Coxsackie Virus Antibody and Incidence of Minor Illness During the Summer

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THE ROLE of Coxsackie viruses in human illness is not fully understood. The existence of 16 antigenic types of these agents with varying pathogenic potential for the mouse has suggested to some that we may actually be dealing with an assembly of agents loosely grouped together rather than with members of a single family (*1–5*). These agents have been isolated from patients with a variety of illnesses, and evidence has been presented for identifying certain members, for example, types A2 (Fleetwood) and A4 (Texas-1), as the etiological agents of herpangina (*6*) and others, for example, B1 (Conn.-5) and B3 (Nancy) as those of pleurodynia (epidemic myalgia, Bornholm disease) (*7, 8*). Although many of these agents have been isolated from patients simultaneously infected with poliomyelitis virus, or from flies also carrying poliomyelitis virus, the role of the Coxsackie viruses in the etiology of the disease entity known as poliomyelitis remains obscure (*1, 2, 3, 9, 10*). The present study was undertaken to gain further information on this group of viruses and their possible relationship to minor illnesses of poorly defined nature which are commonly seen during the summer months.

The observations presented were made as a part of the study of poliomyelitis which is being conducted in Charleston, W. Va.

Laboratory studies of the development of poliomyelitis antibodies and measurement of the incidence of acute unclassified infectious illness have been undertaken in an attempt to define more accurately the epidemiology of poliomyelitis, the pattern of which is confused by the high ratio of mild or inapparent to apparent infections. The prevalence of the Coxsackie viruses and the confusion resulting from their epidemiological similarity to the poliomyelitis viruses led us to attempt to describe the incidence of infections with these agents and to investigate the association with the incidence of summer illness in children. The events which occurred during the summer of 1951 in Charleston are described.

The Study Areas

Relatively homogeneous population groups selected on the basis of certain characteristics of environment and socioeconomic status have

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been under continuous observation since the spring of 1950. District I in Charleston is composed of approximately 900 persons in 200 households in the north central part of the city (fig. 1). In general, the environmental sanitation is poor. The area is not provided with sanitary sewers. The common method of disposal of human excrement is the insanitary privy. A small stream runs through the area receiving surface waste from overloaded cesspools and septic tanks and wash from the privies. The fly-breeding potential is high. Economic status is generally low. Families are rather large, averaging 4.5 persons. Housing is substandard and crowded. There appears to be ready opportunity for spread of infectious agents by either ano-oral or respiratory routes. District IV is composed of about 1,300 persons in 420 families of middle to upper-middle socioeconomic status living in the southeastern part of the city. Environmental hygiene is standard. The fly-breeding potential is low. Average family size is 3.2 persons. Housing is adequate and not crowded. Personal hygiene practices are generally good.

Methods

Incidence of acute minor illness has been measured since the spring of 1950. Morbidity data are obtained from an adult informant in each household by trained lay interviewers at 4-week intervals. Informants are questioned as to the presence or absence in each member of the household of specific symptoms beginning in the 4 weeks preceding interview. Symptoms, duration, family diagnosis, and a measure of severity are recorded. Severity is measured by the amount of interference with usual activity and is classified as "no reduced activity," "reduced activity," and "in bed." A variable but always substantial portion of illnesses reported falls into the first category. Minor illnesses in the first two groups rarely come to the attention of physicians or health agencies, and thus would not be recorded by any of the usual reporting mechanisms. Incidence rates are, therefore, not comparable with rates obtained through ordinary channels. The schedule of enumeration is arranged so that comparable samples of each population are interviewed each week. The enumerators are regularly rotated

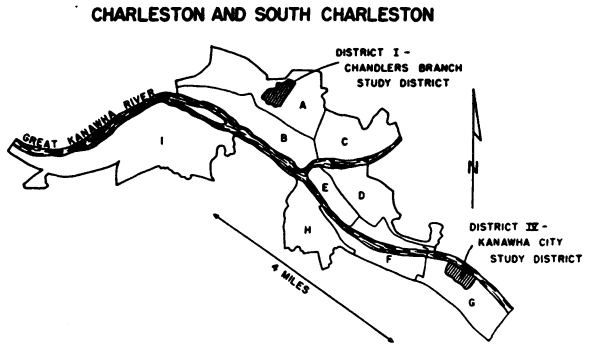

Figure 1. Location of the study areas.

to avoid bias which may result from differences between interviewers.

