

Rheumatic Fever Prevention in Utah

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THE RHEUMATIC FEVER prevention program of the Utah State Department of Health is an outgrowth of a pilot program initiated by the Children's Bureau in an attempt to reduce the State's excessively high death rate from this disease. For the 3-year period 1939-41 the crude death rate from rheumatic fever in Utah was 22.4 per 100,000, higher than the rate for any other State and approximately double the national average (1).

The pilot program, begun in 1940 and continued through 1952, provided diagnostic and treatment services in clinics, hospital and convalescent care, public health nursing, services of a medical social worker, and nutrition consultation in Davis and Weber Counties only. In 1943 the program was extended to Box Elder, and later to Morgan, Summit, and Rich Counties. In 1952 the Utah State Department of Health assumed complete responsibility for the program and extended it to the entire State under its present direction. Unlike the pilot program, the present program does not offer complete care except in cases of total indigency. Principal emphasis of the program has been

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Dr. Joseph P. Kesler, acting director of the Utah State Department of Health, furnished guidance in establishing the present rheumatic fever program; Bessie Hansen assisted in the nursing program; and Ivy Jean Reid provided technical assistance.

This paper was presented in part at the First Scientific Convention of the Utah Heart Association, Salt Lake City, Utah, April 6, 1956.

placed upon prophylaxis to conform to the overwhelming evidence that both the initial and recurrent attacks of rheumatic fever are precipitated by group A streptococcus infections.

During 1953-55, the first full 3 years of operation of the present program, 1,334 patients were seen. These patients were seen in itinerant clinics held in 10 centers of population scattered throughout the State. Each patient was referred to the program by his family physician, who requested one of the following referral categories for his patient:

1. Diagnostic consultation only.
2. Diagnostic consultation and followup to urge patient to continue prophylactic care in physician's office.
3. Diagnostic consultation with followup and prophylaxis in the Children's Heart Center.
4. Complete care (medical indigency only).

As of 1956, categories Nos. 3 and 4 were combined.

During the period 1953-55 more than 300 new patients were referred to the program each year (table 1). Approximately 50 percent of the 661 patients referred in 1953 were carried over from the program already in existence in the northern counties of the State.

In designing the program it had been hoped that most referring physicians would request that patients be placed in category 2. In so doing, it was felt that the public health nurse could assist the family physician in maintaining a closer followup of his patient while still under his management. However, the percentage of patients referred in this category has been disappointingly small, only about 25 percent.

A total of 209 patients in categories 3 and 4 have been followed for at least 6 months. The remaining 417 patients in these two categories

have been divided into two groups, 120 cases of congenital heart disease and 297 cases which were closed because they failed to comply with the modified criteria of Dr. T. Duckett Jones (2). These 297 cases exceed by nearly 50 percent the number with a confirmed diagnosis and stress the great need for more accurate diagnosis of rheumatic fever.

We have adhered rigidly to the modified Jones criteria (2) and, to our knowledge, in only 3 of the more than 1,000 individuals referred to the program have we erred in not making the diagnosis of rheumatic fever. I am certain that this small number does not represent all the cases in which we have erred in diagnosis, but were the figure 10 times greater the criteria would still have been well over 90 percent accurate. To lend further support to the validity of the criteria of Jones, only four individuals with rheumatic heart disease had no history of an additional major manifestation of rheumatic fever.

Of the 209 patients followed for 6 months, 120 (60 percent) had only a history of rheumatic fever, with no residual heart disease. The 89 patients with rheumatic heart disease were categorically placed in the following functional and therapeutic classifications according to the standards of the American Heart Association: I,A, 55 patients; II,B, 30 patients; and III,C, 4 patients. No patients fell into functional

Table 1. Number of patients referred to the rheumatic fever program, Utah State Department of Health, according to referral category, 1953-55

Year	Category No.				Total
	1	2	3	4	
1953-----	162	151	317	31	661
1954-----	114	80	111	25	330
1955-----	123	78	123	19	343
Total-----	399	309	551	75	1,334

classification IV or therapeutic classification D or E except temporarily, during an attack of acute rheumatic fever. Because classification IV,D was only temporary, these patients were included in a classification appropriate to their recovered status.

