

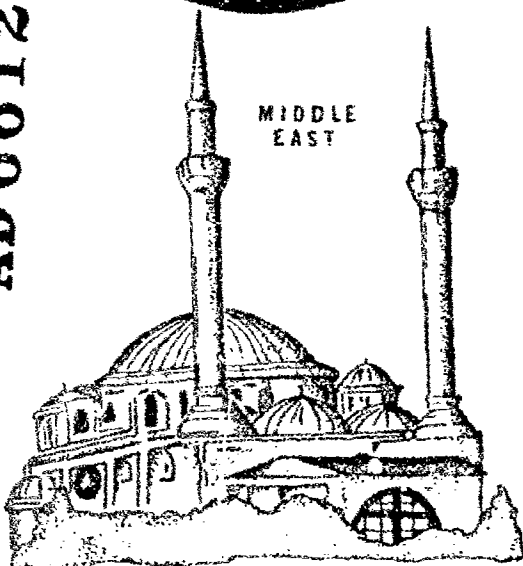


**THE U.S. LOGISTICS GROUP  
DETACHMENT 36  
USAFB  
EPIDEMIOLOGY**

**PROFESSIONAL REPORT**

No. 67-7

AD 661263



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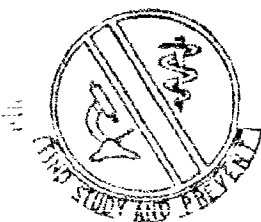


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**MICROBIOLOGICAL, EPIDEMIOLOGICAL AND ECOLOGICAL  
FACTORS IN A STREPTOCOCCAL PHARYNGITIS  
OUTBREAK AT A NATO MILITARY TRAINING  
CENTER**

23 OCTOBER 1967

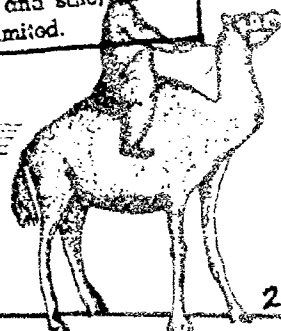
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DEPARTMENT OF THE AIR FORCE  
TUSLOG DETACHMENT 36 (USAF)  
APO New York 09224

EPIDEMIOLOGY

Report No. 67-7

MICROBIOLOGICAL, EPIDEMIOLOGICAL AND ECOLOGICAL  
FACTORS IN A STREPTOCOCCAL PHARYNGITIS  
OUTBREAK AT A NATO MILITARY TRAINING  
CENTER

23 OCTOBER 1967

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Albert L. Johnson, TSgt, USAF

PROJECT NO. 67-5

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### ABSTRACT

Three hundred throat swabs, taken by and from Turkish Army personnel, were cultured for beta-streptococci following an outbreak of pharyngitis at the Turkish Army Engineering Training Center at Abdullahağa Çiftliği, near Izmir, Turkey. From the results of this and data acquired from the bacteriologist/epidemiologist at the Turkish Military General Hospital, Izmir, Turkey, some epidemiological and ecological factors influencing such an outbreak are presented.

### TÜRKÇE ÖZET

Izmir civarında Abdullahağa Çiftliğinde bulunan Türk Kara Kuvvetleri İstihkâm, Er Eğitim Merkezindeki Farenjit salgınını müteakip Türk askeri personeli tarafından hastalardan alınan 300 adet boğaz kültürü beta-Streptokok araştırmasına tâbi tutulmuştur. Bu araştırmalardan ve İzmir Askeri Genel Hastahane Bakteriolog/Epidemiolog'undan elde edilen bilgilere istinaden bu salgına tesir eden bazı epidemiyolojik ve ekolojik faktörler burada taktim edilmektedir.

DEPARTMENT OF THE AIR FORCE  
TUSLOG DETACHMENT 36 (USAFE)  
APO New York 09224

I

INTRODUCTION

During the seven day period, 8 through 14 May 1967, a total of 1954 cases of streptococcal pharyngitis (5) were seen at the Turkish Military General Hospital, Izmir, Turkey. The causative organism, its invasive capabilities perhaps enhanced by a change in meteorological conditions, was most likely introduced to the patients in food from their mess hall. Detachment 36 first became aware of the outbreak on 12 May 1967, when Dr. Maj. Ahmet Gökhan, the bacteriologist/epidemiologist of the Turkish Hospital, requested our assistance in the identification of the disease-producing agent.

All three battalions comprising the Engineering Training Center of the Turkish Army Corps of Engineers (area A on Map - Fig. 4) were affected. This center is said to accommodate about 6000 trainees who are subdivided into three battalions averaging 2000 men each. These battalions are each split into six companies of approximately 300 men each.

