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PREVENTION OF INFLUENZA AND OTHER RESPIRATORY DISEASES - LABORATORY STUDIES

EPIDEMIOLOGICAL SURVEILLANCE OF INFLUENZA AND OTHER RESPIRATORY DISEASES IN MILITARY PERSONNEL

ANNUAL REPORT

GORDON MEIKLEJOHN
THEODORE C. EICKHOFF

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1. Following the Christmas break, both Influenza B and Influenza A were present at Lowry Air Force Base over a period of many weeks, with Influenza B predominating.

2. Post-vaccination antibody titers for Influenza A H3N2 and H1N1 were excellent in the students and reasonably good in the permanent party. Influenza B titers measured with the ether-treated B/USSR/83 appeared to be comparably high.

3. In the student population 48 cases of Influenza B and 2 of Influenza A (H3N2) were detected. In the permanent party 78 cases of Influenza B and 17 of Influenza A were detected. The number of cases of Influenza B far exceeded the number observed in any outbreak since these studies began at Lowry Air Force Base in 1952.

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4. Studies with two Denver strains isolated during the epidemic at Lowry and two other recent Influenza B isolates, B/Ann Arbor/86 and B/Canada/85, showed a significant antigenic drift (8-16-fold) away from B/USSR/82.

5. When ether-treated B/USSR/82 was used as antigen, the relationship between the acute phase antibody titer and clinical illness rates was far less clear-cut than that usually observed with Influenza A H3N2. It appeared that the protective titer was 128 or higher.

6. Comparison of the three tests used for confirmation of the diagnosis of influenza showed that the complement fixing antibody test was positive in 91%, virus isolation in 75% and H.I. tests using B/USSR/ 82-E.T. was 63%.

7. The illness caused by Influenza B virus in this vaccinated population was very mild as judged by the oral temperatures of patients reporting to the clinic. Temperatures of permanent party were between 99 and 100 degrees in 39% and in students 59%.

8. Inapparent infection: Using the distribution of complement fixing antibody titers as a measure of recent infection, it appeared that 20% or more of the Base population was infected with Influenza B during this period.

9. Influenza B and A combined were responsible for approximately 35% of all 218 febrile URIs seen during the season. The only other common cause of febrile URI was streptococcal pharyngitis. In approximately 50% of the patients etiology remained undetermined.

FOREWORD

For the protection of human subjects, the investigator(s) have adhered to policies of applicable Federal Law 45CFR46.

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ANNUAL REPORT

FEBRUARY 1, 1985 - JUNE 30, 1986

INTRODUCTION

The 1985-86 influenza season was unusual in several respects. Again two types of influenza were present in the Denver area and at Lowry Air Force Base. Influenza A (H3N2) was first detected by isolating the virus from a civilian with the date of onset of 8 December 1985. Small numbers of cases were detected in the civilian community in the following weeks, but it was not until the week of January 27 that the virus was first detected at Lowry Air Force Base. A total of 19 cases occurred during the succeeding six weeks.

Influenza B, which turned out to be the dominant virus during the season, began to appear at Lowry Air Force Base immediately after the Christmas break. Cases occurred in numbers which we have not observed since the influenza epidemic of 1977-78 when the A/USSR/77 (H1N1) virus first struck the Base at a time when no vaccine had been given. Both students and permanent party were affected to an equal extent. It became obvious as the season progressed that the vaccine had provided little protection and that there had been very significant antigenic drift. Much of the effort of the present season has been directed toward trying to explain the failure of the Influenza B component to provide adequate protection.

ANTIBODY RESPONSE FOLLOWING VACCINATION

In contrast to the previous three years, sera to assess antibody response following vaccination were collected only from permanent party personnel. In prior years, pre and post vaccination sera have been collected from recruits as well. In recruits these have invariably shown an excellent response to both the Influenza A components (H3N2 and H1N1) and what appeared to be an adequate response to the Influenza B component. Since the vaccine was identical to that used in the previous year, there seemed to be little point in repeating the tests in recruits. The permanent party testing was considered important in view of the questions that had been raised about the value of annual revaccination of regular Air Force personnel. All the permanent party who were bled this year had been vaccinated the year before.

H.I. Antibody Response

Influenza A (Table 1)

A/Philippine/82

Before vaccination, 89% of the permanent party had antibody titers of 8 or more and 56% had titers of 32 or more. Following vaccination, 97% had titers of 8 or more, 84% had titers of 32 or higher, and 25% showed a four-fold increase in titer.

A/Chile/83

Before vaccination, 91% had titers of more than 8 and 69% had titers of 32 or more. Following vaccination, 99% had titers of 8 or more and 81% had titers of 32 or more. 27% had fourfold or greater increases in antibody titer.

