

Case Registry for Rheumatic Fever in Greater Miami, Florida

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REGISTRY of acute rheumatic fever cases is one method of obtaining information concerning the etiology, diagnosis, prognosis, epidemiologic rates, and other pertinent data related to this disease. A previous paper (1) reported the frequency of acute episodes of rheumatic fever and glomerulonephritis in Greater Miami, Fla., as determined from a case register operated for 13 months, September 1, 1955, to October 1, 1956.

The present study, which extended over a 3-year period, September 1, 1955, to October 1, 1958, is a continuation of the previous one. The purpose of the investigation was to record all known active and suspected active rheumatic fever episodes in Miami so that more accurate data on the frequency of rheumatic disease in a tropical climate might be available.

The case registry technique may be employed in other areas of the country, and the data from Greater Miami can be compared with information collected in other geographic areas under various climatic conditions. Thus, the effects of climate and other influences on rheumatic fever incidence rates may be observed.

Method

The method used in collecting information in this study was essentially the same as that described in the previous report (1). A list of physicians and their specialties was obtained from the county medical society. Physicians were contacted by telephone and the purpose of the study and the method to be employed were explained to them. Pediatricians, general practitioners, internists, orthopedists, cardi-

ologists, and urologists cooperated in the study. Only one physician refused to participate.

Names of participating physicians, their telephone numbers, and other pertinent information were typed on 3- by 5-inch index cards. The medical society's membership lists were reviewed monthly and necessary changes were made on the cards. The names of new members were added to the register's index file according to their specialties. Between September 1, 1955, and October 1, 1958, more than 450 physicians and 13 hospitals in Dade County participated in the registry.

Each physician was called by telephone monthly or bimonthly. The date of the contact was recorded on the index card, and the card was returned to the file. If the physician reported any patient suffering from rheumatic fever or suspected of having rheumatic fever, the name, address, sex, age, and race of the patient and the name of the attending physician were recorded in a special register. The physician was requested to complete a questionnaire listing detailed information as to past his-

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tory, date of onset of illness, signs, symptoms according to Jones modified major and minor criteria (2), treatment, subsequent attacks, if any, progress of the patient, and pertinent laboratory findings, such as antistreptolysin O titer, electrocardiogram, erythrocyte sedimentation rate, C-reactive protein, white blood count, hematocrit reading, and hemoglobin.

Saslaw visited each hospital repeatedly and personally checked the chart of each patient hospitalized because of rheumatic fever or suspected rheumatic fever. Data similar to those obtained from physicians were recorded in the registry.

Five volunteer women, members of the auxiliary chapters of the National Children's Cardiac Hospital, recorded specific data, maintained a current file of physicians, telephoned physicians, and performed other clerical work. When such assistance is not available, the aid of volunteers from the PTA, heart association, or similar agencies may be solicited. Lacking such aid, one full-time clerk-typist may be employed. Cost of operation of the registry depends on the use of paid or voluntary help. Additional expenses may include telephone service, minimal stationery, and approximately 20 percent of a physician's time. The current report is based on use of volunteers and therefore involved the expenditure of about \$300 for consultation and forms, an expenditure borne by the Florida Heart Association.

At the conclusion of the 3-year study the findings were reviewed, tabulated, evaluated, and interpreted. The case registry thus served as a central source for the collection of all available information related to rheumatic fever in Dade County. These data are presented in this report.

Results

Eighty-three cases of rheumatic fever were reported during the 37 months of the study. Fifty-three cases, 63.9 percent, were diagnosed as definite acute rheumatic fever, either first attack or recurrence, according to the Jones criteria (2); the remaining 30 cases, 36.1 percent, were suspected acute rheumatic fever. The distribution of these 83 cases is detailed in table 1 by study year.

Table 1. Distribution of active and suspected cases of rheumatic fever, Dade County, Fla., September 1, 1955–October 1, 1958, by year

Type	1955-56	1956-57	1957-58	Total
Active.....	10	24	19	53
Suspected.....	7	20	3	30
Total.....	17	44	22	83

No questionnaires were filed for three cases, but the treating physician was contacted by telephone, and he confirmed the initial diagnostic impression of rheumatic fever. Two of these illnesses were considered definitely active cases of rheumatic fever and one, suspected active.