Laboratory data consist of measurements of complement-fixing (C-F) antibodies to each of four antigenically distinct Coxsackie viruses in paired serums collected in May and November of 1951 from the population under observation in the two districts. The method used for demonstrating antibody has been described (*12*). A "positive" serum is one reacting at a dilution of 1:4 or greater. A "negative" serum is one which fails to react at a dilution of 1:4. Antibodies to the following virus types were studied: B1 (Connecticut-5), B3 (Nancy), A4 (Texas-1), and A2 (Fleetwood). The classification of Coxsackie viruses has been discussed recently with a comparison of nomenclature used by Dalldorf (*3*), Huebner (*4*), and by one of us (*5*). A rise in C-F antibody is regarded as evidence of relatively recent infection with a Coxsackie virus (*12*, *13*, *16*). Even though there are at least 16 immunologically distinct Coxsackie viruses (*5*), there is evidence of crossing between them in the complement fixation reaction, so that in individual cases antibody rises to types other than the one isolated have been demonstrated (*12*, *13*). The average time of persistence of detectable levels of C-F antibody after infection is not certain but it is known to be variable. It may persist for a year or more; on the other hand it is possible that sometimes it may be of such short duration that a rise could have occurred in some of these individuals and could have disappeared between the spring and fall bleedings (*12*, *13*, *16*).

Grab samples of sewage were collected to provide an index of Coxsackie virus infection in the community. Samples were obtained regu-

Table 1. Prevalence of C-F antibody to four types of Coxsackie virus. Paired serums from age samples of two study districts in Charleston, W. Va., 1951

Age	Number of persons	Conn.-5 (type B1)				Type A2				Texas-1 (type A4)				Nancy (type B3)			
		Number positive		Percent positive		Number positive		Percent positive		Number positive		Percent positive		Number positive		Percent positive	
		Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
District I																	
1–4	22	6	19	27	86	3	16	14	73	5	8	23	36	4	6	18	27
5–9	32	19	30	59	94	7	16	22	50	17	17	53	53	13	11	41	34
10–14	9	8	8	89	89	1	3	11	33	6	3	67	33	3	2	33	22
Total 1–14	63	33	57	53	91	11	35	17	56	28	28	44	44	20	19	32	30
15+	20	12	13	60	65	2	4	10	19	3	4	14	19	10	6	50	30
District IV																	
1–4	28	3	10	11	36	7	9	25	32	3	10	11	36	2	2	7	7
5–9	[1] 56	24	30	43	54	17	23	30	41	33	32	60	58	11	5	20	9
10–14	20	6	6	30	30	3	7	15	35	14	9	70	45	6	2	30	10
Total 1–14	[1] 104	33	46	32	44	27	39	26	37	50	51	49	49	19	9	18	9
15+	42	30	23	71	55	4	9	10	22	16	13	38	31	24	11	57	26

[1] One Texas pair incomplete.

larly every 2 weeks during the winter months, and weekly, beginning in May, from lines serving the population of district IV and other residential areas in Charleston and two adjacent towns in the metropolitan area. Weekly privy samples were collected in district I beginning in May. The sewage specimens from each area were run in two pools per month. Privy specimens were run in two pools per month from each of four sections of district I. A description of the methods of collection and of testing these samples will be presented elsewhere.

Results

Table 1 and figure 2 show the prevalence of C-F antibody to the four types of Coxsackie virus in the spring and fall of 1951 in the populations in the two study districts. Only paired specimens are included. Curves are a result of both conversion and reversion between spring and fall. Many individuals developed antibody to more than one type (table 2). It will be noted that in both districts the prevalence of C-F antibody to three types of virus rose during the summer while antibody to the fourth type, Nancy, was less prevalent in the fall than in the spring. No person developed antibody to Nancy alone. The age pattern for each type was different, both in spring prevalence and in change in prevalence between spring and fall.

