widely disseminated, sharply outlined focal necrosis of the minute blood vessels and with so little of alteration except edema in the lung tissue, goes a long way toward at least suggesting an explanation for a number of things, such as the early hemorrhages in the lung, the escape of such large amounts of fluid from the blood into the lungs and from them into the pleural cavities, also the "button-like" firm peripherally located regions of consolidation compared by many observers to hemorrhagic infarcts.

They also suggest that the disease if not very early a systemic infection may become so later, because the nature of these lesions is best explained by embolism. In such sections as these no organisms other than those commonly present have been found.

CONCLUSION

In conclusion it may be well to emphasize that the 7 sq. mm. of Figure 1 is but part of a section, and that the necrotic regions represented by india ink in Figure 2 may be found not only in all parts of the 7 sq. mm. of

Fig. 3.—No red blood corpuscles or very few are present in the necrotic places, more commonly at junctions of adjacent alveoli, and their walls are replaced by leukocytes, fragmented nuclei and fibrin, for the channels and circulation are interrupted. The capillary meshwork is continued at the ends of these necrotic regions and the blood circulates in them as usual; $\times$ about 470.

Figure 1, but also in all parts of the section containing the 7 sq. mm., and in other sections as well; also, as stated, in sections of some of the other lungs examined. It may well be that such discrete necroses as these, with so little of other change except edema, represent a phase of the disease which is of short duration.

Influenza has been compared with the exanthematic fevers such as measles. Prodromal engorgement of the conjunctival blood vessels is referred to by many observers,² also the early appearance of lividity of the pharynx, described as a red fringe or crescent bordering the hard palate, with minute hemorrhages and a papulovesicular rash in the livid mucosa (Alexander). Moreover, Oberndörfer³ has defined the disease as a

bacteriemia with localization of the virus in the pulmonary blood vessels and secondary infection of the lung tissue so involved. For the foregoing reasons it has seemed best to attempt some description of these necroses at this time.

STUDIES IN STREPTOCOCCIC INFECTIONS AT CAMP CUSTER, MICHIGAN

WITH SPECIAL REFERENCE TO INFLUENZA AND OTHER
ANTECEDENT INFECTIONS

WYNDHAM B. BLANTON, M.D. (RICHMOND, VA.)
Captain, M. C., U. S. Army, Chief of Laboratory Service

CHARLES W. BURHANS, M.D. (CLEVELAND)
Captain, M. C., U. S. Army

OLIVER W. HUNTER (MANHATTAN, KAN.)
Second Lieutenant, S. C., U. S. Army
CAMP CUSTER, BATTLE CREEK, MICH.

Sixty-five per cent. of the deaths from acute infections occurring in this camp since its establishment and coming to necropsy have been due to the streptococcus. If the month of October, 1918, is excluded, when influenza was epidemic here, the streptococcus has been responsible for 75 per cent. of the fatal acute infections. For more than a year the attention of this hospital has been focused on the diseases caused by this extremely prevalent and virulent organism, and the facts which this experience has brought to light are here assembled.

TABLE 1.—BACTERIOLOGIC FINDINGS IN ACUTE INFECTIONS
AT NECROPSY

	Deaths from Streptococci		No. Deaths from	
	Number	Per Cent.	Pneumococci	Other Acute Infections
Prior to the influenza epidemic...	37	70	10	6
During the influenza epidemic....	142	62	78	8
Since the influenza epidemic.....	26	86	1	3
Total	205	65	89	17

Reference to the accompanying chart will show the total incidence of streptococcus, compared to its closest competitor, the pneumococcus. The incidence of measles has also been charted. It will be seen that streptococci, except for a period in the spring and summer of 1918, have always outnumbered pneumococci. During the summer months, living conditions peculiar to military establishments are less productive of carriers, and cross infections by such organisms as hemolytic streptococci appear to be less frequent. Certainly during the summer months the relative incidence of these two infections more nearly approached what is commonly observed in civil life.

This camp was several months old before streptococcal infections began to appear. It was in January, 1918, that acutely fulminating pleuritis appeared associated with bronchopneumonia, terminating fatally in a high percentage of cases. Irons and Marine¹ were among the first to recognize the relation of these fatal infections to such antecedent factors as exposure and fatigue, or to other diseases, such as measles. Throughout the winter, streptococcal invasions con-

2. Alexander: Berl. klin. Wchnschr., 1918, No. 38, abstr., Deutsch. med. Wchnschr., 44: 1171, 1918. Bloomfield and Harrop: Bull. Johns Hopkins Hosp. 30: 1, 1919.

