Asian Influenza in High School Students

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IN THE FALL of 1957 throughout Allegheny County, Pa., there was a sudden rise in the prevalence of acute respiratory infections accompanied by systemic symptoms and signs. Because of the forewarning that the Asian variant of influenza type A was likely to become epidemic and because the symptomatology of the prevailing illness was consistent with that of influenza, many of the cases were diagnosed clinically as Asian influenza.

However, as in any epidemic the question arose as to whether all of the acute illnesses had a common etiology or whether several types of illness were concurrent. In this particular epidemic, it was of interest to know which children had not been infected so that susceptibles could be immunized when supplies of vaccine became available. Information concerning attack rate in this population was also desired for estimating the likelihood of a second epidemic later in the year.

During the epidemic there was a high rate of absenteeism in the high schools of the county. A large number of students in several high schools answered a questionnaire concerning characteristics of any illness they had experienced during this period, and many of these students were studied serologically for the presence of specific antibody against the Asian variant of influenza type A. During the same time period, virus isolations were made in the Allegheny County Health Department laboratory from throat washings and autopsy specimens obtained from patients with acute respiratory disease. Finally, in an attempt to determine if the disease spectrum observed during the epidemic was unique, a repeat questionnaire survey of illness was made in one high school in the fall of 1958.

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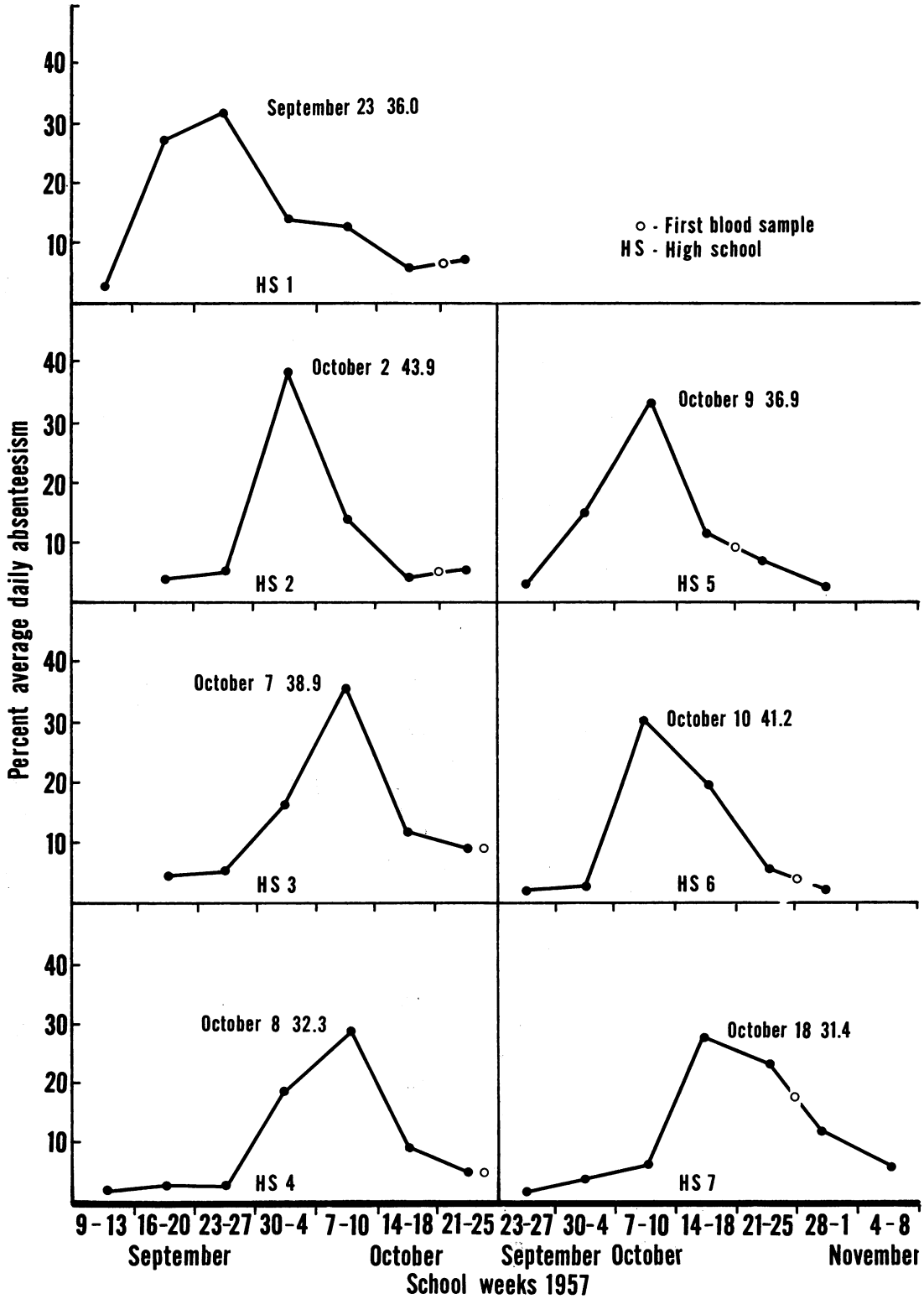
Blood Samples and Illness History

A total of 953 students in seven high schools distributed over the five county health districts were studied. In six of the schools samples were small in number and not selected in such a way as to make them representative of the whole school populations from which they were taken. In the remaining one, Dormont High School, the entire enrollment of 679 students answered questions concerning illness, and 429, or 63 percent, contributed blood samples. Therefore, most of the observations in this study were made on the Dormont school population.

From 10 to 31 days following the peak of absenteeism in each school, student volunteers gave blood samples and, at the same time, answered a simple questionnaire about incidence, duration, and symptomatology of any illnesses experienced in the preceding 30 days. Symptomatology was reported by both the student's written description of illness and a simple checklist of signs and symptoms likely to be present in illnesses of the gastrointestinal, respiratory, or central nervous systems. One year after the first illness history was obtained, the Dormont students were questioned concern-

Figure 1. Average daily absenteeism by percentage of enrollment in selected high schools, Allegheny County, Pa., September–November 1957



ing illness during the preceding nonepidemic month, September 24–October 24, 1958.