The number of cases seen each day, and the percentage of the total trainee strength represented by these cases are listed in Table I. Of the total personnel affected, 44% were from "Battalion I", 43% were from "Battalion II", and 13% were from the so called "Reading and Writing Battalion".

II

MATERIALS AND METHODS

Following the 8 May 1967, pharyngitis outbreak, 100 throat cultures were taken per day on 23 May, 25 May and 5 June 1967, respectively, from trainees at the Turkish Army Training Center, west of Izmir, Turkey.

Of the cultures taken on 23 and 25 May, 50% were from previously symptomatic cases of pharyngitis. These patients had received each day, for six days following onset of symptoms, 800,000 IU, benzathine penicillin and 2 grams of a sulfonamide compound; then, on 20 May 1967, one injection of 1,200,000 IU, benzathine penicillin. This group of trainees was to be transferred to other Turkish Army units when the results of its throat cultures were known.

Twenty five percent of the 23 and 25 May cultures were from asymptomatic trainees who would be remaining on post; who were prophylactically administered a 1,200,000 IU dose of benzathine penicillin (before 22 May 1967); and, who received this same dosage fifteen days later (before 5 June 1967). The remaining

TABLE I

NUMBER OF PHARYNGITIS CASES FROM A TRAINING CENTER OF 6000 MEN SEEN PER DAY BY TURKISH MILITARY HOSPITAL			
DAY OF OUTBREAK	DATE	NUMBER OF CASES	PERCENT OF CENTER
1	8 May 1967	1000	16.66
2	9 May 1967	609	10.15
3	10 May 1967	150	2.50
4	11 May 1967	150	2.50
5	12 May 1967	25	0.42
6	13 May 1967	20	0.33
7	14 May 1967	0	0.00
TOTAL		1954	32.56 %

25% of the 23 and 25 May cultures were from asymptomatic trainees who had received no treatment. The cultures themselves were not identified as to the particular group from which they were obtained.

One hundred additional cultures, taken on 5 June 1967, were from new trainees who had received no antibiotics. These men had arrived after the end of the outbreak and had had no opportunity to associate with the trainees who had reported on station prior to the epidemic.

Sterile, cotton-tipped applicator sticks were used to swab all throats (22). These were aseptically broken off into 2 ml quantities of Todd-Hewitt Broth (Difco) (7) in 13x100 mm, cotton-plugged tubes prepared by this epidemiological unit. Between inoculation of the broths at the Turkish Military Hospital and the primary plating at Detachment 36, and average time of 3 hours elapsed, during which, the cultures were at an approximate temperature of 24° C.

On receipt of the inoculated tubes by this laboratory, the swabs were discarded after twirling in the broth to suspend as much material as possible. The broth samples were then poured into 100 mm plastic Petri dishes and mixed completely with 15 ml of Neopeptone (Difco) Medium containing 5% sheep blood and 1.5% agar (pH 7.2) at 45-48° C, (10, 27, 30, 32).

After solidification, the plates were incubated for 18-24 hours at 37° C, at which time, colonies, showing surrounding, clear zones of beta-hemolysis, were fished out with a straight needle, gram-stained, and streaked for isolation on fresh Neopeptone Blood Agar plates, (22, 27, 32). For group differentiation of the streptococci, a filter paper disk (5mm dia., saturated with a 1.0 unit/ml solution of bacitracin and then dried), (6, 20) was pressed onto the area of heaviest inoculation. These plates were also incubated at 37° C for 18-24 hours.

Cultures which exhibited typical colonial morphology, beta-hemolysis and sensitivity to the bacitracin were subcultured in 5 ml butts of Neopeptone Agar (no blood) in 9 ml specimen vials and stored refrigerated for use in future studies. These subcultures were later grouped by the Lancefield precipitin technique using A, C and G antisera (16, 17, 18, 19). The streptococcal isolates did not fall into one of these 3 groups.

### III

## RESULTS

During the week of the outbreak we found that an average of 40% of throats cultured yielded beta-hemolytic streptococci. On the 16th, 18th and 29th days (23, 25 May and 5 June 1967, respectively), following the onset of presenting,

symptomatic cases, 100 throat cultures each day were analyzed for bacitracin sensitive beta-streptococci. The results of these cultural studies are shown in Table II. The cultures of 5 June 1967, are those taken from untreated, new trainees who were not associated with the outbreak and who had had no contact with trainees present during the outbreak; in fact, we were informed that sometime between 25 May and 2 June, there was an almost 100% turnover in trainee personnel. Therefore, the results of this one set of 100 cultures probably reflects a "normal" oropharyngeal carrier rate for incoming trainees at the Training Center (13, 22) as determinable by the cultural methods utilized, i.e., 5%.