3. Oberndörfer: München. med. Wchnschr. 65: 810, 1918.

1. Irons, E. E., and Marine, David: Streptococcal Infections Following Measles and Other Diseases, J. A. M. A. 70: 687 (March 9) 1918.

tinued to occur with such frequency and astonishing virulence as to awaken the greatest concern. However, with the advent of spring they gradually lessened, and virtually disappeared during the summer. Coincident with the appearance of influenza in October, 1918, the streptococcus again came forward as the cardinal cause of death, regularly manifesting itself in a bronchopneumonia. During the epidemic, 674 deaths occurred, about two thirds of which were due to the streptococcus. During the four months since the epidemic, streptococci have occurred with even greater relative frequency, twenty-six out of the last thirty cases of acute infections coming to necropsy having had a fatal issue owing to the presence of this organism. During February, 1919, eighty-four infected wounds have shown hemolytic streptococci. Many cases of otitis media and numerous very severe mastoid infections have also appeared. Indeed, the greatest variety of localization has been encountered. This has been noted following the crest of each new wave of acute infections.

OCCURRENCE OF STREPTOCOCCI AS SECONDARY INFECTIONS

Streptococci have occurred at Camp Custer chiefly as secondary infections. Two methods of invasion have to be considered:

1. A very sudden and severe antecedent infection may so lower resistance that the ordinary mouth organisms gain admittance to the body with ease and in great numbers. An extensive example of this mode of secondary invasion was seen in the influenza epidemic. In this epidemic, death was invariably the result of a bronchopneumonia. These bronchopneumonias were not produced by a single organism, as would have been the case had a highly virulent and contagious organism been abroad at the time. On the contrary, they appeared to be caused in each case by the organism which the individual happened to have predominating in his mouth at the time, no matter whether that was streptococcus, pneumococcus, staphylococcus or Pfeiffer's bacillus. The very suddenness with which the epidemic came, attended immediately by secondary pneumonias, enforces the same idea. During this epidemic, *Streptococcus hemolyticus* caused only a few more deaths than the nonhemolytic strains. Pneumococci were recovered in about half as many cases as streptococci, and only a few staphylococci and Pfeiffer's bacilli were found. However, with the advance of the epidemic, *Streptococcus hemolyticus* became more and more prominent, while other causative organisms were encountered less frequently. *Streptococcus hemolyticus* appeared to gather virulence and prevalence more rapidly than the other organisms encountered earlier.

2. In other cases the virulence of the streptococcus appears to be the principal determining factor. Such cases were encountered in the early months of 1918, to which we have already referred. At that time masks were not generally used throughout the hospital, and the cubicle system was not in vogue in all wards. Superinfection was therefore much more of a possibility than at the later period, such as during the influenza epidemic. The fact that for several months antedating the appearance of these acute streptococcus infections many cases of measles and quite a number of so-called "colds" had been admitted

to the base hospital with almost negligible complications speaks for a more important factor than the antecedent infection. This was evidently furnished in the virulent strains of streptococci brought into this camp by new troops arriving in January, 1918. The fact that many of these new arrivals were ill on reaching camp was brought out in the empyema report² of this camp covering that period.

FACTORS IN THE INCIDENCE OF STREPTOCOCCIC INFECTIONS

There are undoubtedly many contributory factors making for streptococcic invasions. An analysis of the records of 2,149 cases of pneumonia following influenza was undertaken in an effort to bring to light some of these factors. The majority of these pneumonias were, as we have said, streptococcic in origin.

It was not possible to determine what proportion of troops in this camp came from large cities, small towns, and rural districts, respectively. But it was possible to learn the relative incidence of influenza in

Total incidence of streptococcus and pneumococcus infections charted by months, Camp Custer, Mich., September, 1917, to March, 1919: continuous line, streptococcus; broken line, pneumococcus; dotted line, measles; star, influenza epidemic.

troops falling into these three classes. From these figures the proportion of influenza that was complicated by pneumonia and terminated fatally was obtainable. The results of this analysis are set forth in Table 2. The percentage of pneumonia following influenza was more than twice as high in troops from rural districts as in troops from small towns or cities. This difference did not seem to exist as far as influenza alone was concerned. In other words, the existence of a previously established immunity was not evident in the case of influenza, but was evident in respect to secondary infections such as pneumonia. Troops from rural districts were probably no more susceptible to influenza than any other troops, but twice as high a percentage from rural districts died because they were twice as susceptible to secondary invaders, particularly to the streptococcus. After pneumonia developed, the death rate was approximately the same.