Fourteen to 24 days after the initial blood samples were obtained, additional samples were given by part of the original group. Dormont students who gave blood specimens a second time were chosen in approximately equal numbers according to the time and type of their experience during the epidemic period—not ill, ill and absent at the beginning of the period, ill and absent toward the end of the period, and ill but not absent. Second specimens were obtained from volunteers in other high schools without reference to their previous history.

Laboratory Materials and Methods

Serums. The serum was separated from whole blood on the day the specimen was obtained and stored in rubber-stoppered glass tubes at −10° C. The serum was thawed, diluted 1:20, and inactivated at 56° C. for 30 minutes just prior to testing. Paired serum specimens were tested at the same time. Single serum specimens were tested in large groups with appropriate positive and negative serum controls.

Complement fixation (CF) test. A modification of the standard Kolmer technique was used to detect antibodies against virus of Asian variant influenza type A. The antigen was prepared from pooled chorioallantoic (CA) and amniotic (A) fluid of infected embryonated eggs. Influenza virus A/Asian/Japan/305/57 which had been passaged four times in eggs, once in ferrets, three times in mice, and eight times in eggs was furnished by Dr. Keith E. Jensen. Ten- to 11-day embryonated eggs were inoculated amniotically, harvested after 48 hours incubation at 37° C., and the CA and A fluids tested separately for hemagglutination using human type O cells. Fluids with a titer of 1:64 or greater were pooled, inactivated at 65° C. for 1 hour, and used as the antigen. Two units of antigen, as determined by titration against positive human serum, were employed. Twofold serial dilutions of serum from 1:20 to 1:320 were tested.

The final test contained 0.2 ml. serum, 0.2 ml. antigen, and 0.2 ml. of guinea pig complement containing two exact units. The tubes were incubated at 37° C. for 75 minutes, and immediately afterwards 0.4 ml. of 2 percent sheep red blood cells sensitized with two units of rabbit hemolysin was added. The results were read after incubation for 20 minutes at 37° C. Comparative studies with incubation at 37° C. for 20 minutes and at 4° C. for 18 hours showed greater specificity with the former but greater sensitivity with the latter.

Virus isolations. Specimens were stored in sealed ampules at −70° C. until tested. Lung tissues were ground with sterile alundum and prepared as a 10 percent suspension in nutrient broth containing 250 μ/ml. penicillin and 250 μg./ml. streptomycin. Nose and throat swabs in tryptose phosphate broth (Difco) were first plated on sheep's blood agar. Penicillin and streptomycin were then added and the broth inoculated amniotically into five 10- to 11-day embryonated eggs. Eggs were harvested after 48 hours incubation at 37° C. and CA and A fluids tested for hemagglutination. Specimens giving a negative reaction were passaged again in eggs and those giving positive reactions identified with the antiserums to the influenza strains, A/Denver/1/57, B/GL/1739/54, and A/Asian/Japan/305/57.

Pattern of Spread

In six of the seven schools children answered questions regarding the presence and characteristics of illnesses occurring in the preceding month. Although there was a variation in the several schools, the relative order of frequency of various signs and symptoms was similar. For example, fever, headache, and sore throat were commonly reported, while diarrhea was infrequently reported. Because of the common clinical characteristics, it was considered likely that the same epidemic disease was present in the various schools.

The pattern of absenteeism in the seven high schools was also similar. All showed an abrupt rise in absence rates reaching a peak of 30 to 40 percent of the enrollment within 7 to 10 days and returning to near normal levels by the third week of the epidemic. Schools 3, 4, 5, and 6, which were in widely separated parts of the county, had the time of maximum absence October 7 to 10 (fig. 1). The peak absence dates for the other three schools preceded or followed this period by 1 or 2 weeks.

The pattern of spread within Dormont (HS 4) was examined in detail. It was assumed that students within a given grade were more intimately in contact with one another and that if the epidemic within the school had started first in a small group, such a pattern of spread might be detected by studying absence by grade and time. The daily incidence rate of absence by grade during the period of the epidemic showed no evidence of differences in time, except possibly in the more explosive development of disease in the ninth grade (fig. 2).

Severity of Illness

In Dormont High School, severity of illness in children of different ages was estimated from the relationship between absence and illness. Illness which was accompanied by absence from school was assumed to indicate greater severity than illness without absence. The students, by grades, were classified into three categories according to illness-absence experience during the period September 24 to October 24, 1957. The pattern was similar in all four grades.

Grade	*Ill and absent (percent)*	*Ill, not absent (percent)*	*Neither ill nor absent (percent)*
9	72	10	17
10	75	7	19
11	76	8	14
12	72	11	17
All students	74	8	18

Illness Characteristics by Time Periods

To determine if the illness exhibited by Dormont students changed in characteristics during the period of greatest absence frequency, students who volunteered to give blood specimens were divided into three subgroups according to the week in which their first day of absence occurred. The frequency of symptoms and signs reported was similar for the three groups although it tended to be lower in the last time period (table 1). The duration of individual absence was similar for the first two periods but tended to be shorter in the last. Since data were collected the day following

Figure 2. Daily incidence rate of absence by week in students by grade, Dormont High School, September–October 1957 and 1958