#### IV

#### DISCUSSION

The cultures of 23 and 25 May were not identified as to which were from treated and untreated personnel. Thus, if carrier rates are determined using the total of each set of 100 cultures as an index of the rate on the day of acquisition, we have carrier rates of 11% on 23 May and 5% on 25 May. However, if it is assumed that the beta-streptococci isolated were all from the untreated groups (25 cultures out of 100 per day), then the carrier rate was 44% on 23 May and 20% on 25 May. This is in closer agreement with percentages of postoutbreak streptococcal carriers found by others (1, 2, 13, 14, 24, 26, 32).

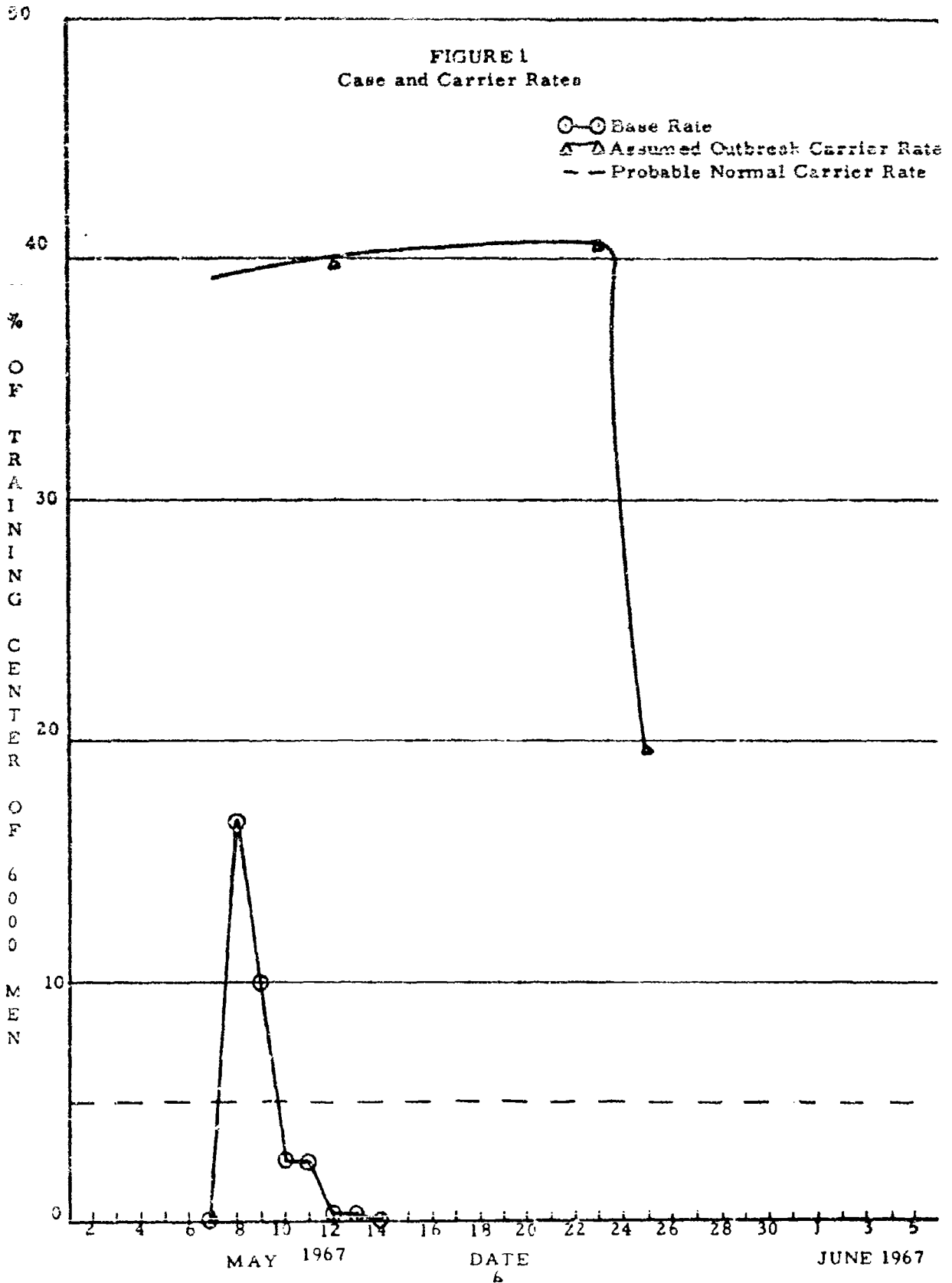
Figure 1 portrays, compositely, the probable "normal" streptococcal carrier rate for this training center, the daily cases of pharyngitis, represented as daily percentages of the center seen at the Turkish Military General Hospital during the outbreak, and the assumed streptococcal carrier rate from the first day of the outbreak on 8 May until 25 May 1967. The precipitous decline of the carrier rate between 23 and 25 May can be credited to:

1. The general and efficacious administration of prophylactic chemotherapy (3, 6, 25).
2. The dispersal and transfer of many trainees from the center (12).
3. Weather stabilization to the typically mild Eastern Aegean summer climatic conditions (i.e. Koppen climatic class Csa - see Map - Fig. 3), (11) which occurred after 10 May in 1967 (See Fig. 2).