2. Review of War Surgery and Medicine, 1, No. 9, 1918.

Out of 39,675 troops stationed at this camp at the time of the influenza epidemic, approximately 23,000 had seen less than two months' service, or about 60 per cent. of the command was composed of new troops. Table 3 illustrates the greater susceptibility of new troops to both the initial and the secondary infections, and the attendant high mortality in such troops. The physical strain incident to change from civilian to army life which new troops have to undergo before they become acclimated probably accounts in part for the increased susceptibility to infections. As Irons and Marine pointed out, the same factors were probably operative during the winter months of 1918. Unaccustomed to long hikes, exposure and the undoubted physiologic shock of vaccination, new troops show less resistance to all acute infections. Opie and his collaborators found the same thing to be true at Camp Pike.³ Wallis collected even more striking figures at Camp Lee.⁴ But in addition to all these possible factors, there seems to be still some intangible but evident difference between new and old troops, on account of which the latter become less susceptible to disease when both classes are under the same conditions.

That organisms gain admission to the body of the host owing to disturbances in the normal balance of

TABLE 2.—COMPARISON OF THE INCIDENCE OF SECONDARY PNEUMONIA IN TROOPS FROM THE CITY AND COUNTRY: BASED ON 8,788 CASES OF INFLUENZA, COMPLICATED BY 2,149 PNEUMONIAS

Source	Per Cent. of Total Influenzas	Per Cent. of Total Pneumonias	Per Cent. Influenzas Developing Pneumonia	Pneumonia Case Fatality per Cent.	Influenza Case Fatality per Cent.
From cities of over 10,000.....	27.6	18.2	16.0	28.5	4.5
From cities and towns under 10,000.....	33.3	21.0	16.1	30.9	4.9
From rural districts*.....	39.1	59.9	37.4	28.9	10.8

* Patients whose occupation was farming or whose address was R. F. D.

resistance and virulence is well known. This method of invasion has already been referred to in discussing postinfluenza pneumonia, and needs no further amplification. But the question of contact infection remains to be considered. Table 4 serves to illustrate the effect of contact on the incidence of secondary pneumonia. This point is forcibly impressed after comparing the figures for medical officers and nurses with those for line officers. The high incidence of infection among those in the hospital in contact with the disease during the influenza epidemic has another explanation in the extreme tax on physical endurance put on every one during those days. We have no ready explanation for the low incidence of influenza and pneumonia in hospital corps men, other than the extreme care taken to protect them by means of instruction, masks, cubicling in barracks and mess table screens. The possibly less intimate contact with patients as compared to physicians and nurses may also offer some explanation. Further, men were instructed to report sick on first symptoms of indisposition, and thus serious complications were, for the most part, avoided. In addition, they were old troops, and had been hardened and kept fit by daily drill.

3. Opie, E. L.; Freeman, A. W.; Blake, F. G.; Small, J. C., and Rivers, T. M.: *Pneumonia Following Influenza* (at Camp Pike, Ark.), J. A. M. A. 72: 556 (Feb. 22) 1919.

4. Wallis: J. Lab. & Clin. Med. 4: 309, 1919.

Pneumonia was twice as frequent in army nurses as in civilian nurses. The latter were a part of the nursing personnel only for the emergency period of the epidemic. In spite of the utmost care exercised to see that every one went to bed as soon as sick, many army nurses were found ill who had given no heed to warnings and remained on duty through several days of sickness.

TABLE 3.—THE EFFECT OF LENGTH OF SERVICE ON THE INCIDENCE OF INFLUENZA AND SECONDARY PNEUMONIA

Approximate strength*	Length of Service		
	One Month or Under	Two Months	Over Two Months
Total number of influenza cases.....	8,598	14,857	16,220
Per cent. of command developing influenza.....	3,184	2,834	3,299
Total number of pneumonia cases.....	37	19	20.3
Per cent. of command developing pneumonia.....	813	645	691
Per cent. of influenza developing pneumonia.....	9.4	4.3	4.2
Deaths:	25.5	22.7	20.9
Total.....	431		203
Per cent. of influenza.....	7.1		6.1
Per cent. of pneumonia.....	29.5		29.2
Per cent. of command.....	1.8		1.2

* Based on weekly headquarters report of mean strength of command.