Since the prevaccination titers of these personnel represent specimens collected 12 months after vaccine was administered in 1984 to the same individuals, it appeared that there has been significant drop in antibody titer during this past year. This will be discussed in a later section.

Influenza B

The evaluation of the H.I. response to the B/USSR/83 component of the vaccine has been difficult because of the characteristics of this virus. When whole virus antigen is used in H.I. tests, titers are low due to the low avidity of the strain. Serial egg passage has improved this slightly but it still appears to be below the desired level. For this reason, on the recommendation of the CDC, ether-treated antigens have been used to measure H.I. antibody response. With these antigens, titers are much higher. The baseline is also raised and there must be considerable doubt about the specificity of the antibody measured.

All 79 of the serum pairs from permanent party were initially tested against B/USSR whole virus preparations. It then seemed desirable to test them with ether-treated B/USSR antigens and also with B/Singapore/79. The results of tests with these three antigens are shown in Table 2.

B/USSR/E.T. (Ether-Treated)

Before vaccination, 14% had titers of less than 8 and 20% had titers of more than 128. After vaccination, only two individuals had titers of less than 8 and 40% had titers of 128 or more. 18% showed a fourfold or greater increase in titer.

B/USSR/W.V.

Before vaccination, 38% had titers of less than 8 and 14% had titers of 32 or more. After vaccination, 26% had titers of less than 8, and 32% had titers of 32 or more. 14% had increases in titer of fourfold or more.

B/Singapore/W.V.

In the prevaccination sera 20% had titers less than 8 and 40% had titers of 32 or more. Following vaccination 6% had titers of less than 8 and 70% had titers of 32 or more. 10% had increases in titers of fourfold or greater.

The significance of these findings will be discussed in later sections dealing with antigenic drift and the relationship between H.I. antibody titer and protection against illness.

H.I. Antibody Levels in Students

While no sera were drawn from recruits at Lackland Air Force Base during the past fall, it was possible to assess antibody levels by measuring the H.I. titers in the acute phase sera of the students who reported with febrile URIs which were not caused by Influenza B.

The distribution of titers in this group were essentially the same as those observed in the post-vaccination sera of students who were studied a year ago. They were somewhat higher than the post-vaccination levels observed in the permanent party. (Table 3)

OCCURRENCE AND INCIDENCE OF INFLUENZA B & A

Surveillance was begun during the last week of October 1985 and continued until the end of May 1986. During the pre-Christmas period, febrile URI rates in students and permanent party remained low. The only viruses isolated during this period were the five parainfluenza viruses, four of which were Type I. The first case of influenza in the civilian community had an onset date of December 8 and was identified as Influenza A (H3N2). At Lowry Air Force Base the first cases of Influenza B occurred in a permanent party individual during the week of December 31 and in students two weeks later, when three cases of Influenza B were confirmed. The course of influenza after that is shown in Table 4 and Figure 1.

At Lowry Air Force Base, as in the civilian community, both Influenza A and B were present over a long period of time, with Influenza B predominating. This is not surprising in view of the fact that there had been a widespread outbreak of Influenza A of the H3N2 type during the preceding season. The peak week in both student and permanent party populations was February 10, when 19 cases of Influenza B in students and 22 in permanent party, and 9 cases of Influenza A in the permanent party were confirmed. Thereafter the number of cases of Influenza B fell off sharply in the students but continued high in the permanent party for another two weeks. The last case of influenza occurred during the week of March 24.

The number of cases shown in Table 4 has been adjusted to include some individuals from whom specimens were not collected. In the student population during most of the year, specimens were collected from virtually everyone reporting with a febrile URI. In the permanent party this figure usually ran in the range of 85%. During the weeks from February 10 to March 9, the volume of patients was overwhelming and the single secretary at Lowry Air Force Base was unable to obtain specimens from all individuals. At least 54% of the persons with febrile URI did have specimens collected and the percent of these which were positive was extrapolated to the whole number of patients reporting with febrile illness to provide the numbers shown in Table 4. The percent of patients from whom specimens were collected is shown in Table 5.

The number of cases of Influenza B in both the students and permanent party was considerably higher than has been observed in recent years. The number of cases of Influenza A was relatively small, and, as in the past

three outbreaks of H3N2 Influenza A, the student body was almost completely spared. The small number of cases in students related well to the high levels of antibodies observed in the students in H.I. tests with H3N2 strain A/Philippine/82. Febrile URI attack rates were estimated in both the students and permanent party, though the latter probably represent relatively soft figures. In the students the peak rate was 8.4 cases per thousand per week, the highest observed in the last five years. It is nonetheless a relatively low figure. Concurrent with the cases of influenza, there was also a sizable rise in the number of patients who reported to the clinic with symptoms of URI without fever. These will be discussed in a subsequent section dealing with inapparent infection rates.