Of the 83 rheumatic fever patients, 51 (61.4 percent) were hospitalized. This included 32 (60.4 percent) of the 53 active cases, and 19 (63.3 percent) of the 30 suspected cases. No differences were apparent in the clinical observations or laboratory data between the hospitalized and the nonhospitalized patients.

The male-to-female ratio of the 83 patients was 1.24:1 (46 males, 37 females). The race of two males was not reported. Fifty-five (67.9 percent) of the remaining 81 patients, 27 males and 28 females, were white; 26 (32.1 percent), 17 males and 9 females, were Negro (table 2). The white-Negro ratio was approximately 2:1; for the total population of Dade County the ratio is approximately 7:1.

The age of two white females and the age and race of two males were not reported. The age distribution of the remaining 79 patients was as follows:

Age (years)	Number	Percent
Under 6 ¹	3	3.8
6-9.....	15	18.9
10-15.....	27	34.2
16-20.....	12	15.2
21-30.....	10	12.7
31 and over.....	12	15.2

¹ Includes 1 patient 27 months old.

The race, sex, and age distribution of these patients is shown in detail in table 2. Fifteen cases were recorded in the group 6-9 years of age, 8 in males and 7 in females. Of the males, 4 were white and 4 Negro; of the females, 5 were white and 2 Negro. The highest number of reported cases, 27, was observed in the group

aged 10-15 years, almost twice as many as in the group 6-9 years old. The cases were equally distributed between males and females: 14 males, 8 white and 6 Negro; 13 females, 10 white and 3 Negro.

Twelve subjects in the age group 16-20 years had rheumatic fever. Twenty-two active cases were recorded in the group 21 years old and over: 10 white males, 8 white females; 2 Negro males, 2 Negro females. Twelve of the 22 patients were 31 years old or older.

Three cases were reported in children under 6 years of age. One was in a 27-month-old white male with questionable rheumatic fever activity, one in a 3-year-old white female, and the third in a 3-year-old Negro male.

Sixty-seven subjects supplied information on whether attacks were first or recurrent episodes. Age was given for 65 of these patients (table 3). Forty-five of the 67 (67.2 percent) reported first attacks; age was given for 44. Of these, 27 (61.4 percent) were 15 years of age or under.

Recurrent episodes were tabulated on the basis of the 67 patients reporting this information to the registry and not on the total number of rheumatic heart disease patients, both active and inactive, in Greater Miami. Age was given for 21 of the 22 patients reporting recurrent episodes (table 3). The highest number of recurrences was observed in those 21 years of age or over, next in the group 10-15 years old, and third in the age group 16-20 years.

Diagnostic Criteria

The modified Jones criteria (2) were used in evaluating the diagnosis and degree of activity of rheumatic fever. These criteria are listed in table 4 according to history, clinical findings, and pertinent laboratory tests.

Of the 83 subjects in the study, 77 (93 percent) presented at least one major and two or more minor criteria. The six who did not present any major criteria may not have had rheumatic fever. However, they are included in the "suspected rheumatic fever" category be-

Table 2. Distribution of patients with active or suspected rheumatic fever, by race, sex, and age

Race and sex	Age (years)						Total
	Under 6 ¹	6-9	10-15	16-20	21-30	31 and over	
Active							
White:							
Male.....	0	4	5	3	1	2	15
Female.....	0	3	7	1	2	3	16
Negro:							
Male.....	1	2	5	4	2	0	14
Female.....	0	2	2	1	1	0	6
Both races:							
Male.....	1	6	10	7	3	2	29
Female.....	0	5	9	2	3	3	22
Suspected							
White:							
Male.....	¹ 1	0	3	1	3	4	12
Female.....	1	2	3	1	1	2	10
Negro:							
Male.....	0	2	1	0	0	0	3
Female.....	0	0	1	1	0	1	3
Both races:							
Male.....	1	2	4	1	3	4	15
Female.....	1	2	4	2	1	3	13
Total.....	¹ 3	15	27	12	10	12	79

¹ Includes 1 white male 27 months old.

cause the attending physician suspected that they had the disease. Twenty-nine patients (36 percent) presented two major criteria, and one patient had three—chorea, carditis, and erythema marginatum.

Past history. A history of rheumatic fever or rheumatic heart disease was reported in 67 cases; 22 (32.8 percent) had a definite history. Seventeen of these 22 cases were recorded as childhood rheumatic fever, with the initial attack at ages ranging from 9 months to 21 years. Three cases were recorded as childhood rheumatic fever, without specific mention of age.