Table 3 shows rates of conversion from negative to positive during the summer for each type. In both districts, the rate was highest for the Connecticut-5 type. The rate of development of antibody to both Connecticut-5 and type A2 was substantially higher in district I than in district IV. If conversion rate is an

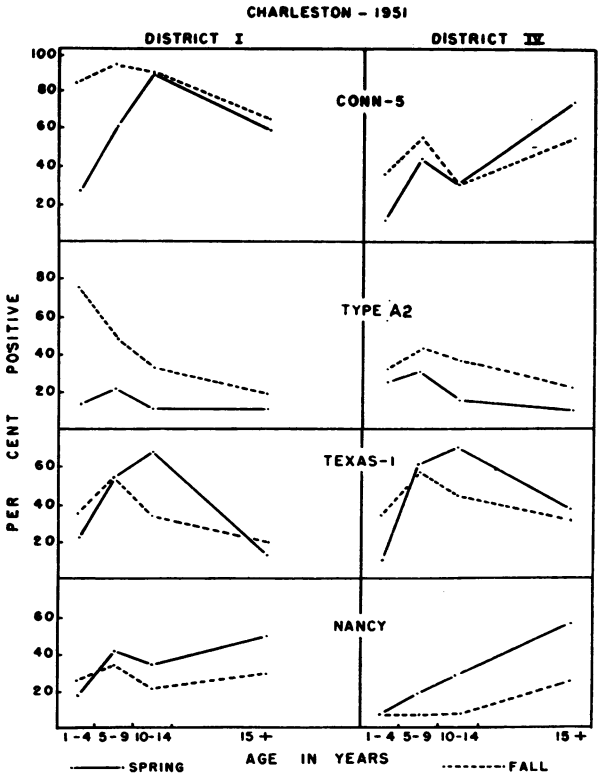

Figure 2. Age distribution of C-F antibodies to four Coxsackie viruses.

indication of extent of spread, then during the summer of 1951 Coxsackie virus spread much more extensively in district I than in district IV. Similar observations have been reported on development of C-F antibodies to the Texas-1 type virus in an urban population during the summer months and its relationship to socioeconomic status and environment (*14*).

The association between the development of C-F antibody, or conversion, and reported morbidity in individuals and households was investigated. In district I the conversion rate was so high that it is not possible to observe any association between morbidity and indication of the presence of infection with one or more types of Coxsackie virus during the summer period. There were only three households in which no pair of serums became positive to one of the Coxsackie viruses. Households with no conversion in Coxsackie virus antibody had no member with a negative complement fixation to Connecticut-5 in the spring. Only 1 child under 10 years of age had no C-F antibody in the spring or fall to any of the 4 types.

In district IV, the presence of households in which no individual tested developed antibody

Table 2. Number of positive C-F antibodies per person in spring and number of conversions per person during summer, 1951

Age	Number tested	Number of positive C-F tests per person in spring					Total number with 1 or more positive C-F tests		Number of new C-F antibodies per person during summer and fall				Total with 1 or more conversions	
		0	1	2	3	4	*Number*	*Percent*	1	2	3	4	*Number*	*Percent* [1]
District I														
1–4	22	10	8	3	0	1	12	55	4	7	6	0	17	81
5–9	32	7	9	6	5	5	25	78	5	5	4	1	15	56
10–14	9	1	2	3	2	1	8	89	1	1	0	0	2	25
15+	20	6	5	5	4	0	14	70	2	3	0	0	5	25
District IV														
1–4	29	21	4	2	1	1	8	28	10	3	1	0	14	50
5–9	56	8	24	12	11	1	48	86	12	3	1	0	16	29
10–14	20	2	10	5	3	0	18	90	5	1	0	0	6	30
15+	44	8	9	15	9	3	36	82	8	0	0	1	9	22

[1] Percent of persons with one or more negative C-F tests in spring.

Table 3. Rate of development of C-F antibodies to four Coxsackie viruses in paired serums from a sample of the population in two study districts in Charleston, W. Va., 1951

Age	District I											
	Connecticut-5			Type A2			Texas-1			Nancy		
	Number negative, spring	Number positive, fall	Conversion rate (percent)	Number negative, spring	Number positive, fall	Conversion rate (percent)	Number negative, spring	Number positive, fall	Conversion rate (percent)	Number negative, spring	Number positive, fall	Conversion rate (percent)
1–4	16	14	87	19	13	68	17	4	24	18	5	28
5–9	13	11	85	25	11	44	15	4	27	19	5	26
10–14	1	1	100	8	2	25	3	0	0	6	0	0
Total 1–14	30	26	87	52	26	50	35	8	23	43	10	23
15+	8	3	37	19	2	10	18	2	11	10	1	10
	District IV											
1–4	25	8	32	21	3	14	25	7	28	26	1	4
5–9	32	10	31	39	7	18	22	3	14	45	1	2
10–14	14	3	21	17	4	24	6	0	0	14	0	0
Total 1–14	71	21	30	77	14	18	53	10	19	85	2	2
15+	12	2	17	37	6	16	26	3	12	18	1	6