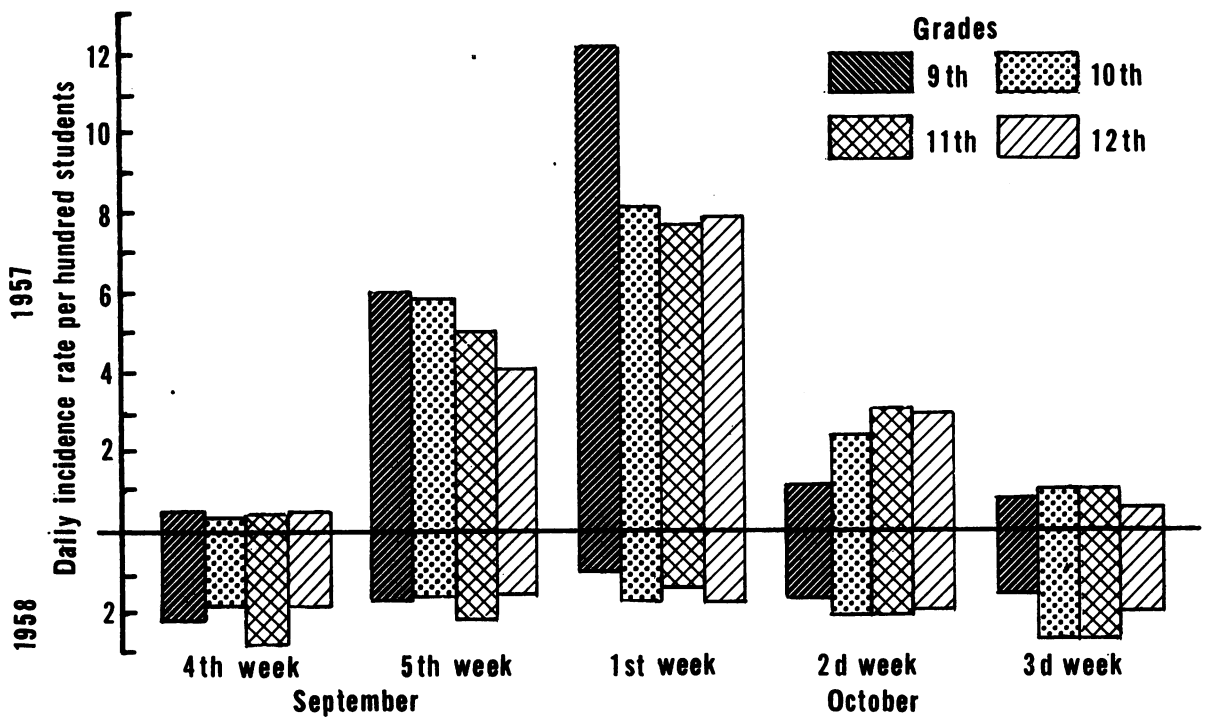


Table 1. Percent frequency of signs and symptoms in 300 students[1] of Dormont High School by week of onset of illness, September–October 1957

Sign or symptom	Onset of illness		
	Sept. 30–Oct. 6 (N=109)	Oct. 7–13 (N=141)	Oct. 14–23 (N=50)
Cough	80	85	72
Fever	81	80	66
Headache	71	77	70
Sore throat	67	72	52
Running nose	60	70	58
Weakness	58	55	42
Body aches	61	40	46
Chills	49	45	44
Dizziness	39	30	28
Retrobulbar pain	27	26	22
Stomach ache	28	17	26
Nausea or vomiting	23	17	14
Diarrhea	2	6	6
Days absent:			
3 days or less	49	51	78
4 days or more	51	49	22

[1] Includes only ill students in volunteer group.

the end of the last time period, observations were not available on students still absent because of illness. Because of persisting absence these students might have been expected to have a large number of symptoms and signs to report and to have longer illnesses.

Serologic Studies, 1957

Approximately two-thirds of the Dormont pupils volunteered to give blood samples in the 1957 study. The rate of volunteering was equal for girls and boys (69 percent and 68 percent, respectively). Girls in all grades volunteered at approximately the same rate, but boys were more numerous in the 9th and 10th grades (80 percent) than in the 11th and 12th grades (53 percent). Participation by classrooms varied from 52 to 89 percent. The lowest rate of volunteering was in one sophomore classroom; only 47 percent of the girls volunteered to give blood samples.

To determine the degree to which the volunteers were typical of the entire high school population, they were compared with the nonvolunteering students in respect to rate of absence and characteristics and severity of illness experienced in the preceding month. The frequencies of specific signs and symptoms are similar in the two groups (table 2). The rates of absence and illness were also similar for the two groups. The close agreement in illness experience in the two groups indicates that the students volunteering to give blood specimens were representative of the whole school population.

Student	*Ill and absent (percent)*	*Ill, not absent (percent)*	*Neither ill nor absent (percent)*
Volunteer	74	9	17
Nonvolunteer	75	6	19

The association was determined between levels of influenza CF antibody and various aspects of illness experience in the 429 Dormont volunteers. There was a consistent tendency for students with higher antibody titers to report various signs and symptoms more frequently. The frequency of symptoms as well as illnesses was markedly diminished in those without detectable antibody (table 3). Similarly, in the other six schools, children without measurable antibodies (titers less than 1:20) were less often ill during the preceding month or, when ill, had fewer signs and symptoms than children with detectable levels of antibody.

Only 23 Dormont students reported receiving influenza vaccinations sometime in the 6 weeks

Table 2. Symptomatology of volunteers and nonvolunteers in Dormont High School ill during September–October 1957

Sign or symptom	Percent with illness showing sign or symptom	
	Volunteer (N=349)	Nonvolunteer (N=178)
Cough	79	74
Fever	76	62
Headache	73	69
Sore throat	65	64
Running nose	64	64
Weakness	52	44
Body aches	47	38
Chills	45	39
Dizziness	33	31
Retrobulbar pain	25	19
Stomach ache	22	19
Nausea or vomiting	18	14
Diarrhea	4	5

Table 3. Percent frequency of signs and symptoms in relation to the level of influenza CF antibody in serums from 429 students, Dormont High School, September–October 1957

Sign or symptom	CF antibody titer			Ratio of percent present [1] to percent absent [2]
	1:40 or greater (N=158)	1:20 (N=78)	Less than 1:20 (N=193)	
Cough	92	69	42	2.0
Fever	86	68	42	1.9
Headache	78	65	45	1.6
Sore throat	66	55	42	1.5
Running nose	62	61	41	1.5
Weakness	66	45	24	2.5
Body aches	50	36	30	1.5
Chills	56	46	20	2.6
Dizziness	45	29	12	3.3
Retrobulbar pain	23	28	15	[3] 1.7
Stomach ache	22	16	17	[3] 1.1
Nausea or vomiting	22	15	8	[3] 2.5
Diarrhea	6	4	2	[3] 2.5
No illness	3	10	32	.2

[1] Titer 1:20 or greater. [2] Titer less than 1:20. [3] Derived from fewer than 35 students.

preceding October 24, 1957. In this small group the proportion of those with present or undetectable antibody titers as well as the proportion of those experiencing illness in the September–October period paralleled that of the nonimmunized group. For this reason the effect of immunization was not considered in this study.

Duration of absence also varied in relation to CF antibody titers. Dormont students (including those without illness) with titers of 1:80 or greater against Asian influenza averaged 3.7 days absence; with titers of 1:40, 3.5 days; with titers of 1:20, 2.8 days; and with titers less than 1:20, 1.7 days.