It was noted during the influenza epidemic that, whereas pneumococci occurred as infecting agents in about one third of the early cases, they gradually gave place to hemolytic streptococci and eventually disappeared entirely. The pneumococcus has been isolated only three times as the cause of disease in a period of two months (January and February, 1919). What led to the disappearance of the pneumococci we do not know. Where did so many hemolytic streptococci come from? Droplet infection as a cause of secondary pneumonia was negligible during the period of prevalent influenza. Practically every bed was cubicled, and everybody wore masks. Moreover, we have repeatedly demonstrated the effectiveness of the mask, as used in this hospital, by coughing into blood agar plates held at various distances from the mouth, with and without masks. Weaver,⁵ in a series of extensive experiments, has shown very conclusively the efficiency of the mask in preventing droplet infection. In this camp special care in the boiling of mess equipment has apparently been effective in stamping

TABLE 4.—THE INFLUENCE OF CONTACT ON THE INCIDENCE OF INFLUENZA AND SECONDARY PNEUMONIA

Organization	Strength	Influenza		Pneumonia		Deaths	
		No.	%	No.	%	No.	%
Total in camp.....	39,675	9,317	23.4	2,149	5.4	674	1.7
All medical and dental officers.....	164	42	25.6	9	5.5	2	1.2
All other officers.....	1,436	95	6.6	22	1.4	0	0.0
Ward men in base hospital.....	120	14	11.7	3	2.5	1	0.8
Other corps men in base hosp.....	455	57	12.0	12	2.6	7	1.5
Army nurses.....	144	44	30.6	15	10.4	2	1.4
Civilian nurses.....	121	44	36.3	8	6.6	1	0.8

out small epidemics of tonsillitis in line organizations. Lynch and Cumming⁶ have presented statistics to show the reduced incidence of influenza in organizations whose mess equipment was properly sterilized after using. Even with the use of masks there is recognized carelessness in the washing of hands. Undoubtedly the hand to mouth route accounts for the spread of at least some of these infections.

5. Weaver, G. H.: *Droplet Infection and Its Prevention by the Face Mask*, J. Infect. Dis. 24: 218 (March) 1919.

6. Lynch, C., and Cumming, J. G.: *Role of Hand in Influenza*, Mil. Surgeon 43: 597 (Dec.) 1918.

LOCALIZATION OF STREPTOCOCCI

There were recently reported a number of wound infections in a clean surgical ward. Cultures were made from the throats and wounds of all patients in that ward. It was found that all of those patients whose wounds were infected by hemolytic streptococci harbored numbers of the same organisms in their mouths, whereas those patients whose wounds were not infected did not have this organism in their mouths at the time. Transfer of organisms from mouth to wound by means of the hands can be considered possible in some cases. A further explanation may be found in the probable occurrence of a transient symptomless bacteremia with portal of entry in the throat and localization at the point of injured tissue in the wound. The fact that blood cultures in all these cases were negative does not exclude the possibility of this route of infection of clean wounds. In one instance a clean abdominal wound had healed and the patient was being prepared for discharge. This wound suddenly broke down, and hemolytic streptococci were recovered. The same organism was also found in the patient's throat.

In another instance, hemolytic streptococci were recovered in pure culture from a small abscess that

TABLE 5.—STREPTOCOCCI IN THROATS IN HEALTH AND IN DISEASE

Condition of Throats	Number of Culture	Total Cultures					
		Showing Streptococci		Showing Hemolytic Streptococci		Having a Growth of 50% Hemolytic Streptococci	
		No.	%	No.	%	No.	%
Normal throats, camp organizations.....	3,299	3,644	92.2	1,409	44.5	374	11.4
Normal throats, laboratory det.....	1,662	1,371	82.4	741	44.5	169	10.1
Patients with upper respiratory infec.....	1,069	1,024	96.1	833	77.9	511	47.6
Patients convalescent from pneumonia.....	203	182	88.6	141	69.4	87	42.8
Patients with empyema.....	739	596	80.6	465	60.2	223	30.1

developed in the arm at the site of an antipneumococcus vaccine injection. This soldier was a carrier of large numbers of hemolytic streptococci in his throat at the time.