Rate of loss of C-F antibodies

Age	District I											
	Connecticut-5			Type A2			Texas-1			Nancy		
	Number positive, spring	Number negative, fall	Reversion rate (percent)	Number positive, spring	Number negative, fall	Reversion rate (percent)	Number positive, spring	Number negative, fall	Reversion rate (percent)	Number positive, spring	Number negative, fall	Reversion rate (percent)
1–14	33	2	6	11	2	18	28	7	25	20	11	55
15+	12	2	17	2	0	0	3	1	33	10	4	40
	District IV											
1–14	33	7	21	27	2	7	50	9	18	19	12	63
15+	30	9	30	4	1	25	16	6	37	24	14	58

Table 4. Reported incidence of total unclassified acute minor illness in children under 10 years of age

Month	Households with conversions [1]			Households without conversions [2]		
	Number	Cases	Rate (percent)	Number	Cases	Rate (percent)
May	42	8	19	39	14	36
June	41	5	12	36	3	8
July	36	9	25	30	7	23
August	38	19	50	32	12	38
September	43	14	33	39	12	31
October	43	27	63	38	10	26

[1] Children in 21 households in which 1 or more persons under 10 developed C-F antibody between May and November 1951.

[2] Children in 25 households in which no person showed rise in C-F antibody.

NOTE: All populations are average number of children present per week during the month.

permits a comparison of minor morbidity between individuals and groups who did and did not show a rise in C-F antibody to one or more of the types of Coxsackie virus tested during that season. Households in which paired serums showed rises to type 2 poliomyelitis virus have been excluded. Since infection with a Coxsackie virus spreads in households (*1*, *2*, *6*, *10*, *11*, *15*), the association between evidence of infection in households and incidence of illness was investigated. Table 4 shows the total incidence by month of onset of acute minor illness in children under 10 years of age in households in which one or more persons, including at least one child under 10, developed antibody to one or more of three types of Coxsackie virus compared with the morbidity reported in children in households in which serum pairs were tested for children under 10 and no development of antibody was demonstrated. Only unclassified acute minor illness has been included. The common acute communicable diseases of childhood, chickenpox, measles, and mumps, and such conditions as summer sores, impetigo, poison ivy, pinkeye, reactions to immunizations, accidents, and injuries have been excluded. The peak of summer morbidity was in August. Rates in July and September were slightly higher than those in May and June. Incidence of total minor morbidity was also high in October in children in converter households. August incidence appeared to be slightly higher in converter households but differences between the two groups were not notable.

Table 5 shows the symptoms reported in the children with an unclassified acute minor ill-

Table 5. Individual symptoms reported in August 1951 by children under 10

Type of household	Number of children	Number of illnesses	Symptoms																Severity		
			Nasal	Cough	Sore throat	Fever	Headache	General aches	Stiff neck	Pains in arms-legs	Vomiting	Diarrhea	Other	Number of symptoms	Average symptom per illness	Fever rate, percent	Sore throat rate, percent	Vomiting rate, percent	Headache rate, percent	Usual activity	Reduced activity	In bed
With conversions	38	19	12	7	6	13	4	0	0	0	6	4	6	58	3.0	34	16	16	10	9	3	7
With no conversions	32	12	7	3	1	2	3	0	0	0	1	1	3	20	1.7	6	3	3	9	6	3	3

Table 6. Illnesses with fever or sore throat reported July–October 1951 in individual children with a rise in antibody to a Coxsackie virus

	1–5 years				6–14 years			
	Conn.-5 only	Conn.-5 + Texas-1 or type A2	Texas-1 only	Total	Conn.-5 only	Conn.-5 + Texas-1 or type 2	Type A2 only	Total
Number of children	6	3	5	14	5	3	6	14
Number with fever or sore throat	6	2	5	13	2	0	0	2
Fever	5	2	5	12	1	0	0	1
Sore throat	3	1	2	6	1			1
Usual activity	1			1	2			2
Reduced activity	1	1	2	4				
In bed	4	1	3	8				
Month of onset:								
July			2	2				
August	4	1	2	7	2			2
September	2	1		3				
October			1	1				