If these patients represent an accurate cross section of the young people of Utah, the picture of the prevalence and severity of rheumatic heart disease is a far from dismal one. If the condition of these individuals can be stabilized at this point by the use of prophylaxis, the outlook is even more encouraging.

In evaluating the effectiveness of prophylaxis, we had only the histories of these patients before prophylaxis was started to compare with their condition after prophylaxis, since we had

American Heart Association Classification

Functional Capacity

CLASS I: Patients with cardiac disease but without resulting limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea, or anginal pain.

CLASS II: Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea, or anginal pain.

CLASS III: Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary activity causes fatigue, palpitation, dyspnea, or anginal pain.

CLASS IV: Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of cardiac insufficiency of the anginal syndrome are present even at rest. If any physical activity is undertaken discomfort is increased.

Therapeutic Classification

CLASS A: Patients with a cardiac disease whose ordinary physical activity need not be restricted.

CLASS B: Patients with cardiac disease whose ordinary physical activity need not be restricted, but who should be advised against severe competitive physical efforts.

CLASS C: Patients with cardiac disease whose ordinary physical activity should be moderately restricted, and whose more strenuous efforts should be discontinued.

CLASS D: Patients with cardiac disease whose ordinary physical activity should be markedly restricted.

CLASS E: Patients with cardiac disease who should be at complete rest, confined to bed or chair.

no control group with which to compare the study group.

Over 50 percent of the group had had only a single attack of rheumatic fever (table 2). Approximately a third had had two attacks, and less than 10 percent had had more than two attacks. No individual had had more than four recognized episodes of rheumatic fever. The average time between attacks, regardless of their number, varied from 2 to 2½ years. Generally speaking, the severity of the heart disease was proportionate to the number of attacks. However, 2 of the 4 patients in functional classification III had a history of only one episode of rheumatic fever.

Prophylaxis

The rheumatic fever prevention program has used four types of prophylaxis (table 3). There have been some recurrences of chorea,

Table 2. Number of attacks and average recurrence time among 209 rheumatic fever patients, Utah State Department of Health rheumatic fever program

Number of attacks	Number of patients	Average recurrence time (years)
1	126	2.3
2	69	2.1
3	11	2.5
4	3	

which will be discussed later. However, during the 3-year period of observation no individual who has maintained continuous prophylaxis has had an episode of clear-cut recurrence of acute "exudative" rheumatic fever with elevations of acute-phase reactants and antistreptolysin titers, with two possible exceptions.

The first patient, a 12-year-old boy, developed migratory arthritis of the knees and ankles, with redness and swelling, 2 months after starting on oral Bicillin. His erythrocytic sedimentation rate became elevated but his antistreptolysin O (ASO) titer showed no rise. He did not develop signs of carditis and he is still on Bicillin prophylaxis.

The second patient was a 13-year-old boy who was receiving oral penicillin prophylaxis. A routine electrocardiogram taken while following him for valvular heart disease with mitral and aortic insufficiency showed a right bundle branch block. He had been asymptomatic during the period in which the electrocardiographic abnormality developed. We had no ASO data on this patient.

Fifteen patients had classic murmurs of mitral insufficiency of class II or greater intensity on entering the clinic, which disappeared on followup examinations. Murmurs of aortic insufficiency disappeared in two persons while they were being followed. These patients are included in the group of 120 patients with only a history of rheumatic fever in categories 3 and 4. On followup examination, three individuals were moved from classification II,B to classification I,A. No patient with rheu-

Table 3. Followup of prophylaxis of rheumatic fever patients, Utah State Department of Health rheumatic fever program

Type of prophylaxis	Daily dosage	Number of patients	Period of prophylaxis ¹	
			Total (years)	Average (years per patient)
Sulfadiazine	1.0 gm	27	54	2.0
Penicillin ²	200,000 units	74	129	1.7
Bicillin ³	200,000 units	113	130	1.1
Bicillin	1,200,000 ⁴ units	59	103	1.8
Total		273	416	1.5

¹ Continuous.