Two patients, one 39 and one 49 years old at the time of registry, had had primary attacks at ages 31 and 43 years, respectively.

Among the 17 patients who had initial episodes in childhood, one had rheumatic fever and chorea at 5 years of age, one was reported to have had intermittent attacks every 3 or 4 months since the age of 8 years, and a third child had a family history of rheumatic fever and now had rheumatic fever. Three other patients had family histories of rheumatic heart disease.

Three children among the 45 patients whose questionnaires did not record an ini-

Table 3. Distribution of patients with primary and recurrent rheumatic fever episodes, by age

Attack	Age (years)												Total
	Under 6		6-9		10-15		16-20		21-30		31 and over		
	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	
First.....	0	0	12	27.3	15	34.1	7	15.9	5	11.4	5	11.4	44
Recurrent.....	0	0	2	9.5	6	28.6	3	14.3	3	14.3	7	33.3	21
Total.....	0	0	14	21.5	21	32.3	10	15.4	8	12.3	12	18.4	65

Table 4. Diagnostic findings ¹ recorded in rheumatic fever case register, Dade County, Fla.

Diagnostic criteria	Active cases						Percent of—	
	Definite		Suspected		Total		Reported cases	Total recorded cases
	Reported	Positive	Reported	Positive	Reported	Positive		
Past history.....	45	13	22	9	67	22	32.8	26.5
Carditis.....	42	34	18	14	60	48	80.0	57.8
Polyarthriti.....	41	38	17	13	58	51	87.9	61.4
Chorea.....	13	2	2	0	15	2	13.3	2.4
Skin lesions ²	7	2	1	1	8	3	39.5	3.6
Antistreptolysin O.....	27	19	8	6	35	25	71.4	30.1
Streptococcal infections.....	27	11	9	3	36	14	38.9	16.9
Electrocardiogram.....	33	14	12	6	45	20	44.4	24.1
Rheumatic heart disease.....	29	16	13	7	42	23	54.8	27.7
Other minor criteria.....	47	41	19	17	66	58	87.9	69.9
Erythrocyte sedimentation rate.....	45	39	17	13	62	52	83.9	62.6
Fever.....	46	45	24	23	70	68	97.1	81.9
Leukocytosis.....	37	28	14	9	51	37	72.5	44.6
C-reactive protein.....	28	20	7	5	35	25	71.4	30.1
Arthralgia.....	32	24	15	14	47	38	80.9	45.8
Suggestive signs.....	29	25	18	16	47	41	87.2	49.4
Preceding infections, non-beta streptococcal infections.....	44	22	21	10	65	32	49.2	38.6
Subsequent attacks.....	50	13	22	9	72	22	30.6	26.5

¹ According to Jones criteria (8).

² Erythema marginatum, subcutaneous nodules, or both.

tial family history of rheumatic fever or rheumatic heart disease were found at a later date to have such histories. One of these three children also had a history of chorea. A fourth child was reported to have had chorea alone 10 years ago but had had no symptoms during the present rheumatic fever attack.

Carditis. Rheumatic carditis was listed as present if significant murmurs, enlargement of the heart, congestive heart failure, or pericarditis was found in the examination.

Forty-eight (80 percent) of the 60 patients reported as having this diagnostic criterion had some form of carditis, as evidenced by clinical findings (major manifestation) and by electrocardiogram (minor manifestation). Two of these patients had congestive heart failure.

In two additional patients, heart murmurs were reported as being of rheumatic origin, though the possibility of congenital etiology—one septal defect and one patent ductus—could not be eliminated at the time the report was made.

Many of the patients whose report forms failed to show murmurs or other evidence of rheumatic heart disease at the first examination were found on subsequent examinations to have developed organic murmurs. Among this group of subjects, other positive laboratory tests and clinical findings were present during

the initial examination, strongly suggesting active rheumatic fever, as judged by the treating physician. Some of these cases were originally tabulated as suspected rheumatic fever but were finally listed as active cases.

Polyarthritis. Of the 58 patients reported to have migratory polyarthritis, 51 (87.9 percent) definitely had this sign present. Many treating physicians reported that some patients had polyarthritis and arthralgia simultaneously during the acute attacks. Since the physicians' reports often were the sole source of information for the registry, any patient listed as having polyarthritis or arthralgia alone was so tabulated, and patients reported as having both symptoms were listed accordingly.