ANTIGENIC DRIFT

Influenza B

Influenza B strains were isolated initially in rhesus monkey kidney tissue culture. One of the earlier strains was passed into eggs, where it grew relatively poorly and even after seven passages was relatively non-avid. For that reason it was useless in determining whether or not antigenic drift had occurred. It was not until April that we received from CDC two egg-adapted strains of recent isolates, B/Ann Arbor/86 and B/Canada/85. At that time we tested eight serum pairs of individuals who had confirmed Influenza B, based on both virus isolation and C.F. antibody rise. These were tested against the following seven Influenza B strains: (Table 6)

1. B/USSR-W.V.
2. B/USSR-E.T.
3. B/Ann Arbor/86
4. B/Canada/85
5. B/Denver/1/86. This was isolated from a civilian who had acquired the disease in New York from a relative who had just arrived with influenza after an air trip from Bombay in India.
6. B/Denver/2/86.
7. B/Denver/3/86. The strains B/Denver/2/86 and B/Denver/3/86 were isolated from patients at Lowry Air Force Base in rhesus monkey kidney tissue culture. Virus pools of the supernatant fluid had been prepared from the second tissue culture passage for use as antigen in the H.I. tests. We had observed in 1973 that with tissue culture supernatants, we could obviate the problem of low avidity. When we tried the same procedure in 1984, the tissue culture virus was not better than the egg passage material. In 1986, we again found the tissue culture fluid useful as an antigen.

The sera all had titers which were very high in both acute and convalescent serum in tests with the ether-treated B/USSR antigen. However, acute sera titers were very low in tests with B/Ann Arbor, B/Canada, B/Denver/1,2,3/86. Convalescent titers, however, were high, indicating a satisfactory level of avidity for B/Denver/2/86 and B/Denver/3/86.

The results with the strain B/Denver/1/86 show what is meant by low avidity. The acute phase sera all show titers of <8, which is not too

different from those obtained with B/Ann Arbor/86. However, the titers obtained with convalescent sera are uniformly low and only four of the serum pairs showed significant rise in antibody titer. With the more avid Denver/2/86 and Denver/3/86 strains, all serum pairs show good rise in titer.

The degree of antigenic drift is best demonstrated by comparing the titers of acute phase antibody of the new Influenza B viruses with B/USSR-W.V. With B/Ann Arbor/86, which has been selected as next year's vaccine strain, the acute phase titers uniformly were 8 or <8. In contrast with B/USSR, acute phase titers were for the most part 32 or 64. Convalescent titers were also low, but most patients did show an increase of fourfold in titer. The convalescent titers observed with Denver/2/86 and Denver/3/86 viruses are considerably higher than those observed with B/Ann Arbor/86. Whether this is due to slightly lower avidity of the B/Ann Arbor strain or to a further antigenic shift in the Denver viruses is not clear.

Further confirmation of the amount of antigenic drift was shown in H.I. tests using the high titer chicken antiserum for B/USSR provided by CDC. Normally our laboratory only runs serum dilutions out to 1024; in this test, however, the test was run with five additional dilutions. In this test the B/USSR-E.T. had a titer of 8192, whereas the two Denver strains had titers of 512 and 1024, indicating a difference of 8-16-fold between the B/USSR and the newer viruses.

RELATIONSHIP OF ACUTE SERUM H.I. ANTIBODY TITERS AND ATTACK RATES OF INFLUENZA B

Observations on the relationship between serum antibody levels and attack rates go back to the 1943 epidemic of Influenza A which was studied at many sites in the military by the Commission on Influenza. At that time Francis and Salk and Eaton and I independently observed that there was inverse relationship between acute phase H.I. antibody titer and clinical attack rate. Subsequently this has been confirmed by many observers with Influenza A, particularly of the H2N2 type. Most cases of influenza occur in individuals who had titers of ≤8. There was a reduction in attack rate of those with titers 1 to 16 and a sharp cutoff at 32.

This relationship has not been as well documented with Influenza B. For that reason we were interested in trying to clarify the relationship. We were handicapped by the fact that we could not use whole virus antigen and we knew that ether-split antigen would produce considerably higher titers than whole virus antigen. Data obtained with the permanent party and students are summarized in Table 7. Attack rates were highest in individuals with titers of ≤8-16 in the permanent party and those with titers of <8-32 in the students. There was a fall in incidence of about 50% at titers of 32-64 and a further drop in those with titers of 128. Thus, in the permanent party, the difference between the individuals with titers of ≥128 and those in the lowest titer range was only fivefold and in the students only sixfold. In general, in the past with Influenza A, the difference has been on the order of 20-fold.