[1] Children who showed rises in C-F antibody to type 2 poliomyelitis virus have been excluded from both groups.

ness during the peak month of August. The symptoms listed are those regarding which specific questions were asked. Other symptoms included earache, upset stomach, and additional respiratory symptoms. There was no report of chest or pleuritic pain. A significant excess of fever was reported by children in households with conversions. Sore throat and vomiting were also present in some excess in this group. In one block in district IV, not included in the spring serum collection, type A2 Coxsackie virus was isolated in July from each of six children tested during a study of a localized excess of acute minor illness. Five of the six tested plus one household contact reported sore throat and fever. This experience is described in the accompanying report.

A summary of acute minor illnesses reported in individual children who developed antibody is shown in table 6. The children have been separated into two age groups, and illnesses are listed by type of Coxsackie virus to which C-F antibody developed. Five children, 1 to 3 years of age, developed antibody to Texas-1 only. All reported febrile illness during the interval between bleedings, 2 in July, 2 in August, and 1 in October. All were too sick for normal activity and 3 were in bed. Two reported sore throat, 1 vomiting, and 1, the 3-year-old, complained of headache. Six children, 5 to 12 years of age, developed antibody to type A2 only. In this group no fever or sore throat was reported. Three had attacks of vomiting in October. Among the individual children 1 through 5 years of age showing a rise in C-F antibody to the Connecticut-5 virus, 7 out of 9 had a febrile illness in August or September, 4 had sore throat, 4 reported vomiting, and 3 headache. Classified by severity, one of the illnesses caused no reduction in the child's activity, two produced reduced activity, and 5 of the children were in bed. Of 8 children 6 to 14 years of age showing a rise in antibody to the Connecticut-5 virus, 1 reported sore throat and another reported fever. It is interesting to note that 13 of the 14 children of ages 1 through 5 had fever, sore throat, or both; only 1 of the 14 in the older group reported fever and 1 complained of sore throat.

Table 7 shows the number of illnesses in the children in each group of households in which fever or sore throat was reported as symptoms. There were 22 such illnesses in the children in households with conversions (average popula-

Table 7. Incidence in 1951 of unclassified acute minor illness with fever or sore throat in children under 10

Month	Households with conversions			Households without conversions		
	Number	Cases	Rate (percent)	Number	Cases	Rate (percent)
May	42	2	5	39	5	13
June	41	2	5	36	0	0
July	36	4	11	30	2	7
August	38	14	37	32	2	6
September	43	8	19	39	1	3
October	43	7	16	38	2	5

tion, 41) in August and September while among those in households with no conversions (average weekly population, 35) only 3 were noted. The rates for May, June, and July are similar in the two groups. In October, the difference is within chance range. The weekly incidence of illness with sore throat or fever in each group of children is shown in figure 3. Such illnesses in the children in households with antibody rise appear to be concentrated in the latter part of August (calendar weeks 33–35). There is also a little concentration in weeks 28–31, the period during which the block outbreak described in the accompanying paper occurred. As also shown in figure 3, Coxsackie virus was isolated from the sewage from District IV in the latter part of July and again in the first half of September. Pools of August collections were negative. Sewage from other areas in the community was positive intermittently from the first half of July until mid-October.

The average population under 10 years of age in district IV was about 380 during July and August. The total incidence of acute minor illness reported during this midsummer period, excluding accidents and injuries, was 28 per 100 in July and 37 per 100 in August. About 6 cases per 100 in each month were identified as mumps, impetigo, pinkeye, or other miscellaneous entities. The remainder fell into an unclassified group. The monthly incidence of total unidentified illness and of those illnesses in which fever or sore throat was reported are shown in tables 8 and 9, compared with reported morbidity in the children in "conversion" and "no conversion" households. Rates for July are similar for the three groups. In August the children in households in which one or more developed C-F antibody reported a higher incidence of unclassified acute minor morbidity than did the whole population, especially of illnesses with fever or sore throat. These children, about 10 percent of the total population, accounted for nearly 25 percent of the total fever and sore throat incidence.