² Buffered penicillin G (Penioral, Wyeth).

³ Benzathine penicillin (Wyeth).

⁴ Per 30 days.

Table 4. Recurrences of rheumatic fever resulting from break in prophylaxis

Patient	Reason for break	Change in classification from—	Time between break and recurrence (years)
E. W.	Sensitive to penicillin	History to I,A	1. 2
B. P.	Physician's advice	do	. 2
B. T.	Inadvertence in clinic	History to II,B	. 3
R. L.	Moved from State	History to I,A	1. 0
S. N.	Own volition	do	. 2
D. L.	do	do	1. 3
L. P.	do	do	. 2
E. S.	do	No change	. 5

matic heart disease who maintained prophylaxis was reclassified in a lower functional classification during the 3-year period of observation.

Siblings of three rheumatic fever patients developed rheumatic fever while the patients were receiving prophylactic treatment. ASO titers were obtained from two patients before and during the time their siblings had rheumatic fever. No rise in titer was demonstrated.

Recurrence of Rheumatic Fever

Eight patients in categories 3 and 4 had recurrences of rheumatic fever (table 4). Each had had a clear-cut break in prophylaxis. Four patients discontinued prophylaxis of their own volition. In one, prophylaxis was inadvertently discontinued by me when I confused her with her sister. One patient moved from the State and had no followup until his return to our program a year later. Another had no prophylaxis because of a history of urticaria following ingestion of penicillin and exfoliative dermatitis following sulfonamide treatment. She since has been on oral Bicillin for 6 months without difficulty. One patient discontinued his prophylactic treatment upon the advice of his family physician.

The shortness of time between the discontinuance of prophylaxis and recurrence of rheumatic fever compared with the average recurrence time without prophylaxis has been striking. In some cases, the recurrence time has been so short that it is obvious that only year-round prophylaxis is completely effective.

Four patients who had broken prophylaxis

developed significant (2 tube) rises in ASO titer. In no individual who maintained prophylaxis did we detect any significant rise in ASO titer.

Recurrence of Chorea

One of the most intriguing occurrences in the past 3 years has been the recurrence of chorea in nine patients who had maintained good prophylaxis. In none of these patients did "exudative" manifestations appear. There was no clinical, roentgenographic, or electrocardiographic evidence of progression of heart disease. Two patients required hospitalization. Chorea appeared in five patients between 3 and 4 months after it had been thought that all clinical evidence of rheumatic activity had disappeared. In three individuals, ASO determinations were done before, during, and after episodes of chorea. These titers showed a decline from the levels that had been present during their preceding acute episode of rheumatic activity. This lends rather strong support to the contention that chorea may be a greatly delayed manifestation of rheumatic fever. Two of the five patients who had early recurrence of chorea were on intramuscular Bicillin and three were on oral penicillin.

For the remaining four individuals, the time between the last clinically detected attack of rheumatic fever and the appearance of chorea varied from 2 to 4 years. Three patients were on oral penicillin. Their chorea appeared in 1953, at a time when we did not have an accurate record of the penicillin dispensed in the clinic, and we have only the word of the parents

and the patient that prophylaxis was maintained. The fourth patient was on oral Bicillin and, according to our records and her own statements, she had received continuous prophylaxis. She showed no rise in ASO titer with the appearance of her chorea.

Fourteen patients with acute rheumatic fever received "large dose" hormonal therapy as recommended by Kelley and his group (3). All 14 had clear-cut clinical evidence of valvular heart disease at the onset of the institution of hormone therapy. Nine showed complete regression of heart damage so that there is no detectable residual at the present time. Five showed a persistence without progression of the heart damage. In no individual was there any detected progression of the severity of the already existent heart damage.

Four patients in the group had received penicillin for their preceding streptococcal infections, but had gone on to develop rheumatic fever. The dosages could not be determined, but in no case was penicillin continued for more than 3 days.