During this season the relationship was obscured by two factors: 1) the ether treatment of the antigen and 2) the antigenic drift. It is clear in

retrospect that trying to estimate protective efficacy before the epidemic on the basis of H.I. tests with ether-split antigen was futile. It is hoped that in the future vaccine will be prepared with virus strains which are avid enough to function well in an H.I. test. This is the only guideline for predicting vaccine efficacy prior to an epidemic. With Influenza A of both H3N2 and H1N1 types, we have been able to predict with some confidence that, if the percent of individuals vaccinated having titers of $\geq$32 exceeds 90%, the incidence of illness will be very low. A simple and inexpensive neutralization test would be most helpful.

SENSITIVITY OF THREE DIAGNOSTIC TESTS

The diagnosis of Influenza B was based on three procedures, namely virus isolation and a $\geq$4-fold rise in titer in complement fixing antibody tests using B/USSR allantoic fluid antigen and/or H.I. tests using B/USSR ether-treated antigen. All three tests were completed on 33 sets of specimens from students and 57 sets from permanent party (Table 8). Virus isolation was accomplished from throat washings of 75% of the patients. Complement fixation tests were positive in 91% and H.I. tests in only 63%. The differences between students and permanent party were very minor. A point of some interest is that the students had been primarily vaccinated whereas the permanent party had been revaccinated.

Very low yields with H.I. tests were undoubtedly affected by the antigenic drift. These sera will be tested subsequently using viruses from the 1985-86 B epidemic.

CLINICAL OBSERVATIONS

The illness caused by Influenza B virus tended to be rather mild. In the civilian community, while attack rates were high in some populations, the impact of influenza did not appear to be as severe as in the prior year when Influenza A of the H3N2 type was epidemic. There was a small number of admissions with characteristic complications of influenza, such as staphylococcal and streptococcal pneumonia in the University Hospital system.

One particular case deserves mention. This was the wife of a physician at Fitzsimons Hospital, a woman in her mid 30s who had previously been in excellent health, became ill with influenza, came into the outpatient department there and died very suddenly. Virus was recovered from her throat. Myocardial sections were tested for viral antigen. Influenza B antigen was demonstrated in the myocardial tissue by fluorescent antibody staining. This presumably represents another case of virus invading tissues other than the respiratory tract and causing a fatal myocarditis.

ORAL TEMPERATURES OF PATIENTS WITH INFLUENZA B

Table 9 shows the number and percent of individuals in the permanent party and student group who reported to the clinic with temperatures at different levels. These were all vaccinated persons. Results are difficult to analyze. It appeared that in the student population, which was forced to report to the clinic if unable to attend classes, the temperatures tended to be somewhat lower. Thus, 59% of students who reported had temperatures of less than 100 degrees. In contrast, in the permanent party, only 35% had temperatures in this low range. This could be explained by the fact that permanent party with minor illness simply stayed home and did not report to the clinic. This might also explain the fact that 33% of the permanent party who reported had temperatures of more than 101 degrees in contrast to 8% in the student body.

The number of cases in unvaccinated permanent party was too small to permit an adequate comparison. Among the 10 unvaccinated people who were confirmed as having Influenza B, 6% had temperatures of <100 and only one of 10 had a temperature of 102. This did not indicate any trend toward higher temperatures in unvaccinated persons.

In Influenza A cases, again the number was very small. Temperatures were distributed in a pattern which was not much different from that with Influenza B, nor were the temperatures of persons with influenza greatly different from those observed in patients who did not have influenza.

EVIDENCE OF INAPPARENT INFECTION

The present year's vaccine, which contains 15 mcg of B/USSR/83, was relatively ineffective in raising the complement fixing antibody levels. In Table 10, the distribution is shown of antibody titers of permanent party who reported with febrile URI but whose laboratory tests indicated they did not have influenza. Most of these persons had been vaccinated in October, a few in September. By November only 11% had titers of 16; the remaining had titers of $\leq$8. Of those bled in December, none had titers of $\geq$16. However, in January 8% had titers of 16 or 32 and of those bled in February, 19% had titers of 16 or 32. In March this number had declined to 15% with titers of $\geq$16. These data can be taken as evidence that about 20% of the permanent party had been infected with Influenza B virus during January and February.

There is a large discrepancy between this estimated infection rate of more than 20%, and the observed clinical illness attack rate of approximately 1.4%. The question is, what happened to these other people infected with influenza virus during this period? The answer in part is seen in Table 11.