Discussion

The development of the C-F test for detection of antibody to the Coxsackie viruses has made available a tool which can be used to measure infection with these viruses in population groups. The test has the advantage of being relatively inexpensive, so that large scale observations are feasible. It lacks type specificity, however, to the point that in individual cases the type of the infecting virus cannot be determined. In spite of this limitation, the use of this technique may be of value in indicating broad epidemiological patterns of infection with this group of viruses. Combined with limited use of more specific but costlier methods of virus isolation and typing and studies of neutralizing antibody, it may permit adequate studies of the epidemiological and clinical characteristics of infection. The data presented here indicate both the usefulness and the limitations of the method.

Index of Incidence of Infection

The prevalence of Coxsackie C-F antibody in population groups should be an index of the incidence of infection during the period of average persistence of the antibody (*14*). The observations show that Coxsackie infection was common in Charleston prior to the first serum collection. In each district over 70 percent of persons tested had C-F antibody in the spring to one or more of the four types studied (table 2). The prevalence of antibody was not sig-

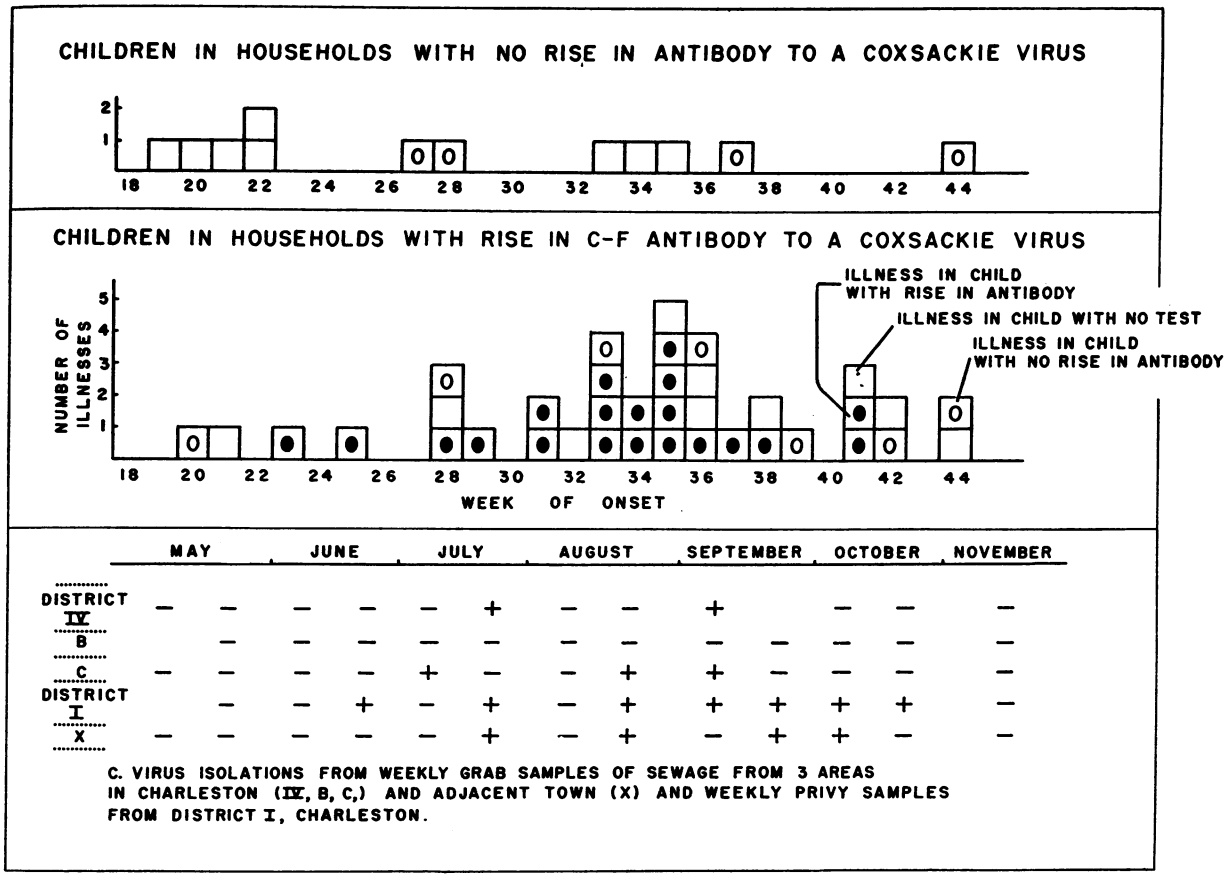

Figure 3. Weekly incidence of illness with sore throat and/or fever in households, and seasonal distribution of Coxsackie viruses in the area.