In one instance, a physician reported that a patient had severe polyarthritis, although he himself recognized the possibility that this sign might have been due to a reaction following an injection of penicillin 7 to 10 days prior to the tentative diagnosis of rheumatic fever. The patient also had a rash which was first believed to be due to scarlet fever but later was shown to be due to exposure to a detergent.

Chorea. Of 15 patients reported as having chorea, 2 children (13.3 percent) had definite histories of episodes of the disease. A third child gave a history of having had chorea 10 years previously. A fourth child, a 15-year-

Table 5. Antistreptolysin O titers correlated with age

Titer	Age (years)						Total patients	
	Under 6	6-9	10-15	16-20	21-30	31 and over	Number	Percent
Negative ¹	0	2	2	1	3	2	10	33.33
Less than 12.....	0	0	0	0	0	0	0	0.00
12.....	0	0	0	0	1	0	1	3.33
50.....	0	0	0	0	1	0	1	3.33
100.....	0	1	0	1	0	2	4	13.33
125.....	0	1	0	0	1	0	2	6.67
166.....	0	0	2	0	0	0	2	6.67
Positive ²	1	3	8	6	2	0	20	66.67
250.....	1	1	3	0	0	0	5	16.67
333.....	0	1	1	1	0	0	3	10.00
500.....	0	0	0	1	1	0	2	6.67
625.....	0	0	3	2	0	0	5	16.67
833.....	0	0	1	2	0	0	3	10.00
1,250.....	0	1	0	0	1	0	2	6.67
2,500.....	0	0	0	0	0	0	0	0.00
Total.....	1	5	10	7	5	2	30	100.00

¹ 166 Todd units or less.

² 250 Todd units or more.

old Negro female, was reported to have a history of psychomotor epilepsy occurring 20 months prior to the onset of the reported attack of rheumatic fever; in view of this rheumatic illness, the episodes of psychomotor epilepsy might have been chorea.

Skin lesions. Only eight questionnaires listed reports of erythema marginatum, subcutaneous nodules, or both lesions. Three patients (37.5 percent) showed these signs. In all probability the small number of reports on this clinical finding reflects its truly infrequent occurrence.

Antistreptolysin O responses. Immunological response to beta hemolytic streptococcal infection may be measured by the antistreptolysin O (ASO) titer. Increased ASO titers were reported in 35 cases. Of these, 25 (71.4 percent), were positive. The numerical recording is given for 30 subjects (table 5). In 20 (66.7 percent) titers were elevated to 250 Todd units (TU) or more, with a maximum recorded level of 1,250 units.

Nonrheumatic persons may exhibit ASO titers up to 250 TU and sometimes even greater (3-5).

The average ASO titer for patients with 166 TU or less was 104; for those with elevated titers, 569 (table 6). The average for the entire group was 414 TU.

ASO titers for the 30 subjects for whom this information was given were correlated with the patients' ages (tables 5 and 6). The highest average titer, 550 units, was found in the age group 16-20 years; the second highest,

412.3 units, in the group 10-15 years old; the third highest, 411.6 units, in the group 6-9 years old; and the fourth highest, 387 TU, in the group aged 21-30 years.

ASO titer elevations in rheumatic children (4,6,7) are the result of beta hemolytic streptococcal infection, but other factors play a role in determining the degree of elevation.

Negroes had higher average ASO titers than whites. This is accounted for by the fact that Negro males had the highest titer for either race or sex (table 7). Furthermore, Negro males had the highest rheumatic fever attack rate and the largest number of preceding infections with beta hemolytic streptococci as well as with nonspecified organisms.

Males had a higher average titer than females, despite the equal distribution of rheumatic episodes.

In table 8 the ASO titers are correlated with carditis and polyarthrits. The mean ASO titer for rheumatic fever subjects with carditis as the only major criterion was lower than for subjects with polyarthrits alone. Subjects with both manifestations had a lower average titer than either of the groups having one criterion only. The titer differences between these categories were small and probably not significant.

For some patients whose ASO titers were not recorded on the original reports, titers greater than 250 TU were found later. These titers were not included in the calculations for the mean average ASO titers.