It is obvious that concurrent with the appearance of influenza in January, there was a sharp increase not only in the number of patients with temperatures over 99^{o} but also in the patients reporting with URIs without fever. This increase peaked during the same week as the peak of influenza, February 10, and then gradually tailed off to levels even lower than those observed before the Christmas break. The figures in the right hand column indicate there was no

sharp outbreak of any other disease during this period, but a rather even level of non-influenzal febrile URIs. Inclusion of patients with non-febrile URIs would raise the number of influenza cases reporting to the clinic from 1.4% to 5% or 6%, but there would still be a large number of infections unexplained. It must be assumed that these were infections which did not produce symptoms serious enough to cause the patient to report for medical help at the clinic. Such infections apparently caused virtually no illness, though they did boost antibody levels. This is a highly desirable situation since it may lead to enhanced immunity during future years.

ETIOLOGY OF FEBRILE RESPIRATORY DISEASE

Surveillance has continued during the period between 24 October 1985 and 30 May 1986. A total of 184 students and 234 permanent party reported to the clinic during that period with febrile respiratory illnesses. The diagnosis of Influenza B was made in approximately 30% and of Influenza A in 4.5% (Table 12). Throat cultures for beta-hemolytic streptococci were positive in 15%, with equal frequency in students and permanent party. No cases of rheumatic fever were observed.

In approximately half of the individuals, no diagnosis was made. It is noted that parainfluenza was detected in five patients in the period before the Christmas break. Adenovirus infection was confirmed in only two patients, in line with experience since routine vaccination was begun. We have in the past looked for other agents to explain this large number of febrile respiratory illnesses. We have detected small outbreaks due to coronaviruses and enteroviruses and a very few cases of respiratory syncitial virus infection. A recent paper by Grayston in Seattle has again raised the possibility that some of these infections may be due to chlamydia and as soon as time is available, sera will be screened to see whether or not antibody is present for the new chlamydia TWAR.

PERSPECTIVE

The 1985-86 season was disappointing in that Influenza B component of the vaccine appeared to protect very poorly against illness. The number of cases of Influenza B in both students and permanent party was considerably larger than at any time since studies were begun at Lowry Air Force Base. This can be attributed in large measure to the rather sharp antigenic drift in the Influenza B. The B/USSR strain that was incorporated into the vaccine was an unfortunate choice in that it was so non-avid that it was impossible btfore the epidemic to obtain any realistic estimate of the protective levels of antibody. As in prior years, the titers obtained with ether-split antigens provided titers comparable to those seen with the Influenza A virus components, but this is misleading and it is hoped that in the future the selection will contain strains which will function more appropriately in H.I. tests.

A small outbreak of H3N2 Influenza A followed a pattern very similar to that observed in prior years. Students were protected almost completely and only a small number of cases occurred in the permanent party.

Data obtained on the persistence of H.I. antibody suggest that the number of persons whose titer places them in the susceptible range is increasing by the time six months have passed after vaccination. Since the last two outbreaks of Influenza B have peaked in March and February, it would appear that vaccination before the latter part of October is undesirable. This would affect the permanent party only, since the students normally reach the Base six weeks after vaccination and the average stay at the Base is only three months. This may account for the fact that over the years the students appear to have done better than the permanent party during epidemics of Influenza B and H3N2 Influenza A.

What will happen during the coming year is obviously open to question. It has already been reported that a strain of H1N1 influenza with considerable antigenic difference from A/Chile has been prevalent in the Far East. This raises the question of whether permanent party who, up to now, have been protected against illness as a result of immunization during childhood by Influenza A H1N1, will be at greater risk. Students, who have almost uniformly been infected during recent years, might also be more vulnerable even though vaccinated. It is helpful to recall that in 1957, at the end of the H1N1 decade, when a markedly different variant known as the Denver or Netherland type of H1N1 caused an outbreak at Lowry Air Force Base, vaccine prepared for an earlier H1N1 virus provided excellent protection in a well controlled field trial. That vaccine, however, contained considerably more antigen than the currently used vaccine and the question of increasing the potency of the different components of the vaccine is still open. It would be worthwhile to consider doubling the potency of each component of the vaccine and better still to look for adjuvants which might enhance antibody response and protection and eliminate the need for annual revaccination of permanent party.

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Richelle Cross for secretarial assistance

Table 1

Distribution of pre- and post-vaccination H.I. antibody titer of 79 permanent party who received trivalent vaccine in October 1985. Vaccine contained 15 ug of hemagglutinin of each of A/Philippine/2/82, A/Chile/1/83, and B/USSR/100/83. All had received influenza vaccine the previous year in the military.