While it was possible to identify certain symptoms and signs with the epidemic illness and to demonstrate that students exhibiting these were more likely to have detectable CF antibody, the association of history of illness and serologic evidence of infection was not absolute. Students ill and absent but without detectable antibodies and students with less severe illness not requiring absence had quantitatively rather than qualitatively different symptomatology from students with typical illness and detectable antibody levels. Even with mild illness, symptoms and signs, although less frequent than with typical illness, were often those associated with influenza-like disease rather than with distinctly different disorders.

These observations were consistent with infection by a single rather than several agents. Individual variations in response to infection could have resulted from differing degrees of exposure to the agent, differing host thresholds for clinical symptoms and signs with infection, or from differing host ability to produce CF antibody following infection. The fact that children without a history of illness also gave evidence, in some cases, of CF antibody formation supports this interpretation.

Many students gave histories of illness typical of the epidemic disease during September and October 1957 but showed no demonstrable influenza CF antibody. One explanation for this observation would be that these students experienced illness so near to the time when blood samples were obtained that antibody rise had not yet taken place. Therefore, to test this hypothesis, second samples were obtained from 175 children 2 to 3 weeks later.

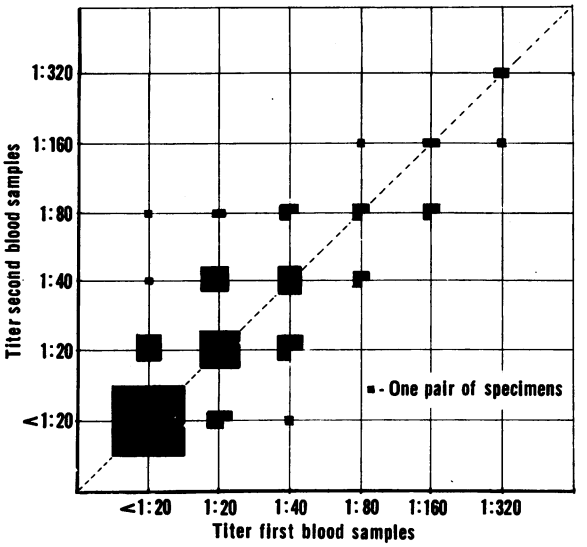
At Dormont, 96 donors of second blood samples were selected from the original volunteers according to their illness experience. The results in the various groups are given in table 4. Of those with illness early in the epidemic, only 3 percent had a rising titer, while approximately 20 percent had a falling titer. Con-

Table 4. Relationship of first and second influenza CF antibody levels in paired specimens from 96 students with varied illness experience, Dormont High School, 1957

Group	Number tested	Rising titer [1] (percent)	Falling titer [1] (percent)	No change (percent)
Ill and absent Sept. 24–Oct. 14	32	3	22	75
Ill and absent Oct. 14–24	23	22	13	65
Ill, not absent Sept. 24–Oct. 24	17	0	18	82
Not ill or absent Sept. 24–Oct. 24	24	13	8	79

[1] A twofold or greater change in titer.

Figure 3. Relationship of first and second influenza CF antibody titers in 175 students, Allegheny County, Pa., October–November 1957



versely, of those with illness late in the epidemic, more had rising than falling titers. However, the magnitude of most of these rises and falls was only twofold, and only 7 percent of patients previously negative became positive by the time the second specimens were obtained. The constancy of antibody level in successive samples suggests that presence of antibody was not a transient phenomenon likely to be missed by variations in the time of sampling. Therefore, the absence of antibody with the influenza syndromes can not be explained on the basis of the time the specimens were obtained.

Second blood samples, obtained from an additional 79 students in two other high schools, confirmed the close agreement between antibody levels on specimens obtained 3 to 4 weeks apart (fig. 3).

Hypothetical Influenza Syndromes

The signs and symptoms were ranked in order of frequency of occurrence in Dormont students exhibiting measurable antibody (table 3). This was assumed to constitute a measure of sensitivity of a particular symptom or sign as indicating influenza infection. However, certain of these were also noted with high frequency in children lacking antibody. Therefore, a measure of specificity was also developed and was expressed as the ratio of the frequencies with which given symptoms and signs occurred in the antibody present and undetectable groups. These ratios were ranked in order of magnitude. The sum of the rank order of sensitivity and the rank order of specificity was calculated. For example, cough was first in sensitivity and fourth in specificity, giving a sum of five. The signs and symptoms with the lowest sums of sensitivity-specificity ranks were presumed most likely to be characteristic of Asian influenza. These were cough, fever, headache, weakness, chills, and dizziness.

Using the results of these sensitivity-specificity ratings, three categories of illness were arbitrarily defined: (*a*) strict influenza syndrome which consisted of a history of absence from school with an illness having three or more of the following symptoms or signs: cough, fever, headache, weakness, chills, and dizziness; (*b*) modified influenza syndrome which consisted of an illness having three of the above symptoms or signs without absence or two of the symptoms and signs with absence; (*c*) other disease which consisted of any illness, regardless of absence, not fitting the strict or modified syndrome categories. The three groups were mutually exclusive.