nificantly different in age groups over 4 years in either district or between the two population groups. Children 4 years of age or under in district I, the insanitary area, had C-F antibody to one or more of the viruses in somewhat higher prevalence (55 percent) than those in district IV (28 percent), an area with standard environmental hygiene. Prevalence of antibody tended to increase with age to about 14 years, after which the level remained essentially the same. It appears that infection was still taking place in the adult population. Since the average time of persistence of C-F antibody after infection is not known, and the picture is complicated by heterotypic responses, yearly incidence rates cannot be estimated. Even if detectable antibody persists longer than a year, incidence of infections with this group of agents must have been high at all ages.

Incidence of infection with a Coxsackie virus during the summer of 1951 was estimated by study of C-F antibody to four types of virus in paired serums collected in May and November. Conversion from negative to positive is considered to be evidence of infection occurring in the interval between serum collections. Sixty-seven percent of children under 10 years of age in district I and 36 percent of children of the same age in district IV developed C-F antibody to one or more of the types studied. Conversion rates in persons age 10 and older was 25 percent in both district I and district IV. In children under 10 in district IV, 22 (73 percent) of 30 conversions were to a single type; 6 children developed antibody to 2 types and 2 children to 3 types. In district I only 9 (28 percent) of 32 conversions were to 1 type. Twelve children (38 percent) developed antibodies to 2 types, 10 to 3 types, and 1 to all 4 types. It is known that in response to infection with a 1 type of Coxsackie virus, rises in C-F antibody may occur not only to the infecting

type but also to heterologous types (*12*, *13*, *16*). The mechanism responsible for rise in heterologous antibody is not known, but it has been suggested that it may be an indication of previous infection with the type involved. This explanation could account for the greater degree of multiple rise in district I where spread of infection appeared to be more extensive.

In spite of the frequency of development of more than one antibody, the patterns of change in prevalence between spring and fall were different for each type studied. One type, Nancy, decreased in prevalence, with no rise to this type alone and reversion of over half of the spring positives to negative. It is reasonable to conclude that this type was not prevalent in Charleston during the summer of 1951. Increase in C-F antibody prevalence to a second type, Texas-1, was limited to the population under 5 years of age. Single rises occurred only in children of ages 1 to 3 in district IV and 1 adult in district I. No child under 4 in district IV and only 1 in district I had C-F antibody to Texas-1 in the spring. The conversion rate was highest in antibody to Connecticut-5 virus and occurred almost entirely in children under 15 years of age. Type A2 antibody prevalence was lowest in the spring and increased in all ages during the summer.

Whether or not one or more of the three viruses which showed increased antibody prevalence was causing infection during the summer cannot be determined from the C-F evidence. Coxsackie viruses were isolated from the sewage from both districts and from other areas in and around Charleston, but these strains have not been typed. Type A2 virus was isolated from stool specimens of 6 children with fever and sore throat and 2 household contacts in a block in district IV which was not included in the serum collections. However, in the two study districts, children with paired serums tested showed a higher rate of development of C-F antibody to Connecticut-5 than to type A2, and single rises to both Connecticut-5 and Texas-1 occurred with no evidence of development of antibody to type A2. It is likely that at least 1 type in addition to type A2 contributed to the Charleston incidence, but whether or not either Connecticut-5 or Texas-1 were present is not known.

