PREVALENCE OF RHEUMATIC FEVER AND RHEUMATIC HEART DISEASES IN SCHOOL CHILDREN IN DHAKA CITY

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SUMMARY : A study was carried out on 4349 School children in the Dhaka City in the year of 1984 and 1985. The age group was 4 to 17 years. Mean age was 10.5 years . 55.35 percent of children were boys and 44.63 percent girls, the percentage of absentees being 12 percent. This study involved 3 types of socio-economic group. A total of 191 cases of RF and 22 cases of RHD were found giving a prevalence rate of 43.90 and 5.05 per thousand respectively. There was no signaficant dif erence in the prevalence between boys and girls. The peak incidence of RF exists in the age group of 10-12 years. The highest prevalence was in low socio-economic group (115 per thousand) and lowest in high socio-economic group(28.7 per thousand). Thfs differences were highly significant. Mitral regurgitation was the commonest lesson, aotic stenosis least and mitral stenosis in between. Mitral regurgitation was preponderent in girls. 40 percent of those having mitral regurgitation and 50 pe cent in cases of mitral stenosis gave the histry of rheumatic fever. 724 cases of positive streptococeal throat throat culture also showed significant raised ASO fibre. There is a very high prevalence of RF and RHD in school children of Dhaka City espcially of poor socio-economic group.

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INTRODUCTION : Rheumatic fever (RF) and Rheumatic heart disease (RHD) are disappearing rapidly in the affluent western countries (Ekeland it a 1968). RF and its sequetal RHD, are important public health problems in many developing countries (Strasser ttal 1973). The steady flow of publication since the early 1950's from developing countries like Mexico, tropical and sub-tropical Africa, the Philippines, the indian subcontinent and the Middle east on RF and RHD provide overwhelming evidence that RHD is today the commonest form of cardiac disease in the children in most developing countries. RHD is the second commonest type of cardiovascular disease in adults (Shaper 1972). There are no sign of downward trends in prevalence of this disease in poor countries (Padmavati 1972). The present prevalence of rheumatic heart disease in under-developed or developing countries is at least ten times more than that in the developed countries. Bangladesh being a developing country country could not be an exception.

Rheumatic fever and rheumatic heart disease do not arouse widespread interest though they continue to play havoc with the lives of poor children. The world Health Organisation (WHO, Geneva 1972) observed : "The magnitude of this problem (RF and RHD) is not fully appreciated particularly in some developing societies. In addition to illness and disability, RF causes also considerable economic loss.

It is important, therefore to study RF in order to assess its importance in the respective countries, and also to make an effort to establish a rational, effective and economically feasible programme for its control".

There are no comprehensive published data on morbidity caused by RF and RHD apart from hospital statistics in Bangladesh. In view of the magnitude of the problem, the Bangladesh Medical Research Council considered it desirable to conduct a prevalence study in the most vulnerable group of the population viz. school children between 4 To 17 years of age in the Dhaka city with the following objectives:

1. To determine the prevalence of RHD is the school children.
2. To study the natural history and pattern of the disease with reference to any special local features of climate, socio-economic status etc.
3. To study the the role of epidemiological factors as related to the causation of the disease.

Patients and methods : A total of 4349 school children in the age range of 4-17 years were included. The schools were selected from three categories of socio-economic status. Socio-economic status of the student were based on their family income and divided into group A monthly income more than Tk. 3000/-, group B between Tk. 1000/- to 3000/- and group C less than Tk. 1000/- per month respectively. A proforma was made and distributed among the older students for filling up names, age, sex and addresses. Technical aspects of the proforma were filed up by the investigators.

All clinicla examination were conducted by six medical graduates with higher qualification and special training in cardiology.

This histroy of all the students were taken in brief with special imphasis to sore throat, tonsilities, joint pain and swelling, palpitation and dyspeoca on exertion. A quick general examination was followed by detailed cardiovascular examintion with careful ansartation of heart in different posture and phase of respiration. The diagnosis of RF and RHD were based on modified gones and American Heart association criteria respectively.

These children with positive history of sore throat or suspected came of RF were advised for throat swab culture and ASO fitre free of cost at IEGMR. But a good numbe was non responents.

ECG and Echocardiography were done in selected cases. The final diagnosis was made in the light of clinical findings and investigations.

Resu lt : Age and sex distribution (Table I) shows 70.42% of the students were in the age group of 10 to 15 years. The next highest group fall in 7 to 9 years and constituted 18.51%. The students below the age of 6 years and above the age of 15 years were the minimum numbers and they constituted 6.80% and 4.25% respectively. Of the 4349 children, 2.408 (55.36%) were male and 1941 (44.63%) female.

Categories of socio-economic condtion (Table II) shows the socio-economic status of the students on the basis of their family income. 47.16% came from group A, 30.35% came from Group B and rest (22.48%) belongs to group c.

Distribution of Rheumatic fever : RF has detected in 191 children giving a prevalence of 43.90 per thousand in the age group of 4 to 17 years (Table III). Of these 87 (2%) belong to age of 10-12 years, 70 (1.60%) were 13 to 15 years age and 9 (0.20%) were of 16 to 17 years ages respectively. No incidence of RF was noted in 4 to 6 years age group. Out 191 children suffering from rheumatic fever, 96 (2.20%) were male and 95 (2.18%) were female.

Symptoms of RF and RHD : (Table IV) shows that out of 191 children suffering from RF, 124 had history of polyarthrities, 67 had polyarthralgia, 149 had sore throat and 109 had either arthrites. Dyspnoea palpitation. chest pain or fatigue during play in single or in combination. (Table V) shows that out of 191 cases of RF 129 were detected during survey and only 62 were diagnosed previously. The incidence of diagnosis at survey was maximum in poor Socio-economic group.

Frequency of rheumatic fever in different socio-economic groups: (Table V) shows the higher frequency of RF in lower socio-economic group (8.99%) in comparison to higher one (2.97%). Those who were diagnosed prior to survey (62 cases), only 47 were taking penicilin regularly as prophylaxis.

Relationship of rheumatic fever and rheumatic heart diseases to housing conditions. (Table VI) shows that out of 4349 students 3585 (82.43%) live in pucca houses, rest 764 (77.56%) live in kacha

houses. Among 491 children suffering from rheumatic fever, 88 were residing in kacha houses and 103 in pucca houses. The average number of residents in signle room was 5.5 persons in kacha house and 1.8 in that of pucca house.

Valvular lesions : Thirty one cases were found to have cardiac disease. Among them 22 were of rheumatic origin, having mitral regurgitation in 15(51.61%), mitral students 6(19.35%) and aortic stenosis 1(3.2%) respectively. Atrial septal defect(ASD) was present in 7(22.58%) and pulmonary stenosis in 2(6.45%) cases. 6 out of 19 children of clinical mitral regurgitation had previous histroy of RF. 3 out of 6 cases of clinical mitral stenosis had previous history of RF. The case of aortic regurgitation did not have any past history of RF(Table VII)

Prevalence of streptococcal infection : Throat swab culture and ASD titre was estimated from 67 cases. Beta haemolytic streptococci were grown from the 24(34.28%) cases. The highest isolation rate was from poor socio-economic group of children. 54 of the 67 cases had ASO titre higher than 333 T.U. at the time of visit to the hospital. All the positive cases of haemolytic strptococcus showed ASD titre higher than 333 T.U. The titre was also raised in another 30 cases where threat swab cuture rebealed other than streptococcal growth. (Table VIII)

In thirty one cases of suspected RF with chest symptom ECG was done 10 showed Sinus tachycardia, 4 had prolonged PR interval, 6 had RBBB, 3 had ventricular preexcitation, 2 had A.F., 1 had intracardiah conduct defect, 1 PR(.11 Sec)and 6 cases had normal tracing. (Table IX)
In only 7 cases where cardiac murmurs were conflicting Echocrdiography was done andthe finding was mitral stenosis in 2 ASD in 3, an in 2 cases mitral regurgitation were supported.

Discussion : The need for screening of school children to detect heart disease was recognised more than half a century age in western countries. Following the first school survey repot of ...

Halsey(1921) from New York city, numerous prevalence studies of heart disease in children have been published. However in Bangladesh, the work is the first of its kind. About 12% of absentees in this study is higher than that reported from Chicago (South at al 1963, Mitral et al 1962, and Metten it al 1962), Michigan city (Leter ital 1965) but lesser than that of India(Shrestha etal. 1979) The large number of non responders in this study may be due to the fact that most of these children belong to middle and poor socio-economic group. Transport problem and ill health are also contributory factors.

This study shows that about half (47.16%) of the children belongs to higher socio-economic status and rest (52.84%) belongs to middle and poor socio-economic status. This figure is reverse of that of Delhi Survey(1978). This reversal is probably due to the fact that Dhaka is the metropolitan capital city where more educated and privileged persons get the chance to send to their children at school. On the contrary the poor Socio-economic group can not afford the expenses of their education fees, moreover this children plays an important role in financial contribution to their family.

The prevalence of RHD in the present survey is lower than those reported recently from other developing countries e.g. India (11 thousand), Egypt (10 per thousand), Algeria (15 per thousand and Tehran (22 per thousand).

The higher prevalence of RHD in older age group is to be expected but in this study the difference of prevalence in two age groups noted here is not similar to that of western countries (Smith et al 1965) where 2 to 4 times higher prevalence of RHD was found in the older age group. This is probably because of the fact that in Bangladesh, children from poor socio-economic group drop out from the schools long before they reach higher secondary status. Smith it al (1965), Mither etal (1962) and Berry (1965), reported the higher prevalence of RHD in female children in comparison to the male. However in this study the

differnces between the sexes was not significant.

The prevalence of RHD was not infrequent(1.9 per thousand) in the middle and higher socio-economic group in this study. Possible cause to this may be attributed to over crowding in the city school. Overcrowding and unhygenic condition favours spread of streptococcal infection.

This study well correlates with the common presenting symptom of RF with other studies (Maleka, 1985, Padmavati 1962, Edwin ital 1981, Mack et al 1983). Shrestha et al (1978) all ther workers (Naiman et al 1964) agree that mitral regurgitation is the most common lesion in childhood representing as such as 50 percent of all lesions. Our series correlates the figure. The prevalence of RHD in this survey thus probably lower than true prevalence for several reasons. This prevalence does not take into account students absent at the screening, students lying ill at home or hospitals with organic heart diseases and students missed(false negative) by the detection procedure. Therefore it is fact that this screening method is not 100 percent sensitive. Descrepancy remains between detection rate and the true prevalence rate of RHD in school age children. Yet, this is the best method available at present (Morton et at 1967).

40 percent of children with mitral regurgitation 50 perdent with mitral stenosis in our survey had past history suggestive of rheumatic fever. This value is higher than that reported by Shrestha etal (1978) from Delhi but it is lower than that of Maresh and Conokerb (1952) from Colorado. Recently awareness of many varieties of Mitral regurgitation has reduced the frequency with which isolated mitral regurgitation is attributed to rheumatic origin( ).

Hence one may wonder whether such cases, without history of rheumatic fever are actually caused by rheumatic fever (undiagonsed or subclinical). Morton (1962)

is of the opinion that in mass screeing prgrammes like the present one, it has been customary to group group all those children with the typical findings of valvular heart disease into the category of RHD. Besides many Indian workers have noted classical rheumatic fever to be uncommon in Indian children as compared to insidious forms of cardiac rheumatism with no pronounced rheumatic symptoms (Padmavati 1962, 42, 47, 48).

Throat swab culture and ASO titre estimation were done in only a small group of children in this study.

The cases where streptococcal growth was positive they showed significantly raised ASO titre. So correlation of streptococcal throat infection with causation of RF is observed is this survey. The cases where raised ASO titre without streptococcal growth indicates past or recent past streptococcal throat infection or already treated with antibiotic.

CONCLUSION :

RF and RHD forms 34% of total cardiovascular admission (Agarwal 1981). Of all forms of heart diseases, rheumatic one is the easiest to prevent. It prevalence is continued and unabated in countries like us. These diseases are common in all developing countries including Bangladesh. Where presumably the same conditions obtain— low standard of living, overcrowding and malnutrition.(Padmavati et al 1912). Over crowding in houses casuse easy transmission of throat infection would seem to be the most important factor. (Agarwal 1981, Padmavati etal 1962). Agarwal commented that poverty affects the prevalence of rheumatic fever in other ways such as the lack of qualified medical aid in rural and urban slums and dependence on cheaper and less effective forms of medical care like homeopathy, indigenous systems. Due to this poor economic condition illiteracy and ignorance many minor illness like sore throat or joint pains go unattended, the prescribed bed rest for rheumatic fever is not acceptable or physical activity is resumed prematurely in these countries where the young often contribute

to the family income. Secondary chemoprophylaxis is hardly ever enforced or followed for the same reasons.

So it can be said that it is possible now to drastically diminish the prevalence of this disease by using the existing facilities, given the national will, dedication of medical personnel, enforcement of secondary chemoprophylaxis and mass education.

ACKNOWLEDGEMENT

We thank Prof. Mashiur Rahman of Microbiology Deptt., IPGMR for kind cooperation in the Laboratory facilities provided.

We are also thankful to Dr. Nazrul Islam, Assistant Professor of Cardiology, I.C.V.D for helping in the Echocardiographic diagnosis.

We are particularly grateful to the school authorities of the city for helping us in the school survey for this study.

TOTAL NUMBER OF STUDENTS = 4,349

AGE BY YEARS	SEX		TOTAL NO.	PERCENTAGE
	MALE	FEMALE		
4 - 6	153	143	296	6.80
7 - 9	411	394	805	18.51
10 - 12	1,108	837	1,945	44.72
13 - 15	602	516	1,118	25.70
16 - 17	134	51	185	4.25
TOTAL	2,408	1,941	4,349	100

TABLE I : DISTRIBUTION OF SCHOOL GOING CHILDREN BY AGE AND SEX.

* MALE AND FEMALE RATIO 1 : 0.80

[illegible] = 4,349

SOCIO-ECONOMIC STATUS	MONTHLY INCOME OF GUARDIAN	SEX		TOTAL NUMBER OF STUDENTS
		MALE	FEMALE	
GROUP A	> Tk. 3,000	1,150	901	2,051 (47.16%)
GROUP B	> Tk. 1,000	706	614	1,320 (30.35%)
GROUP C	< Tk. 1,000	552	426	978 (22.48%)
TOTAL		2,408	1,941	4,349 (100%)

TABLE II : DISTRIBUTION OF SCHOOL GOING CHILDREN BY SOCIO-ECONOMIC STATUS

NUMBER OF STUDENTS = 4,349

AGE BY YRS.	TOTAL STUDENT		STUDENTS SUFFERING FROM R.F.		TOTAL NO. AND %
	M	F	M	F	
4 - 6	153	143	0	0	0
7 - 9	411	394	14	11	25 (0.57%)
10 - 12	1108	837	47	40	87 (2.00%)
13 - 15	602	516	30	40	70 (1.60%)
16 - 17	134	51	5	4	9 (0.20%)
TOTAL	2,408 (55.36%)	1,941 (44.63%)	96 (2.20%)	95 (2.19%)	191 (4.39%)

TABLE III : SHOWING THE DISTRIBUTION OF SCHOOL GOING CHILDREN BY AGE, SEX AND R.F.

TABLE. IV Symptoms of RF and RHD.

Symptoms		No.
Polyarthrities		124
Polyarthralgia		67
Sore throat		149
Dyspnoea Palpitation Chest pain during play.	(Single/Combination)	109

Table IV

NUMBER OF STUDENTS = 4,349

SOCIO-ECONOMIC STATUS	DIAGNOSED DURING SURVEY			PREVIOUSLY DIAGNOSD			TOTAL	
	M	F	TOTAL	M	F	TOTAL		
A - 2,051 (100%)	16	13	= 29	17	13	= 30	61	(2.79%)
B - 1,320 "	5	30	= 35	5	2	= 7	42	(3.18%)
C - 978 "	30	35	= 65	10	13	= 23	88	(8.99%)
TOTAL 4,349 "	51	78	=129	32	30	= 62	191	(4.39%)

TABLE V : TOTAL NUMBER OF STUDENTS SUFFERING FROM R.F. DIAGONSD BEFORE OR DURING THE SURVEY.

TOTAL NUMBER OF STUDENTS = 4,349

NO OF STUDENT AND TYPES OF HOUSE	NO. OF ROOM	NO. OF FAMILY MEMBER	PERSON PER ROOM	R.H.D	C.H.D	R.F
PACCA HOUSE 3,585 (82.43%)	12,870	23,377	1.81	7 (.19%)	8 (.22%)	103 (2.87%)
KACHA HOUSE 764 (17.56%)	1,067	5,927	5.50	15 (1.96%)	1 (.13%)	88 (11.5%)
TOTAL 4,349 (100%)	13,937	28,304	2.03	22 (.50%)	9 (.20%)	191 (4.39%)

TABLE VI: DISTRIBUTION OF SCHOOL GOING CHILDREN SUFFERING FROM R.F. OR HEART DISEASES IN RELATION TO THEIR LIVING CONDITIONS.

NUMBER OF STUDENTS = 4,349

NO OF ROOMS	R.H.D. FAMILY MEMBER >3	>6	>9	C.H.D. FAMILY MEMBER >3	>6	>9	R.F. FAMILY MEMBER >3	>6	>9
1	4	4	7 = 15	-	1*	- = 1*	18	31	39 = 88
(KACHA)	-	1*	1*= 2*	-	-	- -	5*	8*	10*= 23*
2	-	-	- -	1	1*	1 -	8	5	12 = 25
(PACCA)	-	-	- -	-	-	- -	3*		1*= 4*
3	3*	-	- -	2	-	- -	4	13	22 = 39
	-	-	- -	1*	-	- -	3*	8*	9*= 20*
4	1	1*	- -	-	-	- -	6	13	13 = 32
	-	-	- -	-	-	- -	2*	2*	5*= 9*
5	-	1	- -	1*	1	- -	1*	1*	4 = 6
	-	-	- -	-	-	- -	-	-	3*= 5*
6	1*	-	- -	-	-	- -	-	-	1*= 1*
7.	-	-	- -	-	1	- -	-	-	- -
TOTAL	9	5	8 = 22 7*	4	4	1= 9 4*	37	63	91 =191 62*

TABLE VIb: SHOWING RELATION OF HEART DISSEASES AND RHEUMATIC FEVER WITH THE NUMBER OF ROOMS IN THE HOUSES AND NUMBER OF FAMILY MEMBERS.

* PREVIOUSLY DIAGNOSED.

TOTAL NUMBER OF STUDENTS = 4,349

AGE BY YEARS	CARDIAC ABNORMALITY	NO. OF STUDENTS		TOTAL	PAST HISTORY OF R.H.	
		M	F		YES	NO
< 10	M.R.	4	3	7	2	5
10 - 16	M.R.	6	2	8	4	4
	M.S.	3	2	5	2	3
	A.R.	1	0	1	0	1
	A.S.D.	5	2	7	2	5
	P.S.	0	2	2	1	1
> 17	M.S.	1	0	1	1	0
TOTAL		20 (0.45%)	11 (0.25%)	31 (0.71%)	12 (0.27%)	19 (0.43%)

TABLE VII : SHOWING FREQUENCY OF HEART DISEASES IN RELATION TO AGE, SEX AND PREVIOUS HISTORY OF R.F.

TOTAL NUMBER = 70

ORGANISM DETECTED IN THROAT SWAB CULTURE	NO. OF CASES	A.S.O. TITRE
BETA HAEMOLYTIC STREPTOCOCCUS	24 (34.28%)	> 333 T.U. (24 CASES)
STAPH. AURIAS	16 (22.85%)	> 333 T.U. (12 CASES)
E. COLI	2 (2.85%)	> 333 T.U. (2 CASES)
NORMAL FLORA	25 (35.71%)	> 333 T.U. (16 CASES)

TABLE VIII : DISTRIBUTION OF SCHOOL GOING CHILDREN BY REPORTS OF THROAT SWAB CULTURE AND A.S.O TITRE.

Table- IX Distribution of School going children by results E.C.G. findings in 25 cases

E.C.G. Findings.	No. of children M. 25
Sinus Tachy cardia	10(32%)
Prolonged P-R interval	4 (16%)
R.B.B.B.	6 (12%)
Ventricular arrythmia	3 (8%)
Atrial Fibrillation	2 (8%)
Intracardia conduction defect	1 (4%)
L.G.L. Syndrome	1 (4%)
Normal findings	6 (20%)
Total:	33 (100%)

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資料 (7)

リウマチ熱及びリウマチ性心疾患対策
パイロットプロジェクト事前調査報告
(現地中間報告)

62. 6. 23
事前調査団長

調査団は6月16日より23日まで当国に滞在し，カリム保健省次官，ナシム財務省次官補，ホセイン国家開発計画委員会社会福祉担当部長及びマリク循環器病研究所長と面談するとともに，保健省等のプロジェクト関係者と意見交換を行い，併せて，プロジェクトに係る関係施設・機関，並びに村落の実態等を調査した。調査結果についてはバ側提出資料，収集資料及び事情聴取データー等に基づき帰国後とりまとめられるが，以下はその骨子であり，バ側との現時点における合意事項は別添ミニッツの通りである。

1. プロジェクトの名称：標題の通り
2. 技協の対象分野

現時点ではバ側のプロジェクトのマスタープランが詳細の部分で明確でないので特定しにくいが，当該疾病に係る疫学調査，予防，診断，治療に係る技術分野が想定される。

3. 協力期間

1988年の上半期の時点より4年間

4. 協力の拠点

ICVD及び医科大学並びにUpazilla（日本の郡に相当）Medical Complex

5. バ側責任体制

全体の責任は保健大臣が負うこととなるが，プロジェクトの需施に関する管理，運営等については，同省医務局長（D. G. Health Services）とICVD所長が当たることで合意されたが，実質的にはマリクICVD所長が実行責任者となるものと思料される。

6. プロジェクト促進の為の今後の対応

1）バ側

必要な情報，データー等日本側が求めるものについての提供及び予算措置，要員配置計画についても次回調査チーム来訪まで日本側に通報する。（ミニッツ）

2）日本側

双方は，1987年の11月頃プロジェクトの活動計画を詰める為に日本側からチームの派遣がなされることが望ましいという点で意見が一致した。（ミニッツ）

3）日・バ双方

バ側はプロジェクト活動計画として，Action Planを日本チームに提示したが，当該プランの内容は，特定部分においては，ＪＩＣＡの技協制度になじむものでないことから，日本側はこれを検討資料として受領し，今後の協力計画策定の為の基礎資料とすることでバ側と意見が一致した。（ミニッツ）

7. 懸案事項等

1）協力計画策定段階におけるC／Pの受入れ

当該プロジェクトで重要な位置を占める疫学分野のC／Pを早期に日本に受入れ，初期段階でバ側の人的基盤を整える必要がある。

2）海外青年協力隊との連携

ＩＣＶＤには看護婦，検査技師（臨床／Ｘ線）が現在配属されているが，本プロジェクトの性格上，首都以外のウバジィラ（郡）メディカルコンプレックス等における活動を効果的に展開するためにはＪＯＣＶ隊員等との連携が図られることが好ましい。

3）ローカルコストの協力

バ側は基本的には，技協プロジェクトに係るランニングコストは受益国の負担である旨の我方の方針を理解したが，特に人材養成面での費用及び若干の補助要員の配置費用については財政的に非常に逼迫している状況である模様であることから，当該問題に関しては，日本側としてはＬＬＤＣに対する技協のあり方のひとつとして，相当の配慮を示す必要があると考えられる。

4）日本からの専門家派遣

協力計画が具体化していない現時点で，分野，期間等の面から専門家派遣計画を論ずることは時期早尚であるが，相手側C／Pとのプロジェクトに関する協議，日々の技術指導の実効の面から云えば，長期専門家（ＭＤ）と現地語が使用可能な調整員の派遣が望ましく，ＪＩＣＡは厚生省，文部省及び私立大学等の協力を得られるようその対策を検討すべきであろう。

5）ＩＣＶＤのアフターケアー

ＩＣＶＤにおける循環器病対策プロジェクトは1979より86年まで実施され，その協力効果は現在もなお維持され，国内外に高い評価を得ているが，供与済機材の一部はアクセサリーパーツ等の不足から本来機能を発揮していない。

本プロジェクトはＩＣＶＤを拠点とし，リウマチ性心疾患への診断・治療ではその技術移転の機関となることから，機材供与の枠内で上記問題にある程度対応できるが，大型機器については困難であるものと考えられる。

従って，無償供与の機材の稼働状況については別途技術者等の派遣によるチェックと補修及び新規供与が検討されることになれば，バ側の評価は一段と高まることになろう。

EPIDEMIOLOGICAL STUDY OF RHEUMATIC FEVER (RF) AND RHEUMATIC HEART DISEASE (RHD) IN URBAN SLUMS OF BANGLADESH

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INTRODUCTION :

Rheumatic heart disease is common in children in most of the developing countries and cardiovascular disease in adults have been associated with rheumatic fever.

