

from the vaccinated group and 12 from the control group, a difference of 72% in favor of the vaccine. On the basis of above findings, adenovirus vaccine significantly reduced number of adenovirus infections in the vaccinated group compared to the control group. 3) In non-study companies from Mar. 5 to May 5 adenovirus infections accounted for 80% of Dispensary admissions. Forty % of admissions from the control group of the study companies were due to either types 3, 4 or 7 adenovirus while only 15% from the vaccine group were due to these agents.

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Epidemic Asian A Influenza in Naval Recruits.*† (24115)

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Asian influenza was first recognized in the United States in mid-June, 1957(1). One of the first outbreaks occurred among recruits at Naval Training Center at San Diego, Calif. (2). At time of outbreak a study of evaluation of an adenovirus vaccine was being made (3). During the week ending June 15 a sharp rise in admission rates for acute respiratory

disease occurred in both non-study and study companies. From the study companies the admissions came from both adenovirus vaccinated and placebo vaccinated groups. The illnesses resembled epidemic influenza. As it had been pointed out by Hilleman(4,5) that this age group appeared to be non-immune to the new Asian strain of influenza, it seemed

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important to make a detailed laboratory study of this outbreak to determine extent of morbidity among recruit population.

Materials and methods. Population comprised recruits at Naval Training Center. The study began the week ending May 18th and continued until Dec. 21, 1957. **Laboratory procedures.** Approximately 50 throat washings and paired serums were being collected weekly in connection with the adenovirus vaccine study(3). During the first 3 weeks of the outbreak several dozen samples were taken by personnel of Navy Preventive Medicine Unit #5. Collection of throat washings and sera are described in the previous report(3). They were sent to University of Chicago where they were analyzed respectively for influenza viruses and complement fixing antibodies with influenza A/Jap/305/57 and B GL/54 antigens. **Serological procedures.** Hemagglutinin inhibiting (H. I.) antibodies were determined on selected sera employing A'/Denver 57, A/Jap/305/57 and B/GL 54 influenza virus antigens. The H. I. antibody test was that recommended by Committee on Standard Serological Procedures of Armed Forces Epidemiological Board(6). The complement fixation test for determining adenovirus and influenza antibodies was that described by Jensen(7). For influenza virus antigens, undiluted and uninactivated allantoic fluid harvests of Jap/305/57, A'/Denver/57 and B/GL/54 were employed. Pooled HeLa cell tissue cultures of adenoviruses, types 1 through 7, were employed as antigen in the complement fixation test. **Virus isolations.** The fertile egg technic was employed for virus isolation as described by Jensen(7). Newly isolated influenza viruses were typed by hemagglutinin inhibition (H.I.) test with known positive A/Jap/305/57, A'/Denver/57 and B/GL/54 antisera.[†] In addition all strains were tested with influenza A PR8 ferret antiserum to rule out laboratory contaminants. No PR8 strains were isolated.

Results. Epidemiological investigation revealed that recruit companies, service schools and ship company personnel were affected from the onset. Clinical findings were those

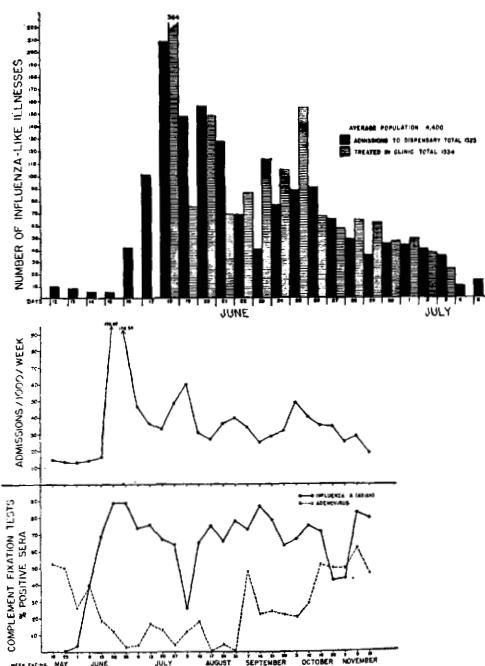


FIG. 1 (top). Daily dispensary admissions and non-admissions from the recruit population for influenza-like illnesses.

FIG. 2 (bottom). Weekly admission rates from the recruit population and per cent positive serums for antibody rise with influenza A (Asian) and adenovirus antigens.

of epidemic influenza. Symptoms occurred abruptly and consisted of fever (100-104°F), chilliness, malaise, frontal headache, myalgia, mild cough, scratchy throat with mild rhinitis and occasional nausea without diarrhea. Physical examination revealed general flushing of skin over face and chest. There was mild conjunctivitis. Throat was diffusely red but not particularly sore. Coughing was not pronounced, and there were essentially no abnormal pulmonary findings.

Daily admissions and visits to Dispensary of recruits for acute respiratory disease from June 12 to July 5, 1957, are shown in Fig. 1. The explosive spread of the infection among recruit population is shown by rapid daily increase in admissions to the Dispensary after the onset. The high daily admission rate continued for 16 days and thereafter gradually fell to a low level by July 5.

The admission rate/1,000 for acute respiratory disease during week ending June 15 was 16.04. During week ending June 22 it was

[†] Kindly supplied by Dr. Keith Jensen.

TABLE I. Influenza Virus Isolation and Antibody Response in Naval Recruits at San Diego Naval Training Center, June 1 to July 20, 1957.