Preceding streptococcal infections. Four-

Table 6. Average antistreptolysin O titers correlated with age

Average	Age (years)						All ages
	Less than 6	6-9	10-15	16-20	21-30	31 and over	
Negative: ¹							
Arithmetic.....	0	113	166	100	62	100	104
Geometric.....	0	112	166	100	42	100	87
Positive: ²							
Arithmetic.....	250	611	474	625	875	0	569
Geometric.....	250	470	425	620	791	0	495
Total:							
Arithmetic.....	250	411	412	550	387	100	414
Geometric.....	250	265	352	462	136	100	278

¹ 166 Todd units or less.

² 250 Todd units or more.

Table 7. Antistreptolysin O mean titers, according to race and sex

Race and sex	Titer ¹		
	250 or more	166 or less	Total
White.....	531. 1	105. 0	367. 2
Male.....	597. 0	104. 3	352. 7
Female.....	491. 6	100. 0	379. 7
Negro.....	593. 7	103. 8	449. 4
Male.....	699. 0	68. 5	584. 4
Female.....	277. 7	202. 5	127. 3
Both races.....	568. 7	104. 4	413. 9
Male.....	673. 5	92. 4	502. 6
Female.....	411. 4	116. 4	279. 9

¹ Todd units.

teen (38.9 percent) of 36 cases had a definite bacteriological or clinical diagnosis of preceding beta hemolytic streptococcal infection, according to reports of the examining physicians. These cases were distributed by age group as follows: 6-9 years, 3 cases; 10-15 years, 5 cases; 16-20 years, 2 cases; 21 years and over, 4 cases.

The temporal relationship between the onset of the preceding beta hemolytic streptococcal infection and the onset of rheumatic fever was mentioned only once; one patient had had scarlet fever 1 month prior to the onset of rheumatic fever. Another patient had a history of scarlet fever 10 years prior to the onset of the reported episode of rheumatic fever. Fewer beta hemolytic streptococcal infections than ASO titer elevations were recorded. Forty-six cases, the 14 subjects who had had beta hemolytic streptococcal infections and 32 with nonbeta infections were reported as having had

preceding infections. Nineteen subjects were in the group 10-15 years old, 10 in the group aged 16-20 years, 5 in the group 6-9 years of age, 1 was under 6 years old, and 11 were 21 years of age or older.

The preceding beta hemolytic streptococcal infections were distributed evenly as to race and sex except for Negro females, for whom infection was reported in only one subject. For all preceding streptococcal infections, the male-female ratio was 1.42:1 and the white-Negro ratio 2:1.

Electrocardiogram. The electrocardiographic changes reported by the treating physicians were primarily concerned with prolongation of the P-R interval. Some physicians in the registry program considered other ECG changes as abnormal and therefore evidence of heart damage. Twenty subjects, 44.4 percent of the 45 reported on, had P-R intervals of 0.18 seconds or greater or were recorded by the examining physicians as having prolonged P-R intervals.

Other ECG changes considered abnormal were observed in four active episodes:

- Left ventricular hypertrophy and left atrial hypertrophy with questionable P-R interval prolongation.
- "Suggested myocarditis."
- Incomplete RBBB and right ventricular hypertrophy.
- "Abnormal T wave changes."

In the group of patients with questionable rheumatic fever there were:

- Incomplete RBBB with LVH and QT interval changes.
- QT interval changes.

Table 8. Antistreptolysin O mean titers for subjects exhibiting polyarthritis and carditis

Disease	Titer ¹					
	250 or more		166 or less		Total	
	Number	Mean titer	Number	Mean titer	Number	Mean titer
Polyarthritis.....	14	562. 4	6	92. 2	20	421. 3
Carditis.....	17	497. 5	7	96. 9	24	380. 6
Polyarthritis and carditis.....	11	450. 7	4	88. 3	15	354. 0

¹ Todd units.

- RVH and questionable P-R interval prolongation.
- RBBB alone.
- "Tall abnormal P wave changes (P2)."

Rheumatic heart disease. Twenty-three subjects (54.8 percent of 42 cases) were reported to have rheumatic heart disease, while 48 patients of 60 reporting were recorded as having rheumatic carditis (cf. Carditis, p. 21).