Rheumatic heart disease, diphtheric myocarditis are causing a lot of morbidity and mortality in younger age group, living in over-crowding, poverty and ignorance (Brig. A. Malik-1984). The present study was carried out to findout the prevelence rheumatic fever and rheumatic heart disease in the urban slums in and around Dhaka city and to establish relationship of various epidemiologica factors in the causation of RH and RHD in the Urban slums,.

MATERIALS AND METHODS :

Two slums were selected purposefully for some definite advantage of study, as such similar characteristics in certain common features of the two slums with some basic difference in sanitation facilities which may explore new facts and findings. The slum choosen were Dattapara slum in Tongi, 30 km from Dhaka. The other Beltala slum in Tejgaon, 5 km from Dhaka city. The people of Dattapara slum areas were enjoying better sanitation facilities than other slum areas. To collect data from the slums the total households were clustered into number of blocks and from each block 16 households were studied, 8 block of Dattapara comprising 128 households, 7 Blocks, 112 households were studied from Beltala slums.

Thus total number of households in the sample were 1600 + 1400 = 3,000. Data were collected by observation, examination and questionaire methods from 22.1.84 to 6.3.84. Cases were diagnosed, on clinical findings, and routine blood examination. Data thus collected, edited, compiled and analysed and the results are presented in tables.

(JOURNAL OF PUBLIC HEALTH ASSOCIATION, BANGLADESH VOLUME 1, NUMBER 1, JUNE 1986)

Table I —AGE AND SEX DISTRIBUTION OF THE TOTAL SAMPLE POPULATION.

Age group (Years)	Dattapara M	Dattapara F	Baltala M	Baltala F	Both slums M	%	F	%	Total	%
0— 5	55	63	48	44	103	(7.7)	107	(8.0)	210	(15.7)
6—10	48	30	46	32	94	(6.0)	62	(4.6)	156	(11.6)
11—15	45	47	48	34	93	(6.9)	81	(6.0)	174	(13.0)
16—20	34	28	24	30	58	(4.3)	58	(4.3)	116	(8.6)
21—25	38	29	29	30	67	(5.0)	59	(4.4)	126	(9.4)
26—30	46	31	49	29	95	(7.1)	60	(4.5)	155	(11.5)
31—35	61	41	48	49	109	(8.1)	90	(6.7)	199	(14.8)
36—40	25	34	38	20	63	(4.7)	54	(4.0)	117	(8.7)
41 +	24	23	21	21	45	(3.4)	44	(3.2)	19	(6.7)
Total	376	326	351	219	727	(54.2)	615	(45.8)	1342	(100.0)

Table—II. COMPARATIVE DISTRIBUTION OF MORBIDITY IN THE TOTAL SAMPLE

Causes of marbidity	No. of Cases Dattapara	Baltala	Total	%	Disease prevelence
Scabies	453	407	860	(42.7)	64.1%
Upper respiratory tract infection	197	207	404	(20.0)	30.1%
Diarrhoeal diseases	94	116	210	(10.4)	15.6%
Worm infestation	64	83	147	(7.3)	11.0%
Peptic ulcer	72	67	139	(6.9)	10.4%
Rhematoid Arthritis	57	51	108	(5.4)	8.0%
Otitis media	29	37	66	(3.3)	4.9%
Malnutrition	18	29	47	(4.3)	3.5%
Rehumatic fever	07	05	12	(0.6)	0.9%
Rheumatic Heart Disease	11	12	23	(1.1)	1.71%
Total	1002	1014	2016	(100.0)	Total

Total = $x^2 = 11.6$, df = p > 0.05

RF / RHD = $x^2 = 0.04$ df = 1, p > 0.05 with other diseases.

Table : III. AGE AND SEX DISTRIBUTION OF CASES WITH RHEUMATISM.

Age of the patients (yrs)	Sex of the patients Male	(%)	Female	(%)	Total	(%)
0—5	1	(2.9)	1	(2.9)	2	(5.7)
6—10	2	(5.7)	1	(2.9)	3	(8.6)
11—15	3	(8.6)	2	(5.7)	5	(14.3)
16—20	4	(11 4)	9	(25.7)	13	(37.1)
21—25	3	(8.6)	3	(8.6)	6	(17.1)
26—30	3	(8 6)	2	(5.7)	5	(14.3)
31—35	0	0	1	(2.9)	1	(2.9)
Total	16	(45.7)	19	(54.3)	35	(100.0)

M=45.7% F = 54.3%, M:F = 100 : 119

Table : IV. DISTRIBUTION OF 12 RHEUMATIC FEVER AND 25 RHEUMATIC HEART DISEASE PATIENTS ACCORDING TO CLINICAL FINDINGS.

Clinical Findings of R. F.	No. of patients	% of Total	Clinical findings of RFD.	No. of patients	% of Total
Carditis	11	91.7	Fatigue	23	100.0
Migrating polyarthritis	12	100.0	Murmur	23	100.0
Fever	12	100.0	Palpitation	22	95.7
Arthalgia	12	100.0	Breathlessness	20	87.0
Leukocytosis	11	91.0	Rheumatic fever	20	87.0
Raised ERS	09	75.3	Raised ESR	11	47.8
Repeated sore-throat	07	58.3	Oedema of the leg	07	30.4
			Chest pain	06	26.1

RESULTS :

Table I—showed the age and sex distribution sample population. The majority of the study population were in the age group 11—15 years and least were 12 years above

Table II—showed the pattern of morbidity in terms of case proportionate morbidity and disease prevalence among the total sample population in both slums. There is no significant variation of the morbidity pattern in two slums (since $x^2 = 11.6$, $df = 9$, NS, when $P > 0.05$) and also no significant variation between R F, RHD with other diseases. ($x^2 = 0.04$, $df = 1$, $P > 0.05$)

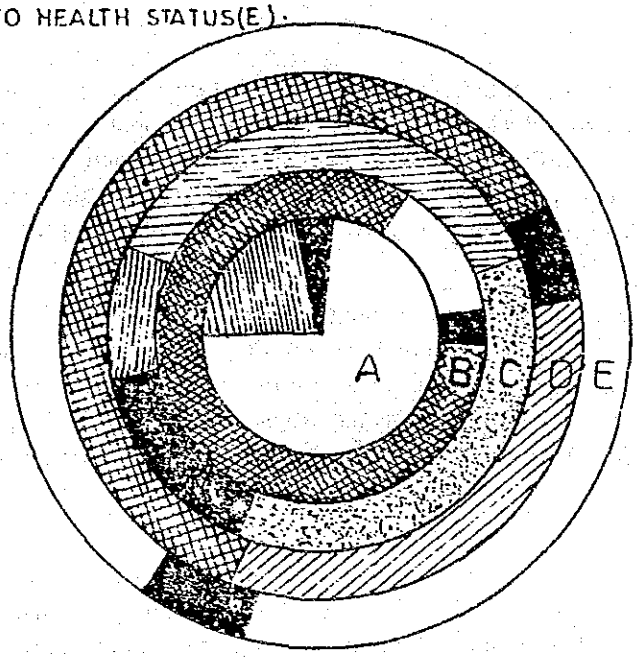
The total number of rheumatic patients were 35 (1.7%), 12 (0.6%) cases were diagnosed of rheumatic fever and 23 (1.1%) were rheumatic heart disease. Table III—showed the age and sex distribution of 35 rheumatism cases where male cases were 16 (45.7%) and female cases were 19 (54.3%) and male-female ratio is 100:1.9, indicating slight predominance of female patient over male patients.

The maximum age incidence of rheumatic disease (i.e. RF & RHD) is in between 5—25 years, 29 (82.86%) out of 35. Table IV—showed that all the 12 patients (100%) had clinical findings of migrating polyarthritis, fever, and arthralgia. 11 patients (91.7%) out of 12 has carditis, 9 (7.5%) patients had raised ESR, 11 (91.7%) had leukocytosis and 07 (58.3%) had a history of repeated sore-throat. On the other hand fatigue and murmur were found in all the rheumatic heart disease patients. The other commonest clinical findings obtained were palpitation in 22 (95.7%), Breathlessness and rheumatic fever in 20 (87%) cases, sore-throat in 19 (82.6%) cases. Oedema of leg, a very late complication due to heart failure was found in 7 (30.4%) cases and chest pain in 6 (26.1%) cases. Raised ESR was found in 11 (47.8%) cases,

All most all the patients had poor, damp and overcrowled kacha housing conditions : majority of the patients 29 (82.86%) belong to very poor income group, monthly family income less than 501 taka and 27 (77.14%) patients having a large family comprising of 6-8 members living in a single room (Fig 1).

FIGUR-I

FIGUR I IS THE SUPERIMPOSED PIE CHARTS, SHOWING DISTRIBUTION OF 2[illegible] RHEUMATIC PATIENTS (RF)& (RHD) ACCORDING TO EDUCATIONAL STATUS OF HOUSE HOLDS HEADS (A), MONTHIY FAMILY INCOME (B) DURATION OF STAY IN THE SLUM (C) NO OF PERSONS LIVING IN A ROOM (D) AND 240 HOUSE HOLDS ACCORDING TO HEALTH STATUS(E).



A – EDUCATIONAL STATUS

- ILLITERATE 74·3%
- BELOW SECONDARY 2·9%
- PRIMARY 22·9%

B – MONTHLY FAMILY INCOME

- LESS THAN 501 TAKA 82·9%
- 1001+ TAKA 2·9%
- 501–1000 TAKA 14·3%

C – DURATION STAY

- 2–3 YEARS 8·6%
- 4–5 " 37·1%
- 6–7 " 40·0%
- 8+ " 14·3%

D – NO OF PERSONS LIVING IN A ROOM

- 2–3 PERSONS 5·7%
- 4–5 " 17·1%
- 6–7 " 40·0%
- 8+ " 37·1%

E HEALTH STATUS

- DISEASED 94·2%
- HEALTH 5·8%

DISCUSSION :

It was obviously a hard task to detect the rheumatic cases without the help of sophisticated laboratory facilities which are essential for coming to a definite pinpoint diagnosis. Neverthelss, only the frank clinical cases were recorded with the supporting help of laboratory examinations (ESR, TC, DC and Hb%). Thus 35 rheumatic cases were detected, out of which 12 were cases of RF and 23 cases of heart RHD in the total sample population of both the slums.

There seems to be an early onset of RF 10 (83.33%) out of 12 at an age group if 5-12 years where as RHD has a late onset 19 (82.60%) out of 23 at an age group of 16-30 years. It was evident from the comparative distribution that the disease pattern in two separate slums were more or less same and the x^2 — showed no significant result. The comparison between rheumatic fever and rheumatic heart disease with other diseases were also not significant in that particular slums. The female seems to suffer more, 22 (62.85%) out of 35 rheumatic cases, probably due to the fact that the female were neglected and unattended in the poor and ignoranct society.

The other common disease morbidity observed in the slum community were scables (63.8%) URTI (30.0%), diarrhoeal diseases (15.6%), worm infestation (10.9%) comparative to rheumatic diseases (1.73%).

B.L. Agarwal (1981) reported significantly that rheumatic fever and rheumatic heart disease is someway related to poverty, damp and crowded living conditions in the slumsof low income groups in cities. It is fact that rheumatic heart disease account 20% of all heart dicease in temperate countries (Paul Wooes-1969).

It has also been found that except for a few patients 6 (17.14%) treated by qualified doctors, the majority 29 (82.85%) were treated by unqualified Allopath, Homeopath Kabiraz, Hakim etc. indicating that large number of cases did not have proper treatment at the early onset of the disease with group A beta haemolytic streptococci.

There are many limitations of the present study, however from the study it may be concluded that epidemiological relationship of RF and its sequele RHD exist between poverty, illiteracy, ignorance, lack of knowledge regarding personal hygiene, overcrowding, and inadequate facilities of environmental sanitation.

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ANNEX

CHECKLIST OF SURVEY ITEMS / QUESTIONNAIRE

(PRELIMINARY SURVEY TEAM FOR THE PILOT PROJECT ON SURVEILLANCE AND CONTROL OF RHEUMATIC FEVER(RF) AND RHEUMATIC HEART DISEASES(RHD))

(日本側調査団からの質問事項(左)と小児リウマチ熱例回答(右))

I. BACKGROUND INFORMATION OF THE PROJECT

1. General Situation of Health and Medical Care

1) Basic health statistics

Birth rate (per 1000) 33.2(as per 86)
Death rate (-do) 11.4
Infant Mortality rate (per 1000) 110.7

2) Organizational structure of health and medical care

(1) Central governmental organization

Honorable Minister for Health Family Planning

Secretary Ministry of Health Family Planning

Joint Secretary Administration Joint Secretary.(Dev.)

Dy. Secretary Dy.Secretary Deputy Secretary.(Dev.)

Assistant Secretary Assistant Secretary.

Director General of Health Services.

Director, Director, Director, Director

Dy.Dir. Dy.Dir. Dy.Dir.Dy.Dir. Dy.Dir.Dy.Dir. Dy.Dir.Dy.Dir.

At 4 divisions.

Deputy Director

Civil Surgeon Civil Surgeon

1 Civil Surgeon for each 64 districts.

(Shown in Upazilla Health Complex 5)

(2) Rural governmental organization

(3) Institute at national level

Institute at National level

Director

Professor

Associate Professor

Assistant Professor

Resident Physician

Registrar

Assistant Registrar

Medical Officer

Nurses

Other staff.

(4)District hospital, Medical college

Superintendent /Civil Surgeon
100 beded General Hospital
Consultant (Medicine, Surgery, Gyneco.)
Principal of Medical College
Professor of Medicine/ Cardiology . — Prof. Microbiology
Associate Professor -do- — Prof. of Epidemiology
Assistant Professor -do- — Laboratory.
Resident Physician -do-
Registrar
Asstt. Registrar

(5)Upazila health complex

Upazilla Health & Familly Planning Officer

Field staffs.
Familly Planning Officer
Health Inspector
Asstt.Health Inspector
Health Assistant.

30 beded Hospital
Specialists(3)
Resident Medical Officer
Medical Officer
Nurse
Pharmacist
Others.

(6)Health center,Clinic, Health post at Union,Ward,Village level

Medical Officer(1)
Medical Assistant(1)
Health Visitor (Leady)(1)
Health Assistant(F.W.W.)
One/ 4000 population.

2.Outline of RF/RHD Control Program.

1)Statistics(estimated number of patients,mortality rate,infecion rate,etc.)

a. Prevelence rate 7.5 / 1000 population.
b. 30% of all Cardiovascular Patients in I.C.V.D.
c. 60% of all Surgical work load of I.C.V.D.
d. 40% of all Echocardiography Examination in I.C.V.D. is of RHD cases
e. 3.3 percent of school children .

2)Activities to the present

(1)Organizations involved (ICVD,Medical College,etc.),including organizational chart

I.C.V.D. started case recording of R F & R H D cases, . . . by filling up a standard proforma. They also treat those cases and apply secondary Preventive measures.

The Organization for control and prevention of Rh. fever and Rh. heart diseases has not yet been formed.

(2)Activity,achivement records,problems
—Target area
—Strategies and methods employed
—Staffing

Does not arise.

3)Cooperation from third countries and/or international organization
—WHO
—Others

N I L

3.National Development Plan
1)Chapters covering health and medical care, particularly those related to the project

a. EPI programme
b. Diarrhoeal diseases control programme.
c. Malaria Eradication programme.

2)Any other projects similar to the proposed project,if any.

-do-

II.DESCRIPTION OF THE PROJECT
1.Purpose of the Project and its relation to the National mid and long term RF/RHD Control Project

Mentioned in p.p.

2.Organization and Function of ICVD
1)Composition and function of each section

(Shown in booklet.)

2)Position of ICVD in the governmental organization and its legal foundation

No other Governmental Orgenization is giving support to the ICVD except Ministry of Health & Family Planning.

3.Scheme of Activities
1)Formulation of plans and policies
(1)Data management
—Data to be collected
—Methods of transmission,record and analysis of data
—Methods for feedback
—Necessary personnel and equipment etc.

Proforma attached.

2)Operation and supervision of RF/RHD control project
(1)Target district and its population

Rajshahi	-	60,78000
Chittagong	-	63,29000
Barisal	-	53,85000
Khulna	-	49,93000
Mymensingh	-	75,75000
Dhaka	-	115,54000
Rangpur	-	7,50000
Sylhet	-	6,52000

(2)Targts(number of cases to be found,cure rate,contents of "guideline",etc.)

Each upazilla of approximate 2 lac population number of cases to be found is aprox. 1400.

(3)Strategy

—Case finding

—Treatment methods(medicine dosage,amount and frequency of medicine etc.)

Shown in action plan.

—Case holding and follow up(methods(Register,etc.),frequency,etc.)

—①Describe the preliminary study protocol of prevention of RF. (By Dr.WAGATSUMA)

②What is the ideal ID given to each pupils or students? Or for all of residents? (Dr.UEDA)

③How is the census registration? (〃)

④Computer registration is possible? (〃)

Computer registration is possible through yhe Bureau of statisties Government of Bangladesh.

Your special letters can be replaced by alphabet of roman letters? Or do you have special keyboard in your computer system?

Communication between host computer and pheripheral computers?

What is the most popular communication protocol? Or do you have any special procedures?

—Surveillance services

—Health education and Publicity

(4)Enforcement structure

—Personnel

Qualification of Medical Assistant.Diploma in Medical Science.
Qualification of Health Assistant. Secondary pass.

—Assignment of works among each organization and each section

—Medicines and equipments(type,quantity and price),facilities

For primary prevention a single shot of Benzathine PC.
For secondary prevention monthly injection of Benzathine PC.

—Utilizing PHC system

—①What is the proposed plan for integrating the program with the already existing PHC system? Is there any possibility of imposing extra work load on the health staff(HA,MA and voulunteers,etc.)? (Dr.WAGATSUMA)

Shown in action plan .
Each health assistant will visit schools and houses, as they are utilized in other activities some more (10 per upazillas) will be recruited, so that it does not become and extra burden.

②How can the proposed plan be integrated with the PHC system? (〃)

③Describe the details of the existing PHC system.(〃)

④What kind of existing PHC infrastructure can be utilized for the surveillance and prophylactic services?

⑤Describe the nature,facilities and activities of Upazila Health Complex. (Dr.WAGATSUMA)

Surveillance ---------- One assistant Inspector per 5 health assistant
One health Inspector per 3 asstt. Inspector.
Also Upazilla health and family planning and Medical officer.

⑥Describe the reason why Dhaka and Rajshahi were selected as primary project areas. (〃)

⑥ Dhaka is at National level and ICVD will act/as central Coordinator. Rajshahi is far way place in the northern part of the country.

⑦In Japan we experienced heart disease programs were successful when they were included in school health administration system. Mass examinations are supposed to be effective procedure for case finding of asymptomatic rheumatic valvalar diseases in your place,too. So the questions are related to the statistics of education system.

⑦ There are 10 to 13 schools in each Union. Each school pas average 240 students . Absentee rate 10 to 20 person. Students resides about 1 to 2 Kilometer from there school. School personel can visit homes of the students.

How many schools each village and ward has?
How many pupils or students and teaching staffs?
What is the participation rate by location?
What is the absentee rate by location and by school?
Not only for Upazila in Dhaka and Rajshahi,but also data for the rest of the country are hopefully obtained.These data are helpful, or rather mandatory to obtain when you have nation wide plan.
In the case of absentee, the reasons are expected to be reported?
How far from schools are pupils or students living?
Is it possible for any school personnels to visit students in the case of absentee?
(Dr.UEDA)

3)Out patient treatment
(1)Estimated number of patients
(2)Scope and method of examinations and treatments
(3)Necessary personnel,equipments and facilities
(4)Estimated amount of budget
—How was calculated the cost of prevention of Tk.400.00 per year for a child?

(1), (2), (3) - Shown in action plan and P.P.

The cost of prevention of Tk.400.00 was calculated at the rate of Tk.33/- per injection Benzathine PC plus disposable syring (the cost may be less if the medicine is being manufactured in Bangladesh).

4)Examinations of Streptococcus,Diagnosis of RHD
(1)Estimated number of specimens and cases(patients)
(2)Test items,test methods and diagnosis items,diagnosis methods
—①Describe the pratical methods of detecting and identifying cases in the community. (Dr.WAGATSUMA)
②If the case finding is carried out by nonprofessional persons such as volunteers,is it possible to grasp cases of RF in active phase or RHD without any symptoms? (Dr.UEDA)
③What is the most popular symptoms of acute RF in your place? (〃)
Do you have any special features of acute RF compared with those encountered in other countries?
Persentage of each symptom corresponding to major or minor criterion.(Multiple joints involvement,carditis, chorea,subcutaneous nodules and erythema marginatum---major criteria. Fever,joint pain----minor criteria)
④What kind of serologic tests have been done for streptococcal infections? ASO?,ASK?,AHD?,ADN B?,any others?
⑤Do you have sufficient swab taking and culture for bacterial examination? (Dr.UEDA)
⑥What kind of diagnosis methods have been carried out for above infections? How about Rapid strept ID test?
⑦How many cardiologists for this?
Are these machines available?

20,000(aprox) in each upazilla. 17,400 cases -do-

①②, -------- The non professional persons will be able to grasp cases of RF in active phase or RHD without any symptoms if they are given treining.

③ Most popular symptom is joint pain. No special featureas
Serologic tests -- ASO.

⑦ There are 7 cardiologist working in ICVD and 7 cardiologist are ready to go to the periphary. Another 5 cardiologist are working in Postgradute Instt. and different medical colleges(Dhaka, Rajshahi). ECG machine are available in ICVD and medical colleges but some to be provided(shown in P.P.). Only one PCG is availab -le in ICVD. X-Ray facility is available upto district level and in some upezillas . Many of the upazilla has constant supply of electricity.

5)Surveillance(Epidemiology)

(1)Contents and methods of (field) survey

—①When did you take a census of population in Bangladesh? Can we get the report? (Dr.MORIBE)

②Could you have the population by age and sex in a study area for epidemiological purpose? (〃)

③Are you interested in studying the prevalence of RHD in a general population? In the case,how much response rate can you expect? (〃)

④Could we get any data or statistics concerning about these items? (Dr.FUJIKAWA,Dr.UEDA)

- the number of the death,the death rate from RF/RHD on the national level and/or on the pilot project area level every year during five years.
- the patient rate of pupils and students(in primary school and junior high school) from RF/RHD.
- The number of in patients from RF/RHD at some facility(e.g.medical college) every year during five years.
- RF/RHD increase with time passing? Or decrease?
- The Streptococcus Rosenbach carrier rate?
- Which strain type of Streptococcus is more in Bangladesh?
- The rate of development of cardiac sequellae.