The course followed by this pharyngitis outbreak, as shown in Figure 1 by the daily percentages of trainees appearing at the hospital for treatment, has some interesting aspects, especially the explosive onset of cases. Also,

TABLE II

BETA-STREPTOCOCCI ISOLATED FROM POST-OUTBREAK THROAT CULTURES		
POST - OUTBREAK DAY AND DATE	NUMBER OF THROATS CULTURED	NUMBER OF THROATS YIELDING BETASTREPTO- COCCI (All Bacitracin Sensitive)
16 (23 May 1967)	100	11
18 (25 May 1967)	100	5
29 (5 June 1967)	100	5
TOTAL	300	21



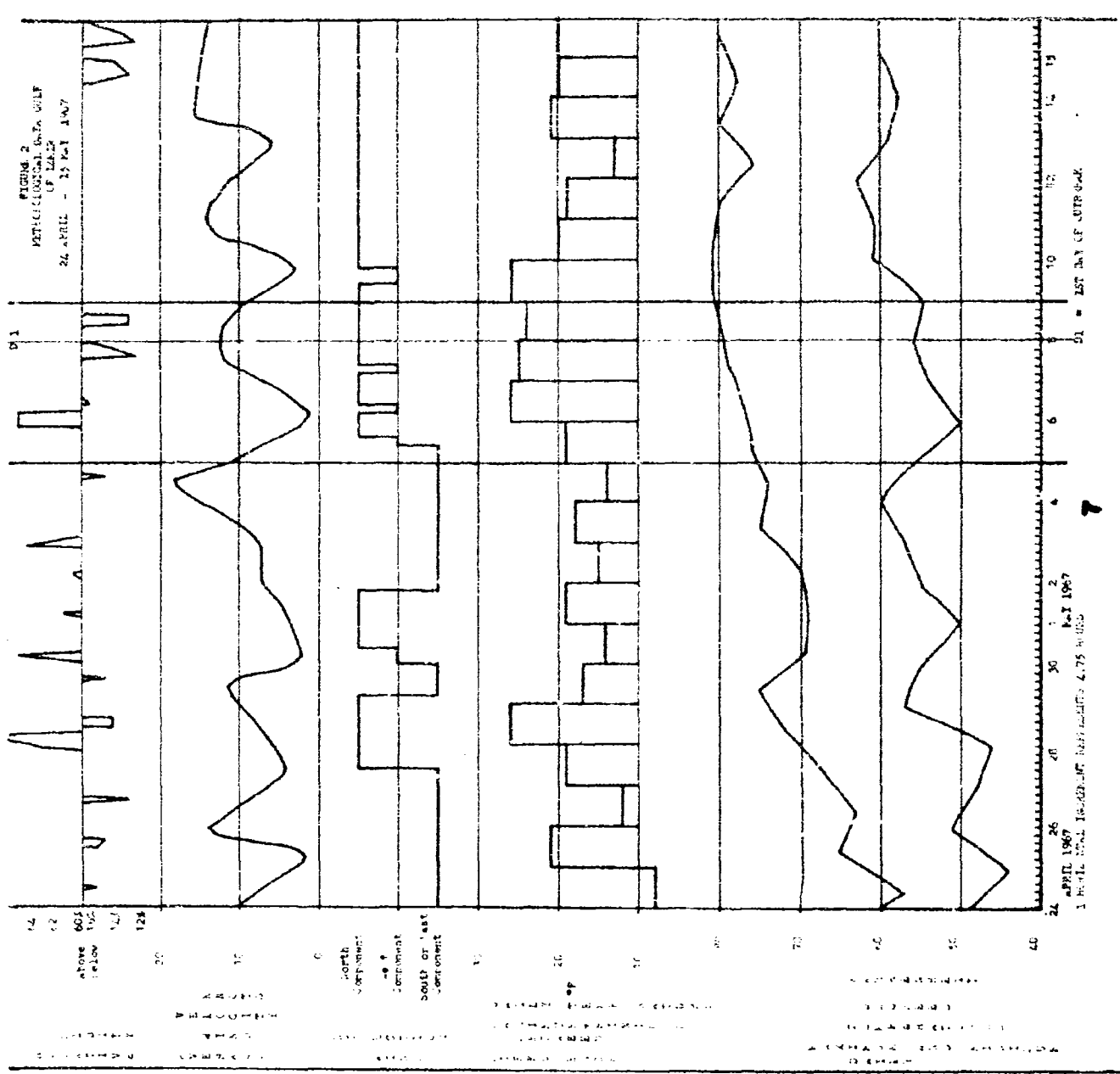