Cultures on blood agar plates to the number of 6,972 have been made from the throats of both sick and normal individuals. These cultures were taken during a period of several months, and included patients in the hospital and members of other camp organizations. The principal fact brought out was that many normal as well as ill persons are carriers of hemolytic streptococci, and that the significant observation lies not merely in the presence of the hemolytic streptococcus, but rather in knowing in what numbers it occurs. For this reason an endeavor has been made to ascertain the percentage of throats showing on culture over 50 per cent. of hemolytic streptococci. This estimation was made in each case, after a rough determination of the total number of colonies growing on blood agar plates, by calculating the percentage of hemolyzing colonies with streptococcic characteristics. The importance of this distinction was made apparent in the summer of 1918, when the small number of hemolyzing colonies on plates was striking, whereas during the fall and winter it has been not unusual to find from 60 to 80 per cent. of hemolytic streptococci in so-called normal mouths.

In our experience, hemolytic streptococci are rarely found in the nose. From the posterior pharyngeal wall and sputum they may be recovered in a considerable number of cases. The tonsil plays the most important rôle in harboring this organism. Many careful cultures from the tonsils of normal persons not particularly exposed to patients ill with streptococcic infections have shown hemolytic streptococci in 90 per cent. of cases. On the other hand, we have only occasionally found them in the throats of those who have had their tonsils removed. Hemolytic streptococci have been recovered from the depths of 80 per cent. of tonsils examined after operative removal. These results are in line with those of Nichols and Bryan.⁷ In some cases we were surprised to find hemolytic streptococci in throats from which tonsils were said to have been removed. These patients were examined by a throat specialist, and in every instance some remaining tonsillar tissue was found.

LESIONS PRODUCED BY STREPTOCOCCI

Lungs.—Sixty-eight per cent. of all streptococci recovered in the last fourteen months were from patients with acute pulmonary infections. In these cases bronchopneumonia has been an invariable finding. The organism was identified either from the lung at necropsy or in the sputum during life. Moreover, 70 per cent. of all the pneumonias occurring in this camp have been of streptococcic origin.

Pleura.—Likewise by far the greatest number of pleural infections have been produced by the streptococcus. Coincident with the bronchopneumonias of the winter of 1918, very acute and fatal suppurative pleuritis were encountered. In many instances it was impossible to say which process preceded the other. Strikingly different were the pleural infections encountered in the wake of the influenza epidemic. The proportion of all pneumonias developing fluid in the chest was nine times as great during January, February, March and April as in the month of October, 1918. Pneumonia definitely preceded the appearance of fluid in the latter group of cases. Unlike also were these two periods in the course and outcome of their pleural infections. Pleuritis following influenza ran a much less violent course and was accompanied by a lower mortality. It should be noted, however, that the average duration of life in fatal cases during the epidemic was from six to ten days, and many patients died in from one to three days after the onset of pneumonia, a period of time too short to allow of the development of lesions such as empyema, which ordinarily require a longer time to become clinically evident.

Blood.—The infrequency of septicemia accompanying other localizations of streptococci in the body has frequently invited remark. On many occasions, organisms have been recovered from the blood at necropsy which repeated cultures had failed to reveal during life. An exception to this has been found in cases of mastoiditis. In this condition, 30 per cent. of blood cultures have yielded *Streptococcus hemolyticus*. Recently several strains of hemolytic streptococci have been recovered from blood cultures which grew distinctly better at low oxygen tension. Without the routine use of anaerobic plates, one of these organisms would never have been isolated.

7. Nichols, H. T., and Bryan, J. H.: The Tonsils as Foci of Infection, J. A. M. A. 71: 1813 (Nov. 16) 1918.

Pericardium.—Infections of this serous membrane have been encountered in a small proportion of cases. Considering the close topographic relation of the pleura and the pericardium, it has seemed remarkable to find so few extensions from one to the other.

Peritoneum.—Peritonitis of streptococcic origin has likewise been a comparatively unusual finding. Several of those discovered were subphrenic localizations. Not a single case of appendicitis out of more than 200 coming to operation has been shown to be produced by *Streptococcus hemolyticus*. In one case, only, of periappendicitis was this organism demonstrated.

Mastoiditis.—An unusual number of cases of streptococcic mastoiditis have arisen and have run very acute and stormy courses. Half of these have appeared since the influenza epidemic. About eighty such cases have come to operation. Thirteen per cent. have terminated fatally. Mastoiditis has unquestionably been one of the most serious late complications of influenza. Associated with mastoiditis, sinus and jugular vein thrombosis have been encountered four times each. Two patients developed meningitis and two brain abscesses.