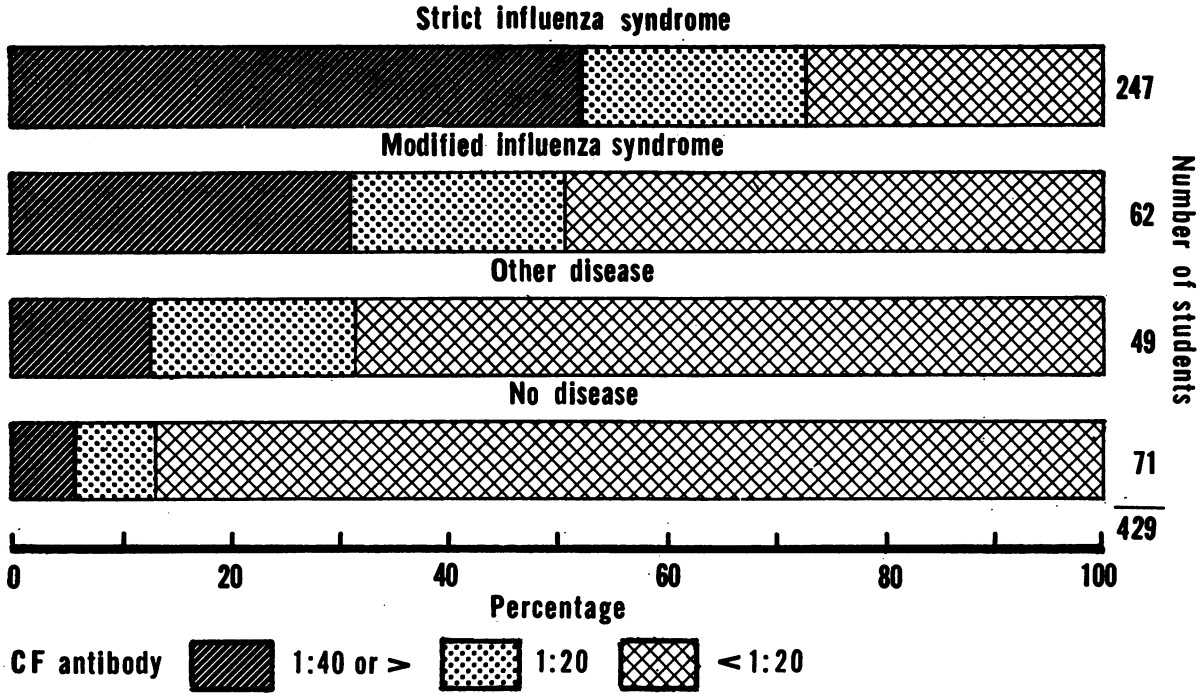
When students were divided into these illness categories or grouped according to antibody titer, there appeared to be a gradient of illness involvement (moving from strict syndrome, to modified syndrome, to other disease, to no disease) which was directly associated with the height of antibody titers (fig. 4).

Comparison 1957, 1958

All 804 Dormont students again answered questions concerning the characteristics of illness experienced during September and October of 1958. These data were compared with data collected in 1957. Illness-absence experience for 1958 was classified by grade.

Grade	*Ill and absent (percent)*	*Ill, not absent (percent)*	*Neither ill nor absent (percent)*
9	23	9	68
10	24	11	65
11	27	6	67
12	22	5	73
All students	24	8	68

Figure 4. Relation of clinical gradient of illness involvement to level of influenza CF antibody, Dormont High School, September–October 1957



Again, there was no difference in the pattern by grade. However, when the 2 years were compared, there were approximately one-third as many in the category of ill and absent and approximately four times as many in the category neither ill nor absent in 1958 as in 1957.

When 1958 incidence rate of absence was plotted by grade (fig. 2), there was no variation by week or grade.

When symptoms and signs exhibited during illness were compared for the 2 years, students in 1957 not only reported almost twice as many symptoms and signs per illness, but certain specific signs and symptoms were much more frequently reported. Fever, weakness, chills, body aches, and pain behind the eyes were reported two and a half to more than three times as frequently in illnesses occurring in the epidemic year. On the other hand, the frequencies with which diarrhea, nausea or vomiting, and stomach ache were reported were essentially the same in both years.

Illnesses of 1958 were grouped according to the 1957 classification of strict and modified influenza syndromes, other disease, and no disease. The percentage of students falling into each category differed markedly in the 2 years (fig. 5). Because of the great difference in the numbers of children with no disease between 1957 and 1958, only ill children were considered. It appears that the illnesses experienced in 1957 and 1958 differed markedly not only in attack rate but also in symptomatology.

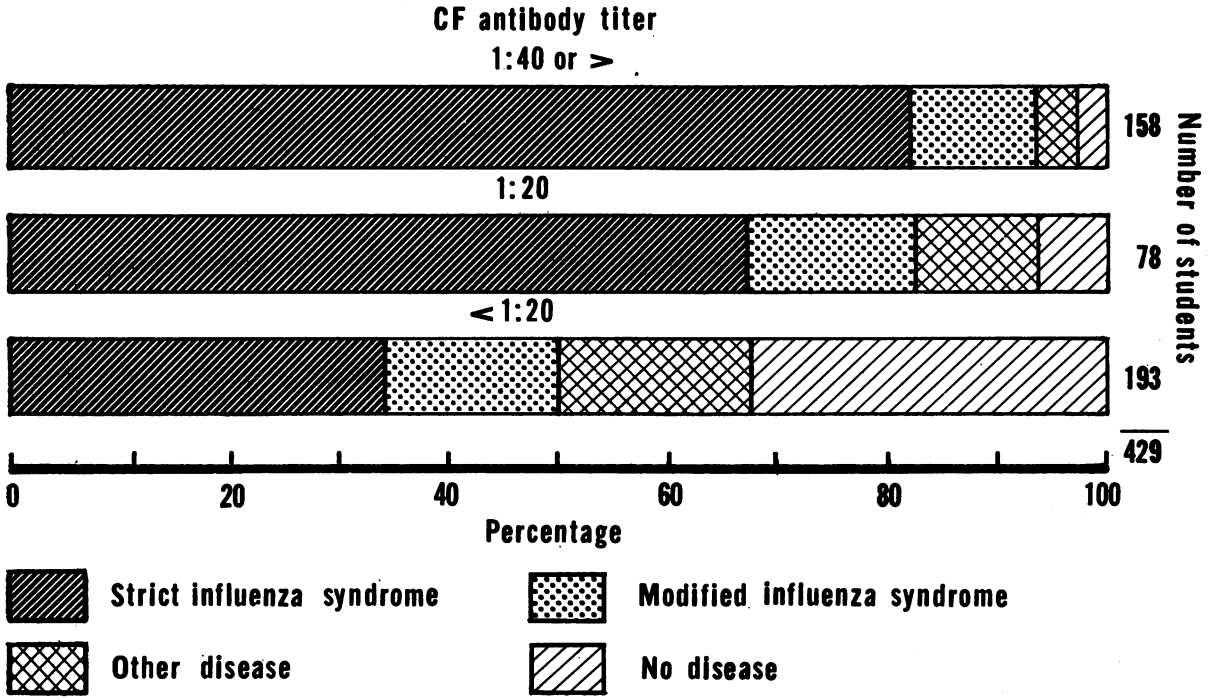
	Percent ill children by category	
Category	*1958*	*1957*
Strict influenza syndrome	17.9	66.6
Modified influenza syndrome	25.3	17.7
Other disease	56.8	15.7

Spring 1959 Illness

During March and April 1959 increased school absenteeism due to influenza-like illness was reported to the Public Health Service from 29 States and the District of Columbia. In 16 States and the District isolations of type B influenza were reported but they were few in number and made with difficulty.