⑤Describe the practical methods of surveillance of known cases. (Dr.WAGATSUMA)

(2)Necessary personnel,equipments and facilities

—①Identify the epidemiologist who will be responsible for this project. (〃)

②Does ICVD have extra space to be headquarter of this project? (〃)

(3)Estimated amount of budget

4.Staffing(Staff needed to fulfill functions described in 3-1) ～ 3-5) above:number of necessary staff,existing staff and staff to be trained in future.Staff training program)

—① Number of officals by facility —from Ward level to National level — and by kind of works in general before you start this project. What is the capacity of officals and volunteers? (Dr.UEDA)

② What kind of training of manpower are you expecting for this project? (Dr.MORIBE)

③ How many clinical examinations school are there? (Dr.FUJIKAWA)

5.Budget Allocation

1)Outline of budget for the Health Div., Ministry of Health and Population Control.

(1)Outline of budget system

(2)Changes in amount of budget during the past five years

(3)Resources of the budget during the past five years (self-generated funds,and funds from foreign countries and foreign orgnizations)

5) Last census was done in 1981.

Population by age in study area.

District	0-4	5-9	10-14
Rajshahi	913	835	722
Chittagong	886	829	737
Barisal	795	763	637
Khulna	686	661	591
Mymensingh	1130	1073	842
Dhaka	1157	1532	1324
Rangpur	1179	1103	813
Sylhet	936	902	748

① Doctor Monzoor Kader

② yes.

Shown in P.P.

Shown in action plan.

(1) Out line of budget for the health division Ministry of Health and Family planning. (in thousand)

Year	Pay of Officer	Pay of staff	Allo.& Hono.	Expen. and C..C.	M.S.R.	Total
1982-83	8,29,85	17,57,10	22,56,69	54,26,57	23,40,00	92,74,21
1983-84	13,59,40	19,52,40	28.70.00	50,50,00	27,50,00	115,39,00
1984-85	14,47,99	25,97,60	45,25,07	57,71,59	31,00,00	140,42,25
1985-86	13,35,34	15,41,07	20,42,94	53,05,63	29,70,00	100,25,20
1986-87	26,25,41	79,97,57	68,10,21	83,69,67	43,00,00	250,05,86

2)Budget allocated for RF/RHD Control Program
(1)Changes in amount of budget till the year 2000
(2)Resources of the budget till the year 2000(self-generated funds and funds from foreign countries and foreign orgnization

3)Funds necessary for the implementation of the project(amount needed to fulfill functions described in 3-1) ~3-5):amount already obtained and amount to be obtained)
(1)Capital investment
(2)Management expenses(including depreciation fund)
(3)Labor costs
(4)Operational costs

—What is the detail of budget,US$ 63,225.00 in the page 5 of the document above-mentioned? (Dr.MORIBE)

—How are you going to strengthen the existing laboratory? (Dr.MORIBE)

III.REQUESTS FOR TECHNICAL COOPERATION OF SIDE

1.Name of the project

2.Fields of cooperation and targets

3.Term of cooperation

4.Project sites

5.Project activities
(1)Experts (field , long or short term , number of experts needed , working place , living facilities , etc.)

(2)Trainees of Bangladesh personnel of the Project (field , number , duration of training , etc.)

(3)Equipment

(4)Others

IV.MEASURES TO BE TAKEN BY BANGLADESH SIDE BEFORE THE TIME WHEN THE RECORD OF DISSCUSIONS FOR THE PROJECT WILL BE SIGNED BY BOTH SIDES

1) Counterpart budget
2) Personnel appointment
3) [illegible]

V.ADMINISTRATION OF THE PROJECT

(1) It will be done if the project is accepted by the Govt.of Japan.
(2) No other country was approached.

- Shown in P.P.

WORLD HEALTH ORGANIZATION
ORGANISATION MONDIALE DE LA SANTÉ

WHO/CVD/83.4
ORIGINAL: SPANISH*

PREVENTION AND CONTROL OF RHEUMATIC FEVER IN THE COMMUNITY

Manual of operational standards for a programme to extend coverage at different levels of care

Scientific Publication No. 399

CONTENTS

* The original Spanish edition was published by the Pan American Health Organization in 1980. Full reference: Prevención y control de la fiebre reumática en la comunidad. Manual de normas operativas para un programa de extensión de la cobertura en los diferentes niveles de atención. Washington, DC, PAHO, 1980 (Publicación Científica No. 399).

PREFACE

Cardiovascular diseases - like cancer, diabetes mellitus and other non-communicable diseases - are assuming ever greater importance in the countries of the Americas, particularly in Latin America and the Caribbean. Death rates from heart disease (ischaemic, hypertensive, rheumatic and other) range from 47.7 to 491.6 per 100 000 inhabitants, being under 50 in one country and over 400 in three.

The size of the problem, as reflected in rates of morbidity, disability and mortality, depends on the availability of effective measures of prevention and control, such as exist in the case of rheumatic fever and rheumatic cardiopathy. However, despite such measures, the estimated magnitude of the rheumatic fever and rheumatic cardiopathy problem does not show any tendency to decrease in many of the countries in this Region.

Consequently, the prevention of rheumatic fever and rheumatic cardiopathy represents a priority area within the Organization's disease control programme; mindful of this PAHO is coordinating a research programme covering several countries with a view to demonstrating the feasibility and effectiveness of preventive measures in the general health services, with special stress on activities at the primary level. Secondary prevention is the main aspect of this intercountry project; it is based on a plan of action under which all known rheumatic fever patients are registered so that suitable surveillance methods can be used to determine whether they are observing the preventive regimen prescribed (i.e. taking benzathine penicillin). The factors responsible for failures to do so are then identified and studied.

A preliminary analysis of data from the participating countries seems to suggest certain general trends. The programmes that show the highest degree of effectiveness are those in which preventive activities are incorporated in the health services and include active participation by local health centres and auxiliary staff together with health education and community participation at the primary care level. At the other extreme the greatest number of failures are recorded in specialized pilot centres where the programmes are vertically organized and lack logistic support in the communities.

The Member States of the World Health Organization have agreed that the main social target in the coming decades should be the attainment by all the citizens of the world by the year 2000 of a level of health that will permit them to lead a socially and economically productive life, and have stressed that primary care is the key to attaining that goal.

In October 1980, the Directing Council of the Pan American Health Organization approved the regional strategies for attaining this goal, among which emphasis was laid on strategies of inter-country cooperation.

Experience in this Region shows that to solve certain health problems joint action by several countries is needed and hence joint strategies have to be designed. In this connection, an analysis of the national strategies that have been formulated by the Member States discloses specific areas that for their planning and development will require collective action by groups of countries, as is precisely the case with rheumatic fever and rheumatic cardiopathy.

The pursuance of this collaborative study has demonstrated the importance of this strategy, which through an interchange of knowledge and experience has successfully demonstrated the feasibility and desirability of integrating control programmes in the general health services.

Work is also being done to achieve the objective providing a direct service to the population under study and at the same time keeping that population protected over a period of several years, thus reducing the risk of known complications of the disease occurring among them.

The study, which was launched in centres with a certain degree of specialization, is to be extended, once its feasibility has been demonstrated to cover wider groups of the population. This extension of the programme will be achieved not by increasing the number of specialized centres but by defining and expanding promotional and protective activities at all levels of care, including the primary level; not by establishing new structures for the purpose but by using the resources now existing in the countries for providing general health care.

Eventually these activities will have to be coordinated with those for the control of other diseases of the circulatory system in an integrated programme for controlling cardiovascular diseases and other non-communicable conditions, such as diabetes mellitus and cancer of the uterine cervix.

An important means of making coordination easier is the preparation of general guidelines on the planning, implementation and evaluation of control measures, such as those contained in this handbook; this work has been prepared with the help of the whole Working Group for this inter-country service and research project, which has been coordinated by the Organization in pursuance of Resolution XIV of the XXV Meeting of the Directing Council of PAHO.

The handbook defines 17 activities at the primary care level. A definition is required of the function of each practical resource at existing levels of care, so that it can be integrated with the activities of other programmes conducted by the general health services.

The Organization's Directing Council has entrusted us with the task of preparing a plan of action to implement the strategies agreed upon for attaining the goal of Health for All by the Year 2000.

It has been extremely useful to incorporate in the activities designed to help us carry out this mandate efforts to prevent and control rheumatic fever, which we hope can be extended to all the countries in the Region of the Americas.

Dr Hector R. Acuña
Regional Director

PART I: THE PROBLEM

INTRODUCTION

In its first report the WHO Expert Committee on Rheumatic Diseases (1954) stated that "there appears to be a possibility that rheumatic fever, a disease in which infection with haemolytic streptococci is believed, on good evidence, to be an important initial factor, can be controlled and perhaps prevented by the use of antibiotics and of sulfonamide drugs. This possibility if eventually substantiated, will offer an opportunity for preventive action on a worldwide scale..."[1]

At the Third Pan American Conference on the Study and Prevention of Rheumatic Fever (Lima, 1968), Dr Angelo Taranta emphasized that eradication of the disease was within our grasp and should be achieved in our generation.

Nevertheless, the data available on the incidence and prevalence of rheumatic fever in Latin America, although incomplete and partial, suggest that there is still a long way to go before this goal can be achieved.[2]

Unfortunately, very few countries in the Region have undertaken systematic activities for the control of rheumatic fever. Despite the fact that effective means are available for preventing the first attacks and particularly for preventing recurrences, the disease continues to be an important cause of death and invalidity among children of school age and young adults. Moreover, more information is needed on the frequency of rheumatic fever among the population and on the care requirements thus generated in the health services before it will be possible to determine the methods and procedures best suited to local realities for implementing control programmes.

The Pan American Health Organization, with the cooperation of the Pan American Committee for the Study and Prevention of Rheumatic Fever, in 1975 began efforts to coordinate inter-country collaborative programmes with a view to demonstrating the feasibility and effectiveness of preventive measures and treatment and acquiring the experience needed for the organization or control programmes. A part is being played in this programme by 16 centres in 7 countries (Argentina, Bolivia, Brazil, Chile, Ecuador, Peru and Venezuela) on the basis of a joint protocol drawn up by the Organization and adopted by the centres at the First Meeting of the Working Group on the Prevention of Rheumatic Fever, held in Porto Alegre, Brazil, in 1975.[3]

The preliminary results of the collaborative study have demonstrated the effectiveness of secondary prevention and have made it clear that the major difficulty in our programmes lies in ensuring adequate follow-up of the patients; this difficulty restricts coverage.

In many Latin American and Caribbean countries, these programmes have generally been under the direction of "pilot centres" for prevention, which include an important research component and inevitably use a vertical system of organization for developing their activities. The results of the studies carried out show that the programmes launched by the pilot centres have lower coverage and a higher percentage of patient attendance failure than those that are integrated into the regular work of a country's health services. Consequently, there is an obvious need to incorporate rheumatic fever prevention programmes in existing systems for the provision of services as an essential precondition for making control of the disease a normal activity of the general health services, in order to achieve nation-wide coverage.

At the Third Meeting of the Working Group (Lima, 1977), attended by representatives of the centres participating in the programme, this fact was acknowledged and it was recommended that PAHO should collaborate in drawing up standards of diagnosis and control applicable at the different levels of care; special emphasis was laid on the work of auxiliary personnel and on community participation.[4]

The Fourth Meeting of the Working Group (Quito, 1978) discussed draft operational standards for extending coverage. The same difficulties as those already mentioned were given prominence and it was decided that in each centre the programme would be reformulated on the basis of a fresh look at the resources available and the way in which they are used, coordination with primary levels of care to improve follow-up possibilities and the possible employment of auxiliary personnel to improve contact with the patients.[5]

This handbook is the result of the recommendations made and the fruit of the joint efforts of all the participants in the collaborative study. It is not intended that the standards laid down should become a substitute for the vast mass of reference material on this subject that already exists but simply to provide the necessary minimum of available knowledge, to be applied not only at the level of individual medical care, but also through control activities made accessible to the whole population.

MAGNITUDE OF THE PROBLEM

It is not easy to obtain precise information on the frequency of rheumatic fever in a particular country. No single source of data will show the dimensions of the problem and it is therefore essential to combine the information derived from various sources in order to have a general idea of the incidence of acute rheumatic fever (ARF) and chronic rheumatic cardiopathy (CRC).

Even less precise are the data on streptococcal infections, in spite of their importance as the first link in the epidemiological chain which the prevention programmes, once extended to community level, are designed to break.

Information is given below that has been selected from recent studies on the subject which provide a basis for public health activities and may be useful in drawing up control programmes until more adequate data are available at local level.

Incidence of upper respiratory tract infections caused by a group A beta-haemolytic streptococci

It is an established fact that about 20% of clinically frank upper respiratory tract infections (particularly sore throats) that occur in school-age children (5-15 years) are caused by group A beta-haemolytic streptococci.[6]

It is estimated that only some 20% of all streptococcal infections of the upper respiratory tract produce symptoms. This means that for every streptococcal sore throat with symptoms, there are 4 streptococcal infections of the upper respiratory tract that do not produce symptoms. The possibility of an acute attack of rheumatic fever (RF) being caused is much higher in the case of symptomatic than of asymptomatic infections. Moreover, it is estimated that for every two cases of ARF detected in which there is a history of upper respiratory tract infections, there is one case without such a history.[7]

For an acute attack of rheumatic fever to occur, it is essential that an immune reaction take place in which a high titre of antibodies is produced[8,9] and in such cases streptococcal infection generally produces symptoms. The risk of an attack of ARF occurring following a symptomatic upper respiratory tract infection caused by group A beta-haemolytic streptococci is 0.3% under endemic conditions and ten times as high (3%) under epidemic conditions[10,11].

Every case of symptomatic streptococcal pharyngitis is capable of transmitting the infection to family contacts or people living in the same household in a proportion that varies between 8% and 50%. The worse the socio-economic conditions, the more this proportion increases and the greater the degree of overcrowding and the number of children the more intense is the clinical picture[12,23].

Healthy carriers who harbour group A beta-haemolytic streptococci in their throats without showing any clinical signs and without antibodies being present form a high proportion (between 20 and 50%) of the school-age population.[13,14,15] Nevertheless, in general, they are not important as a source of infection or of cases of ARF.

Although nothing definite is known on the effect that might be achieved on transmission of group A beta-haemolytic streptococci by eliminating a large number of carriers among the population, some reports suggest that systematic elimination of symptomatic streptococcal sore throat is of decisive importance in reducing the average levels of streptococcal antibodies in the community, provided that efforts are kept up for a sufficiently long time.

Incidence of acute rheumatic fever

-- Incidence in hospitals: According to data from hospitals in Brazil, Chile, Uruguay and Venezuela[17,21] incidence ranges from 1% to 3% of hospital admissions at all ages and from 6% to 7% of hospital admissions up to 12 years of age.

-- Incidence among the public at large: No data available.

Prevalence of chronic rheumatic cardiopathy

-- Prevalence among the general public: Seventy-seven cases per 10,000 adults aged 20-74 years were recorded in the State of Rio Grande do Sul, Brazil[22].

-- Prevalence among children of school age: This varies in different Latin American countries from about 1% in Caracas, Montevideo, Sao Paulo and Porto Alegre[2,4,5] to 10% in Bolivia[23].

-- Number of cases of CRC with a history of ARF: It is thought that for every identified case of CRC with a history of an acute attack of rheumatic fever, there is another without such a history, generally among the young adult group.

-- The importance of rheumatic fever as a cause of cardiopathy: this varies in different Latin American countries from 5% in Venezuela[17,18] to 30% in Bolivia.[23]

Seriousness of the cardiac lesions in rheumatic fever

Among the lesions produced by acute rheumatic fever, the only ones that may cause death or leave chronic sequelae (which in their turn lead to illness, disability and early death), are the cardiac lesions. The seriousness of rheumatic fever hence depends almost exclusively on the frequency and seriousness of the carditis, which in its turn causes residual rheumatic cardiopathy.

-- Frequency of carditis in ARF: In the Latin American countries, carditis is more frequent at the moment than in the industrialized countries of American and Europe, varying from 33% in Caracas, Venezuela[11,18] to 75% in Lima, Peru.[17,25]

-- Case fatality rate from chronic rheumatic cardiopathy: The relationship between the number of deaths among persons with this condition and the total number of cases diagnosed provides valid information on the seriousness of CRC. A study carried out in Caracas, Venezuela, revealed an 11% case fatality rate per annum.[17] Another study, carried out in Mexico City over an observation period of five years, showed a case fatality rate of 34%.[26]

-- Survival rates among patients with CRC: Studies of survival rates among CRC patients on the basis of actuarial calculations show that the rate among symptomatic patients with lesions of the aortic and/or mitral valves is 52% after 5 years.[17,27,28] This means that out of a group of patients with rheumatic lesions of the mitral or aortic valves or both, about half will have died within a five-year period.

-- Disability from CRC: Of all disability pensions granted by social security systems, 11.5% are due to cardiovascular diseases, of which only 1% are accounted for by chronic rheumatic cardiopathy.[30]

Death rates from ARF and CRC

The death rates recorded among the general public from rheumatic fever and chronic rheumatic cardiopathy are tending to fall considerably in some Latin American countries such as Venezuela and Uruguay. In most of the other Latin American countries, the decrease has been less noteworthy[17] but a downward tendency has been apparent in the last 15 years. An analysis covering this period shows that the joint ARF and CRC death rate has moved downwards, i.e. from a range of 4 to 8 per 100,000 to a range of 2 to 4 per 100,000.[17-20,31] Almost all the deaths from these causes occur in CRC patients and the highest death rate is found between 35 and 55 years of age.[18,31]

-- Characteristics of the population at higher risk: The population group exposed to a higher risk of contracting rheumatic fever is the school-age group (5-15 years of age) among low-income groups. Among the indicators, it is overcrowding that stands out as the factor most closely associated with the prevalence of rheumatic fever.[17,18,31] A streptococcal respiratory infection can be infective for a distance of 6-9 m but the smaller the distance, the greater the probability of actual infection.

Population groups that live crowded together in closed environments where there is a greater probability of streptococcal infections (schools, hostels, barracks) are also exposed to a higher risk of contracting rheumatic fever. Similarly, the risk increases among populations living at high altitudes.[17,33]

Rheumatic fever control as a public health objective

Despite the fact that highly effective preventive measures have been available for the last 30 years, rheumatic-fever incidence and prevalence rates in developing countries in the Americas have shown little or no change over the last 15 years. This handbook therefore proposes to define a new strategy for preventing and controlling rheumatic fever, a strategy that should be publicized in health systems at all levels of care.

The paragraphs that follow contain a summary of the main reasons for including the problem among public health objectives, particularly in developing countries.

The group at highest risk is the group of children of pre-school and school age, among whom the highest incidence of group A streptococcal infections is observed and hence the largest number of acute attacks of rheumatic fever, whether initial or relapses. Heart valve impairment, when it occurs, may last throughout the lives of the patients and incapacitate them permanently.

Among the cardiovascular diseases, rheumatic fever is one of those that affects individuals earliest during their lives.

The problem exists in many countries of the Americas and is all the more serious because of the frequency with which the disease occurs among young people, the high case fatality rate amongst those who contract it and the earliness of the deaths that result.

Despite the fact that at the moment there is no immunizing agent against streptococci that is usable in practice, it has been proved that secondary prevention is effective in over 99% of cases, protecting against new bouts of rheumatic fever susceptible persons who strictly observe the preventive regimen prescribed. It is also knowledge that a single injection of benzathine penicillin eradicates the streptococci in more than 95% of infections and that even in a susceptible person early treatment of the infection can forestall an acute attack.

Another important element to be taken into consideration is the low cost of the material resources necessary for the prevention programme. The cost-benefit ratio is highly favourable to preventive measures when compared with the cost of treating an acute attack of rheumatic fever: the cost of treating a young person with heart condition throughout his life, the large sums required for cardiac surgery (which almost never succeeds in curing the patient, who goes on needing continuous medical follow-up and treatment), and the losses in productivity due to the incapacitation of young adults.

Almost all the follow-up activities can be left to general practitioners and to non-physician health personnel. Specialists are only necessary to deal with the few cases in which complications occur (their number will tend to decrease as the prevention programme comes into operation).

The fact that a high proportion of those exposed to high risk attend school, where they have better access to health services, makes follow-up simpler.

The activities planned for preventing rheumatic fever do not require any special infrastructure. Preventive activities can be incorporated in general medical care for the population through existing health services (network of primary care clinics, school health services, etc).

Finally, it should not be forgotten that study of external predisposing factors shows a positive relationship between rheumatic fever and poverty. It is also recognized that this problem, which affects many sectors, cannot remain the sole responsibility of the health sector, since an improvement in living conditions, and particularly in housing, will bring in its wake a decrease in the incidence of this and other diseases.

THE NATURAL HISTORY OF RHEUMATIC FEVER

The natural history of rheumatic fever and the points at which a control programme can act*

There are various aspects of the history of rheumatic fever that have not yet been thoroughly elucidated, particularly as regards the dynamics of streptococcal infection among the population.[33] Nevertheless, our present level of knowledge makes it possible to suggest a provisional model, such as the one given in Figure 1, which shows the essential points on which the activities of a control programme should be concentrated.

Infection with a group A beta-haemolytic streptococci (1) of a person susceptible to rheumatic fever (2) is followed by infection of the upper respiratory tract (3) and an attack of rheumatic fever (5), which may develop without carditis (7) and be cured without after-effects (9), or may damage the heart in its acute phase (8) and may or may not lead to chronic rheumatic cardiopathy (9 or 10).

Streptococcal infection produces definitive specific immunity against the serological type of the causal agent, but the person concerned remains unprotected against the other serotypes and may therefore undergo new infections; if he were susceptible there might be a recurrence of the complication (RF) with the possibility of the cardiac sequelae being aggravated.

Secondary chemoprophylaxis (6), applied to persons suffering from chronic rheumatic cardiopathy and/or who have had rheumatic fever, interrupts the "reinfection-recurrence" cycle, thus preventing the onset of fresh streptococcal infections.

As primary prophylaxis, treatment to eliminate the streptococci in a case of sore throat, if applied in time to a susceptible person, may avoid complications. If applied to a community, it may reduce the possibilities of infection.

Theoretical evolution of streptococcal infection in a community*

The theoretical evolution of streptococcal infection in a community is shown in graphic form in Figure 2, which shows with unbroken lines effects and relationships that can be detected clinically without using special diagnostic resources and with dotted lines effects and relationships that are not obvious.

The figures are arbitrarily chosen but approximate to the minimum frequency considered possible in a community in which no control programme is in operation. When applied to a real community the figures will be replaced by those found from observations carried out locally.

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*The numbers in brackets (1) refer to the stages shown in Figure 2.

If a theoretical population of 30,000 persons is taken as a basis (1) one-third of whom are school age (2), roughly 10,000 acute symptomatic infections of the upper respiratory tract (3) can be expected in a year if every child has at least one episode in the year. If 20% of these infections should be due to sore throats caused by group A streptococci (4), given that the anticipated incidence of rheumatic fever under endemic conditions is 3 out of every 1,000 infected persons, six cases of acute rheumatic fever should occur during any one year (5), of which two may result in valve damage (6).

As a result of several studies it is known that one-third of the diagnosed cases of acute rheumatic fever have not been preceded by a frank case of sore throat and hence if six cases of rheumatic fever are recorded in which sore throat has occurred there should be half that number (three cases) without sore throat (8). Of these again one-third (one case) will not result in valve lesions (9). These cases must be ascribed to asymptomatic streptococcal infections (7), which are known to be much more common in the community than sore throats.