Morbidity and Coxsackie Viruses

The children in district IV who developed C-F antibody to one or more of the Coxsackie viruses studied and their household contacts reported more febrile illness and sore throat than were observed in households in which paired serums showed no rise in antibody. This excess in morbidity was most notable in August and September. The clinical syndrome in about half of the cases was similar to herpangina (*6*). The others were less specific. No chest pain or pleurodynia was reported. Seven of the 14 cases in individuals with conversion were associated with rise in antibody to the Connecticut-5 type only, and 4 with rise in Connecticut-5 plus either Texas-1 or type A2. Similarly, 4 of the 9 household contact cases were associated with rise to Connecticut-5 only and 3 with rises to Connecticut-5 plus Texas-1 or type A2. Since virus was not isolated from any of these individuals at the time of illness, it is not possible to say positively that any type of Coxsackie virus was responsible for the illnesses or the development of C-F antibody. It is interesting, however, and perhaps worthy of further investigation, that while the greatest

Table 8. Incidence of unclassified acute minor illness in children under 10 years of age, District IV, 1951

Month	All children			Households with conversions			Households without conversions		
	Number	Cases	Rate (percent)	Number	Cases	Rate (percent)	Number	Cases	Rate (percent)
July	373	79	21	36	9	25	30	7	23
August	388	119	31	38	19	50	32	12	37

Table 9. Incidence of unclassified acute minor illness with symptoms of fever or sore throat, District IV, 1951

Month	All children			Households with conversions			Households without conversions		
	Number	Cases	Rate (percent)	Number	Cases	Rate (percent)	Number	Cases	Rate (percent)
July	373	39	10	36	4	11	30	2	7
August	388	61	16	38	14	37	32	3	9

number of antibody conversions were to the Connecticut-5 virus, and the association of conversion to Connecticut-5 with minor morbidity was most marked, the minor illnesses reported were herpangina-like. The Connecticut-5 virus has been suggested as one of the etiological agents of pleurodynia (*7*, *8*). No symptoms suggestive of this syndrome were reported.

Summary and Conclusions

1. Spring and fall prevalence of complement-fixing antibodies to four antigenically distinct Coxsackie viruses in paired serums collected in the spring and fall of 1951 from two selected population groups in Charleston, W. Va., is presented with conversion rates for each age group. Each population is relatively homogeneous, but the two differ in socioeconomic status and environmental sanitation. Antibodies to the following Coxsackie virus types were studied: Connecticut-5 (B1), Nancy (B3), Texas-1 (A4), and type A2.

2. In spite of the fact that many persons showed development of antibody to more than one type of virus, each type shows a distinct and different pattern of change in prevalence between spring and fall.

3. The conversion rate for the two types which showed increase in prevalence at all ages was definitely greater in the district characterized by substandard socioeconomic status and environment.

4. In the district selected for good sanitary environment and better than average socioeconomic status, there appeared to be an association between the development of antibody to one or more of the Coxsackie viruses and the reported incidence of unclassified acute minor morbidity, particularly those illnesses with symptoms of fever or sore throat in individuals and family contacts under 10 years of age.

5. The incidence of unclassified acute minor illnesses in the total population under 10 years of age in this district during August was about 31 cases per hundred. Ten percent of the children, identified by laboratory study as individuals or household contacts of individuals who developed complement-fixing antibody to one of the Coxsackie viruses, reported incidence rates higher than the rates for the total population and accounted for about 25 percent of the morbidity with symptoms of fever or sore throat.

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Isolation of a Coxsackie Virus During a Summer Outbreak Of Acute Minor Illness

By JOSEPH L. MELNICK, Ph.D., MARY WALTON, M.D., Dr.P.H., and IRA L. MYERS, M.D.

COXSACKIE VIRUSES have been isolated from patients with a variety of illnesses (*1*, *2*, *3*). However, the characterization of these viruses as the etiological agents of specific disease is not a simple matter. Extensive and detailed investigations were required before Huebner and his associates (*4*) were able to demonstrate that certain members of the Coxsackie group could induce the clinical entity known as herpangina. The fact that at least 16 antigenic types are included in the Coxsackie group (*5*) confuses the problem. Additional investigations combining epidemiological observations and laboratory study of specimens collected in the field are necessary to elucidate the role of these viruses in human illnesses. One such investigation is recorded here.

The observations described were made as a part of a study of the epidemiology of poliomyelitis which is being conducted in Charleston, W. Va. (See the preceding paper.) In the last week of July 1951 an unusual incidence of unclassified acute minor illness was noted in a block in one of the study areas in which households are regularly visited by in-

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Dr. Myers, a commissioned officer of the Public Health Service, was assigned to the Communicable Disease Center poliomyelitis project, at Charleston, W. Va., when a part of this study was in progress. He is now with the Communicable Disease Center, Atlanta, Ga. Biographical data for Dr. Melnick and Dr. Walton will be found with the article by them on p. 1167 of this issue.

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