Between March 9 and 27, 1959, absence in Dormont High School reached a peak of 23 percent of the enrollment during the second

Figure 4. Relation of clinical gradient of illness involvement to level of influenza CF antibody, Dormont High School, September–October 1957—Continued



week, and about 70 percent of the children were absent at some time during this period. Prevalence rates and length of absence (approximately 3.5 days) were similar for all grades. Attempts to isolate an influenza virus from throat swabs of 17 students in the first day of clinical illness were unsuccessful.

Clinical characteristics of the illnesses were studied to determine the possible etiological agent and the proportion of absence caused by the illnesses. The 1957–58 questionnaire concerning signs and symptoms of illness was given to 103 children returning from absence on March 16 and 17, 1959. Sixty percent of children had symptomatology compatible with the strict influenza syndrome previously described, 17 percent were classified as modified syndrome, and 23 percent as other disease. These figures were in close agreement with the symptomatology reported with Asian influenza in 1957 and markedly different from the experience in October 1958.

Because of the high prevalence of the characteristic influenza syndrome, the known high level of immunity to Asian influenza in this population, and the isolation during the same time period of influenza type B in similar outbreaks in other parts of the United States, it was considered likely that most of the absence in Dormont High School from March 9 to 27, 1959, was due to influenza type B infection.

Virus Isolation

Starting in July 1957 throat swabs and washings for virus isolation from patients suspected

Figure 5. Gradient of illness involvement of Dormont High School students, September–October 1957 and 1958

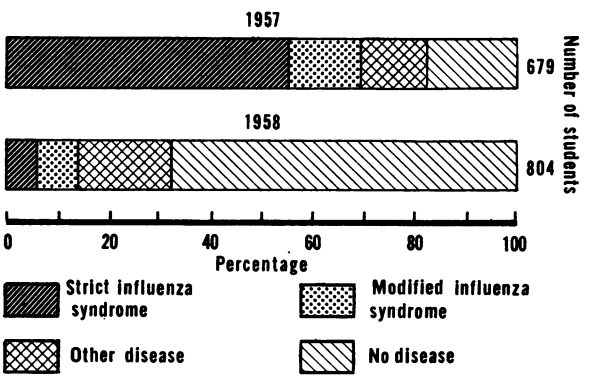


Table 5. Asian variant type A influenza virus isolations from specimens received by the Allegheny County Health Department laboratory, July–December 1957

Month	Throat swab or washing		Autopsy: lung tissue or bronchial swab	
	Number specimens	Percent positive	Number specimens	Percent positive
July	1	0	(1)	-------
August	5	0	(1)	-------
September	59	15	(1)	-------
October	371	30	24	58
November	25	4	6	0
December	12	0	6	0

[1] No specimens.

of having influenza were received at the Allegheny County Health Department laboratory. As illness in the community increased and physicians became more aware of the diagnostic service available, more specimens were submitted. In the last quarter of the year lung tissue and bronchial secretions obtained at autopsy were also submitted. Asian variant type A influenza virus was isolated in 1957 only during September, October, and November. The data indicate that the highest percentage of virus isolation from specimens from all sources occurred during October when the population of the county was experiencing the peak of an epidemic (table 5).

Discussion

Both serologic and clinical indexes were used to estimate the incidence of infections caused by Asian variant influenza type A virus in the 1957 epidemic in Dormont High School. Since this virus was newly introduced into the United States during the summer and late fall of 1957, the percentage of persons showing antibody to it after an epidemic of influenza-like illness could be considered one index of group infection. In other populations studied after such an epidemic illness in the same year, specific antibodies (CF or hemagglutination inhibition) were reported in 35 to 75 percent of persons (with and without history of illness) from whom blood samples were obtained (*1*, *2*). In Dormont High School specific antibody was exhibited by 55 percent of the total population studied and in 63 percent of those children ill during the epidemic.

The validity of using the clinical history as an index of influenza infection was based on the highly characteristic signs and symptoms occurring in previous influenza epidemics and reported in the 1957 influenza-like illnesses in various parts of the world (*1*, *3–6*). These were fever, headache, cough, sore throat, fatigue or malaise, chills or chilliness, ocular pain, and bone, muscle, and joint ache. Nausea, diarrhea, abdominal pain, chest pain, and rash were almost always absent. In addition, these illnesses were characterized by sudden onset, high attack rate, moderate severity, short duration, and rare complication by secondary infection.

A majority of these symptoms was also evidenced in histories given by ill students in the Dormont school. Sixty-seven percent exhibited a strict influenza syndrome consisting of absence from school plus three or more of these signs and symptoms—fever, cough, headache, dizziness, chills, and weakness. Further evidence that this 1957 epidemic illness had distinct symptomatology was supplied by a study of illness characteristics during the same time period the following year. In 1958 only 18 percent of the ill children exhibited the strict influenza syndrome.

In the previously cited studies of Asian influenza infections in other populations, positive association between a clinical history of influenza-like illness and presence of specific antibody was reported. In Dormont High School this was also true. Sixty-seven percent of children with strict influenza syndrome had detectable levels of specific antibody as compared with 50 percent with the modified influenza syndrome, 31 percent with other illness, and 13 percent with no illness. However, the lack of association between presence of antibody and a history of influenza-like illness has also been reported previously in both natural and experimental infections. Bell and associates (*7*) artificially induced Asian influenza infections in volunteers and demonstrated not only variations in clinical response of different individuals given equal dosage of virus

but also development of serologic evidence of infection in asymptomatic subjects. Therefore, the minimum incidence of Asian influenza infection in the Dormont school was considered to be represented by the number of children exhibiting specific antibody or a history consistent with the influenza syndromes, or both. The incidence, thus determined, was 78 percent.

Since the antibody test identified few children who were not already identified by the clinical pattern of illness, but not vice versa, it was concluded that clinical history alone (presence of influenza syndromes) might constitute a satisfactory estimate of the incidence of Asian influenza infection. If such a clinical history index were also a valid measure of incidence of influenza infection due to other types, it would have the advantage of minimizing the need for laboratory studies. However, the syndrome derived from an epidemic experience is not necessarily applicable in nonepidemic years. In the fall of 1958 no isolations of influenza virus were made locally and essentially none was reported nationally. Yet, during this same period 5 percent of the population of Dormont High School demonstrated the strict influenza syndrome, and 7 percent, the modified influenza syndrome.