It has been found in prevalence studies that for every case of chronic rheumatic cardiopathy with a previous history of acute rheumatic fever, there is another (12) without a history of ARF but presumably secondary to an undiagnosed active rheumatic fever (11) caused by symptomatic or asymptomatic streptococcal infections (10,7,4). Generally speaking, these patients are older at the time of detection than the others and may not belong to the school-age group.

The figures should be adjusted for each community. If the proportions are not maintained, it may be that this is due to: the existence of undetected cases, to the fact that the community in question does not fit the epidemiological pattern of the suggested model, or that the model has been modified by external factors such as the existence of a control programme.

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PART II: RHEUMATIC FEVER CONTROL PROGRAMME AT COMMUNITY LEVEL

PLANNING

In accordance with information stated in Part I, a programme will require first an overall plan defining the objectives that are to be attained and a list of the activities needed and responsibilities in regard to those activities, everything being integrated in the general organization of the health services.

Below, a suggestion is given in general terms for subsequent adaptation to each particular situation.

Objectives

General objective: In a given community to reduce the incidence of acute rheumatic fever (initial attacks and relapses) and its cardiac sequelae by means of early treatment to eliminate streptococcal sore throats and maintenance of secondary preventive measures in the case of susceptible patients.

Specific objectives	Secondary objectives
1. Detect and treat any cases of streptococcal sore throat in the 5-15 year age group.	1. Detect suspected cases of streptococcal sore throat and carry out a clinical diagnosis.
	2. Prescribe treatment for eliminating the sore throat. To seek out symptomatic contacts in the 5-15 year age group
2. Detect cases of acute rheumatic fever and give them suitable treatment.	3. Detect suspected cases of acute rheumatic fever. Select cases of acute rheumatic fever for out-patient treatment or treatment in hospital or in a specialized centre.
	4. Treat cases of acute rheumatic fever without carditis or with only mild carditis.
3. Keep the susceptible patients detected (with or without cardiovascular sequelae) under secondary prevention.	5. Detect those liable to new attacks of rheumatic fever.
	6. Prescribe secondary preventive measures for patients who had acute rheumatic fever and take steps for such measures to be applied to those referred as liable to new attacks.
	7. Seek out those who do not comply with the preventive regimen.
4. To prevent or treat complications in patients suffering from chronic rheumatic cardiopathy	8. Follow up developments in patients with chronic rheumatic cardiopathy.
	9. Send to a specialized centre for evaluation of new cases of chronic rheumatic cardiopathy or cases in which complications are suspected.

Activities at the various levels, including responsibilities at the primary level

A. Central level

1. Programme health activities and submit them to the Government for approval.
2. Plan, promote and coordinate the training of staff to work in the approved programmes.
3. Launch and carry out the programmes in areas previously defined.
4. Standardize, supervise and coordinate the activities at the various levels.
5. Coordinate programme activities with other health programmes and particularly with the epidemiological surveillance subsystem.
6. Plan and coordinate epidemiological research.

B. Primary level

	Responsibility*		
	Auxiliary	Nurse	Physician
1. Provide health education on subjects related to acute infections of the upper respiratory tract, streptococcal sore throat, transmission, treatment facilities, acute rheumatic fever, chronic rheumatic cardiopathy and secondary prevention.	A	N	P
2. Examine patients in the 5-15 year age group with symptoms suggesting acute infection of the upper respiratory tract.	A	N	P
3. Make a clinical diagnosis of streptococcal sore throat.	(A)	(N)	P
4. Prescribe treatment to eliminate the sore throat in patients not suffering from allergy.	(A)	(N)	P
5. Give an intra-muscular injection of benzathine penicillin.			(P)
6. Prescribe treatment to eliminate the sore throat in patients allergic to penicillin.			P
7. Seek out symptomatic contacts aged 5-15 years.	A	N	(P)
8. Examine patients aged 5-15 years suspected of having acute rheumatic fever.	(A)	(N)	P
9. Examine patients who have already had an acute attack of rheumatic fever previously and/or are suffering from from chronic rheumatic cardiopathy and suspected of a new attack.	(A)	(N)	P
10. Prescribe eliminatory treatment for patients with a diagnosis of acute rheumatic fever (or in highly suspect cases, in which diagnostic confirmation is delayed or difficult).	(A)	(N)	P

*Where brackets are used, the choice of the type of staff to carry out the activity in question will depend on circumstances.

11. Send cases suspected of ARF for diagnostic confirmation and treatment to a suitable institution (hospital).	(A)	(N)	P
12. Give guidance on the need for rest and the indications for anti-inflammation treatment in the case of patients presenting only polyarthritis or mild carditis (when it is impossible to send them to a specialized centre).	(A)	(N)	P
13. Send to the specialist, hospital or specialized centre, any case of moderate or serious carditis or patients being followed up on suspicion of possible complications or in whom the condition is evolving unfavourably.	(A)	(N)	P
14. Send to the specialist or the specialized centre, for clarification diagnosis or determination of susceptibility, any patients with a history giving grounds for suspicion that an acute attack of rheumatic fever has occurred in the past with or without cardiac sequelae.	(A)	(N)	P
15. Apply secondary preventive measures to susceptible patients although some time after the acute attack (when indications for doing so have been reported by the specialist).	A	N	P
16. Check on the application of secondary preventive measures and seek out those who are not carrying them out.	A	N	(P)
17. Record cases of streptococcal sore throat and acute rheumatic fever.	(A)	(N)	P

C. Intermediate level

When the department responsible for the intermediate level also functions at primary level in that it is directly responsible for a particular population area, in addition to the activities mentioned below, all items in Section B should be carried out.

1. Carry out laboratory examinations to determine whether reactions denoting the acute phase or recent Group A streptococcal infection are present.

2. Take chest X-rays and electrocardiograms.

3. Treat in hospital cases of acute rheumatic fever, particularly those accompanied by moderate or serious carditis or by complications.

4. Send to the most complex level of care cases that have not been elucidated, that are difficult to resolve or that need more elaborate forms of treatment.

5. Support all the activities at primary level.

D. Level of maximum complexity

When possible, all the activities of the two previous levels will be included.

1. Find a definite solution to the problems not resolved at the other two levels, including heart catheterization and heart surgery.
2. Train staff to work at various levels.
3. Take part in clinical, nosological and epidemiological research.

E. Community level

1. Cooperate in spreading information on the risks of streptococcal sore throat and rheumatic fever and the need to make use of health resources.
2. Make known the place where health centres are situated and the extent of their facilities.
3. Wherever necessary, facilitate for necessitous persons to have access to the services.
4. Provide the various levels with information on the implementation of the health programmes and their degree to which they are adapted to community needs.

Programming and supervision schedule for primary level

Programming

The bulk of activities for the primary prevention of rheumatic fever are carried out in the peripheral services of the health system, where the staff with the task of meeting the people's requirements must be capable of detecting, treating, and recording cases suspected of being streptococcal sore throat. Furthermore, in some cases, they may have to be able to detect cases suspected of being acute rheumatic fever. It will be the task of the health staff in the peripheral units, together with the supervisor, to programme the activities to be carried out and the resources needed to carry them out, i.e. manpower (working hours) and material resources (medicaments, instruments, etc.) on the basis, wherever possible, of previous local experience. The details will be given later.

Even when programming is precise and detailed, it will result merely in a document which in itself will produce no change in the health situation if it is not given constantly practical effect by means of periodic supervisory visits. It is therefore necessary that it should be at the most peripheral level in the system.

With this in view, programming schedules have been simplified by eliminating intermediate calculations and leaving in only the most elementary.

It is hoped that when programming and supervisory tasks are being carried out, a mutual understanding will be established between the operational staff at primary level and the supervisor and that as a consequence, the work will be carried out along lines that make numerical evaluation of the results achieved easily.

During the periodical supervisory visits, the values previously estimated can be adapted to local situations; otherwise this could wait until the end of the programme period, which is generally one year. It will also be possible at the end of the programme period to weigh up the results obtained locally and compare them with those achieved by other establishments operating under similar conditions.

When the supervisor who instructs the primary level staff (nurse and/or auxiliary) prepares the components of his programme, he will be able to base them on the concepts described below.

Primary health care staff (nurses and/or auxiliaries), duly trained in the prevention of rheumatic fever, in places where there is no permanent physician or laboratory, must carry out primary prevention, the management of acute rheumatic fever cases and secondary prevention.

Details of these activities are given below that supplement the data given under previous heading B.

Primary prevention

Detection of streptococcal sore throat among patients who seek advice because they suffer from an infection of the upper respiratory tract; prescription and application of eliminatory treatment in patients and their symptomatic contacts suspected of being infected with streptococci.

	Activity
-- Examination of patients with an infection of the upper respiratory tract	B-2
-- Diagnosis of probable streptococcal sore throat	B-3
-- Prescription and application of the eliminatory treatment	B-4,5
-- Seeking out and examining symptomatic contacts	B-7
-- Diagnosis of probable streptococcal sore throat in contacts	B-3
-- Prescription and application of eliminatory treatment to suspect cases among the contacts	B-4,5

Management of acute rheumatic fever cases

Initital treatment of the acute attack when a physician cannot be consulted within 48 hours.

-- Examination of patients suspected of having acute rheumatic fever	B-8
-- Prescription and application of eliminatory treatment	B-10
-- Prescription of rest and anti-inflammatory treatment (aspirin)	B-12

Secondary prevention

Administration of benzathine penicillin once a month for whom the physician has previously prescribed preventive treatment.

-- Administration of benzathine penicillin once a month to susceptible persons	B-15
-- Determination of whether the monthly preventive injection is being given regularly	B-16
-- Home visits to those who fail to follow the preventive regimen regularly	B-16

On the basis of local experience, an estimate will be made of the extent of the activities needed (consultation, injections, home visits) and the time that should be spent by the staff on each of these activities (hourly "output").

The basic information necessary in each establishment will be the size of the population, the degree of coverage planned and wherever possible the incidence of respiratory infections, streptococcal sore throats and acute rheumatic fever.

If data on the incidence of these conditions are not available at primary level, the theoretical data given in Table 1 can be used as a basis; they refer to a community with a total population of 10,000, including 3,000 aged between 5 and 15 years. This is a so-called "modular" schedule, designed in such a way that by means of simple calculations, these theoretical data can be adapted to the actual size of the population to be covered by the programme.

Origin of the data contained in Table 1 (p. 38)

Table 1 shows in outline form the primary-level activities to be carried out for controlling rheumatic fever in the community. This information can be used as a basis for programming primary units that have no local data available.

The origin of these data will be described later and is based on what was stated in Part I, "Theoretical evolution of streptococcal infection in the community" and Figure 2. This information can be used as a basis for estimating the incidence of certain conditions such as acute infections of the upper respiratory tract, streptococcal sore throats, acute rheumatic fever and chronic rheumatic cardiopathy in a theoretical population.

As a basis for calculating these incidence rates, a population of 30,000 persons with 10,000 young people aged 5-15 years was used and the data given below will refer to that population. Nevertheless, for operational purposes, data for a population of 30,000 persons are not easy to adapt to the real size of the population to be covered by programming and hence at the end of this Section, the procedure followed to prepare the modular schedule in Table 1 will be indicated.

In a theoretical population of 30,000 persons, there will be 10,000 aged between 5 and 15 years and each of them will have on average one infection per annum of the upper respiratory tract (10,000 x 1 = 10,000 infections). One-fifth of these will be streptococcal in origin (10,000 x 0.2 = 2,000 streptococcal sore throats). Under non-epidemic conditions, every 1,000 streptococcal infections may produce three cases of acute rheumatic fever (2,000 x 0.003 = 6 cases of acute rheumatic fever). One-third of these may be left with chronic rheumatic cardiopathy (6 x 0.33 = 2 cases of chronic rheumatic cardiopathy).

In addition to these cases, a further three cases of acute rheumatic fever will be found during the year that have not been preceded by a symptomatic respiratory infection and of these one-third also will have given rise to a residual chronic rheumatic cardiopathy (3 x 0.33 = 1). Moreover, there may be in the population three cases of chronic rheumatic cardiopathy without a known history of an acute attack of rheumatic fever.

To sum up, in a population with 10,000 persons between the ages of 5 and 15 years, there will be 10,000 acute infections of the upper respiratory tract; of these 2,000 will be of streptococcal origin and during the year nine cases of acute rheumatic fever will appear (6 with and 3 without a previous history of sore throat). In the same way, there will be a total of six cases of chronic rheumatic cardiopathy, of which three will have a history of an acute attack of rheumatic fever, while the other three will have no such history.

It is assumed that out of a total number of patients with respiratory infections, only the most serious cases will seek medical care and among these, the probability of streptococcal origin will be greater. If one-fifth of those who suffer from an acute infection of the upper respiratory tract seek advice (10,000 x 0.2 = 2,000 consultations) and if a probable diagnosis of streptococcal infection can be made in those cases (i.e. a maximum of 2,000 streptococcal sore throats), that will be the number of benzathine penicillin injections needed to eliminate the streptococci.

In cases where there is a great probability of streptococcal causation, it will be necessary to seek out symptomatic contacts in the 5-15 age group. If they represented

one-tenth and if of those only half attended the health care unit for examination (0.1 x 0.5 = 2,000 cases, 0.1 x 0.5 x 2,000 = 100 cases), a further 100 consultations would have to be added to the programmed activities. If it is estimated that of these, roughly one-tenth will be cases of probable streptococcal etiology, it will be necessary to administer a benzathine penicillin injection to ten contacts.

Bearing these estimates in mind, primary prevention will require staff (nurses and/or auxiliaries) sufficient to care for 2,000 persons and to administer 2,010 injections of benzathine penicillin. The "output" of staff in relation to the tasks must be estimated in each programming unit on the basis of local conditions. For instance, if 5 patients can be dealt with in one hour (hourly output "O" = 5), by dividing the number of examinations envisaged by the index O, the number of hours necessary for this activity will be obtained: 2,000 ÷ 5 = 400. The necessary materials will consist of 2,010 flasks of benzathine penicillin, ampoules of diluent (distilled water), syringes and disposable needles.

As for the care of the cases of acute rheumatic fever that may arise (9 cases), if all were to come for consultation and there were no physicians available within 48 hours, the nurse or auxiliary in charge would carry out the initial treatment, which would include a presumptive diagnosis, by immediately taking steps to eliminate the streptococci and prescribing rest. If it should prove impossible to obtain supervision by a physician, anti-inflammatory treatment (aspirin) will also be prescribed at a maximum daily dose of eight 0.50g tablets for four weeks. It is estimated that during one year every case of acute rheumatic fever will require a further two consultations. Hence, to care for acute rheumatic fever patients, three consultations per patient will be needed (9 x 3 = 27).

The time needed at the rate of five consultations per hour (O = 5) will be approxmately 5 hours. It will be necessary to provide penicillin, diluent, syringes and disposable needles in sufficient quantity for these consultations i.e. 9 of each item. It will also be necessary to have 0.50g aspirin tablets available, which at the rate of 8 per day for a period of four weeks will amount (for 9 consultations) to 2,016 tablets (8 x 7 x 4 x 9 = 2,016). If a patient should suffer from serious carditis, prednisone would be required in an amount of 3,000 mg.

In regard to secondary prevention, it is calculated that on the average, it would be given during the year to half the new patients (5), to whom must be added those under treatment from previous years (6), making a total of 11 patients who will each be given 12 injections (11 x 12 = 132). The time required for examination and administration of the penicillin at the rate of 5 per hour will be 132 ÷ 5 = 26 hours.

During the year, some patients will fail to attend, and to complete the preventive treatment and will be visited in their homes so that they can be given the injections. The hourly output in the case of home visits is estimated at one (O = 1). If three patients fail to attend, three visits will be necessary, i.e. 3 hours. In total, 30 hours will be taken up (27 for consultations and 3 for home visits) and the following supplies must be provided: flasks of benzathine penicillin; ampoules of diluents; syringes and disposable needles (132 of each item).

To make calculations easier, a modular schedule has been prepared in which the data quoted above have been divided by 3, thus providing an estimate of the activities needed for a total population of 10,000 persons with 3,000 children aged between 5 and 15 years.

A model programming sheet has been designed which will enable every primary care unit to record the data connected with the activities to be programmed and calculate what resources will be necessary to carry them out (see Form 1). (p.48)

The same sheet includes the names of the establishment, the hospital and the region. The size of the population, the degree of coverage planned, the staff involved (in programming local implementation and supervision) the programming period and the dates for preparing the programme and for the supervisory visits envisaged will also have to be recorded. In addition, the elements needed to calculate the activities to be carried out and the resources needed for them in both primary and secondary prevention are included.

On the back of the sheet a few simple hints are given regarding the way to carry out certain necessary calculations. The instructions for filling in the sheet give detailed indications and an explanation of the use that should be made of the various elements needed for carrying out programming calculations.

The programming sheet will have to be filled in at every primary-level establishment by the staff of the establishment in cooperation with the supervisor. The supervisor will have to give thorough study in the first place to the programming sheet and instructions, then to Table 1 with the theoretical data appertaining to the modular example and the explanation of the data in Table 1, in order to be in a position to discuss with the primary-level personnel the way in which the sheet should be filled in.

Instructions for filling in the programming sheet

Note down the data needed to identify the establishment or primary health unit: establishment, hospital area or region.

Section I. The population covered by the programming

Note all the amounts in such a way that if they are less than the number of boxes, zeros are placed on the left in order to fill up all the blanks.

Note the two pieces of information already known: population directly concerned; and programmed coverage (%).

The multiplication factor (MF) is used to calculate the extent of activities. It is unnecessary to calculate it in institutions where local data are available on the extent of activities needed for the programme. In this case, fill in the boxes with XXX. It must be calculated in institutions or units which do not have data available on the extent of activities; to estimate these, use will be made of the theoretical data given in the modular schedule. In this case, the MF will be calculated on the basis of the indications given above. When setting down the figures, it is absolutely essential to place the millions, thousands, hundreds and units in their proper places. Transcribe the figures for: population directly concerned (a); percentage coverage programmed (b).

The coverage index is the percentage coverage transformed into a decimal number. It will be obtained as shown by the arrows by transferring the values from (b) to (c) vertically.

The programmed population is the number of people for whom the necesary activities and resources will be programmed. It is obtained by multiplying the population directly concerned (a) by the coverage index (c). To make further calculations easier, the result will be rounded off to the nearest thousand (from 001 to 500 to the thousand below and from 501 to 999 to the thousand above). For example:

Population directly concerned	(a)	0 220,400
Programmed coverage	(b)	80%
Coverage index	(c)	0.80

The programmed population is 220,400 x 0.80 = 176,320. This figure is rounded off to the nearest thousand. Since 320 lies between 001 and 500, it will be rounded off to the thousand below and the result entered will be:

Programmed population	(d)	0.176,000

The multiplication factor is an indispensable element for adapting the modular numbers (MN) given in the theoretical model to the size of the programmed population in each particular establishment. It is obtained, as shown by the arrows, by transferring vertically the values in the four boxes to the left of (d) to (e). For example:

Programmed population	(d)	0.176,000
Multiplication factor	(e)	0 17.6

The MF will be used in filling in the "activities" columns in sections IV and V.

Section II. Programming period

Note the dates of beginning and end of the programme period.

Section III. Staff responsible

Note the names of the person in charge of programme and local implementation and of the person in charge of supervision.

Section IV. Primary prevention

This is filled in differently according to whether or not the institution has data available on the extent of the activities to be carried out.

If local data are available leave the MN column blank. Note the extent of the activities envisaged in the box underneath "Activities". To fill in column O (output per hour), viz. the extent of the activities that each member of staff can carry out in one hour, data derived from local experience will be used. If this should prove impossible, the values of O given in the theoretical model will be adopted.

If local data are not available, mark next to the MN column the value given in Table 1 for each activity and next to the O column note also the value given in the Table. With these basic data, it will be possible to calculate the extent of the activities needed. On the basis of the MN and to adapt it to the size of the programmed population, the value MN will be multiplied by MF (the multiplication factor, which has been described in Section 1). The extent of the activities needed will be noted in the box under "Activities". For example:

"Activities"	Consultations and injections	MN	600
	Multiplication factor	MF	17.6

(600 x 17.6 = 10,560 — 10,560 consultations and injections

In every case, whether previous data on the extent of activities are available or not, the extent of resources will be calculated (in staff hours) by dividing the amount of activity by the output index O and noting the result as number of hours in the corresponding box.

For example: "Activities" (consultations and injections) 10,560 ÷ 5 = 2,112 hours

Section V. Secondary prevention

Repeat the steps indicated for primary prevention, doing so on the one hand for "consultations and injections", the result of which will be divided by the O given under "physician, nurse, auxiliary", and on the other hand for "home visits", the result of which will be divided by the O given under "health visitor".

Section VI. The resources needed

This represents a summary of the data in Sections IV and V, to which will be added the estimated quantities of material resources needed (penicillin, diluent, aspirin, prednisone, syringes, needles, etc.).

Section VII. Level of referral

Enter information on the institution (or the professional health worker) to whom special cases will have to be sent for specialist advice and/or treatment. If necessary, the information will be supplemented on the back of the sheet.

Section VIII. Dates of programming and supervision

Enter the date on which programming was done and the dates envisaged for future supervisory visits, indicating also the programming year (1st, 2nd, etc.).

CARRYING OUT THE PROGRAMME

Once the norms have been approved, it is suggested that their dissemination be ensured in the following way:

-- Obtain official approval from the relevant health authorities for the norms adapted to local conditions;

-- Estimate the number of people in the health system who should receive a copy of the norms;

-- Print the number of copies necessary;

-- Prepare a manual giving instructions on the norms for health staff.

For this purpose, a team of rheumatic fever specialists and teaching specialists will meet with a view to preparing teaching materials on the basis of the text of the norms. The group must determine what points in the text should be emphasized during teaching and what points merit explanation or illustration to supplement those given in the norms. Once these points have been determined, a manual will be prepared, containing questions and answers designed for teaching by modules; modules in general will correspond to chapters in the norms;

-- Print the forms corresponding to the teaching handbook;

-- Bring together at national level the persons who will be responsible for disseminating the norms locally, so as to give them information on the programme and train them for supervising teaching at the local level;

-- Ensure that those in charge of supervision distribute the norms together with the handbooks and teaching materials at operational level;

Once the decision has been taken, and in parallel with the work described above, a timetable for carrying out the programme will be drawn up which will:

-- State where within the catchment area of the service the extension of coverage will be launched;

-- Check, within the initial area, the number of inhabitants and the number of children aged 5-15 years on the basis of the census and/or estimates;

-- Check the number of schools, the number of classes and the number of pupils enrolled by the age group;

-- Find out whether there are establishments where overcrowding is rife (hostels, dormitories, etc.);

-- Check the health care establishments in operation;

-- Check on the health resources available in the area; the number and site of primary care clinics, clinics attached to secondary schools, physicians, nurses, other health professionals and auxiliaries;

-- Check on the number of specialists, hospitals (number of paediatric beds and laboratories);

-- Study the reports on outpatient consultations (first visit) and the diagnoses recorded, in order to define the categories among which streptococcal sore throats, rheumatic fever and chronic rheumatic cardiopathy are at present being notified with a view to determining among the existing health resources those establishments (e.g. outpatient clinics in paediatric emergency departments) that will be most likely to receive children suffering from sore throat and rheumatic fever and ensuring coordination with the programme;

-- Compare and bring into line the number of available health resources with those suggested for the plan of implementation, adapted to the number of inhabitants selected for the extension of coverage being launched; the basis used should be the averages suggested in this publication or those available locally.