FIGURE 2  
 METEOROLOGICAL DATA, GULF  
 OF MEXICO  
 24 APRIL - 15 MAY 1967

24 APRIL 1967  
 26 APRIL 1967  
 28 APRIL 1967  
 30 APRIL 1967  
 2 MAY 1967  
 4 MAY 1967  
 6 MAY 1967  
 8 MAY 1967  
 10 MAY 1967  
 12 MAY 1967  
 14 MAY 1967



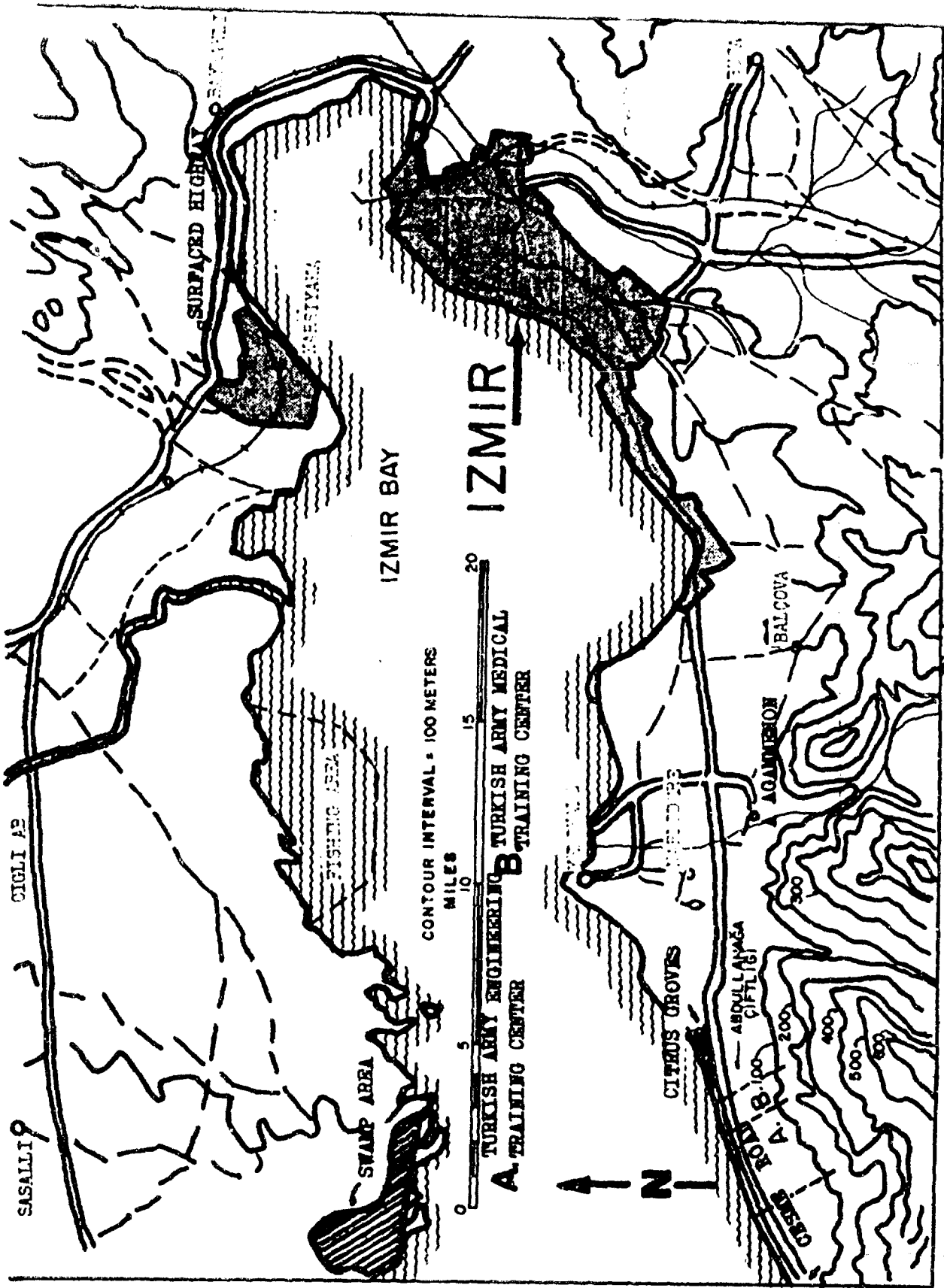


FIG 4

because of the physical layout of the training complex there was a unique opportunity to compare two neighboring centers; Engineering, which suffered this outbreak; and Medical, which escaped an outbreak (areas A and B on Map - Fig. 4).