Wounds.—Many infected wounds have shown the presence of the hemolytic streptococcus, in a majority of cases in pure culture. On many occasions this organism has occurred following clean operations the technic of which had the most critical scrutiny and laboratory control. Considering the very wide distribution of hemolytic streptococci in so-called normal mouths, such infections are more easily explained.

Among other localizations of streptococci have been cellulitis, arthritis, phlebitis, sinusitis, endocarditis, osteomyelitis, abscess of the thyroid, and abscesses of the kidney. Streptococci have been recovered in large numbers from many cases of tonsillitis. Erysipelas has been a common complication. It has been noted that streptococcic empyemas tend to remain uncontaminated by other organisms over long periods of time. Empyemas originally caused by pneumococci and other organisms have in spite of scrupulous surgical care in dressing later shown hemolytic streptococci, which ultimately were the only organisms recoverable from such cavities.

SUMMARY

1. Streptococci as observed at Camp Custer have manifested themselves almost uniformly as secondary invaders.

2. It is impossible to divorce a discussion of streptococcic infection from such antecedent diseases as influenza, measles and the acute upper respiratory inflammations.

3. Important factors in the incidence of streptococcic infections and their outcome are disclosed after investigating the effects of length of service, rural and city life, and bodily fatigue and exhaustion.

4. Streptococci have been responsible for a variety of lesions, but their predilection for the respiratory system far exceeds all other localizations.

Antitoxin in Diphtheria.—Depending on the way it is treated, diphtheria is one of the least dangerous or one of the most dangerous diseases. It is one of the least dangerous when promptly treated with antitoxin; it is one of the most dangerous when the antitoxin treatment is not given or is delayed or is insufficient.—Keep Well Series No. 4, U. S. Public Health Service.

REPORT OF THROAT CULTURES IN MEASLES

R. H. KNOWLTON, M.D. (ST. PETERSBURG, FLA.)

First Lieutenant, M. C., U. S. Army

TAKOMA PARK, D. C.

From Oct. 20, 1918, to the present date, a routine throat culture has been made in each case of measles as soon as possible after the patient enters the wards. This was done for the purpose of selecting those patients harboring hemolytic streptococci and isolating them, usually in a separate ward. The cubicle system as used in this hospital undoubtedly offers a large degree of protection against the spread of infection by coughing, but as the sheets are not always properly placed, the special ward was thought to be best. The statistics of these cases were kept to determine what relation was shown between the throat cultures and the complications. The diagnosis of complications was made by the different ward surgeons and the personnel changed from time to time. The presence of pathogenic organisms was determined by various persons of the regular laboratory force, so that their opinions were quite unbiased. This report, therefore, is largely a correlation of the findings of the ward surgeons by physical examination and the reports of the laboratory on the throat cultures.

The tables included show records of 458 cases of measles covering a period of eight weeks, from Oct. 20 to Dec. 13, 1918. The cultures were taken post-nasally with a wire swab, bent at right angles, and applied to a small area of a human blood agar plate. The spread was made with a platinum loop wet with a drop of salt solution. From this point the work was taken up by the regular laboratory force. The culture was examined next day and colonies resembling hemolytic streptococci picked and planted in broth. The following day the broth was examined and mixed with an equal amount of 5 per cent. suspension of red blood corpuscles and incubated for not over an hour, to determine the presence of hemolysis. Only those showing this reaction were considered positive. The percentage of positives for hemolytic streptococci varied materially in different weeks, the lowest being 19 per cent. the fourth week, and the highest 45 per cent. the eighth week. It also varied in different wards, the highest percentage being in B-4, where, of the twenty-three cases, there were fourteen positives. This ward was taken over for measles rather unexpectedly and for the first day or two there were no cubicles, which may account for the high percentage of positives. Also, cultures were taken in this ward three times, the first time determining nine positives, the second four more and the third time one more.

The chief interest lies in the relation between the throat organisms and the principal complications, pneumonia and otitis media. Pharyngitis, laryngitis and bronchitis have not been considered as complications but as more properly a part of the disease. While acute tonsillitis occurred not infrequently, it is hard to say whether it was a complication or not since it sometimes came after the patient was convalescent. The presence of bronchopneumonia is sometimes a matter of opinion, but the diagnosis of the ward surgeon was taken in all cases. Cases of otitis media have not been included unless the process went on to suppuration. Mortality statistics are practically com-