-- Provide any supplementary data shown to be necessary by this exercise;

-- Present the programme to the health staff and the heads of schools in the zone;

-- Define the functions of each person and institution or service involved in the programme;

-- Give teachers information on streptococcal sore throat, rheumatic fever and chronic rheumatic cardiopathy for inforporation in the health education plans; give similar information to parents' associations, welfare establishments and mass media for dissemination among the public. The points that should be emphasized are:

-- Every child between 5 and 15 years of age with recent soreness of the throat and a high temperature should be examined. The disease may be caused by a microbe and lead to serious complications. There is a simple and completely effective treatment that will cure the patient and prevent transmisson of the microbe to other persons, thus preventing the onset of new cases;

-- Every child aged between 5 and 15 years with a high temperature that has lasted for more than 5 days and who is suffering from joint pains or swelling or involuntary movements of the arms and head (St. Vitus' dance) should be examined. These symptoms may be those of acute rheumatic fever with the possiblity of damage to the heart;

-- Every child aged 5-15 years who has or has had such clinical symptoms and in whom the physician has diagnosed rheumatic fever, even when at the moment free from any symptom, is liable to a recurrence of the illness, this can be avoided if the patient remains under supervision and follows a simple treatment which is completely effective.

NB If treatment is free of charge, that point should be emphasized.

-- Draw up timetables for implementing the programme in cooperation with the central and local authorities. The timetables should comprise a preliminary stage and initially cover a limited area with a view to trying out the operational system and making any adjustments necessary;

-- Periodically (every quarter or every six months), the activities carried out should be adjusted by comparing them with the activities programmed, so that the material resources of the working centres can be adapted to the real necessities;

-- Once the programme has been carried out in the initial area, coverage can be extended at national level, depending on the availability of resources and the training of staff;

-- It is essential to set up a simple system of epidemiological surveillance (or to include one in an existing system) for the following three diagnoses: probable streptococcal sore throat; active rheumatic fever; and chronic rheumatic cardiopathy.

-- For each of these diagnoses a description has been prepared which makes it possible to identify and notify these conditions at all levels (see Operational Handbook).

-- Because of the sometimes epidemic nature of streptococcal sore throat, it is recommended that in places with a population of 20,000 and more, notification of these diseases should be weekly. In the case of the other conditions and/or in places with fewer than 20,000 inhabitants, notification can be monthly.

-- Once launched, the programme should be subjected to short-term evaluation, initially based on determining the extent of coverage achieved. Long-term evaluation will be based on the reduction in the number of acute rheumatic fever and chronic rheumatic cardiopathy cases notified.

Supervision

Once programming has been completed, the necessary resources obtained and local staff trained, a beginning will be made on activities at institutional level. To ensure continuous implementation of the programme and to keep up the quality of the activities involved, it is essential to carry out periodic supervisory visits to the establishment; these visits will be made quarterly and will be designed to solve the physical and technical problems encountered while the activities were being carried out. To ensure uniformity in supervision, a specific form will be used (Form No. 2).

Maintenance of the programme

Implementation of the programme norms along the lines given above will of necessity take a long time. The activities programmed at establishment level must be supervised at the intermediate level. The main purposes of such supervision are:

-- To make sure that the programmed activities are being carried out;

-- To determine any factors that might be hindering them; and

-- To propose solutions for eliminating any shortcoming detected.

During the supervisory visit, the person carrying out the activities and the supervisor will hold discussions that will make it possible:

-- To adapt the operational norms to local conditions;

-- To determine the level of knowledge of the local staff;

-- To discuss possible epidemiological problems (distribution of cases, sporadic outbreaks); and

-- To detect and solve administrative problems.

As supervision is developed, the weak points in the local staff's knowledge of the programme activities will be detected. The supervisor will note them down and discuss them with the staff at the end of his visit. If they are few and not serious, verbal rectifications may be sufficient. In the contrary case, the supervisor must be capable of presenting and discussing the elements in the training manual on the norms that relate to the situation encountered.

Supervision should be periodical: quarterly at the beginning of the programme. Afterwards, it can be carried out every four or six months. The supervisory visits should be planned beforehand with the staff supervised and must never be in the nature of a "surprise". The results of supervision should be recorded in a special form filled in in duplicate, with one copy for the supervisor and the other for the person in charge of implementation. This form can be used as a starting point for the next supervision.

As the process of programming at local level implies gradual adaptation of the mean parameters to conditions in the establishment concerned, every supervisory and educational visit should end with reprogramming the establishment's activities for the period up to the next supervisory visit. This type of coordination makes it possible to solve administrative problems, such as those connected with the availability of staff and medicaments, before they threaten the continuity of the programme. Furthermore, it brings the person responsible for implementing the programme into personal contact with his supervisor and establishes an accord between them which will ensure better continuity in the activities programmed.

Instructions for filling in the supervision form

-- Give the name of the establishment

-- Enter the day, month and year when the supervision will take place.

-- Enter the population covered by the programme in thousands from the Programming sheet (Form 1). Name the person in charge of the programme in the establishment and his supervisor.

-- State whether the initial programme sheet and the form which was filled in during the previous supervisory visit, are available.

-- State in figures what was programmed for the period and what was actually carried out. Any discrepancy encountered should be entered in the relevant column.

-- Compare in the next item the resources, staff and medicaments envisaged in the programme with what was actually used during the period.

-- When the review and discussions have come to an end, state where applicable the reasons for which the programme encountered difficulties during the period covered by the supervision.

-- Enter in the last table the measures discussed and agreed upon jointly and, as they are gradually put into effect, enter the results in the relevant column.

-- The supervisor and the person supervised should sign the supervision sheet in duplicate. One copy is for the establishment archives and the other for the supervisor, who will pass it on to the relevant level (generally the hospital or sometimes the Region).

DIFFERENTIAL DIAGNOSIS OF ACUTE RHEUMATIC FEVER

A. Differentiate streptococcal sore throat from:

Suppurative tonsillitis caused by staphylococci or mixed infection
Vincent's angina
Diphtheritic sore throat
Viral pharyngitis
Mononucleosis

B. Differentiate acute rheumatic fever from:

Sickle-cell anaemia
Gonococcal arthritis
Yersinia arthritis
Juvenile rheumatoid arthritis
Septic arthritis
Viral carditis
Huntington's chorea
Bacterial endocarditis
Serum sickness
Viral hepatitis
Leukaemia
Lupus erythematosus
Meningococcal meningitis
Arterial myxoma
Osteomyelitis
Non-specific pericarditis
German measles
Septicaemia
Reiter's syndrome
Tuberculosis

C. Differentiate chronic rheumatic cardiopathy from:

Physiological cardiac souffle
Congestive cardiomyopathy
Hypertrophic cardiomyopathy with or without mitral failure
Congenital cardiopathy:
- Interventricular communication with aortic insufficiency
- Partial defect of the atrio-ventricular canal
- Valvular, sub-valvular or supra valvular aortic stenosis
- Mitral insufficiency
- Bicuspid aortic valve

Prolapsed mitral valve
Sequelae of myocarditis
Valvular sequelae of endocarditis

PART III: ADDITIONAL CONSIDERATIONS ON PRIMARY AND SECONDARY PREVENTION

PRIMARY PREVENTION OF RHEUMATIC FEVER

Diagnosis and eradication of streptococcal infections of the upper respiratory tract.

Streptococcal infection

Infections of the upper respiratory tract caused by group A beta-haemolytic streptococci represent the initial focus in which the chain of events that will end in a case of rheumatic fever has its origin (see Fig. 1).

In this first stage of the disease, a certain clinical diagnosis can be made only when pharyngitis is present with the typical clinical features of scarlet fever.

In all other circumstances a definitive diagnosis can be based only on cultivation of pharyngeal exudate or later by finding an increase in serum antibody levels. As these means of diagnosis are not available at the primary care level, it will be extremely useful to possess a set of practical guidelines indicating more or less reliably when a clinical diagnosis of streptococcal infection of the upper respiratory tract is called for.

It must be remembered that a single culture of pharyngeal exudate may give negative results even when infection is present, and that when faced with a typical picture of streptococcal sore throat, it will be necessary to carry out repeated cultures before being sure that the infection is not streptococcal, in which case it is often more effective to treat these patients with penicillin without making cultures or waiting for the results of those already made.*

The clinical manifestations of acute infections of the upper respiratory tract combined with soreness in the throat may be classified in two categories (as explained in detail in the Operational Handbook for Primary Level Care):

(a) Characteristic symptoms: an exudate in the throat, elarged and tender anterior cervical lymph glands, a temperature above 38°C and erosion of the edges of the nostrils with scabbing. When these symptoms are present, it is extremely probable that the infection is of streptococcal origin; and

(b) Uncharacteristic are the occurrence of cold, cough, tracheitis or conjunctivitis, which add up to a probable diagnosis of a viral infection and make it improbable that streptococci are the cause. These cases will have to be given only symptomatic treatment.

Treatment to eliminate streptococcal infections (Table 2).

To achieve primary prevention of rheumatic fever, i.e. prevention of the initial attack, treatment must be given that will eliminate the streptococcal infection before those pathogenic mechanisms are triggered off that lead to an acute rheumatic fever attack. Treatment must therefore be early and in any case should begin no more than nine days after the onset of the clinical illness.

To eliminate group A beta-haemolytic streptococci, it is essential to achieve bactericidal blood concentrations of the antimicrobial agent used for a period of at least 10 days. This can be ensured by a single intra-muscular injection of benzathine penicillin in the dosages given below:

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*Peter, G. and Smith, A.L. Group A streptococcal infection of the skin and pharynx (Part II of a two-part article). N. Eng. J. Med. 297 (7): 365-370, 1977.

Drug of choice:	Benzathine penicillin in a single intramuscular injection;
Recommended dose*:	Under 6 years of age - 600,000 U; 6 years and above - 1,200,000 U;
Drug of second choice:	Erythromycin, by mouth. This will be used only when there is a known history of allergy, hypersensitivity or intolerance in regard to penicillin. In these cases, a strict watch must be kept on the carrying-out of oral treatment with erythromycin, keeping to the doses, frequency and length of time indicated.
Recommended dose:	Daily dose for children under 12 years of age: 20 mg/kg of body weight, one quarter of the dose being given every six hours (four times a day). The course of treatment lasts 10 days. Daily dose for persons aged 12 years or above: 1,000 mg, a quarter dose (250 mg) being given every six hours (four times a day); the course lasts 10 days.

Use should not be made of tetracycline, chloramphenicol or other antibiotics, save in extremely exceptional cases with undoubted evidence of allergy to, or intolerance of, penicillin and erythromycin.

Diagnosis and treatment of acute rheumatic fever

Diagnosis

Jones' criteria (modified) are still the best guide for diagnosis, which is basically clinical, of rheumatic fever (see Operational Handbook).

As a guide to treatment, the following classification is recommended:

(a) without carditis; (b) with mild carditis (with cardiomegaly); (c) with moderate carditis (with cardiomegaly but without cardiac insufficiency); and (d) with serious carditis (accompanied by cardiac insuffiency).

Treatment (Table 3)

The main elements in treatment are the same whatever the circumstances. The duration of the course of treatment, the doses and the type of anti-inflammatory drugs chosen will vary from case to case.

A. Rest (See General guide to the period of rest required - in tables at end of text)

B. Treatment to eliminate the streptococcal infection

The drug of first choice is penicillin in a single intramuscular injection of 600,000 U for those under six years of age and for 1,200,000 for the rest, as has already been stated.

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*The antibiotic doses given on this page (see also Table 2) (benzathine penicillin: 600,000 U for children less than 6 years of age, and erythromycin: 125 mg four times a day for children less than 6 years of age) differs from the recommendations of the Committee on Prevention of Rheumatic Fever of the American Heart Association. The AHA Committee wrote the recommendations for the American Heart Association in 1977, using 60 pounds (appx. 27 kg) as the dividing dose for penicillin (600,000 U for less than 60 pounds, and 12,000,000 U for over 60 pounds) and used 40 mg/kg/day for erythromycin. The American Academy of Pediatrics recommends the same doses. In view of the increasing numberss of treatment failures which have been demonstrated in the last few years (e.g. Kaplan et al. Journal of Laboratory and Clinical Medicine, 98:326, 1981), the larger dose is favoured.

C. Treatment against inflammation

Aspirin. This is used in cases without carditis or with mild carditis. Dose: 100mg/kg/day administered in four partial doses, one every six hours.

Aspirin must be administered with sufficient fluid (one glass) to ensure its dilution and always after meals. In the case of gastric diseases, it is administered together with an antacid (except for bicarbonate of soda which must not be used). The usual length of treatment is approximately 2-4 weeks.

Steroids: These are used in cases of moderate or serious carditis or if the condition develops unfavourably when aspirin alone is used. The possibility of tuberculosis being re-activated must be borne in mind. For that reason, every case must be considered individually.

Dose: Initially 1.5-2 mg/kg/day, without exceeding 60 mg/day of prednisone.

Minimum treatment time: One week. In general, treatment time is about two weeks. Following this, the dose is gradually reduced. A reduction of 2.5 mg in the daily dose should be made every 3 days until a daily dose of 10 mg is reached. This dose should be maintained for one or two weeks and then gradually reduced until it can be left off altogether. The daily dose can be administered in fractional doses or in a single dose in the morning, at the discretion of the treating physician. Aspirin should be given in association with it during the last two weeks (100 mg/kg/day).

D. Ending the absolute rest period and beginning the reduction in doses of anti-inflammatory agents

Before this can be done, the following criteria must be met:

1. Normal temperature
2. Absence of joint symptoms and signs.
3. Absence of tachycardia at rest.
4. Absence of signs of cardiac insufficency.
5. Disappearance, reduction and/or stabilization of cardiac souffles or of changes in heart sounds.
6. In teleradiography of the thorax: a return to normal or stabilization of the dimensions of the heart shadow.
7. Erythrocyte sedimentation rate less than 25 mm.
8. C - reactive protein negative.
9. Return to normal or stabilization of the PR interval on the electrocardiogram.

For a general guide to the length of the rest period, see table at end of text.

SECONDARY PREVENTION OF RHEUMATIC FEVER

Recommended chemotherapeutic methods (Table 4)

Before any prolonged chemotherapeutic schedule is begun, the patient must be given treatment to eliminate group A beta-haemolytic streptococci (BHA). A bacteriostatic level against BHA steptococci must be permanently maintained during the whole treatment schedule.

Drug of choice:	Intramuscular benzathine penicillin
Individual choice:	Under 6 years of age: 600,000 U
6 years and over:	1,200,000 U
Frequency of injections:	Once every four weeks
Drug of second choice:	Sulphadiazine by mouth

This should be used only when the patient suffers from penicillin allergy or intolerance.

Recommended dose:	0.5g (1 tablet) per day for persons weighing less than 30 kg; 1g (2 tablets) per day for those over that weight.

Duration of preventive treatment

Patients who are not suffering from chronic rheumatic cardiopathy and have only had an attack of acute rheumatic fever should be kept on this preventive regimen for five consecutive years or until they are 16 years of age (whichever is longer). Patients suffering from chronic rheumatic cardiopathy, including those who have undergone cadiovascular surgery, will be kept on the preventive regimen throughout their lives.

Duration of the programme for preventing relapses

The minimum duration of the programme for patients without rheumatic cardiopathy is five years after the last attack or until they have reached 16 years of age (see Figure 3). Of these two periods, select the longer, i.e. a patient who reaches 16 years of age without 5 years having elapsed since the last attack must continue under this regimen until the five years have passed and a patient who has not had an attack for five years but has not reached 16 years of age must continue the preventive regimen until he has reached that age.

In patients with rheumatic cardiopathy, the preventive treatment must be lifelong. Obviously, patients who have undergone heart surgery will be included, since the treatment will also serve to prevent bacteria endocarditis.

CONSIDERATIONS ON CENTRES WHERE MORE COMPLEX CARE IS AVAILABLE

In almost all the countries of Latin America, there are vertically structured cardiological centres, many of which bear comparison with the most developed medical centres in the world.

The solution of the rheumatic fever problem is not to develop high technology with a view to trying to salvage a few extremely serious cases, but to act on a wide scale in order to encourage protection of the largest possible number of persons so as to avoid the illness.

If this objective is achieved, as the number of cases of valve lesions gradually diminishes, the specialized centres will be able to devote their efforts to other more necessary activities.

While many cases of chronic rheumatic cardiopathy still exist, the specialized centres will play today a very important support role and it will merely be necessary to ensure coordination with intermediate centres and primary care clinics, which will refer the cases that require specialized examination.

As a general rule, the specialized centres provide very good treatment for their patients. Nevertheless, when an attempt is made to review the clinical record cards, in a large number of cases, the most important data cannot be obtained because those available appear to be incomplete.

In services which deal with a large number of chronic rheumatic cardiopathy, it is suggested that the records be kept in a uniform manner, so that a standard form will have to be made available for use in every case.

There must also be continuous monitoring of patient follow-up. Two forms are given, one for initial registration and the other for follow-up. These have been used by the collaborative study group under the auspices of PAHO. They can be used as they are or could be modified to suit each case.

The specialized centres, apart from devising better ways of treating the more difficult cases and in addition to their research efforts, should also be asked to cooperate in training the staff needed for primary care clinics and to provide clinical and laboratory support for less specialized centres.

The highly qualified health system will be able to make a decisive contribution by laying down standards and supervising health activities and will also be able to study more rational working systems to make an extension of coverage possible.

Finally, it is suggested that the specialized centres should not devote themselves exclusively to rheumatic fever, but should try to act more as preventive cardiology centres, providing care at least for people with high blood pressure; this would produce a higher demand for services and justify the carrying-out of programmes at this level. In addition, they would be ready for the reduction in the number of heart patients resulting from the programmes for preventing rheumatic fever.

PART IV

OPERATIONAL HANDBOOK FOR PRIMARY LEVEL CARE

PREVENTION AND CONTROL OF RHEUMATIC FEVER

(Operational Handbook for Centres without a laboratory)

At this operational level, activities can be divided into 3 broad categories:

1. Detection and treatment of streptococcal sore throat.
2. Treatment of suspected cases of acute rheumatic fever.
3. Guidance on the prevention of recurrences of rheumatic fever.

Streptococcal sore throat

This condition is more frequent in pre-school and school-age children and in some cases is complicated by rheumatic fever, which in its turn may cause heart damage.

Patients come to the hospital services with acute infections of the upper respiratory tract, which can be subdivided into two broad groups: the typical cases which must be considered as streptococcal, and the non-streptococcal infections.

It is important in all typical cases to examine symptomatic family contacts aged 5-15 years as a source of new cases of streptococcal sore throat.

Criteria for classifying acute infections of the upper respiratory tract and diagnosing streptococcal sore throat - Clinical manifestations in sore throat

A. Characteristic of streptococcal sore throat	B. Not characteristic
Temperature over 38°	Cough
Soreness of the throat, acute at outset	Hoarseness
Tenderness of the anterior cervical lymph nodes	Watery nasal secretion (as in common cold)
Redness (hyperaemia) of the pharynx	Conjunctivitis
Exudate	
Petechiae on the palate	
Scabby erosions on the edges of the nostrils	
Scarlatina	

The recent onset of at least 5 of the characteristic manifestations but none of the non-characteristic manifestations makes a clinical diagnosis of streptococcal angina very probably correct.

The simultaneous presence of some non-characteristic manifestations or the absence of some of the first characteristic manifestations makes a diagnosis of streptococcal sore throat doubtful or improbable (see differential diagnoses from acute rheumatic fever).

Management of a case of possible streptococcal sore throat (Figure 4)

Every child aged 5-15 years with an acute infection of the upper respiratory tract should be sent for consultation either to a physician or to a nurse (or trained auxiliary).

On the basis of the criteria already mentioned, the case will be classified as typical or atypical. If it is atypical, it will not be treated. If it is typical, it will be treated as if it were of streptococcal origin and the patient will be asked to name symptomatic contacts between 5 and 15 years of age.

Before treating the patient, it is essential to check whether he has reacted to penicillin when it has been administered previously. In most cases, there will have been no reactions. The treatment indicated is intramuscular injection of a single dose of 1,200,000 U benzathine penicillin (see recommendations on administration of benzathine penicillin below). The rare cases which have had previous reactions to penicillin or which are allergic will be referred to a physician so as to select the treatment best suited for each particular case.

Data on health education should be sent both to patients and to members of their family (see procedure to be followed after a consultation for streptococcal sore throat).

Recommendations for administration of benzathine penicillin

The best place to inject the penicillin is in the outer upper quadrant of the gluteal region.

A 5 ml syringe should be used (disposable or not). The needle should be of 0.8 mm size (30 x 8 or 25 x 8).

The injection should be given by properly trained staff.

Procedure for preparing the injection

Preparation of the benzathine penicillin: Prepare the container, remove the metal cap and apply antiseptic to the rubber stopper. Then put the needle in the syringe.

If the penicillin is not already diluted, open the ampoule of distilled water, draw out the contents and inject them into the container of penicillin.

Withdraw the needle from the container, shake the container vigorously several times to homogenize the penicillin dilution. Place the patient in the proper position for injection and apply antiseptic to the skin. Introduce the needle into the container of dilute penicillin. Inject 2 ml of air and draw off the penicillin solution. Expel the rest of air from syringe. If possible change the needle. If this is not possible, make sure that it is not obstructed by releasing a small quantity of the penicillin.

The injection: Tauten the skin in the place where the injection is to be given. Push in the needle as deeply as possible and before depressing the plunger, draw out some liquid to avoid injecting the penicillin into a blood vessel, then inject the penicillin slowly but vigorously.

Withdraw the needle and put a cotton compress soaked in alcohol over the site of the injection.

Procedure to be followed after a consultation for streptococcal sore throat

Guidance must be given to the patient and members of his family on the disease, its infectiousness, the need for treatment and the assistance that will be received from the health service.

The patient and the members of his family accompanying him should be asked what they think of the soreness of the throat.

It is essential to explain the danger of streptococcal sore throat for the patient, the possibility of cardiac and renal damage and the risk of infecting other persons.

Explain that with a single injection, the patient will be cured of his sore throat and will thereby avoid all the risks mentioned above. Ask him to send to the centre all the symptomatic contacts in the same age group residing in the house and check whether there are cases of rheumatic fever in the family.

In the same way, check the number of persons aged 5-15 years living with the patient. If any of them have similar symptoms (sore throat), ask them to come to the centre.

It is essential to find out whether any member of the family has had rheumatic fever in the past or, if he is young, whether he has any cardiac lesion. If so, ask him whether he is undergoing preventive treatment and request his attendance at the centre for examination, since he runs a higher risk of a new attack of rheumatic fever if he contracts a streptococcal infection.

Acute rheumatic fever

Most patients are children of school age or young people suffering from their first attack of rheumatic fever following a streptococcal infection, or they may also be children or adolescents who are having relapses of rheumatic fever, possibly because they have not complied with the procedure for secondary prevention.

Many conditions that appear at these ages may be mistaken for rheumatic fever so that the patient must be examined by a physician, although it is not essential that the physician should be a specialist.

Jones' criteria for diagnosing acute rheumatic fever

Major manifestations	Minor manifestations
Polyarthritis	High temperature
Carditis	Joint pain
Chorea	History of previous rheumatic fever and/or presence of chronic rheumatic cardiopathy.
Subcutaneous lymph nodes	Changes in the "acute phase reactions" as found by supplementary examinations.
Erythema marginatum	

Where two major or one major and one minor manifestation are present together with evidence of recent streptococcal infection, a diagnosis of acute rheumatic fever is very probably correct.

N.B. When chorea is present, this by itself will suffice for diagnosis so that there will be no need for several minor manifestations to be present or to check whether there has been recent streptococcal infection. No account should be taken of joint pain as a minor manifestation, if polyarthritis is the only major manifestation (see Differential diagnoses from acute rheumatic fever).

Procedure to be followed (Figure 5)

If the patient is a child aged between 5 and 15 years who is suffering from joint pain and high temperature, send him to the physician as soon as possible. If no physician is available, make the patient rest and carry out the eliminatory treatment if he has not suffered from allergy.