The small number of adverse reactions to prophylaxis has been encouraging. Sulfadiazine was discontinued on two patients because of a morbilliform rash, which disappeared upon withdrawal of the drug. Had we been able to follow these two individuals more closely, prophylaxis probably would have been resumed. Oral penicillin was stopped in 3 patients who developed urticaria and in 2 who developed a morbilliform rash. All five reactions reappeared upon readministration of the drug.

We have observed no reactions to oral Bicillin and have recorded no cases of gastric intolerance to this drug. Three patients developed urticaria while on intramuscular Bicillin. Bicillin was discontinued in 11 other cases because of local intolerance and extreme emotional reaction to injection of the drug. Tolerance to Bicillin injection has varied greatly; some patients have been greatly upset and others have not been bothered at all. Because we have had to discontinue Bicillin in 25 percent of our patients, we do not feel that it is satisfactory for routine clinic use. We are certain, however, that it is effective and that,

if used wisely in individual patients, it could well prove to be one of the more valuable forms of prophylaxis.

Followup

The most disappointing phase of our program has been the handling of patients in category No. 2 (those who had been seen in the clinic for a diagnostic visit and later followed by the family physician and the local public health nurse). We do not know the exact status of these individuals at this time. Reports from the local public health nurses are discouraging. Maintenance of prophylaxis has been poor, and unconfirmed recurrences of rheumatic fever have been reported. What had been hoped would be the most successful phase of our program has thus far proved to be the most inadequate.

According to reports of the local public health nurse, only 62 (50 percent) of the 122 patients in category No. 2 have maintained prophylaxis. The remaining 60 gave the following reasons for discontinuing prophylaxis:

Advice of family physician.....	22
No reason given.....	18
Too expensive	17
Language barrier.....	1
Urticaria (oral penicillin).....	1
Advice of chiropractor.....	1

These figures support the author's opinion that the key to maintaining prophylaxis is the active participation of the family physician. One-third of the patients who discontinued prophylaxis did so on the advice of the family physician. Another third stopped because of a lack of awareness or of regard for the value of prophylaxis. Apathy of patients toward prophylaxis, I feel, can be overcome by the family physician who is sufficiently enthusiastic and convincing.

Assistance from public agencies or modification of the type of prophylaxis could solve the very real problem of expense for many families. Increasing the amount of penicillin should not be recommended until it is conclusively shown that it will result in an appreciable decrease in the recurrence rate of rheumatic fever, since the additional expense would

be likely to result in complete discontinuation of prophylaxis.

Physician Education

It was hoped that the program would serve as a good medium for educating the referring family physician regarding criteria for the diagnosis of rheumatic fever and the value of prophylaxis. To determine how well this purpose has been served, the percentage of agreement between the referring physician's diagnosis and the clinic diagnosis and the percentage of rheumatic fever patients who were on prophylaxis when they were referred to the clinic were determined for each of the 3 years. In 1953, allowing a very liberal interpretation, the referring diagnosis agreed with the clinic diagnosis in 56 percent of the cases. In 1954 there was no appreciable difference (59 percent), but in 1955 this percentage had risen to 70 percent.

In 1953 only 4 percent of the individuals with rheumatic fever histories referred to the clinic were receiving prophylaxis; in 1954, 12 percent; and in 1955, 31 percent. This last figure is low inasmuch as many referrals were made with the specific request for prophylaxis even though the patients had actually not been started on prophylaxis. We feel that we have definitely made some progress in the education of private physicians regarding the importance of prophylaxis for the prevention of rheumatic fever. We have been aided in this phase of the program by the educational campaign of the Utah Heart Association. However, physician education is still one of the weakest facets of our program.