The method described in this study for establishing incidence of a specific infection during an epidemic might be applied to the study of other epidemic illnesses. The method consists of selecting the signs and symptoms reported most frequently with illnesses during an epidemic period (sensitivity); obtaining blood samples during the acute and convalescent stage (or in the convalescent stage only with a newly introduced agent) from a representative sample of the study population to determine antibody against the determined etiological agent; and calculating the signs and symptoms most frequently present in patients exhibiting changes in titer of specific antibody (specificity). By combining sensitivity and specificity indexes, a clinical syndrome may be constructed for use in estimating incidence of specific illness in other groups during an epidemic.

Summary

The etiology of an epidemic of acute influenza-like illness in Allegheny County, Pa., in the fall of 1957 was investigated. High school students were questioned concerning symptomatology of any illnesses during this time period and CF tests against the Asian variant of influenza type A were done on blood samples from part of this group. The signs and symptoms reported most commonly with illness during this period (sensitivity) were combined with the signs and symptoms most frequently present in patients exhibiting changes in titer of specific antibody (specificity). The combined sensitivity-specificity index was used to construct a clinical syndrome considered appropriate for estimating incidence of specific illness during an epidemic period.

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Health Research Facilities Grants

Fifty-seven grants to help build and equip additional health research facilities were approved by the Public Health Service in August 1959 for 47 institutions in 23 States and the District of Columbia.

The grants, totaling $11,235,480, are made on a matching-fund basis. They are authorized by the contingent resolution for fiscal year 1960 passed by the Congress on June 30, 1959, and are the first awards under the 3-year extension authorized by the 85th Congress during 1958. The extended program, like the initial one set up in 1956, has at its disposal $30 million annually.

Administered by the National Institutes of Health, Public Health Service, the health research facilities construction program awards grants to both public and nonprofit hospitals, medical and dental schools, schools of public health, and other research institutions. The recipient institutions and facilities follow.

Alabama

University of Alabama, Birmingham: equipment for clinical research laboratories, $144,126.

California

The California Institute of Technology, Pasadena: equipment for sanitary engineering research, $39,900.

City of Hope Medical Center, Duarte: facilities for medical research $112,000.

Stanford Research Institute, Menlo Park: biological research laboratories and equipment, $300,000.

University of California, Los Angeles: scientific equipment for new wing of medical center for basic research in neurology and psychiatry, $107,625.

University of California, Berkeley: health sciences research building and equipment, $1,292,975.

University of San Francisco: equipment for previous award for chemistry and biology research laboratories, $8,778.

District of Columbia

Catholic University of America: biology building and equipment, $216,642.

Georgetown University: science and basic health research building, $350,000.

Florida

Florida Agricultural Experiment Station, University of Florida, Gainesville: research equipment for previous construction grant for veterinary science, $15,064.

National Children's Cardiac Center, Miami: medical research building and equipment, $72,877.

Illinois

Armour Research Foundation of Illinois Institute of Technology, Chicago: equipment for previous construction grant for research laboratories in chemistry building, $12,250.

Presbyterian-St. Luke's Hospital, Chicago: equipment for previous construction grant for medical science research building, $24,780.

University of Chicago, Chicago: clinical research building, $1,068,034; research equipment for chronic disease hospital, $11,489.

University of Illinois, Chicago: construction and equipment for research in zoonoses, $128,100.

Indiana

Purdue University, Lafayette: research facilities for speech pathology and bioacoustics, $24,331.

Indiana University, Bloomington: psychological research building, $543,700.

Kansas

Kansas State University of Agriculture and Applied Science, Manhattan: dairy and poultry research building, $93,020.

University of Kansas Medical Center, Kansas City: medical science building and equipment, $850,200.

Maryland

Johns Hopkins University, Baltimore: equipment for previous grant for biophysics research building, $22,806.

Massachusetts

Massachusetts General Hospital, Boston: equipment for previous grant for research facilities at McLean Hospital, Waverly, $5,775.

Massachusetts General Hospital, Boston: expansion, remodeling, and equipment for pediatric neurology research unit, $98,425.

University of Massachusetts, Amherst: bacteriology and zoology research laboratories and equipment, $132,212.

Michigan

University of Michigan, Ann Arbor: equipment for previous construction grant for college of pharmacy, $17,500.

Wayne State University, Detroit: equipment for previous grant for microbiology and organic chemistry research facilities, $47,250.

Minnesota

University of Minnesota, Minneapolis: equipment for biological laboratory building for Hormel Institute, $28,002.

Missouri

Washington University, St. Louis: equipment for previous grant for medical research laboratories, $68,250.

Montana

Montana State College, Bozeman: equipment for veterinary research building, $14,331.

Nebraska

University of Nebraska, Omaha: equipment for previous grant for research addition to university hospital, $21,350.

New York

Beth Israel Hospital, New York: renovation and expansion of research laboratories and equipment, $184,865.

Maimonides Hospital, Brooklyn: equipment for medical science research building, $38,500.

State of New York (Roswell Park Memorial Institute), Buffalo: equipment for previous grant for basic science research institute in field of cancer and allied diseases, $56,525.

University of Buffalo, Buffalo: equipment for health sciences building, $48,828.

Waldemar Medical Research Foundation, Port Washington: equipment for basic medical research, $1,062.

North Carolina

University of North Carolina, Chapel Hill: additional grant for medical science research building, $25,300; research equipment for school of pharmacy, $36,750; school of public health research facility, $653,000.

Ohio

Children's Hospital, Columbus: equipment for medical science research building, $15,750.

Columbus Psychiatric Institute and Hospital, Columbus: equipment for addition to psychiatric research wing, $31,282.

Ohio State University, Columbus: equipment for sanitary engineering research facility, $5,000; equipment for veterinary pathology research building, $50,000.

Western Reserve University, Cleveland: equipment for research, Mather Building, $165,865.

Oregon

Reed College, Portland: addition to chemistry building, $47,529.

University of Oregon Medical School, Portland: medical science research building and equipment, $1,297,955.

University of Oregon Dental School, Portland: basic science research laboratories, $71,900.

University of Oregon, Eugene: expansion of science building for Institute of Molecular Biology, $277,641.