The physician should examine the patient before 48 hours have elapsed and check whether he presents the symptoms mentioned in the Jones diagnostic criteria. If he does not, he should be kept under observation for two weeks and then discharged if the diagnosis cannot be established within that period. If the Jones criteria are fulfilled, the physician will check whether the streptoccal infection has been treated and will classify the case.

Classification of the case

If the patient is not suffering from carditis, he can be treated by a general practitioner, but wherever possible, he should be admitted to hospital as an in-patient for confirmation of the diagnosis and the beginning of treatment (rest, aspirin), without forgetting that secondary treatment must be begun and must be continuous so as to prevent relapses. If the patient has carditis, he must always be admitted to hospital as an in-patient.

SECONDARY PREVENTION OF RHEUMATIC FEVER OR PREVENTION OF RECURRENCES

Secondary prevention will be prescribed for rheumatic fever patients of all ages, but more frequently in school children and young adults who have had one or more attacks of rheumatic fever.

Some will not have a heart problem, while others will have valve lesions. They are all exposed to the risk of a new attack if they do not carry out the prevention procedures carefully. Furthermore, the heart impairment may worsen with time.

All the patients must be examined by the physician who will order the beginning of prevention. A nurse or auxiliary will be able to continue the measures so long as the evolution of the disease remains stable.

Whenever a new acute attack of rheumatic fever is suspected, the steps will be taken that are described in "Procedure to be followed after a consultation in cases where patient have had ARF and/or have CRC".

Whenever it is suspected that the heart impairment is becoming worse as a result of the onset of fatigue or other symptoms the patients will be sent again to the physician.

The following paragraph describes the official classification proposed by the New York Heart Association, which makes it possible to categorize the patients according to the importance of the heart problem. So long as the case does not change category, the same medical guidance given as before can be followed.

Functional classification

Class I. Patient with cardiopathy but with "no limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnoea, or anginal pain".

Class II. Patients with cardiopathy that results in a "slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in fatigue, palpitation, dyspnoea or anginal pain".

Class III. Patients with cardiopathy that leads to "marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes fatigue, palpitation, dyspnoea or anginal pain".

Class IV. Patients with cardiopathy that makes them "unable to carry on any physical activity without discomfort. Symptoms of cardiac insufficiency or of the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort is increased".

Procedure to be followed for secondary prevention. (Figure 3).

Patients who have had one or more acute attack of rheumatic fever in the past, with or without present chronic rheumatic cardiopathy, will be brought into the secondary prevention programme on instructions from the physician.

The first essential is to check whether they are hypersensitive to penicillin.

Those not hypersensitive to penicillin will be given a monthly preventive dose of 1,200,000 U of benzathine penicillin by the intramuscular route.

Those who are hypersensitive, but not undergoing a preventive regimen will have to be given initially an eliminatory course of treatment with erythromycin by mouth for ten days: 125 mg four times a day for those under 6 years and 250 mg four times a day for older patients.

Later they will be given oral sulfadiazine daily in a single dose (0.5g for those weighing less than 30 kg and 1.0 g for those weighing 30 kg or more).

During the preventive regimen, it is again necessary to separate the cases into two groups depending on whether they have cardiac lesions or not and whether they have suffered more than one acute attack of rheumatic fever.

Patients who are not suffering from CRC and who have not had more than one acute attack will follow the same treatment schedule for five years until they are over 16 years of age.

When they have fulfilled these two requirements, i.e. that they should be 16 years of age or over and that five years or more should have elapsed since the last acute attack, prevention will be suspended and they will be kept under surveillance.

The preventive regimen will continue throughout life for those with cardiac lesions, but care must be taken to ensure that the condition remains stable. If symptoms of fatigue appear and if there is a change of functional category, the persons concerned will again be sent to the physician for examination.

Procedure to be followed after a consultation in cases where patients have had ARF and/or have CRC

Inform the patient and members of his family about the disease, the risk of fresh streptococcal infections and recurrences of rheumatic fever, the need to carry out secondary prevention and to watch the evolution of the disease, and the facilities that will be provided by the health services.

Check what knowledge the patient and his family possess concerning streptococcal infection, rheumatic fever, relapses and residual heart lesions and find out whether they have understood the physician's explanations.

Inform the patient (or strengthen his knowledge) of the protection afforded by secondary prevention and of the impossibility of knowing when he will be in contact with streptococci. Tell him that for this reason, it is essential to carry out the preventive measures, since they will then prevent the onset or worsening of heart lesions.

Inform the patient of the time and place of attendance for injections and tell him what he should do if he cannot attend on the appointed day. Inform him of the other recommendations made: rest, symptoms that must be watched for, other medicaments, etc.

Inform him of the need to come back before the date set for the consultation if he should have a prolonged rise in temperature, a soreness of the throat, joint symptoms or others which could be attributed to heart impairment or if a reaction to a medicament should be suspected.

Explain why he should come for consultation to the hospital, the specialist or the specialized centre when the physician so recommends, and should then return to his place of origin, where the results will be sent.

Keep an up-to-date record of the patient's address so that he can be contacted in the case of need.

Keep a record of attendance for consultations and, where applicable, for preventive measures.

Record every new case seen so that it can be notified.

Steps to be taken in regard to patients who do not attend for consultation

It is recommended that the patient be sought out in his home: (i) when six months have not elapsed since the beginning of the acute attack and within a week at most of the attendance that he has missed, or (ii) when six months or more have elapsed and within a month of a missed appointment.

Efforts must be made to determine why he has not attended for consultation and to solve the problem:

(a) before the visit, the records on the patient and his family should be carefully reviewed;

(b) if necessary a talk should be arranged with the physician or the nurse supervising the prevention programme;

(c) a visit should be made to the family and information obtained on the state of health of the patient and his reasons for non-attendance;

(d) it should be ascertained whether the family and the patient are concerned by the failure to attend;

(e) a discussion should be held with the family and with the patient with a view to eliminating the reasons for non-attendance.

Guidance will be given to the family and the patient regarding the problem and the need to continue treatment and prophylaxis.

An attempt will be made to hold the family responsible for carrying out the treatment. The patient will be invited to return and submit to treatment.

The home visit will be recorded on the patient's clinical record together with notes on the conclusions drawn from the visit and the new date of appointment.

PART V

DEFINITION OF TERMS

Coverage

The proportion of the total population or of the subgroup covered by a programme and which really receive the benefits from the activities planned and implemented. It should be noted that a service may have a high attendance but low coverage.

Scarlatina

An infrequent disease which in addition to the symptoms of streptococcal sore throat comprises a cutaneous eruption, particularly on the throat, chest, axillae, elbows and groin and on the inner surface of the thighs. There is no eruption on the face, but the cheeks are red with pale borders. The tongue is usually red, particularly on the edges and the papillae are enlarged and look like strawberries. There is frequently nausea and vomiting.

About two weeks following the onset of the disease, there is sloughing of the skin, mainly at the tips of the fingers and toes. The condition always results from streptococcal infection.

Strategy

The way in which existing resources (technical, material, human or institutional) are used to attain a particular objective.

Hypersenstivity to penicillin

Reactions to penicillin occurring in some persons. Because of this every new patient must be asked whether he has had any reaction previously. Some reactions are quite mild: cutaneous eruption, pruritus, pain at the site of the injection and a slight rise in temperature. More considerable reactions have been reported, but there is almost never a case of hypersensitivity to benzathine penicillin and the condition does not affect children.

A more thorough watch must be kept for patients with a history of multiple hypersensitivity, bronchial asthma or cutaneous skin allergy; nevertheless, symptoms are often attributed to penicillin which have nothing to do with it, such as general malaise, confusion, etc.

Intradermal tests for hypersensitivity are of no value.

Health indicators

These are data indicative of health or health problems converted into terms of frequency capable of being analysed or compared in time and space.

Asymptomatic infection

A condition in which there are no symptoms, but where cultures show positive results and a high antibody level.

Healthy carrier

An individual in whom the pathogenic agent can be found and cultivated, but who does not show any clinical manifestation of infection or any immune response. In the case of streptococcal disease, a healthy carrier is an asymptomatic individual with a positive culture of group A beta-haemolytic streptococci (but with only a few colonies) and without an increase in antibody level.

Programme

A set of elements in an administrative system designed to solve a particular problem through the use of specific resources over a particular period.

Recurrence of rheumatic fever

A fresh acute attack of rheumatic fever in any unprotected susceptible individuals as a result of fresh streptococcal infection. The new attacks usually have the same characteristics as the previous ones in the same individual and the existing valve lesions tend to worsen with each new attack.

If manifestations of the acute phase appear anew less than three months after the previous attack, they should not be attributed to a recurrence, but should rather be considered as a consequence of the previous attack.

Table 1. Modular primary programming schedule for a population of 10,000 persons

Activities and materials	Extent of services "0"	Staff time (Hours)		Material resources
Primary prevention				
Consultation for sore throats and examinations of contacts including injection of benzathine penicillin	600	5	120	
Penicillin and diluent, syringes and disposable needles				120
Management of acute rheumatic fever cases				
Consultations for possible ARF and the eliminatory injection for 1 patient plus 2 additional visits per patient	9	5	2	
Penicillin and diluent, syringes and disposable needles				3
Aspirin (0.50g tablets)[a]				672
Prednisone (mg)				3,000
Secondary prevention				
Care for patients undergoing secondary prevention, including a monthly injection	48	5	10	
Home visits, including an injection	1	1	1	
Penicillin and diluent, syringes and disposable needles				48

Resources	Summary of resources (Activity)			
	Primary prevention	ARF care	Secondary prevention	Total
Manpower (hours)				
Nurse/auxiliary	120	2	10	132
Health visitor				1
				133
Materials				
Penicillin and diluent	600	3	48	651
Aspirin (0.50g tablets)		672		672
Prednisone (mg)[a]		3000		3000
Syringes and disposable needles	600	3	48	651

[a] An indivisible material, the amount necessary for one case.

See page 18 for origin of data contained in this Table.

Table 2. Treatment of typical streptococcal pharyngitis*

Age	Drug of choice	Dose	Frequency	Route of administration	Total needed for treatment
Under 6 years	Benzathine penicillin	600,000 U	Single dose	Intramuscular	1
6 years of age and above	Benzathine penicillin	1,000,000 U	Single dose	Intramuscular	1
		Patients sensitive to penicillin			
Under 6 years of age	Erythromycin	125 mg	Four times a day for 10 days	Oral	40
6 years of age and above	Erythromycin	250 mg	Four times a for 10 days	Oral	40

In no case should sulphonamides be used for eliminating streptocci.

* See also footnote on page 27 concerning dosage.

Table 3. Treatment of acute rheumatic

A. Rest

State of the heart	Absolute rest	Reduced activity	Full activity
No carditis	1-2 weeks	2-6 weeks	After 6th week
Mild carditis	2-4 weeks	2 months	After 3rd month
Moderate carditis	2-3 months	3 months	After 6th month
Serious carditis	3-6 months	6-12 months	After 12-18 months depending on the functional classification

B. Treatment to eliminate the streptococcal infection

Age	Drug of choice	Dose	Frequency	Route of administration	Total needed for treatment
Under 6 years	Benzathine penicillin	600,000 U	Single dose	Intramuscular	1
6 years of age and above	Benzathine penicillin	1,000,000 U	Single dose	Intramuscular	1
		Patients sensitive to penicillin			
Under 6 years of age	Erythromycin	125 mg	Four times a day for 10 days	Oral	40
6 years of age and above	Erythromycin	250 mg	Four times a for 10 days	Oral	40

C. Treatment against inflammation

Condition of patient	Drugs of choice	Dose	Frequency	Route of administration
Without carditis or mild carditis	Aspirin	0.50g up to 8 times/day	4 times a day	Oral
Moderate or serious carditis	Prednisone kg/day to maximum 60 mg/day*	1.5 to 2 mg/	2-3 times a day	Oral

*Prednisone: minimum one week, generally two weeks, followed by progressive reduction (see below "Minimum treatment [illegible]").

Table 4. Secondary prevention of rheumatic fever or preventive relapses

Age	Drugs of choice	Dose	Frequency	Route of administration
Under 6 years of age	Benzathine penicillin	600,000 U	1 injection per month	Intramuscular
6 years and above	Benzathine penicillin	1,200,000 U	1 injection per month	Intramuscular
	Patients sensitive to penicillin			
Under 6 years of age	Sulphadiazine	0.5 g	1 x 0.50 g tablet per day every day	By mouth
6 years and above	Sulphadiazine	1.0 g	2 x 0.50 g tablets per day every day	By mouth

Table 5. Treatment of streptoccal pharyngitis at primary level

Patients	Drug of choice	Dose	Frequency	Route of administration	Total for the course of treatment
	Benzathine penicillin	1,200,000 U	Single dose	Intramuscular	1
Under 12 years	Erythromycin	125 mg	4 times a day for 10 days	By mouth	40
12 years and above	Erythromycin	250 mg	4 times a day for 10 days	By mouth	40

Figure 1. Natural history of rheumatic fever and the points at which a control programme can act