Costs

The yearly costs of the program during 1953-55 and the yearly costs for 1948-50, a period when the program was confined to the six northern counties of the State, offered complete medical services, and maintained a small convalescent hospital, are compared below:

<i>Former program</i>		<i>Present program</i>	
1948-----	\$22,590	1953-----	\$17,168
1949-----	26,542	1954-----	10,017
1950-----	19,218	1955-----	15,704
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Total-----	\$68,350	Total-----	\$42,889

The fact that the present program now serves 22 of the 29 counties of the State and includes patients with congenital heart disease as well as patients with rheumatic heart disease makes these figures even more impressive.

Conclusions

Although our experience with a program of rheumatic fever prevention during the past 3 years has not resulted in any new concepts, it has added strong support to certain previously accepted principles. Our findings and conclusions are as follows:

1. The modified Jones criteria are valid and offer the best available means for accurate diagnosis of rheumatic fever.
2. Continuous prophylaxis against group A streptococcal infections prevents recurrences of rheumatic fever.
3. The four types of prophylaxis evaluated—sulfadiazine, penicillin, buffered penicillin G and benzathine penicillin—appear to be equally effective.
4. To be completely effective, prophylaxis must be continuous.
5. In some individuals considered to be maintaining good prophylaxis, chorea appears as a "delayed" manifestation of rheumatic fever and occurs without evidence of a preceding streptococcal infection.
6. Active participation of the family physician is the key to providing continuous prophylaxis.
7. Rheumatic fever occurs when the initiating streptococcal infection is treated with inadequate doses of penicillin.

8. In patients with acute rheumatic fever, hormone therapy in sufficiently large doses, as recommended by Kelley (3), appears to be effective in stopping progression of heart damage.

9. To care for and control children with rheumatic fever and rheumatic heart disease, a program offering consultation and followup and primarily emphasizing prophylaxis is more effective and less expensive than a program offering complete care.

REFERENCES

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- (2) Wannamaker, L. W., Rammelkamp, C. H., Jr., Denny, F. W., Brink, W. R., Hansen, H. B., Hahn, E. C., and Dingle, J. W.: Prophylaxis of acute rheumatic fever by the treatment of the

preceding streptococcal infection with various amounts of depot penicillin. *Am. J. Med.* 10: 673-695 (1951).

- (3) Kelley, V. C.: The role of the pituitary-adrenal system in rheumatic fever. *J. Lancet* 75: 291-308, July 1955.

Air Pollution and Radiological Courses

Pittsburgh. Various aspects of air pollution will be the subject of study in a new program leading to the degree of master of science in hygiene at the University of Pittsburgh Graduate School of Public Health, Pittsburgh, Pa. The program will begin in September 1957 and continue through August 1958. It is open to applicants who have an engineering degree and adequate training in chemistry. Preference will be given applicants with some years of experience in engineering.

The program has been organized to meet increasing governmental and industrial demands for air pollution engineers who are broadly educated and are able to deal with both the technical and administrative aspects of the air pollution problem.

A lecture and seminar course in air pollution will include study of health, nuisance, and agricultural aspects; causes, sources, and characteristic emission rates; meteorological influences; and rate of dispersion from a source. In an air pollution laboratory and seminar course, students will study and apply air pollution measurements. One half of the year will be devoted to measuring contaminants in community atmospheres and the other half to field exercises in measuring source emissions. From the end of the spring semester through August, the student will complete a research problem as part of the requirements for the degree.

In addition to instruction pertaining specifically to air pollution, the program's full curriculum is designed to provide students with a good understanding of the basic physical and social relationships between man and

his environment. To this end, background courses such as principles of statistical reasoning, of epidemiology, and of public health practice; man and the environment; environmental physiology; industrial hygiene; industrial toxicology; and health physics are included.

Michigan. One of the country's first programs of integrated study in radiological health and safety will be offered by the University of Michigan School of Public Health, Ann Arbor, beginning in September 1957. The new program has been set up in response to growing demands for personnel highly trained in this field.

Courses scheduled to be given in September will be concerned with radioactive wastes and their disposal; the biological effects of radiation on man, plants, and animals; techniques used in studies of radioactivity; and methods of providing environmental protection.