		Cumulative percent with H.I. titer of:									% with
Antigen	Serum	<8	8	16	32	64	128	256	512	1024	4x rise
A/Philippine	Pre-	11	89	78	56	36	28	18	9	1	25
	Post-	4	97	93	84	61	39	25	10	5	
A/Chile	Pre-	9	91	85	69	53	29	13	9	4	27
	Post-	1	99	96	81	69	20	12	8	8	

Table 2

Distribution of pre- and post-vaccination H.I. antibody titers of 50 permanent party who received trivalent vaccine in October 1985. Vaccine contained 15 ug of hemagglutinin of each of A/Philippine/2/82, A/Chile/1/83, and B/USSR/100/83. All had received influenza vaccine the previous year in the military.

		Cumulative percent with H.I. titer of:									% with
Antigen	Serum	<8	8	16	32	64	128	256	512	1024	4x rise
B/USSR-E.T.	Pre-	14	86	78	64	50	20	8	-	-	18
	Post-	2	98	92	84	60	40	6	-	-	
B/USSR-W.V.	Pre-	38	62	38	14	2	-	-	-	-	14
	Post-	26	74	56	32	4	-	-	-	-	
B/Sing/79	Pre-	20	80	69	40	14	6	2	2	-	10
	Post-	6	94	82	70	28	10	6	-	-	

Table 3

Distribution of H.I. antibody titers in sera of students who had febrile URIs before appearance of influenza on the Base.

Antigen	No. of Persons	Cumulative percent with H.I. titer								
		<8	8	16	32	64	128	256	512	1024
A/Phil/82	65	0	100	100	89	75	58	46	31	20
A/Chile/83	72	0	100	99	97	86	71	64	42	28
B/USSR/83 E.T.	43	0	100	100	100	88	67	43	30	23