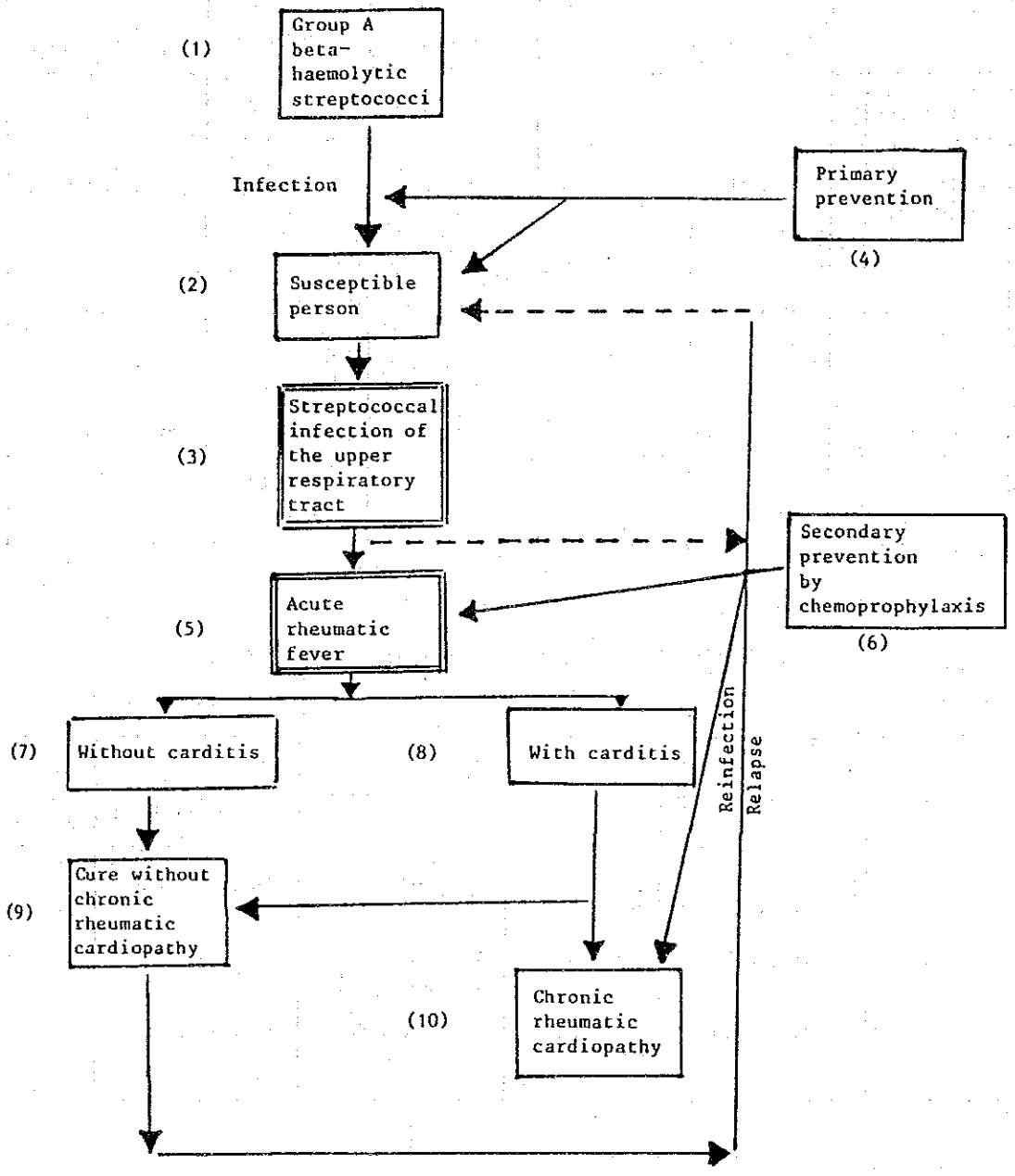


Figure 2. Theoretical evolution of streptococcal infection in the community

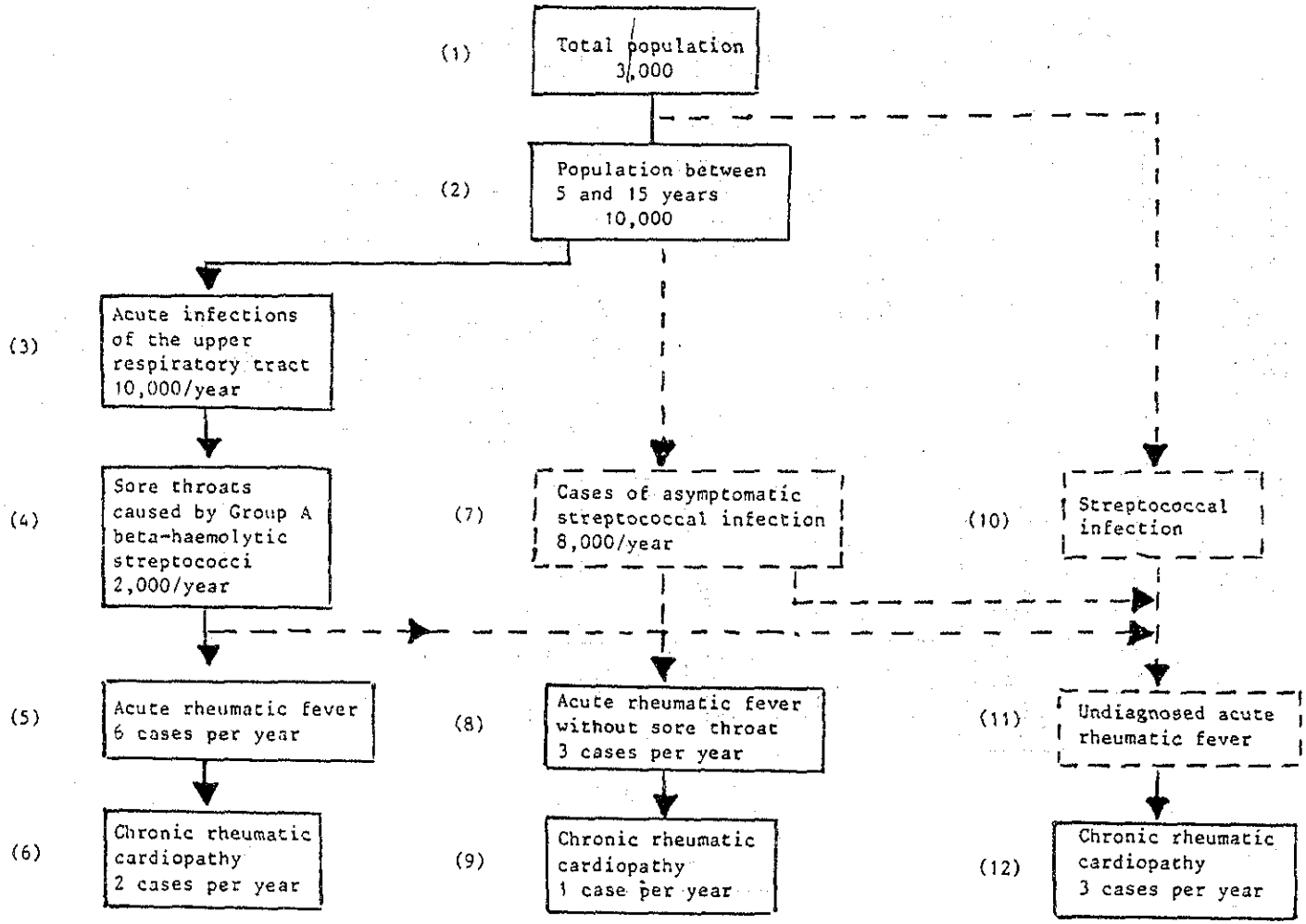


Figure 3. Flow chart for secondary prevention of rheumatic fever

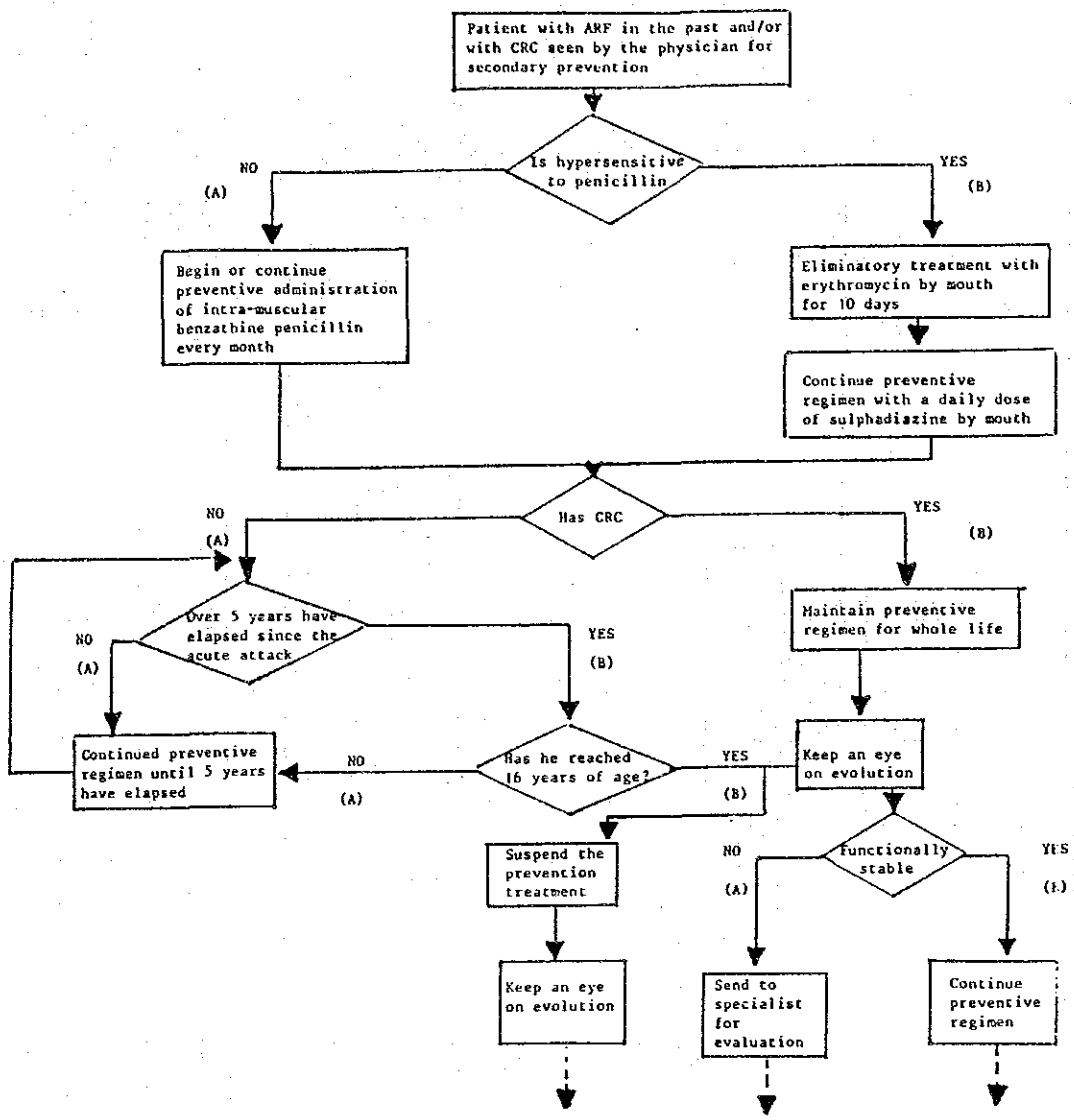


Figure 4. Flow chart for diagnosis and treatment of streptococcal sore throat

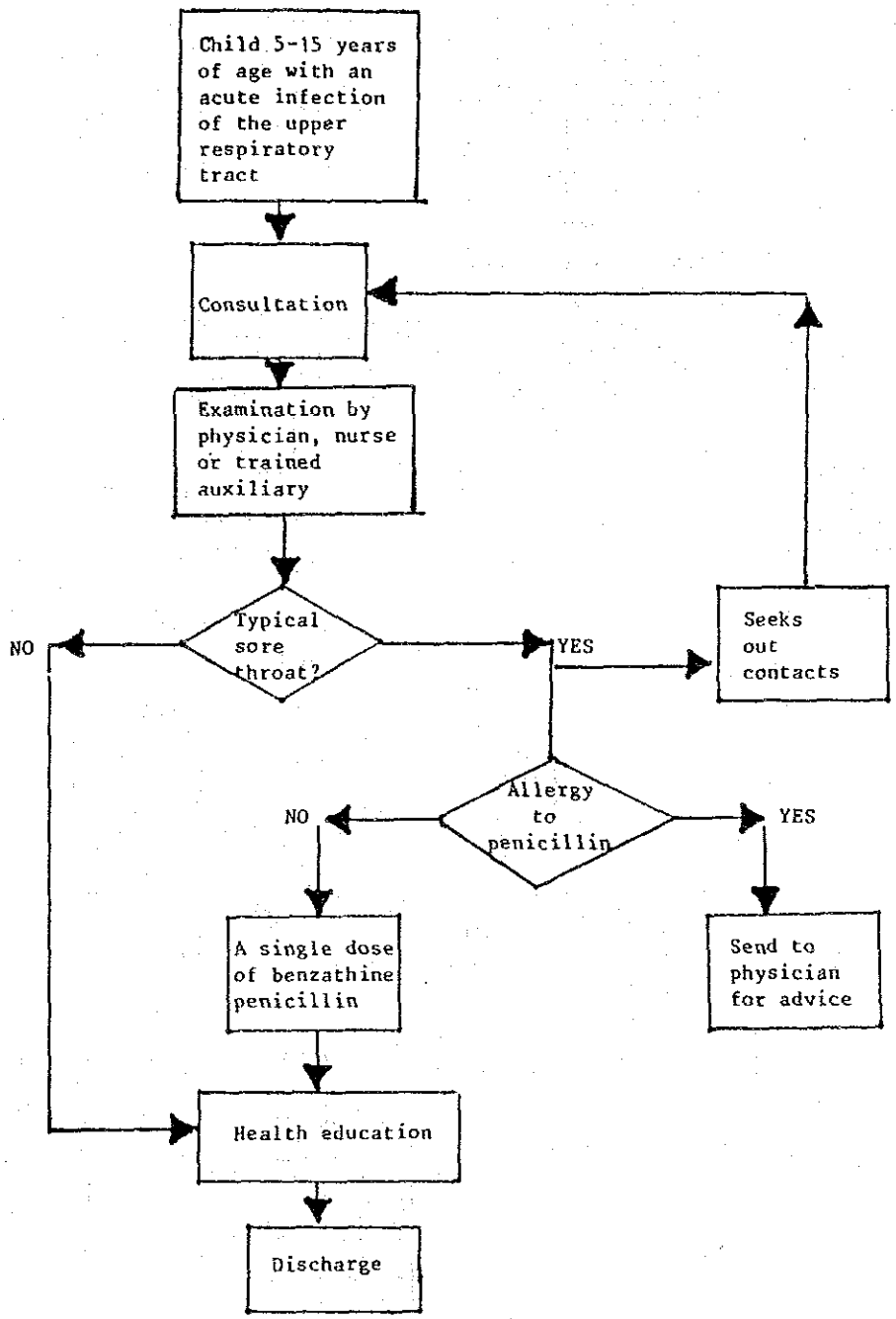
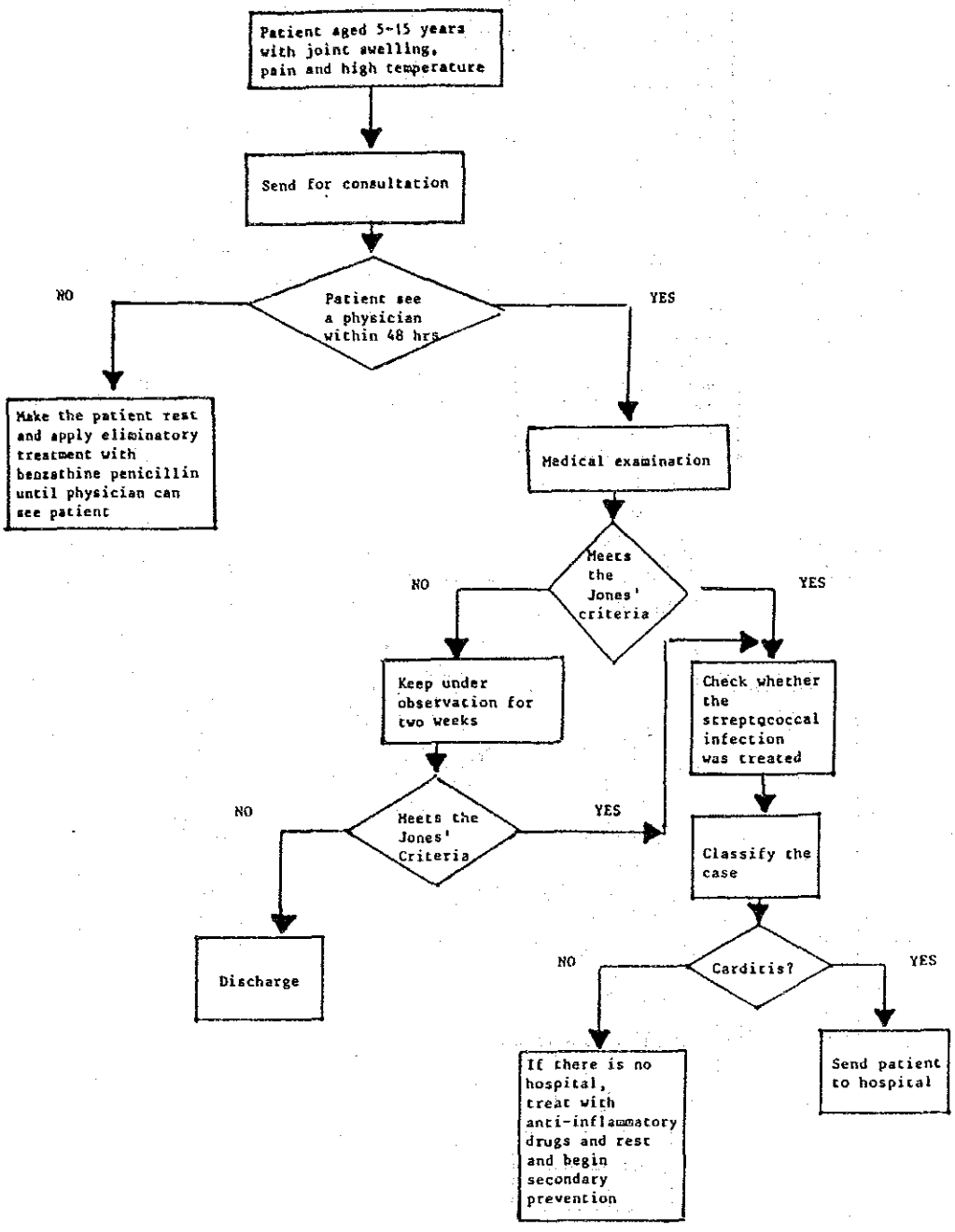


Figure 5. Flow chart for the management of cases of acute rheumatic fever



FORM No. 1

PROGRAMMING SHEET

(Module for a population of 10,000 persons including 3,000 aged 5-15 years)

Region _____ Hospital area _____

Establishment _____

I. POPULATION TO BE COVERED BY PROGRAMMING

Population directly concerned (No. of persons) ☐☐☐☐☐☐☐

Degree of coverage planned ☐☐☐

Multiplication factor* ☐☐☐

* Leave this blank if local data are available on the extent of the activities needed. If such data are not available, calculate them in accordance with the instructions given on the back of this sheet. The multiplication factor will be used to multiply the modular number.

II. PROGRAMMING PERIOD

From ___/___ to 19 ___

From ___/___ to 19 ___

Date of programming _____

III. STAFF INVOLVED

in programming and local implementation _____

in supervision _____

IV. PRIMARY PREVENTION

Activities	Instruments
Consultants and injections	Physician Nurse Auxiliary
MN _____	O _____

V. SECONDARY PREVENTION

Activities		Agent	
Consultations and injections	Home visits	Physician Auxiliary	Health visitor
MN _____	MN _____	O _____	O _____

VI. RESOURCES NEEDED

Type of resources	Amount		
	Primary prevention	Secondary prevention	Total
Staff			
Physician			
Nurse			
Auxiliary			
Medicaments			
Penicillin and diluent			
Aspirin (0.5g)			
Prednisone (mg)			
Syringes and disposable needles			

VII. LEVEL OF REFERRAL AND/OR SPECIALIZED TREATMENT

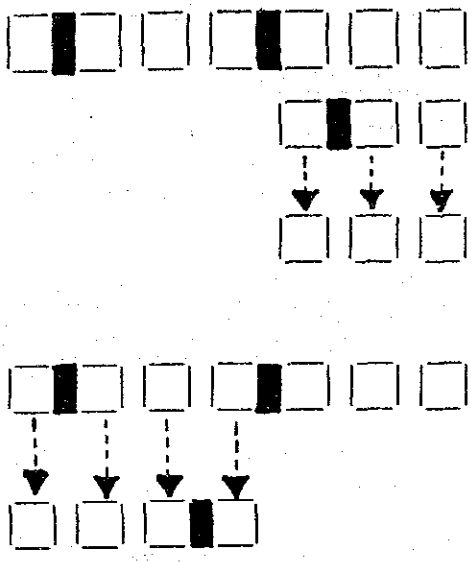
	Day	Month	Year
Preparation of the programme			
Supervision during the year of operation			
1st Visit			19
2nd Visit			
3rd Visit			19
4th Visit			19

(Form No. 1 contd.)

CALCULATION OF THE MULTIPLICATION FACTOR

Fill in all the boxes without leaving blank spaces. If necessary, insert zeros on the left.

			Millions	Thousands	Units
Note					
Population directly concerned (number of inhabitants	(a)				
Degree of coverage programmed	(b)	%			
Calculate					
Coverage index Transfer the figures from (b) to (c) vertically	(c)	(decimal)			
Population covered by the programme					
Multiply the population directly involved (a) by the percentage covered (c) and round off the result to the thousand below (or thousand about when the last 3 figures exceed 500)	(d)				
Multiplication factor (MF)					
Transfer vertically the four figures on the left of (d) to (e)	(e)				



CALCULATION OF ACTIVITIES AND RESOURCES

To fill in the relevant boxes for activities and agents in the programming sheet for primary and secondary prevention, the following calculations will have to be made:

Activities: The modular number (MN)* for each activity will be multiplied by the multiplication factor (MF) and the result entered in the corresponding box.

Agents: For every activity the amount of resource or number of agents needed will be calculated by dividing the number of activities as indicated above by the index of output (O).

*The modular number (MN) is obtained from a theoretical model which will be used when no local data are available for calculating the amount of activity.

FORM NO. 2

SUPERVISION FORM

Region _____ Hospital Area _____

Establishment _____

Period covered by supervision: from _____ 19_____ to _____ 19 _____

Programmed population (in thousands)* _____

Person in charge of programming/implementation _____

Person in charge of supervision _____

Does an initial programming sheet exist? _____

Does a previous supervision sheet exist? _____

1. REVIEW OF ACTIVITIES

Activities	Programme	Observed	Notes
Number of consultations for infections of the upper respiratory tract (sore throats)			
Number of benzathine penicillin injections in cases of streptococcal sore throat			
Number of cases of acute rheumatic fever during the period: Diagnosed			
Under treatment			
Number of benzathine penicillin injections given because of ARF			
Number of patients undergoing secondary prevention			
Number of benzathine penicillin injections for secondary prevention			
Number who have given up treatment			
Number of home visits			
Number of cases referred			
Number of cases transferred			
Number of deaths from ARF			

*Enter the figure found in Form 1 in the paragraph entitled "Population covered by programming"

Form No. 2 (contd.)

2. REVIEW OF RESOURCES

	Hours	
	Programmed	Spent
Staff:		
Physician		
Nurse/health visitor		
Auxiliary		

	Amounts	
	Programmed	Used
Medicaments:		
Penicillin for sore throat		
Penicillin		
Aspirin		
Prednisone		

CONCLUSION: Has programming been adhered to? _____

Explain the reasons for any failure, whether total or partial, to carry out the original programme _____

_____

_____

WHAT MEASURES SHOULD BE TAKEN TO REMEDY THIS SITUATION?

Solutions proposed	Person in charge of carrying them out	Result

First name(s) and surname of supervisor _____

First name(s) and surname of person supervised _____

Form No. 3

INITIAL REGISTRATION FORM

Collaborative Study on the Prevention of Rheumatic Fever

Programme Centre (4-5) ☐☐ Registration No. (6-9) ☐☐☐☐

Name of patient _____

Address (10-11) ☐☐ _____ School (12-13) ☐☐ _____

Sex: 1 = Male, 2 = Female (14) Year of birth (15-16) ☐☐

Date of registration (17-22) ☐☐ day ☐☐ month ☐☐ year

Source of notification to the registry (23) ☐

1 = Hospital inpatient department
2 = Hospital outpatient clinic
3 = Private physician
4 = Laboratory
5 = School health service
6 = Mass examination
7 = Outlying clinic
8 = Other

Section I. Active rheumatic fever: 1 = positive; 2 = suspected; 3 = negative; 4 = not determined.

☐ (24) Diagnosis

Major manifestations

☐ (25) carditis
☐ (26) polyarthritis
☐ (27) chorea
☐ (28) erythema marginatum
☐ (29) subcutaneous nodules

Minor manifestations

☐ (30) joint pain
☐ (31) high temperature
☐ (32) history of rheumatic fever
☐ (33) previous chronic rheumatic cardiopathy
☐ (34) positive C-reactive protein test or increase in sedimentation rate
☐ (35) increase in the PR interval (ECG)
☐ (36) previous infection by beta-haemolytic streptococci

☐ (37) initial attack (1 = yes; 2 = no; 3 = not known)

☐ (38) severity of heart damage 0 = None; 1 = very little; 2 = moderate; 3 = serious; 4 = not determined.

Section II. Chronic rheumatic cardiopathy: 1 = positive; 2 = suspected; 3 = negative.

☐ (39) diagnosis
☐ (40) mitral stenosis
☐ (41) aortic insufficiency
☐ (42) mitral insufficiency
☐ (43) aortic stenosis
☐ (44) organic lesion of the tricuspid valve
☐ (45) heart failure

☐☐ (46-47) year of initial attack ☐☐ (48-49) year of last attack

☐ (50) number of recurrences 1 = one; 2 = two; 3 = three or more; 4 = not known; 5 = none; 6 = initial attack.

☐ (51) preventive regimen in previous year

Penicillin
1 = regular intramuscular
2 = irregular intramuscular
3 = occasional intramuscular
4 = oral
5 = sulphonamides
6 = erythromycin
7 = any combination
8 = initial attack
9 = none

☐☐ (52-53) Source of information _____

Address: _____ Telephone No.: _____

FORM NO. 4

ANNUAL FOLLOW-UP FORM

Collaborative Study on the Prevention of Rheumatic Fever

Programme Centre (4-5) ☐☐ Registration No. (6-9) ☐☐☐☐

Name of patient _____

Address (10-11) ☐☐ _____ School (12-13) ☐☐ _____

Date of attendance (14-19) ☐☐ day ☐☐ month ☐☐ year

☐ (20) Follow-up

1 = Lives in the area
2 = Has moved from the area
3 = Deceased
4 = Not located
5 = Taken off register (state why) _____

Type of preventive treatment: 1 = Yes; 2 = No; 3 = Not known

☐ (21) Intramuscular penicillin

☐ (22) January ☐ (23) February ☐ (24) March ☐ (25) April

☐ (26) May ☐ (27) June ☐ (28) July ☐ (29) August

☐ (30) September ☐ (31) October ☐ (32) November ☐ (33) December

☐ (34) Penicillin by mouth ☐ (35) Other (specify) _____

☐ (36) Reason why prevention was not carried out:

0 = Is not applicable
1 = Patient dropped out
2 = Physician's order (specify) _____
3 = Other (specify) _____

(37) Streptococcal pharyngitis since the last registration

1 = one; 2 = two or more; 3 = suspected; 4 = none; 5 = not known.

(38) Attack of active rheumatic fever since the last registration

1 = one; 2 = two or more; 3 = suspected; 4 = none; 5 = not known.

Present diagnosis: 1 = positive; 2 = suspected; 3 = negative; 4 = not known.

☐ (39) Active rheumatic fever ☐ (40) Mitral stenosis ☐ (41) Aortic insufficiency

☐ (42) Mitral insufficiency ☐ (43) Aortic stenosis ☐ (44) Organic lesion of the tricuspic valve

☐ (45) Functional classification (NYHA):

1 = Grade I; 2 = Grade II; 3 = Grade III; 4 = Grade IV.

☐☐ (46-47) Source of information _____

Address _____ Telephone No. _____

Comments _____

FORM NO. 5

DAILY RECORD

Establishment _____ Hospital Area _____ Region _____

Year 19 _____

Day	Month	No. of the clinical history	Surname	First names	Sex M	Sex F	Age	Diagnosis

FORM NO. 6

Monthly summary record of suspected cases of streptococcal sore throat and acute rheumatic fever

Establishment _____ Hospital Area _____ Region _____

Date		Clinical History No.	Sex		Age	Suspected diagnosis		
						Sore throat		Acute rheumatic fever
Year	Month		M	F		Strepto-coccal	Other	

PART I

COLLECTION, TRANSPORT, AND DETERMINATION OF HEMOLYSIS

A. INTRODUCTION

Streptococci should be differentiated and identified for several reasons. About 35% of all upper respiratory tract infections (URI) are caused by beta-hemolytic streptococci; the remainder are caused by viruses. Since no unique clinical signs or symptoms are associated with either streptococcal or viral URI, culturing for and confirming the presence or absence of beta-hemolytic streptococci is the only method of determining the cause of the disease. A small percentage of patients with Group A streptococcal pharyngitis develop acute rheumatic fever (ARF) if they are not properly treated. Rheumatic fever can be prevented if the patients with streptococcal infections are identified and treated properly. During outbreaks of streptococcal pharyngitis and impetigo, poststreptococcal sequelae, both ARF and acute glomerulonephritis (AGN), are more frequently observed. Carriers as well as diseased patients must be identified and treated if the spread of the disease is to be controlled. Thus, culturing specimens from contacts and siblings of patients with ARF and AGN is common medical practice.

Recent increases in group B streptococcal diseases among neonates have caused some physicians to suggest that all laboratories should have the capacity to identify group B streptococci. Identifying maternal carriers of group B streptococci is important because the neonate runs the risk of acquiring these organisms. The physician can use the information to properly manage his patient.

Antibiotic therapy for patients with systemic enterococcal infections, such as subacute bacterial endocarditis, differs from therapy for patients with other streptococcal infections. Enterococcal group D streptococci are resistant to penicillin, and, therefore, knowledge of the identity of the infecting organism assists physicians in prescribing therapy.

The genus Streptococcus contains a diversity of organisms that are not easily characterized. They are Gram-positive cocci generally occurring in chains, but diplococcal forms and even clumps are occasionally observed. One species even appears rod-like when Gram stained from solid media. They do not contain cytochrome enzymes, and thus are catalase negative. Most species can be accurately classified only by determining the hemolytic, antigenic, and physiologic properties of each strain. The important species are easily categorized, however, by a minimum of simple tests. The extent of identification depends on the kinds of procedures the laboratory uses. This, in turn, depends on: (1) the source of the specimen; (2) the volume of work load; and (3) the philosophies of the physicians and bacteriologists using and performing the laboratory services.

B. COLLECTION, TRANSPORT AND ENRICHMENT

1. Collection

(a) Swabs. Several kinds of swabs are available for obtaining specimens from the throat, skin lesions, and wounds. Although several investigators have expressed concern that toxic substances in cotton swabs may kill some of the bacteria, the basis for these concerns has not be substantiated. Studies comparing recovery rates of streptococci from swabs made of cotton, Dacron, Fortrel, calcium alginate, and cotton treated with polyvinyl alcohol fibers show no appreciable differences in recovery rates. Therefore, the cheapest swab available may be used.

(b) Throat Cultures. Figure 1 shows the proper procedure for obtaining a throat culture. The patient's head is tilted back, and the throat well illuminated. The tongue is depressed so that the back of the throat can be seen. The swab is rubbed up and down the back of the throat and against any white patches in the tonsillar area. The tongue and cheek are avoided.

(c) Skin and Wound Cultures. Figure 2 shows the proper procedure for obtaining a skin culture from a crusted lesion. The crusted skin is aseptically removed with a sterile scalpel. The lesion is cleaned with gauze and the swab pressed firmly into the lesion and rolled over the entire surface of the lesion. Wounds may be handled in the same manner. Th outer crust is removed and the swab is introduced into the deepest area of the wound with care being taken not to rupture membranes. The patient may experience some discomfort as these techniques are being performed. Using moistened (with broth) swabs will alleviate som of the discomfort.

(d) Body Fluid Cultures (Blood, Cerebral Spinal Fluid (CSF), Urine, etc.). Standard techniques for obtaining body fluids for cultures are described in Chapter 6 of the American Society for Microbiology's Manual of Clinical Microbiology, second edition.

2. Transport

The method of transporting the swab to the bacteriology laboratory depends upon (1) the source of the specimen; (2) the length of the time the specimen is expected to be in transit; and (3) the philosophies of the physician submitting the specimen and of the laboratory director, that is, which bacteria they consider to be upper respiratory tract pathogens. Before laboratory procedures are begun, the submitting physician and the laboratory director should decide on the extent of bacteriological examination needed for each specimen from each source. Special procedures and media may be used in some situations but not in others. If the specimen is taken from the throat, only the beta-hemolytic streptococci and Corynebacterium diphtheriae are usually considered as pathogens. On occasion, Haemophilis influenzae is considered pathogenic, especially in young children, and some physicians request special bacteriological work-ups of specimens taken from patients at risk. If streptococci are the only pathogen that the swabs are going to be examined for, then the transport systems described in Table 1 can be used. In fact, recent data indicate that these same systems can also be used for diphtheria organisms.

If no more than 2 hours are expected to elapse between the time the swab specimen is collected and the time it is examined in the laboratory, then no special precautions have to be taken. The streptococci survive well in a dry environment. The swab is returned to the paper envelope or a sterile test tube for transit to the laboratory. If the swab is not to be processed until the next day, or if other pathogens, such as those from wound infections, must be considered, a holding medium (for example, Stuart's or Amies') should be used. If the swab is to be in transit for more than 1 day, then the silica gel or the dry filter paper transport system should be used. These systems can be used for both throat and skin swabs. The materials needed for these systems are available commercially. A modified silica gel transport system can be made by placing enough silica gel crystals in a 15- x 125-mm screwcap tube to cover the cotton tip of the swab. The tube and crystals are autoclaved and dried in a hot air oven.