Other minor criteria. The data on erythrocyte sedimentation rate (ESR), temperature level, white blood count, and C-reactive protein distributions are listed in table 4. For all ages, the average ESR level was 36.5 mm. in 1 hour for all 52 reported acute rheumatic fever episodes, and the average temperature level was 101.6° F. for the 68 reported cases. The average white blood count was 17,000. A count of more than 10,000 was considered abnormal for all ages. Fourteen patients, 27.5 percent of the 51 reported, had normal white blood counts, 37 patients (72.5 percent) had leukocytosis. The C-reactive protein was reported in 35 instances; 25 (71.4 percent) were positive (1+ or greater); the average level was 3+.

Arthralgia. In several instances, both arthralgia and polyarthritis were reported as being present and both were recorded. In others, only arthralgia was observed. In all, 38 subjects, 80.9 percent of 47 cases reported, had arthralgia.

Suggestive signs and symptoms. Tachycardia while sleeping, loss of weight, anemia, easy fatigue, and other nonspecific clinical findings are suggestive signs and symptoms (2). These findings were reported as positive in 41, or 87.2 percent, of 47 recorded cases (table 4).

Preceding infections. The 32 preceding infections that were not due to beta hemolytic streptococci, 49.2 percent of 65 recorded cases, were reported as follows: upper respiratory infection with or without cervical lymphadenopathy, otitis media, chest cold, cough, sore throat, tooth infection with extractions, recurrent or nonrecurrent pharyngitis, and tonsillitis. A few cases were recorded as having been susceptible to upper respiratory infections in the past. The time between the preceding infection and the onset of rheumatic fever varied from 4 days to 4 weeks.

All first attacks of acute rheumatic fever were treated with combinations of aspirin and penicillin, aspirin and steroids, or steroids and penicillin.

Three patients, all with active cases of rheumatic fever, were reported as having negative sickle cell preparations. Another patient with an active case had a negative lupus erythematosus preparation. One patient had a heterophil agglutination titer of 1:28 and one, a sheep cell agglutination titer of 1:28; both were suspected rheumatic fever cases.

Discussion

Eighty-three episodes of acute rheumatic fever were recorded in the case registry for Greater Miami, Fla., during the 3-year period September 1, 1955, to October 1, 1958. These are less than might be anticipated, based on the concept that rheumatic fever follows infections with group A beta hemolytic streptococci or other groups of streptococci (8,9), if the patients are inadequately treated or are not treated at all (10). Actual percentage relationships have not been established except following epidemics and in certain populations, where the 3 percent of untreated infections are followed by rheumatic fever (11).

Studies carried out in Miami substantiate the low occurrence of rheumatic fever in that area. Factors which may influence this low incidence rate also have been investigated (9, 10, 12-16). Saslaw and Johnson (12) have shown that there is a lower frequency of rheumatic fever and rheumatic heart disease in Miami, Fla., than elsewhere, as indicated by postmortem examinations of the hearts of residents of Florida and residents of other States. Also, the incidence rate for acute rheumatic fever is lower in the south than in the north (16), as evidenced by the lower rheumatic heart disease rate in Miami than in northern cities (12-14).

The favorable climate of southern Florida might protect susceptible individuals from rheumatic fever or it might influence the disease so that the clinical picture is less severe (13) despite the fact that group A beta hemolytic streptococci are as ubiquitous in Miami as in other cities. Therefore, lack of exposure or inadequate exposure to streptococci cannot

account for the low attack rates of rheumatic fever in Miami (17, 18).

Many ideas, theories, and inferences have been postulated to explain this phenomenon, but as yet no factor or group of factors has been implicated. Geographic, climatic, genetic, and environmental factors, all influences on both host and agent, appear to play a role.

"Sensitivity" resulting from previous infections with beta hemolytic streptococci may influence the development of rheumatic fever, whether genetic predisposition plays a role or not (3, 7, 15, 19).

Other factors also may influence the development of rheumatic fever. Among these are crowding, exposure to inclement weather, latitude, nutrition, and socioeconomic conditions (3, 15, 16, 20).

Our report has shown that children 10-15 years of age had a higher attack rate for rheumatic fever than did children 6-9 years old. One possible explanation is that rheumatic fever episodes in the younger age group were not reported, either because of the mildness of the attacks and lack of early recognition or simply because the physician did not report the episode. Another possible answer is that the older age group, those 10-15 years old, may be more susceptible to rheumatic fever in Miami (21), either due to genetic or environmental influences or to late development of sensitivity based upon recurrent exposure to beta hemolytic streptococci. However, studies in Miami (2) have shown that there is a higher rate of recovery of these bacteria from the throats of the younger group than from the older.