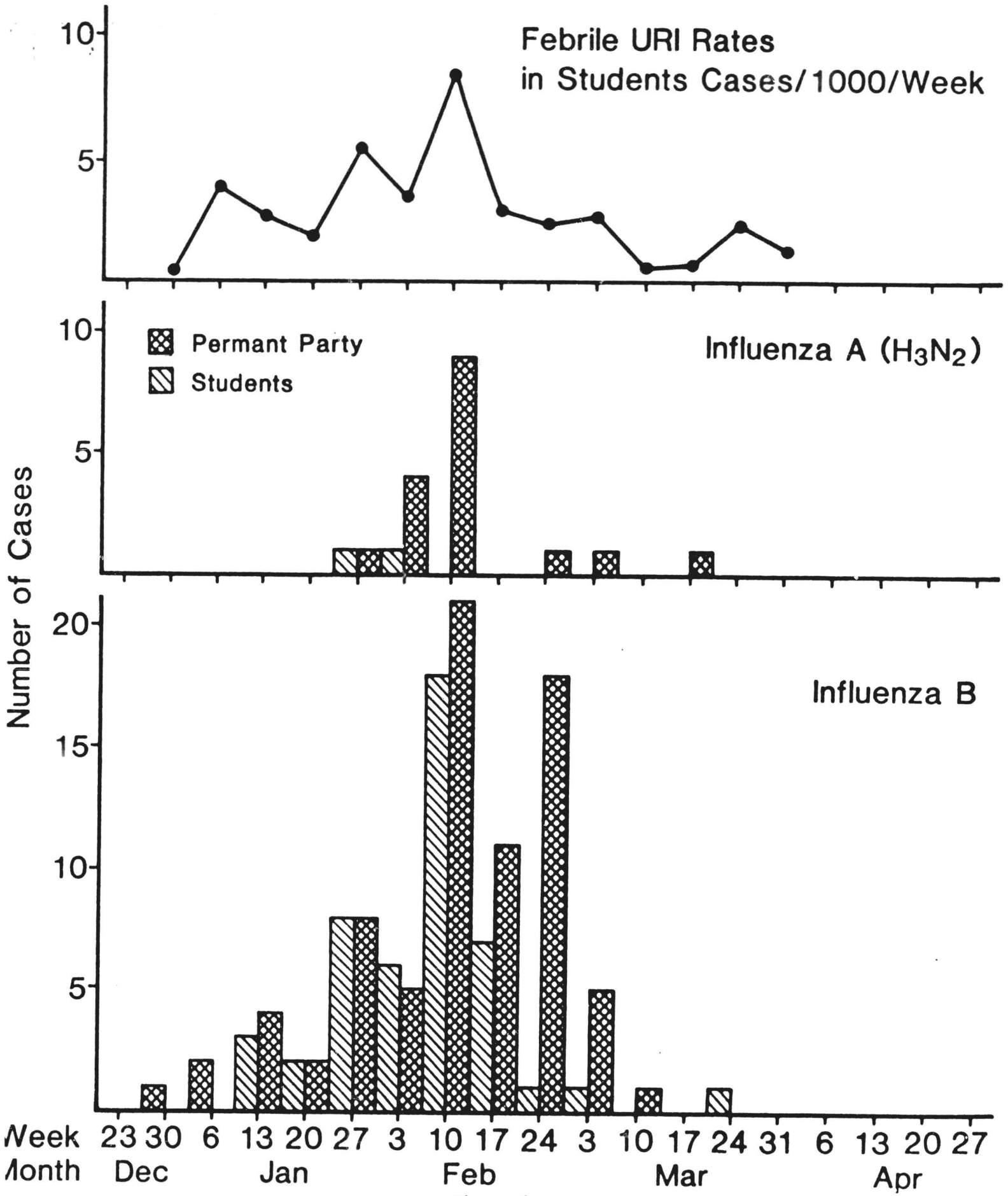

Figure 1

Weekly Febrile URI rates in student population and the number of cases of Influenza B and A (H_3N_2) in students and permanent party, 1985-86

Table 4

Febrile U.R.I. rates and influenza cases at Lowry Air Force Base, 28 October 1985 to 24 March 1986.

	Number of Febrile U.R.I.							
	Student				Permanent Party			
			Influenza				Influenza	
Week of:	No.	Rate*	B	A	No.	Rate*	B	A
Oct. 27	4	1.1	-	-	4	0.6	-	-
Nov. 3	5	1.4	-	-	7	1.2	-	-
10	2	0.5	-	-	5	0.8	-	-
17	4	1.1	-	-	11	1.8	-	-
24	5	1.0	-	-	9	1.6	-	-
Dec. 2	7	2.0	-	-	14	2.4	-	-
9	4	1.0	-	-	8	1.4	-	-
16	7	2.0	-	-	6	1.0	-	-
23	-	-	-	-	-	-	-	-
30	1	0.3	-	-	5	0.8	1	-
Jan. 6	14	4.0	-	-	7	1.2	2	-
13	10	2.8	3	-	13	2.2	4	-
20	6	1.7	2	-	10	1.7	2	-
27	20	5.7	8	1	22	3.7	6	1
Feb. 3	12	3.4	6	1	20	3.3	5	4
10	29	8.4	19	-	35	6.8	22	9
17	10	2.9	7	-	25	4.2	11	-
24	8	2.3	1	-	30	5.8	19	1
Mar. 3	9	2.6	1	-	8	1.3	5	1
10	2	0.6	-	-	4	0.8	1	-
17	3	0.9	-	-	3	0.6	-	1
24	8	2.3	1	-	7	1.4	-	-
31	4	1.1	-	-	5	0.9	-	-
Apr. 7	3	0.8	-	-	1	0.2	-	-
14	4	1.1	-	-	5	1.1	-	-
21	11	3.1	-	-	4	0.8	-	-
28	10	2.8	-	-	10	2.2	-	-
May 5	6	1.6	-	-	7	1.5	-	-
TOTAL			48(1)	2(0)			78(0)	17(2)

( ) Not vaccinated in 1985

*Cases/1000/week

Table 5

Percent of patients with febrile U.R.I. from whom specimens were collected in 1985-86

Week of:	Students			Permanent Party		
	No. of Clinic Visits	No. of Specimens Collected	%	No. of Clinic Visits	No. of Specimens Collected	%
Oct. 28	4	3	75	4	1	25
Nov. 4	5	4	80	7	5	71
11	2	1	50	5	5	100
18	4	3	75	11	10	91
25	5	5	100	9	7	78
Dec. 2	7	5	71	14	9	64
9	4	4	100	8	6	75
16	7	7	100	6	5	83
23	0	-	-	-	-	-
30	1	1	100	5	5	83
Jan. 6	14	14	100	7	6	86
13	10	9	90	13	11	85
20	6	6	100	10	8	80
27	20	20	100	22	21	95
Feb. 3	12	12	100	20	19	95
10	29	20	69	35	19	54
17	10	6	60	25	15	60
24	8	6	75	30	19	63
Mar. 3	9	7	78	8	7	88
10	2	1	50	4	3	75
17	3	3	100	3	3	100
24	8	8	100	7	7	100
31	4	4	100	5	5	100

Table 6

Results of H.I. tests with paired sera from 8 patients with Influenza B using 7 different antigens*