		Throat washings			Paired sera (C.F. test)					
		Adm. rate per 1000	Total	No.	% pos.	Total	Type A		Type B	
Week ending							No.	% pos.	No.	% pos.
June	8	14.47	16	0	0	13	5	38	0	0
	15	16.04	33	3	9	23	16	69.5	1	4.3
	22	192.19	127	73	57	90	79	88.0	3	3.3
	29	170.58	43	23	53	61	54	88.5	1	1.6
July	6	46.83	13	2	15	23	17	74	0	0
	13	36.07	15	2	13	29	22	76	0	0
	20	33.41	13	3	23	22	15	67	0	0

192.19. The following week it was 170.58. By the week ending July 5 it was 46.83. From June 8 to July 5 approximately 75% of the recruit population either were admitted to or treated in the Dispensary for acute respiratory illnesses resembling epidemic influenza. Figs. 1 and 2.

Laboratory diagnosis. Throat washings and paired sera collected during week ending June 8 through July 20, were examined respectively for influenza viruses and complement fixing antibody response with influenza virus antigens A/Jap/305/57, and B/GL/54. Table I shows that while no viruses were isolated during week ending June 8, five of 13 paired serums showed significant antibody rises with A antigen. During week ending June 22, the period of highest admission rate, 57% of throat washings yielded Asian A influenza viruses and 88% of paired sera showed 4-fold or greater complement fixing antibody rises with type A/Jap/305/57 antigen. During this week one strain of influenza B virus was isolated. Hemagglutination inhibition tests employing Asian A (Jap/305) as antigen showed that essentially all antibody rises were due to this strain. A few showed antibody rises with influenza B antigen.

As seen in Fig. 2 during the summer and fall months, the weekly admission rates for acute respiratory disease continued 2 to 3 times higher than they were during the pre-epidemic period. After the first week in October they declined steadily. Serological studies on paired sera (20/week) for complement fixing antibody rises to influenza A (Asian) and B antigens showed that the majority of admissions following the epidemic

outbreak were influenza A infections. A few were due to influenza B infections. Also, many showed complement fixing antibody rises with adenovirus antigen. The number showing rises with adenovirus antigen was low during June, July and August but rose during September and was highest from middle of October through November 16. After this time serological studies were discontinued because an influenza vaccination program was begun.

In Table II are given results of Asian A virus isolation and complement fixing antibody rises in paired sera with Asian A antigen from May through December. Approximately 75% of the paired serums tested during June through November showed rises with Asian A antigen. During August through December selected throat washings of individuals whose serums showed complement fixing antibody rises were tested for Asian A influenza viruses. The results are also shown in Table II. Five of 7 specimens collected during last 2 weeks in August, one of 7 collected during September, 6 of 10 collected during October, 3 of 10 collected during November and 3 of 3 collected during the first 2 weeks in December yielded Asian influenza viruses.

Antibody response survey. The personnel of 3 companies receiving adenovirus vaccine had been bled May 29, 30 and 31, two weeks before outbreak of influenza. They were again bled July 8, approximately 4 weeks after epidemic began. H. I. tests on paired serums for the presence of antibody rises with influenza Asian A antigen were carried out. The results are shown in Table III. It can be seen that 95% of individuals admitted to Dispensary for acute respiratory disease showed

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TABLE II. Influenza Virus (Asian A) Isolation and Complement Fixing Antibody Response to Asian A Antigen.

Mo	Avg adm. per 1000 per wk	Throat washings			C. F. antibody rises to Asian A antigen		
		Total	No. pos.	% pos.	Total	No. pos. A	% pos. A
May	13.36	nd	nd		63	0	16
June	98.32	219	99*	45	199	159	80
July	44.89	41	7	15	122	76	62
Aug.	33.48	7†	5	71	85	61	72
Sept.	29.57	7	1	14	80	59	74
Oct.	36.87	10	6	60	86	57	66
Nov.	22.47	10	3	30	17	14	82
Dec.	17.15	3	3	100	nd	nd	

* One type B also isolated.

† Spot check throat washings from persons showing a rise in complement fixing titer to type A.
nd = not done.

TABLE III. Asian Influenza H.I. Antibody Rises in Individuals from 3 Companies of Recruits Bled 2 Weeks before and 3 Weeks after Outbreak of Influenza at San Diego.

Co.	Individuals	Adm. to dispensary		4-fold or greater rise		Non-adm. to dispensary		4-fold or greater rise	
		No.	%	No.	%	No.	%	No.	%
156	44	15	34	13	87	29	66	19	66
157	53	19	36	19	100	34	64	30	88
158	56	23	43	22	96	33	61	24	73
Total	153	57	37	54	95	96	63	73	76

antibody rises. Of individuals not admitted to Dispensary, 76% showed antibody rises. These serological findings confirm the high morbidity of Asian influenza in the recruit population at San Diego during early part of epidemic.

Summary. 1. An explosive outbreak of Asian influenza beginning the week ending June 15, occurred at San Diego Naval Training Center. The peak admission rate of 192.2 from the recruit population occurred the following week. After the first 3 weeks the rates subsided but continued to be 2 to 3 times the pre-epidemic levels through the first 2 weeks in November. Serological and virus isolation studies showed that approximately 75% of admissions from onset of epidemic through November were due to Asian A influenza infections. A few were due to influenza B infections. Admissions due to adenoviruses occurred also in increasing numbers during Sept., Oct. and Nov. On the basis of serological studies essentially all admissions to the Dispensary from onset of epidemic to Nov. 16 were due either to influ-

enza or adenovirus infections. 2) The general lack of immunity to Asian influenza virus in the recruit population is reflected in the high attack rate during the first 3 weeks of the outbreak and high percentage of individuals showing an antibody response to Asian A antigen in the 3-survey companies bled before and 4 weeks after the onset of the epidemic.

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