More than 40 percent of the rheumatic fever subjects were 16 years of age or older. Either rheumatic fever episodes in the younger age group are not reported or this difference is a true one.

Data related to the five cases which occurred in patients over 31 years of age were inadequate to permit analysis. A transient diastolic murmur was reported in one instance, and a P-R interval of 0.29 second in another. Polyarthrititis was not present, but joint pains were recorded in four patients. Diagnosis depended upon the presence of three or more minor manifestations rather than on major criteria. Justification for considering these cases as definite

rheumatic fever remains to be proved, as indicated by Friedberg (22).

The male-female ratio for acute rheumatic fever attack rates was 1.24:1, statistically about the same as reported by other investigators (3, 19, 20).

The white-Negro ratio for acute rheumatic fever attack rates was 2.12:1. Based upon the distribution of whites and Negroes in the total population of Dade County, a ratio of 7:1, this proportion is very significantly higher ($X^2=15.6$; $P<0.001$) for Negroes than for whites.

Based upon the 7:1 white-Negro population ratio, Negro males had an attack rate four times as great as white males, and Negro females had an attack rate twice as great as white females.

The occurrence rate for rheumatic fever among Negroes has been reported to be higher than, equal to, or lower than that among whites in various locations in the United States (3, 7, 20). The finding of this race-sex difference in Miami is reported here for the first time.

This race-sex difference may be true or spurious. A true difference might be due to greater susceptibility of the Negro to rheumatic fever, possibly influenced by socioeconomic or genetic factors, or both, or by more frequent exposure to beta hemolytic streptococci (3, 19). On the other hand, a spurious difference might be explained by more frequent and earlier diagnosis of rheumatic fever in Negroes than in whites. This seems unlikely since, in general, whites see their physicians for illnesses of this type more commonly than do Negroes and live under better socioeconomic conditions. Possibly reporting of rheumatic fever in whites is not as accurate as in Negroes, though this too is unlikely.

Negro males have higher rheumatic fever attack rates than Negro females, based upon a 1:1 sex distribution. This may be explained by the fact that, in spite of apparently equal attack rates for both sexes, males work at labor which forces them to see physicians more promptly than do females and, therefore, cases of rheumatic fever in males are recognized more often than cases in females. Negro females with rheumatic fever may remain at home, be treated by their families, and never see a physician. A second possible explanation is that Negro males are exposed more frequently to streptococcal

infection in the environment in which they work and therefore are attacked by rheumatic fever more commonly. A third possibility is that males may be genetically more susceptible to rheumatic fever than females. Streitfeld and Saslaw (9) found that groups A, B, F, and nongroupable streptococci were isolated from the throats of nonrheumatic white and Negro subjects with equal frequency, but group G beta hemolytic streptococci were isolated more frequently from the throats of Negroes. Group C strains of streptococci were isolated four or five times more often from throat cultures from Negro children than from cultures from white children.

The changing clinical picture of rheumatic fever makes diagnosis more difficult today than prior to the era of penicillin. According to our report and to reports of similar investigations, rheumatic fever may exist in the absence of many of the major and minor criteria (4, 23). Furthermore, other diseases may produce clinical syndromes resembling rheumatic fever (23-25). Astute clinical observation in conjunction with laboratory tests is essential to confirm or negate a diagnosis of rheumatic fever.

The diagnostic criteria observed in the present investigation (table 4) differed in some ways from reports based on similar studies (3-5, 26, 27). These differences indicate a lower frequency of many of the clinical and laboratory findings in rheumatic fever than has been found in other studies. These findings include chorea, erythema marginatum, subcutaneous nodules, congestive heart failure, pericarditis, migratory polyarthritis, and preceding infection with definite bacteriologic proof of the presence of beta hemolytic streptococci in throat cultures. The lower frequency of these findings represents either inadequate reporting or a true low incidence of rheumatic fever in the subtropical climate of Dade County. Most likely both possibilities play a role.

Case registry is the most accurate method currently available for recording known acute episodes of rheumatic fever in Greater Miami. However, in collecting data for this study many problems and difficulties were encountered.