Patient No.	Serum	B/USSR/83 E-29 W.V.	B/USSR/83 E.T. (CDC)	B/AA/86 E1	B/Can/3/85 E7	B/Den/1/86 E7	B/Den/2/86 TC2	B/Den/3/86 TC2	CF Titer B/USSR/83
1	Ac.	32	1024	<8	<8	<8	8	8	<8
	Conv.	1024	1024	64	64	16	128	256	64
2	Ac.	16	64	<8	<8	<8	8	<8	<8
	Conv.	1024	1024	1024	1024	128	1024	1024	512
3	Ac.	32	128	8	8	<8	8	<8	<8
	Conv.	512	1024	128	128	32	256	1024	64
4	Ac.	32	128	8	16	<8	16	16	8
	Conv.	256	1024	32	64	8	64	64	64
5	Ac.	128	512	8	8	<8	16	16	<8
	Conv.	1024	1024	32	64	16	256	1024	128
6	Ac.	64	512	<8	<8	<8	<8	8	8
	Conv.	1024	1024	16	32	<8	128	1024	128
7	Ac.	32	128	<8	<8	<8	8	8	<8
	Conv.	64	256	8	16	8	64	64	32
8	Ac.	32	256	<8	<8	<8	<8	<8	<8
	Conv.	128	1024	32	32	8	64	128	64
Antisera									
A/Phil/82		<8	<8	<8	<8	<8	<8	<8	-
A/Chile/83		<8	<8	<8	<8	<8	<8	<8	-
B/USSR/84		1024	1024	1024	1024	64	64	128	-
≥4x rise		7/8	5/8	/8	8/8	4/8	8/8	8/8	8/8

*All whole virus antigens except B/USSR/83-E.T.

Table 7

Relationship between acute serum H.I. antibody titer for B/USSR/83-E.T. and estimated attack rates of Influenza B in permanent party and students.

Group	Titer	Est. No. of Persons	No. of Cases	Attack Rate/%
Permanent Party	<8-16	920	24	2.4
	32-64	2552	26	0.9
	≥128	2318	11	0.5
Total		5800	55	0.9
Students				
	<8-32	448	19	4.2
	64	536	12	2.2
	128	726	5	0.7
	≥256	1720	3	0.2
Total		3430	39	1.1

Table 8

Comparison of sensitivity of three diagnostic tests for Influenza B

	Virus Isolation	C.F. Test	H.I. Test (B/USSR/E.T.)
Students			
No. +/total	25/33	29/33	21/33
% positive	76%	88%	64%
Permanent Party			
No. +/total	45/57	53/57	36/57
% positive	79%	93%	63%
Total			
No. +/total	70/90	82/90	57/90
% positive	75%	91%	63%

Table 9

Distribution of oral temperatures of vaccinated permanent party and students who had Influenza B

Temp (F)	Permanent Party		Students	
	No.	%	No.	%
$99-99^{9}$	17	35	23	59
$100-100^{9}$	16	33	13	33
$101-101^{9}$	13	27	3	8
>102	3	6	0	0
	49		39	

Table 10

Distribution of C.F. antibody titers for Influenza B in permanent party who did not have Influenza B by month of serum collection. Most had been vaccinated in October 1985.

Month	No. of Persons	Percent with C.F. antibody titers of:			
		<8-8	16	32	64
Nov.	18	89	11	0	0
Dec.	22	100	0	0	0
Jan.	37	92	5	3	0
Feb.	37	81	8	11	0
Mar.	16	87	13	0	0

Table 11

Number of U.R.I.s at Lowry Air Force Base with and without fever, October 1985 - May 1986

Week	Clinic Visits	URI s Fever	URI c Temperatures ≥ 99°		
			Total	Influenza A & B	Not Influenza
Oct. 28	955	88	8	-	
Nov. 4	896	107	12	-	
11	705	60	7	-	
18	698	135	14	-	
25	568	106	14	-	
Dec. 2	733	155	21	-	
9	635	108	12	-	
16	573	122	13	-	
23	160	22	-	-	
30	252	43	6	1	5
Jan. 6	757	133	21	2	19
13	804	155	23	7	16
20	731	159	16	4	12
27	843	170	42	15	26
Feb. 3	759	179	32	15	17
10	797	221	64	50	14
17	682	176	35	18	17
24	905	198	38	21	17
Mar. 3	799	177	17	7	10
10	719	158	6	1	5
17	623	132	6	1	5
24	689	117	15	1	14
31	461	96	9	-	
Apr. 7	559	83	4	-	
14	631	81	9	-	
21	666	110	15	-	
28	713	94	20	-	
May 5	635	80	13	-	

Table 12

Etiology of febrile U.R.I. 28 October 1985 - 29 May 1986, Lowry Air Force Base

	Students	Perm. Party	Total	%
	3400	5800	9200	
Etiology				
Influenza B	48	78	126	30.1
Influenza A	2	17	19	4.5
Strep. pharyngitis	27	37	64	15.3
Parainfluenza	3	2	5	-
Adenoviruses	1	1	2	-
Unknown	104	99	203	48.5
TOTAL	184	234	418	

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