Pennsylvania

St. Christopher's Hospital, Philadelphia: equipment for pediatric research laboratories, $17,500.

University of Pennsylvania, Philadelphia: equipment for previous grants for medical research buildings, $130,095.

Rhode Island

Brown University, Providence: building for research in biology, $476,700.

Tennessee

Meharry Medical College, Nashville: medical research building, $200,000.

University of Tennessee, City of Memphis Hospitals: radiological research facility and equipment, $144,422.

University of Tennessee, Memphis: dental-pharmacy research facility and equipment, $325,000.

Virginia

University of Virginia, Charlottesville: life sciences research building, $612,500.

Washington

State College of Washington, Pullman: biological sciences annex, $377,498; plant sciences research building, $65,000.

Wisconsin

University of Wisconsin, Madison: equipment for chemical research laboratory, $7,221.

PUBLICATION ANNOUNCEMENTS

Address inquiries to the publisher or sponsoring agency. WHO publications may be obtained from the Columbia University Press, International Documents Service, 2960 Broadway, New York 27, N.Y.

A Psychiatric Look at Children. Special issue of Public Health News, vol. 40, No. 6, June 1959, pp. 155–215. New Jersey State Department of Health, 129 East Hanover Street, Trenton 25, N.J.

Automobile Litter Containers. Project guide number 1. 18 pages. Keep America Beautiful, Inc., 99 Park Avenue, New York 16, N.Y.

Litter Receptacles. Project guide number 2. 17 pages. Keep America Beautiful, Inc., 99 Park Avenue, New York 16, N.Y.

Litter Laws. Project guide number 3. 34 pages. Keep America Beautiful, Inc., 99 Park Avenue, New York 16, N.Y.

10 Years of Cleansing New Jersey's Streams and Waters. A summary report of activity, 1948–1958. 37 pages. New Jersey State Department of Health, 129 East Hanover Street, Trenton 25, N.J.

Easter Seal Research Foundation. A report. 1959; 40 pages. National Society for Crippled Children and Adults, Inc., 2023 West Ogden Avenue, Chicago 12, Ill.

Food Guide for Older Folks. Home and Garden Bulletin No. 17. Prepared by Institute of Home Economics, Agricultural Research Service, U.S. Department of Agriculture. Revised June 1959; 16 pages; 10 cents. U.S. Government Printing Office, Washington 25, D.C.

A Statement on Arteriosclerosis. Main Cause of "Heart Attacks" and "Strokes." By Paul Dudley White, M.D., and others, supported by 106 members of the American Society for the Study of Arteriosclerosis. 19 pages. National Health Education Committee, Inc., 135 East 42d Street, New York 17, N.Y.

Group Methods in Therapy. Public Affairs Pamphlet No. 284. By Jerome D. Frank, M.D. 1959; 28 pages; 25 cents. Public Affairs Pamphlets, 22 East 38th Street, New York 16, N.Y.

Progress and Problems of Community Mental Health Services. Papers presented at the 1958 Annual Conference of the Milbank Memorial Fund, held October 22–23, 1958, at the New York Academy of Medicine. Part I. 1959; 232 pages; $2. Milbank Memorial Fund, New York, N.Y.

Progress in Action. How the Metropolitan Sewer District Brings Sewers to Your Neighborhood for a Healthier and More Attractive Community. 9 pages. Metropolitan St. Louis Sewer District, 901 Washington Avenue, St. Louis 1, Mo.

"You Are Not Alone." A guide to sources of care and treatment of the crippled child. By Lawrence J. Linck. 1959; 32 pages; 25 cents. National Society for Crippled Children and Adults, Inc., 2023 West Ogden Avenue, Chicago 12, Ill.

Food Habits of New Canadians. A report prepared by the Toronto Nutrition Committee. 1959; 36 pages; 50 cents. Bakery Foods Foundation of Canada, 20 Carlton Street, Toronto 5, Ontario, Canada.

General Handbook for Radiation Monitoring. Compiled and edited by Jerome E. Dummer, Jr., for the U.S. Atomic Energy Commission. 1959; 180 pages; 60 cents. U.S. Government Printing Office, Washington 25, D.C.

Home Care of the Child with Rheumatic Fever. A Guide for Parents. 1959; 25 pages; no charge for single copies. American Heart Association, 44 East 23d Street, New York 10, N.Y.

Let's Be Practical About a Nursing Career. With a list of State approved schools of practical nursing, 1959–1960. May 1959; 36 pages. Committee on Careers, National League for Nursing, 10 Columbus Circle, New York 19, N.Y.

Coccidioidomycosis (Valley Fever) in Arizona. Special issue of Arizona Public Health News, vol. 52, No. 2, March–April 1959, 27 pages. Arizona State Department of Health, Phoenix.

Released Mental Patients on Tranquilizing Drugs and the Public Health Nurse. Nursing Research Monograph No. 1, Department of Nurse Education, New York University. By Ida Gelber, Ed.D., R.N. 1959; 139 pages; $3. New York University Press, Washington Square, New York 3, N.Y.

Agricultural Migrant Film Listing. June 1959; 8 pages. Division of General Health Services, Public Health Service, Washington 25, D.C.

News in Review. Monthly newsletter from the Metropolitan Sewer District to local governments on problems of mutual significance. (Distributed to officials and elected representatives in the Greater St. Louis area.) Metropolitan St. Louis Sewer District, 901 Washington Avenue, St. Louis 1, Mo.

World Health Organization

Zoonoses. Second Report of the Joint WHO/FAO Expert Committee on Zoonoses. WHO Technical Report Series No. 169. 1959; 83 pages; 60 cents.

Mental Health Problems of Aging and the Aged. Sixth Report of the WHO Expert Committee on Mental Health. WHO Technical Report Series No. 171. 1959; 51 pages; 60 cents.

Biological Standardization. Twelfth Report of the WHO Expert Committee on Biological Standardization. WHO Technical Report Series No. 172. 1959; 43 pages; 30 cents.

Cholera. By R. Pollitzer, M.D. WHO Monograph Series No. 43. 1,000 pages; $20.

World Directory of Venereal-Disease Treatment Centres at Ports. Application of the International Agreement of Brussels, 1924, respecting facilities to be given to merchant seamen for the treatment of venereal diseases. 1959; 162 pages; $1.75.