On the third and fourth days of the outbreak, 10 and 11 May, the Medical trainees were checked for symptoms of pharyngitis at their training center. It is not known whether cultural studies were performed concurrently, but, only about 1% were found with mild pharyngeal symptoms (12).

The Abdullahaga Çiftliği Training complex is approximately 9 miles west of the center of Izmir, Turkey. The Engineering Training Center has a 4920 foot frontage on the Gulf of Izmir, is continuous with, and west of the Medical Training Center, which has a 2624 foot front on the water (Map - Fig. 4).

The normal complement of Medical trainees is about 1000 as compared to the 6000 Engineers, however, their age range and backgrounds are said to be the same. Both groups occupy the same type of barrack, adhere to similar academic and physical training schedules, and receive comparable meals cooked in separate kitchens and served in separate mess halls.

Topographically, the training complex is constructed on rocky, gravelly, uneven land, separated from a 10 to 30 feet wide beach by a double lane asphalt highway. The land begins rising rapidly about 500 feet from the road, reaches an elevation of 1000 feet in 1 1/2 to 2 miles, 2000 feet in 2 1/2 to 3 miles, with a crest peaking at 3419 feet, 4 1/2 miles south of the shoreline (Fig. 4).

The Engineer barracks are constructed on a slope facing the water and are otherwise unprotected from winds coming off the water from a north-easterly to northwesterly direction. The Medical barracks are built on a level area nearer sea-level and are protected from northeasterly winds by citrus trees. This measure of protection, when regarded in the light of the weather situation immediately preceding the outbreak, may be one factor explaining why one center had a pharyngitis problem and the other did not.

The weather picture shown in Figure 2, up until 3 days preceding the outbreak is the normal spring pattern of fluctuating, but slowly rising, maximum and minimum daily temperatures, with prevailing southerly to easterly winds of moderate velocity. Beginning on 5 May, however, a greater difference is noted between the maximum daytime temperatures and the minimums at night, especially between 5 and 8 May. On the night of 5 - 6 May there was a drop of 25°, from 75° to 50° F. On the same day the wind changed to a predominantly northerly - northeasterly component which fluctuated to westerly for two days, finally stabilizing to the prevailing northerly wind of the

summer months. Coupled with these changes was a rise in relative humidity to 64% which sustained itself most of the night of 5 - 6 May. This combination of factors, even with a wind velocity of 1 to 2 knots coming off the water, was sufficient to increase discomfort among the trainees and cause them to cover their windows with blankets during the night (12). However, the added protection given the Medical barracks by the shield of trees between them and the water was sufficient to preclude such chilling of these trainees. Perhaps, therefore, their resistance did not diminish to the point where an invasive streptococcal strain, introduced in high numbers, could cause serious infection.

In a two year study of streptococcal infections in a ship's crew, Ulewicz and others found a significant relationship between increased numbers of infections and meteorological conditions with carrier rates which fluctuated between 10 and 47% (29). In a comparison of the carrier states in two climatological zones in the United States, Krause and others have reported that differences in climate had no effect on the length of the carrier state, although, organisms disappeared from the anterior nares more rapidly from men at Tyndall Air Force Base, Panama City, Florida, (Cfa Köppen climatic class), than from those at F. E. Warren Air Force Base, Cheyenne, Wyoming (Bsk Köppen climatic class). They also postulated that the spread of streptococcal infection might be enhanced because the mucous membranes of the upper respiratory tract are rendered more susceptible by a change in climatic conditions (4, 15). F. E. Warren AFB, as well as, Lowry AFB, Denver, Colorado, other Rocky Mountain area installations, Sampson AFB, New York, and Loring AFB, Maine, have been reported as having had continuing problem with streptococcal infections and high carrier rates as compared to other bases elsewhere in the United States (1, 4, 8, 23).

A tabulation of streptococcal pharyngitis infections recorded for the United States Military population in the Izmir area, (See Fig. 5), (31) preceding and following the 7 May 1967, Turkish trainee outbreak, implies that a widespread weather change was not the major factor influencing the sudden rise in pharyngitis cases at the Engineering Training Center. Only a slight upward deviation from the steady downward winter to summer pharyngitis trend in American active duty personnel is seen during May 1967, with no similar deviation in the American dependent population.

