity of the affection. In the Russian army the following are the recent rates:

Year.	Admissions per 1,000 strength.	Deaths per 1,000 strength.
1890	10.4	0.99
1891	10.2	.90
1892	8.7	.81
1893	10.7	.87
1894	7.7	.62
1895	8.3	.66
1896	7.7	.62
1897	6.4	.49

In the Austrian army, for the year 1897, the admissions for pneumonia, per thousand strength, amounted to 5.1, while the death rate was .49.

Dissemination and Infection.—The specific micrococcus of pneumonia discovered by Surgeon-General Sternberg, of the United States army, is found in the sputum of practically all persons suffering from this disease. It has also been found in acute peri- and endocarditis, acute pleuritis and empyema, acute meningitis, and otitis media. After death it may be found, in varying numbers, scattered throughout the body. It has been found to be constantly present in the mouth cavity of healthy individuals, and by some has been thought to be present in the mouth of every one at some time or other. While the micro-organism usually loses much or all of its virulence by artificial cultivation, its original qualities are retained in sputum, blood, and other pathological exudates for considerable periods, according to Abbott for as long as fifty-five days, even in the dried condition. It is not unlikely, therefore, that dried pneumonic sputum, when ground into dust and inhaled, may induce the occurrence of the disease in susceptible individuals. This condition of susceptibility is, however, essential. "There must be some predisposing cause, for the micrococcus is widely disseminated, and is often present in the mouths of healthy persons without producing any ill effect. Under ordinary circumstances the protective mechanism of the body prevents invasion." Since the micro-organism of pneumonia is so frequently present in the mouth, it is probable that the sporadic cases of the primitive disease so commonly seen are the result of auto-infection depending upon a lowered vital resistance. As the lungs are the seat of attack, it is probable that the infective organism gains entrance by the air passages, though there is some evidence that it may be brought to the lungs from distant parts by the vascular or lymphatic circulation.

Predisposing Causes.—Among the predisposing causes of pneumonia those of latitude and season are of importance; the disease being most common in cold climates and, as shown in the accompanying diagram, during late winter and early spring. The negro race appears to be especially susceptible to the disease; the rates per thousand for our own service, for the decade 1879-88, being 7.52 for admissions and 1.79 for deaths among the colored troops, and but 4.46 and .76 respectively, for the white troops. Among the whites, figures for the seven years 1890-96 showed the American-born to be about 20 per cent. more liable to contract the disease than soldiers born in Ireland, Germany or England. Age appears to be a factor of no small importance; soldiers under twenty-five years of age and over fifty years being more than twice as liable to contract the disease as those between twenty-five and thirty-five years of age. Among the sev-

eral arms of the service the admission rates per thousand strength, for the period 1890-96, were 4.13 for cavalry, 3.46 for infantry and 2.95 for artillery.

Pneumonia is especially apt to follow upon exposure to sudden and extreme variations in temperature. Troops returning from service in the tropics, and especially such as are insufficiently clothed for the colder climate, are particularly liable to this disease. Wetting appears not infrequently to precipitate an attack, as do exhaustion

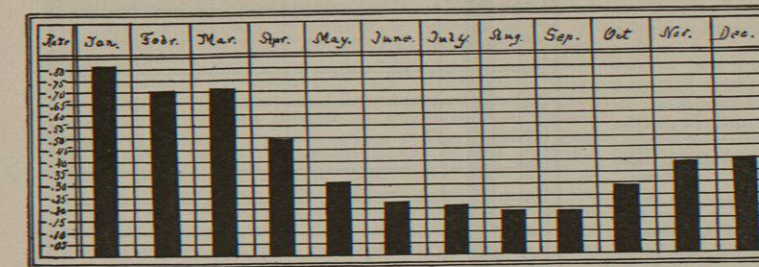


FIG. 1085.—Distribution, by Months, of Cases of Pneumonia Occurring in the United States Army, per Thousand Strength, During the Decade 1875-84.

and alcoholism. The disease often occurs in soldiers who, after having been exhausted by fatiguing exercise, expose themselves while sweaty to chilling draughts. Insufficient heating of barracks has been thought to favor pneumonia. Repeated outbreaks sometimes occur in the same buildings, especially in casemates. It is a matter of common knowledge that epidemics of this disease among troops often occur at the same time as epidemics of pneumonia or influenza in cavalry horses with whom the soldiers come in frequent contact.

Prophylaxis.—From what has been said, it is evident that measures having reference to the prevention of pneumonia among troops are particularly those which look to the maintenance of a high physical tone. Good and sufficient food, suitable clothing and shelter, rational exercise in the open air, cleanliness of person and temperate habits are all important. Chilling after drills and exercise should be avoided.