The major difficulty was lack of explicitness concerning the presence or absence of certain

major and minor criteria, their severity, mode of onset, and time between onset of symptoms and their cessation. The questionnaires revealed insufficient data concerning (a) ASO titer elevations and depressions for both acute and convalescent serums; (b) except in three instances, presence of bacteriologic findings on throat cultures as the basis for preceding beta hemolytic streptococcal infections; and (c) reporting of presence or absence of chorea, erythema marginatum, and subcutaneous nodules. Our findings of two cases of chorea and three cases of erythema marginatum and subcutaneous nodules may represent a true low incidence of these signs in Greater Miami. Also, there was a lack of differentiation between polyarthritis and arthralgia when both were recorded as being present simultaneously in the same patient. Results of serial WBC's, ESR's, ECG's and ASO's obtained during followup of patients during both the acute and convalescent phases of rheumatic fever were not recorded.

The population of the Greater Miami area coming under consideration in this case registry is approximately 800,000, and the 83 episodes of rheumatic fever were observed over a 37-month period. Therefore, the incidence of acute rheumatic fever is one attack, either initial or recurrent, per 30,000 persons. Similarly collected case registry data in other geographic areas will provide comparative incidence rates for acute rheumatic fever.

To increase the value and accuracy of a case registry, all physicians who contribute data should be aware of the problems involved in establishing a registry and should record accurately and completely all information requested. Intensive case registry in Greater Miami and elsewhere will not only assist in evaluation of variations in findings based on geographic factors but also in better understanding of many etiological, diagnostic, pathological, and epidemiologic problems related to rheumatic fever. In this way, eventual prevention and control of this chronic disabling heart disease may become a reality much sooner.

Summary

A case registry of rheumatic fever cases in Greater Miami, Fla., was tabulated for a 3-year

period, September 1, 1955, to October 1, 1958. The purpose of the registry was to record all known acute episodes of rheumatic fever in the area and to compare the data with those from other geographic locations.

Eighty-three episodes of acute rheumatic fever were registered; 53 were definitely active and 30 were suspected active cases. Jones modified criteria were used for diagnosis.

In this southern geographic area the attack and recurrence rates for acute episodes of rheumatic fever and rheumatic heart disease are low.

Factors such as climate, location, other environmental influences, socioeconomic conditions, genetic predisposition, habitat of the streptococci, and the effect of the environment upon the bacteria are possible influences to explain the lowered incidence of rheumatic fever in Miami.

The data for age, race, and sex groups were compared. The peak incidence for first attacks occurred between the ages of 10 and 15 years. The highest average antistreptolysin O (ASO) titer, 550 Todd units, was found in the group aged 16-20 years. The average titer for all age groups was 414.

Negroes had a higher rheumatic fever attack rate than whites, a higher ASO titer average, and twice as many preceding infections. The attack rate for Negro males was four times the attack rate for white males. Negro males also had the highest ASO titer levels. Negro females had twice the attack rate of white females.

The sex distribution correlated with other rheumatic fever studies. Males had higher ASO titers than females, despite the absence of a similar increase in the number of preceding infections.

More than 90 percent of all patients reported in the registry presented a minimum of one major criterion and two minor criteria. Many criteria were reported infrequently, either because of incompleteness of reporting or because of a true low incidence of these symptoms in this southern area.

Inaccuracies and difficulties encountered in the case registry are mentioned so that future investigations may avoid them, thus permitting more complete and accurate data to be accumulated.

Based on the case register, the incidence rate

for acute rheumatic fever, both initial and recurrent attacks, in Greater Miami is one episode per 30,000 population per year.

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Carbon Monoxide Poisoning

In 1959, carbon monoxide poisoning caused 644 deaths in the United States, according to the Public Health Service. Automobile exhausts were the source of the gas in 385 of the deaths. After automobile exhausts, faulty gas-burning appliances are the next most frequent source of carbon monoxide in poisoning incidents.

The danger of carbon monoxide poisoning increases in the winter because of closed windows in homes and automobiles. To prevent poisoning, the Public Health Service recommends that gas-burning appliances be checked and cleaned, and exhaust systems of cars be inspected for leaks. Ample fresh air should always be allowed to circulate in garages and cars.

Since the first symptoms of carbon monoxide poisoning—nausea, dizziness, headache—do not readily suggest the cause, they are easily disregarded. By the time a victim is aware that he is being poisoned, he may be only seconds from unconsciousness and unable to help himself.

First aid can be given to someone overcome by carbon monoxide by moving him to fresh air and applying artificial respiration.