The sudden onset of cases on 8 and 9 May 1967, at the training center points most strongly to a common source of infection, especially with the absence of a similar infection rate in the adjacent Medical Training Center and the paucity of observed pharyngeal symptoms in neighboring Turkish civilian (12, 23), and American military communities. In subsequent discussions of the situation with the Turkish epidemiologist, it was ascertained that an unspecified item of food, served in the common dining hall a day or two prior

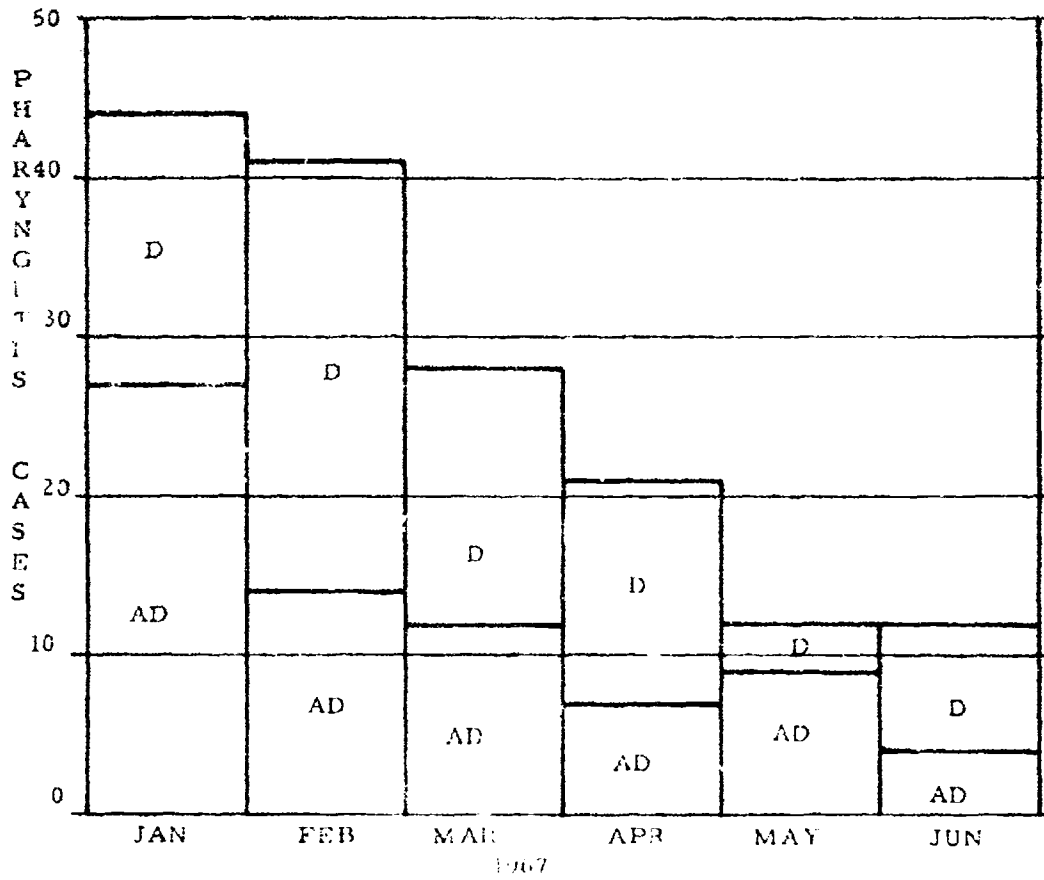
FIGURE 5

Number of Pharyngitis Cases in The United States  
Military Population for the First Six Months of  
1967

AD = Active Duty  
D = Dependents

Average Total Strength

AD - 1715  
D - 3480



to 8 May 1967, was highly suspected.

A contaminated food as the source of infection is strikingly substantiated when we compare this outbreak to an outbreak of streptococcal pharyngitis reported at Fort Bragg, North Carolina, in November, 1944 (21). A creamed egg dish contaminated with streptococci was calculated to be the means of introducing the infection to members of two companies of an air-borne infantry regiment. As in the case of the Turkish trainees, the majority of cases appeared at the outset of the epidemic and the infection rate quickly fell within a week to a low level which continued for another week (see Fig. 6). This extended tailing of the infection rate in the Fort Bragg episode can be explained by the difference in prophylaxis used for streptococcal pharyngitis in 1944. No weather data was included.

Although it was expected that some cases of rheumatic fever or glomerular-nephritis might result among the Turkish troops from the high number of pharyngitis infections, i. e., 1954, (9, 28, 33), none have been reported as of 5 October 1967. This fortunate circumstance presumably resulted from the rapid removal of the streptococcal organism from the throats of the treated patients by penicillin, given in adequate dosage for an adequate length of time (15, 25).