When pneumonia assumes an epidemic or infectious type the patients should be isolated. All the precautions required in the case of tuberculosis should be taken in this disease also. Attendants on pneumonia cases should be well nourished and have sufficient rest; it being borne in mind that by being overworked and in constant association with the patient they offer the conditions most favorable to their own infection.

SCARLET FEVER.—This affection can scarcely be regarded as a soldier's disease; being rare in our own army, though less uncommon in those of other nations. During the period 1868-98, there were reported in our service only 160 cases in a total numerical strength of 859,908 men. Of these 160 cases there were but 6 deaths. The disease occurs in garrison rather than in camp, there being but 12 cases during the year of war with Spain. Of these 12 cases, however, 3 were fatal, while of 148 cases occurring during the previous thirty years of peace but 3 succumbed, thus showing the unfavorable influence of the exposure unavoidably incident to treatment in field hospitals. The admission rate per thousand strength was .19 for the period 1868-84; .18 for the period 1885-94, and .21 for the period 1895-98. In the Austrian army, for 1897, the admission rate is given as .30 per thousand strength and the death rate as .01. In the German army scarlet fever has occurred as follows:

Period.	Admissions per 1,000 strength.
1881-82 to 1885-86	1.2
1886-87 to 1890-91 .....	.95
1891-92 to 1895-96 .....	.92
Year 1896-97 .....	.66

Epidemics of scarlet fever have frequently occurred among children living at our army posts without the troops being affected. It usually occurs in late winter or early spring. The contagion of scarlet fever is probably not developed until the eruption appears, and is especially to be dreaded during desquamation, when the poison is spread by the fine particles of epidermis which are disseminated from the person. The morbid agent is very tenacious of life and may cling to rooms, clothing,

and other articles for long periods, retaining its power to reproduce the disease under favorable conditions. The infection appears to be given off by the breath and the secretions from the nose, mouth, ears and kidneys. The disease does not appear to be spread by water, although infected milk appears to have caused several outbreaks. Infection is almost always contracted by inhalation. The incubation period is from one to six days; the quarantine required is usually from seven to nine weeks, or until desquamation is at an end. Prevention includes isolation of the sick as a matter of the first importance. The apparel, equipment and former surroundings of the patient should be carefully disinfected. All discharges should be disinfected before removal from the sick-room, and the arrest of contagious material from the skin secured by the application of some antiseptic ointment. The convalescent soldier should not associate with others until all desquamation has ceased, the process being aided by repeated bathing in warm soapsuds. Careful shampooing of the head is essential in securing disinfection of the person.

SMALLPOX.—Occurrence.—Until well within the past fifty years this disease has prevailed generally among armies, being regarded as one of the most common and at the same time most fatal affections to which troops were ordinarily exposed. Its prevention among soldiers by means of vaccination was not attempted until 1831, when this operation was introduced in the army of Württemberg. Some years later it was taken up in other armies and practised with more or less thoroughness. During the Revolutionary War the failure of our invading expedition into Canada was largely due to a scourge of smallpox among the Continental forces. It was present during the war with Mexico, and during the Civil War there were 18,962 cases with 7,058 deaths. In the Confederate army of northern Virginia, from October, 1862, to January, 1864, there were 2,513 cases and 1,020 deaths. During the Franco-Prussian War the German troops, who had been carefully vaccinated, had only 278 fatal cases of smallpox in a total strength of 913,967 men; among the poorly protected French troops the deaths were said to have amounted to 23,400, and Coustan states that during the siege of Paris the mortality from smallpox among the besieged forces was no less than 6.76 per cent. In the military hospitals the German wounded escaped variola, where the French wounded prisoners were generally attacked. The lesson was not lost on the French authorities, and a vigorous system of vaccination was later instituted, so that 92 deaths from smallpox in 1877 were progressively reduced to 4 in 1890 and 3 in 1892. In the German army, excluding the Saxons and Bavarians, for the period 1873-74 to 1896-97, inclusive, there were but 17 cases of variola in a constant strength of over half a million men. Of these cases but 2 were fatal. In the Italian army of 204,312 men, for the year 1897, there were but 2 cases of variola; in the Russian army, for the same year, the admission rate per thousand amounted to .4. In the British army, for the period 1888-98 inclusive, there were no cases of smallpox among troops stationed in the temperate zone. In the tropics, however, the disease prevailed to no small extent; the admissions per thousand strength being 1.1 for