The teaching and research staff in radiological health and safety has been expanded and the curriculum in environmental health reorganized to provide opportunities in the new program for intensive graduate study and for basic and applied research. In addition to teaching and research responsibilities, radiological health and safety staff members will assist in the university's program in the peacetime uses of atomic energy and will be represented in a team of University of Michigan consultants which has been requested to provide advisory services to the International Cooperation Administration.

publications

What Is Mental Illness?

PHS Publication No. 505 (Health Information Series No. 88). 1957. 2-fold leaflet. \$3.00 per 100.

This leaflet describes briefly and generally the major classifications of mental disorders: the psychoses, the neuroses, and personality disorders. Also discussed are the causes of mental illness, what research is being done, facilities for treatment, and recovery chances for the mentally ill.

The importance of the attitude of the family and the community in rehabilitating the mentally ill is stressed.

Sunburn and Suntan

PHS Publication No. 104 (Health Information Series No. 1). Revised 1957. 1-fold leaflet. \$2.00 per 100.

All persons interested in getting a suntan or in avoiding suntan and sunburn will find the information in this leaflet an invaluable aid. Discussed are exposure precautions, pharmaceutical preparations, and what to do in case of sunburn.

Salaries of State Public Health Workers, August 1956

PHS Publication No. 524. 1957. 41 pages.

The study of salaries paid to selected classifications of personnel employed by State and Territorial health departments is the eighth of a series started in 1947.

Data for this study were taken from August 1956 State and Territorial health department payrolls. It includes salaries of health officers; program directors of dental public health, sanitary engineering, laboratories, public health nursing, business administration, and directors of vital statistics or records (or

both). Graphs and tables showing salary distributions are also included for the following occupational groups: medical personnel, exclusive of State health officers, sanitary engineers, sanitary personnel, public health nurses, nutritionists, health educators, analysts and statisticians, nonmedical administrators, dentists, veterinarians, and for the first time, medical and psychiatric social workers.

A major change in presentation of data is the tabulation by Bureau of the Census regions rather than by individual States. This change was made to expedite comparisons with other salary studies of national scope, which generally use the census regions to portray geographic variations.

Guide for a Tuberculosis Control Program for General Hospitals

PHS Publication No. 516. 1956. 12 pages. 15 cents

Discussed in detail are the essential elements of a tuberculosis control program for patients and personnel in general hospitals. Included are comprehensive plans for initial and followup examinations, and a time schedule for repeat tuberculin tests and chest X-rays.

A section is devoted to methods of coordinating hospital and other community services for the care of tuberculosis patients and their families.

Manual of Septic-Tank Practice

PHS Publication No. 526. 1957. 85 pages; illustrated. 35 cents.

The new Manual of Septic-Tank Practice has been prepared by the Division of Sanitary Engineering

Services in cooperation with the Joint Committee on Rural Sanitation for use as a guide by health agencies, builders, installers, and others. It is the result of 5 years of study, laboratory research, and field trials. Much of the material is based upon results of extensive research carried on at the Robert A. Taft Sanitary Engineering Center, Public Health Service.

This work combines data from professional and technical organizations, official agencies, and industry. It also presents in one volume three previous technical reports on Studies on Household Sewage Disposal Systems.

Scientific Translations

A preliminary guide to sources and services

PHS Publication No. 514. 1957. 12 pages. 15 cents.

This guide represents an attempt to provide a directory of sources for finding and procuring translations of scientific literature, including data on cooperative translation programs, governmental agencies which collect or prepare translations, and a list of commercial translation services in the United States.

Although incomplete, the guide is offered at this time as a stopgap measure for meeting the critical need for information in this field.

This section carries announcements of all new Public Health Service publications and of selected new publications on health topics prepared by other Federal Government agencies.

Publications for which prices are quoted are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Orders should be accompanied by cash, check, or money order and should fully identify the publication. Public Health Service publications which do not carry price quotations, as well as single sample copies of those for which prices are shown, can be obtained without charge from the Public Inquiries Branch, Public Health Service, Washington 25, D. C.

The Public Health Service does not supply publications issued by other agencies.