## V

### SUMMARY

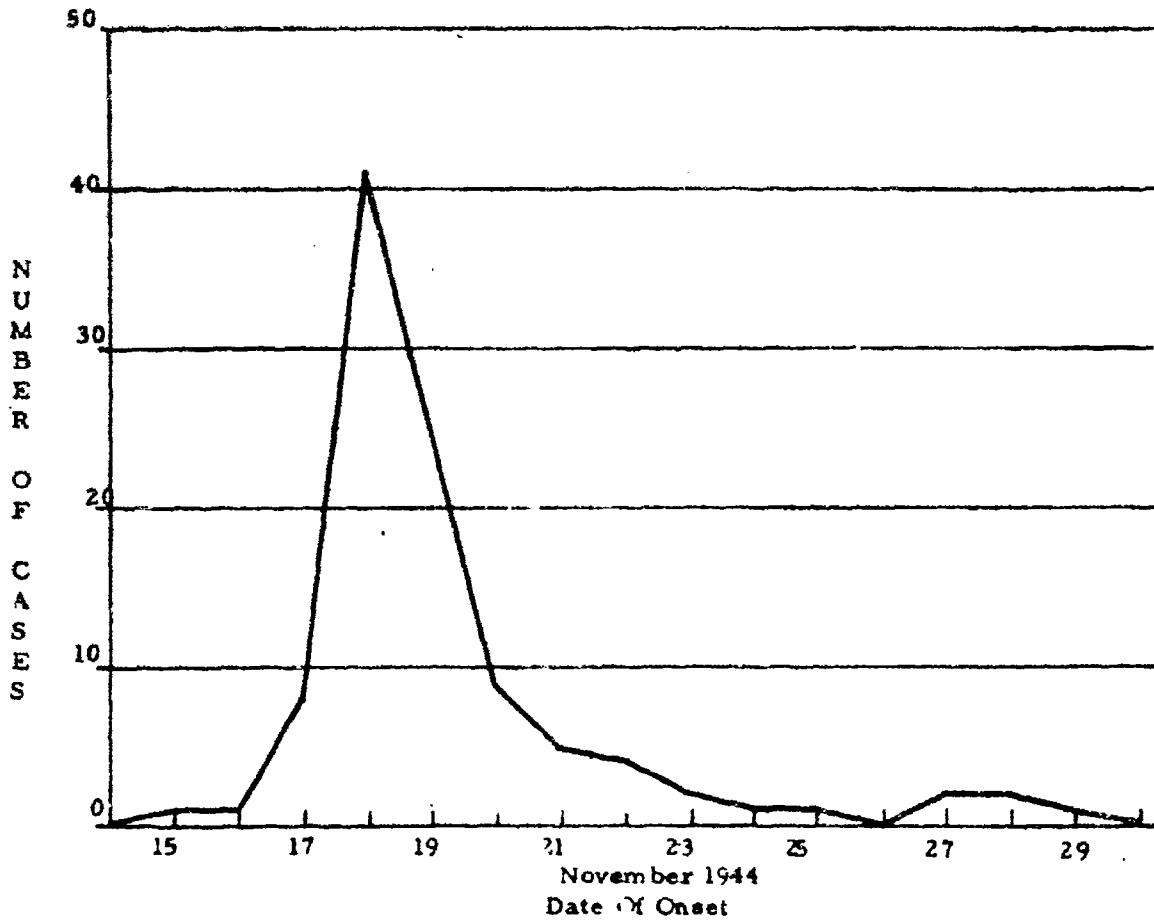
An explosive outbreak of pharyngitis involving 1954 trainees at the Turkish Army Engineering Training Center, near Izmir, Turkey, between 8 and 14 May 1967, was determined to have been caused by a massive introduction of bacitracin-sensitive, beta-hemolytic streptococci into the three training battalions comprising the center, probably by means of a contaminated food item consumed one or two days before the onset of symptoms.

The course of the epidemic may have been influenced by the change from spring to summer weather conditions which occurred between 5 and 9 May 1967, and by the prompt and efficacious chemotherapy administered by the Turkish medical staff.

FIGURE 6

Pharyngitis Cases During  
A Food-Borne Streptococcal  
Epidemic At Fort Bragg, N. C.  
November 1944

Personnel Exposed  
To Risk = 288.



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	ROLE	WT	ROLE	WT	ROLE	WT
Streptococcus						
Epidemic						
Pharyngitis						
Tonsillitis						
Throat culture						
Serological grouping						
Troops						
Housing						
Food borne						
Ecology						
Climate						
Weather						
Season						
Carrier rates						
West Turkey						

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