3. Enrichment

Enriching transported swabs enchances recovery of beta-hemolytic streptococci. They are enriched by being placed in a broth medium for a designated period of time (4-24 hours) before being plated onto blood agar. Some physicians question this technique and the use of selective inhibitors in broth and agar media on the basis that the resulting culture is not truly representative of the patient's illness. All physicians and investigators do not, however, share this view. Some, in fact, have expressed the opinion that all patients whose cultures are positive for group A streptococci should be treated for infection regardless of the number of streptococcal colonies on the primary agar plate. These philosophies concerning symptomatic patients aside, however, enrichment and selective inhibitors are very useful in epidemiological studies when carriers of streptococci as well as patients with streptococcal disease are to be identified. Any good infusion broth base is satisfactory for the enrichment procedure. Brain heart infusion, trypticase soy, Todd-Hewitt, and heart infusion are some of the commonly used broths. Selective inhibitors, such as crystal violet (1 ug/ml), neomycin (30 ug/ml), and gentamycin (5.5 ug/ml), have all been used successfully as inhibitors in broth or blood agar media. The use of agar bases and broths with a combination of selective inhibitors, such as colistin-nalidixic acid and gentamycin-nalidixic acid for isolating the streptococci from heavily contaminated swabs, has been reported. These selective media are especially useful in epidemiological studies of streptococci isolated from burns and from the anus and vagina. When selective media are used, however, a nonselective medium should also be used.

Physicians and laboratory directors establish guidelines for the microbiologist to follow in examining cultures from each source and type of patient. The amount of bacteriology performed on specimens from different sources can vary considerably. A minimum of bacteriological tests can be performed on throat cultures, but extensive examinations may be necessary for wound cultures.

C. DETERMINATION OF HEMOLYSIS

The most important step in identifying the streptococci is determining the hemolytic activity of the culture. The expression of streptococcal hemolytic activity is affected by the composition of the base medium, the atmosphere of incubation, and, to some extent, the kind of blood used in the agar base. The agar base medium should be rich enough to support the growth of streptococci and free of reducing sugars. Even small amounts of reducing sugars inhibit the expression of beta-hemolysis in blood agar plates. Most commercial blood agar bases are free of reducing sugars. Some of the agars more commonly used as base medium for blood agar plates are trypticase soy, heart infusions, and neopeptone.

The amount and kind of blood used to detect the lysins of the beta-hemolytic streptococci have very little to do with the final expression of the hemolytic activity. Only the hemolysis of the enterococci is affected by different animal bloods. Some strains of S. faecalis give a beta-hemolytic reaction on horse, human, and rabbit blood, but are alpha-hemolytic on sheep blood. All other streptococci are consistently either beta-hemolytic, alpha-hemolytic, or nonhemolytic, regardless of the kind of blood incorporated into the agar. The degree of alpha-hemolysis may vary somewhat, but microscopic examination should resolve the identification of the lytic activity.

Sheep blood is recommended as the blood of choice for detecting beta-hemolytic streptococci from throat cultures. Sheep blood contains a factor that inhibits the growth of H. hemolyticus, the colonies of which appear identical to those of beta-hemolytic streptococci on the surface of the blood agar. Human blood should not be used unless it has been proven to be free of possible inhibitors of streptococcal growth and hemolytic activity. Human blood may contain type specific antibodies, antistreptolysin O antibodies, antibiotics, or citrate ion concentrations that inhibit growth or lytic activity. Each pint of blood used should be tested for these inhibitors with control strains.

Five percent defibrinated blood is the optimum concentration in agar for determining streptococcal hemolysis. Concentrations as low as 3% and as high as 10% have been used. These concentrations affect only the size of the zone, not the definition. If streak plates are used, the lower concentration of blood may give the inexperienced observer trouble in distinguishing alpha from beta-hemolysis. In plates with higher concentrations of blood, many strains of beta-hemolytic streptococci appear nonhemolytic, unless the agar is cut or stabbed with growth from the surface streaking.

Blood agar plates for primary inoculation should be approximately 4 mm thick. One ml of defibrinated blood should be added to 20 ml of melted agar and mixed well, then poured into a 15- x 100-mm Petri dish. Reference or control cultures giving known hemolytic activity should be included in tests so that media and procedures can be evaluated.

1. Streak-Stab Plates. The correct procedure for inoculating a blood agar plate is shown in Figure 3. The swab is used to inoculate approximately one-sixth of the plate. The swab is rolled over the surface of the agar so that the entire surface of the swab makes contact with the agar. A wire inoculating loop is then used to streak the plate as diagrammed in Figure 3. This is done to thin the organism into isolated colonies. After the plate is streaked, the wire loop is stabbed into the agar to the bottom of the plate. The stab should be perpendicular to the surface to ensure a clean cut without ragged edges. This makes the incubated culture easier to read with a microscope. This procedure is the minimum that should be used. Ideally, pour-plates should be used to determine hemolysis, but by stabbing the agar and reading the hemolysis from the stab through a microscope, the definitions of hemolysis described from pour-plate subsurface colonies can be applied.

2. Pour-Plates and Pour-Streak Plates. The pour-plate technique is outlined in Figure 4. Fifteen millilitres of agar is melted, then cooled to and held at 50 to 55° C. If the swab has been incubated in enrichment broth overnight, the inoculum should be diluted by placing one loop of the culture in 15 ml of saline. One loop of the saline dilution is then transferred to the melted agar; 0.6 ml of defibrinated sheep blood is added, mixed well by swirling the tube, then poured into a 15-x 100-mm Petri dish. If the culture is from 0 to 4 hours old, then the saline dilution step is omitted. One loopful of the culture is transferred directly to the melted agar and the blood is added. The solution is mixed well and poured into the plate.

The pour-plates can be incubated under any atmosphere. They are anaerobic because of the nature of the preparation. By melting the agar and keeping it melted, the oxygen is driven out and kept out until the agar is cooled. Streptococcal hemolysis develops before oxygen has diffused to the subsurface growth area. Preferably streak plates should be incubated, in an anaerobic atmosphere. A mixture of 5% to 10% CO_2 and 95% to 90% N_2 should be used in an anaerobic chamber, or the Gas-Pak system can be used. If anaerobic atmospheres are not available, the plates should be incubated in a normal atmosphere. The plates should not be incubated in a candle jar or CO_2 incubator. Increased concentrations of carbon dioxide in the presence of oxygen increases the peroxide production by beta-hemolytic streptococci as well as by the alpha-hemolytic streptococci that are part of the normal flora of the oral cavity. Peroxide affects the red blood cells in such a way that it renders them not susceptible to the lysins of the beta-hemolytic streptococci. Thus, incubation of streak plates in increased CO_2 is less than ideal for determining streptococcal hemolysis.

J.H. Brown described and defined streptococcal hemolysis in 1919 by microscopically observing the hemolytic reactions of streptococci surrounding subsurface growth. Although these reactions are described objectively, very few microbiologists use the pour-plate technique for determining the hemolytic reactions of streptococci. Most microbiologists use the streak plate method of determining hemolysis and subjectively determine the hemolytic reactions. This method of determining hemolysis is convenient, but it is subject to error because applying the same definitions of hemolysis to surface growth as to subsurface growth is, in some areas, difficult, if not impossible. An alternative procedure has been developed that correlates with the pour-plate method of determining streptococcal hemolysis. This procedure is the streak-stab method alluded to earlier (Figure 3). The stabbed area of growth can be examined microscopically, and the objective definitions of hemolysis described from subsurface growth can be applied.

Figure 5 shows three kinds of streptococcal hemolytic reactions that may occur in blood agar. These photographs were taken with the aid of a microscope adjusted to magnify 35 times. The left column shows subsurface pour-plate colonies, and the right column shows the stabbed areas of surface growth. Figures 5a and 5b show beta-hemolytic reactions. Note the clear area from the edge of the colony and from the edge of the stab outward. Figures 5c and 5d are wide-zone alpha-, alpha prime-, or incomplete beta-hemolytic reactions. Again, a subsurface pour-plate colony is on the left, and the stabbed area of surface growth is on the right. Note the hazy areas right next to the colony and cut, then the clear area, and then another hazy area. Figure 6 will clarify these areas and allow us to describe the reaction in more detail. Figures 5e and 5f are alpha-hemolytic reactions. A subsurface pour-plate colony is shown on the left, and the stabbed-surface growth is shown on the right. Note that there is a zone of partial lysis, but complete lysis is not apparent in either picture.

Figure 6 shows the same hemolytic reactions as Figure 5, except that the magnification is 100 instead of 35 times actual size. This magnification allows us to examine the area of lysis for intact red blood cells and use the definitions of streptococcal hemolysis to describe the reactions.

Figures 6a and 6b are beta-hemolytic subsurface pour-plate and surface-stabbed growth, respectively. Note the complete absence of intact red blood cells from the edge of the growth outward. The important observation here is that there are no intact red blood cells next to the growth. The definition of beta-hemolysis is as follows: the area immediately adjacent to the growth is completely cleared of red blood cells. This completely cleared area extends outward away from the growth.

Figures 6c and 6d show wide-zone alpha-hemolysis of subsurface pour-plate and surface-stabbed growth, respectively. Note the intact red blood cells immmediately surrounding and adjacent to both the subsurface colony and the surface-stabbed areas of growth. The numbers of intact red blood cells are reduced, but the areas are not completely cleared. Therefore, by definition this is not beta-hemolysis, regardless of whether zones of complete or nearly complete lysis is observed outside these areas. Wide-zone alpha-hemolysis is defined as follows: the area immediately adjacent to the colony has some red blood cells, but an area outside that may be completely, or nearly completely, cleared of red blood cells. Strains that demonstrate wide-zone alpha-hemolysis do not have defined group antigens. They are members of the viridans streptococci and are considered part of the normal flora of the human oral cavity.

Figures 6e and 6f are pictures of alpha-hemolytic subsurface pour-plate and surface-stab growth and the partially cleared zones surrounding the growth. Alpha-hemolysis is defined as follows: the area immediately adjacent to and surrounding the growth may have reduced numbers of red blood cells, but the area is not completely cleared of cells. Applying these definitions of streptococcal hemolysis to surface growth is very difficult unless the stab technique is used. Streptococcal growth continues down into the agar along the edge of the stab. The hemolysis surrounding the stab resembles the hemolysis surrounding subsurface colonies obtained with the pour-plate technique, and Brown's definitions of hemolysis, surrounding subsurface colonies can be applied. Thus, by using a microscope and Brown's definitions of hemolysis, an objective rather than a subjective description can be applied to streptococcal hemolysis. Microscopic examination of the subsurface or surface-stab growth will improve the identification of streptococci because it will eliminate the subjective identification of wide-zone alpha-hemolytic streptococci, as beta-hemolytic streptococci and peroxide-producing beta-hemolytic streptococci as alpha-hemolytic streptococci. In addition to improving the accuracy of identification of pathogenic streptococci from the throat and skin, correct determination of hemolysis is the first and most important step in classifying all streptococcal species from all sources. We will elaborate on this point in the next part of this manual.

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PART II

EXTRACTION AND SEROLOGICAL IDENTIFICATION

A. INTRODUCTION

1. Group reactions of beta-hemolytic streptococci

The best method for identifying the beta-hemolytic streptococci is to extract the carbohydrate antigen from the streptococci and react the antigen extract with group-specific precipitating antisera. Lancefield described the serological differentiation techniques for identifying the beta-hemolytic streptococci in 1933. There have been attempts to extend the serological grouping system to the alpha-hemolytic streptococci, but the system works only for groups D and N streptococci. This opinion is based on the data in Tables 2 and 3. Table 2 shows the serological reactions of all the beta-hemolytic streptococci submitted to CDC's streptococcus reference laboratory over a 7-year period. Note that less than 1% of all the strains failed to react with groups A, B, C, F, and G antisera. Only one A-variant, one A-intermediate, and one group L streptococci were identified over this same period. In addition to group A variant and group L antisera, group E, H, K, M, and O antisera were used. Extracts of a few nonbeta-hemolytic strains reacted with these antisera, but no extracts of beta-hemolytic strains did so. In addition, over the same period, 98% of 665 strains of group D streptococci were reactive with group D antiserum. A few of these strains were beta-hemolytic, all extracts of which reacted with the group D antiserum. According to Brown's definitions of hemolysis - that is, determinations made from subsurface pour-plate colonies, streptococci belonging to groups A, B, C, E, F, G, L, M, P, U, and V and some group D streptococci are beta-hemolytic. Streptococci belonging to groups H, K, N, O, Q, R, S, T and most belonging to D are alpha-hemolytic or nonhemolytic according to these same definitions. The data in Table 2 show that more than 99% of the beta-hemolytic streptotocci from humans can be serologically identified with group A, B, C, D, F, and G antisera. Practically, only these sera are needed to identify clinical isolates of beta-hemolytic streptococci.

2. Serological cross-reactions of viridans streptococci

Nonbeta-hemolytic streptococci (alpha or nonhemolysis) should be extracted and reacted only with group D and, occasionally, group B antisera. Table 3 shows the cross-reactions of the 10 viridans streptococcal species with group A, C, F, and G antisera. Note that none of the extracts of the 1,187 strains reacted with group B or D antisera. The reason for this is that the alpha-hemolytic and nonhemolytic varieties of group B and D streptococci have physiological characteristics that differentiate them from any of the 10 species shown in Table 3. Beta-hemolytic strains of groups A, C, G, and F streptococci, however, have heterologous physiological characteristics which sometimes resemble the physiological characteristics of the viridans species. The 10 species listed in Table 3 are differentiated from each other and from other species of streptococci by individual physiological characteristics. Each of the strains in Table 3 had physiological characteristics similar to one of the 10 species listed and not to one of the species with specified polysaccharide antigens listed in Tables 4 and 5. In other words, none of the non-beta-hemolytic strains whose extracts reacted with group A antiserum contained the virulent factor (M protein) attributed to Streptococcus pyogenes, a group A streptococcus in the Lancefield classification. The strains of S. MG intermedius and S. anginosus-constellatus containing extracts which reacted with group F antisera can be described a non-beta-heymolytic varieties, group F streptococci in the Lancefield classification, or S. anginosus but it is preferred to designate these strains as members of the viridans streptococci. The reasons for this are explained in a forthcoming publication. Particular note should be taken of the heterogeneity of strains which react with each antiserum; this rules out any possibility of using these antisera to identify given species. Moreover, it should be noted that no species is especially associated with one antiserum. These sera therefore have no value for identifying the different viridans species and should not be used to identify these strains. The viridans streptococci are better defined by physiological characteristics. Moreover, the fact that an extract of an alpha-hemolytic streptococcus reacts with group A, C, F, or G antiserum does not mean that the strain is an alpha-hemolytic variety of the group in

question. Furthermore, extensive tests need to be carried out to confirm the alpha-hemolytic varieties of group A, B, C, F and G streptococci.

Key to the classification of beta-hemolytic streptococci

Table 4 shows the classification of the streptococci with specific antigens of the group commonly encountered in human infections. The group A beta-heymolytic streptococci are S. pyogenes; the group B beta-hemolytic streptotocci are S. agalactiae, and the group C beta-hemolytic streptococci are S. equisimilis, S. zooepidemicus, or S. equi. S. equisimilis is the group C streptococcus generally isolated from man, but the other two species have also been isolated in human infections. The differentiation of the group C streptococci is indicated in Table 5.

The group D streptococci may be beta-hemolytic, alpha-hemolytic or non-hemolytic. S. faecalis, S. faecium and S. durans are enterococci; S. bovis and S. equinus are group D streptococci but not enterococci. The enterococci are regarded as penicillin-resistant, and antibiotic therapy for the enterococcal infections differs from the therapy for all other streptococcal infections. Consequently, the enterococcal group D strains must be differentiated from the other strains. This differentiation is indicated in Table 5. The group F beta-hemolyutic streptotocci are S. anginosus, and the beta-hemolytic streptococci with group G antigen have no species name; they are known simply as group G streptococci in the Lancefield classification.

4. Physiological differentiation of the group C and D streptococci

Table 5 indicates the physiological tests used to differentiate the group C and group D streptococci. S. equisimilis produces acid in trehalose broth but not in sorbitol broth. S. zooepidemicus produces acid sorbitol broth but not in trehalose broth, while S. equi does not produce acid in either broth. S. faecalis, one of the group D streptococcal species, grows in 6.5% NaCl broth, hydrolyzes the arginine and utilizes pyruvate. S. faecium grows in 6.5% NaCl broth and hydrolyzes arginine, but does not utilize pyruvate. S. bovis does not grow in 6.5% NaCl broth, does not hydrolyze arginine and does not utilize pyruvate. These are the three most common species of group D streptococci which have been found in human infections. S. durans is isolated occasionally and S. equinius rarely in human infections. Additional physiological characteristics need to be determined to confirm the identity of all the group D species. This classification should be regarded as a presumptive identification.

5. Media formulation for physiological tests

(a) Trehalose and sorbitol broths

1) Heart infusion broth, 22.5g in 900 ml distilled water.
2) Trehalose or sorbitol, 10g in 100 ml distilled water.
3) One-ml indicator (1.6g bromcresol purple in 100 ml of 95% ethanol).

Add 1, 2, and 3 together, dispense in 3-ml amounts in 13- x 100-mm screwcap tubes. Sterilize in an autoclave for 10 minutes at 121° C. A positive reaction is recorded when the indicator changes from purple to yellow.

(b) 6.5% NaCl broth

1) Heart infusion broth, 25 g.
2) NaCl, 60 g.
3) Indicator, 1 ml (same as above)
4) Dextrose, 1 g.
5) Distilled water, 1,000 ml.

Add all reagents together up to 1,000 ml; do not compensate for the volume loss caused by the NaCl. Final volume should be 1,000 ml. Dispense in suitable tubes (15- x 125-mm screwcap) and sterilize in an autoclave 15 minutes at 121° C. A positive reaction is recorded when the indicator changes from purple to yellow or when growth is obvious even though the indicator does not change.

(c) Moeller's decarboxylase media for arginine hydrolysis

1) Peptone (Orthana special), 5 g.
2) Beef extract, 5 g.
3) Bromcresol purple, same as above, 0.625 ml.
4) Cresol red (0.2%, prepared by grinding 0.5 g cresol red powder, adding 26.2 ml of 0.01 N NaOH, and diluting to 250 ml with distilled water) 2.5 ml.
5) Pyridoxal, 5 mg.
6) L-arginine, 10g (if DL-arginine is used, add 20g).
7) Distilled water, 1,000 ml.

Adjust pH to 6.0-6.5 and dispense in 3-ml amounts in 13- x 100-mm screwcap tubes. Sterilize in an autoclave for 10 minutes at 121 C. Immediately after inoculation, add a layer (about 10 mm) of sterile mineral oil. A positive reaction is recorded when the indicators turn to a violet to reddish violet. A yellow colour is not a positive reaction; this only indicates an acid reaction, not deamination.

(d) Pyruvate broth

1) Tryptone, 10g.
2) Yeast extract, 5 g.
3) K_2HPO_4, 5 g.
4) NaCl, 5 g.
5) Sodium pyruvate, 10 g.
6) Bromthymol blue, 0.04 g.
7) Distilled water, 1,000 ml.

Check the pH; adjust to pH 7.1-7.4 if necessary. Dispense in 13- x 100-mm screwcap tubes; sterilize by autoclaving 15 minutes at 121 C. A positive reaction is recorded when the indicator changes from green to a definite yellow. Yellow-green indicates a weak reaction and should be regarded as negative utilization of pyruvate.

B. EXTRACTION PROCEDURES

1. Comparison

Several methods of extracting the group antigens from the streptococci are described below. They differ considerably in complexity and effectiveness. The Lancefield hot acid technique is considered the standard technique to which all others should be compared. Unfortunately, it is relatively complex and time-consuming. However, if group A and B streptococci are to be typed, the Lancefield technique must be used. It is the only technique that extracts the protein-type antigens as well as the carbohydrate (groups A, B, C, F, and G) and teichoic acid (groups D and N) antigens from streptococci.

The Fuller hot formamide technique is also relatively complex, and like the Lancefield technique, extracts all group antigens. This technique destroys the protein-type antigens of group A and B streptococci, and thus the formamide extracts cannot be used to type these streptococci.

Rantz and Randall's autoclave technique is relatively simple to perform, and although less group antigen is extracted, it can be used very effectively in identifying the streptococci by serological procedures. We could not detect any differences in the effectiveness of extraction by the Lancefield, Fuller, or Rantz and Randall techniques with CDC grouping antisera. One hundred percent of 130 strains of group A, B, C, D, F, and G streptococci were identified by all three extraction methods.

El Kholy's nitrous acid technique is a simple chemical extraction. The pH must be adjusted once, but the procedure does not require the use of heat. Investigators using group A, B, C, and G streptococci have indicated that this technique works very well. These reports have included only minimal numbers of stock strains and no clinical isolates of group D and F streptococci. Just how well the nitrous acid technique works with groups D and F is unknown.

Maxted's Streptomyces albus enzyme extraction technique is easy to perform and works very well with the beta-hemolytic group A, B, C, F, and G streptococci. This technique has not performed well with the group D streptococci. Most group D strains are not extracted by the S. albus enzyme.

Ederer's pronase B enzyme extraction technique is like the S. albus enzyme technique. It is easy to perform, but does not work as well as the S. albus technique. It does not extract the group D and F streptococci as well as the Lancefield, Fuller, Rantz and Randall, or Watson techniques. When we compared this technique to the others, only group A streptococci were extracted 100% of the time.

Watson's albus-lysozyme enzyme extraction technique has an advantage over the other two enzyme extraction techniques in that it extracts group D streptococci as well as the beta-hemolytic group A, B, C, F, and G streptococci. Unfortunately, the reagents for this technique are more costly than those for any of the other techniques.

The effectiveness of all extraction techniques depends largely on the quality of the antisera used in the precipitin test. With potent, specific antisera, all techniques work well within the limits of the tests described above. Test strains of streptococci should be available for quality control testing of each new lot of commercial antisera. Some have been notoriously poor. The Lancefield, Fuller, Rantz and Randall, and Watson techniques can be used to extract and identify the group A, B, C, D, F, and G streptococci with good antisera. The El Kholy and Maxted techniques can be used to identify the group A, B, C, F, and G streptococci, but an alternative procedure must be adopted to identify the group D streptococci. Ederer's technique will not perform well unless antisera of exceptional quality are used.

Extraction techniques and the complexities of each are listed in Table 6. Cost, complexity, time requirements, and effectiveness are all factors that must be considered before a technique is adopted for use in the clinical laboratory.

2. Instructions for each procedure

(a) Lancefield's hot acid extraction.

1) Strains for extraction are grown on 30 ml of Todd-Hewitt or other suitable broth. The broth is inoculated and incubated overnight (16-24 hours) at 35-37° C.
2) Pack the cells by centrifugation.
3) Discard the supernatant fluid; save the cells.
4) Add 1 drop of 0.04% metacresol purple and about 0.3 ml of 0.2N HCl to the sedimented cells. Mix well and transfer to a Kahn tube. If the suspension is not a definite pink (pH 2.0 to pH 2.4), add another drop or so of the 0.2N HCl. The HCl is made up in 0.85% NaCl.
5) Place in boiling water bath for 10 minutes, shaking the tube several times.
6) Remove from water bath and pack the cells by centrifugation.
7) Decant supernatant into clean Kahn tube; discard sediment.
8) Neutralize the extract by adding 0.2N NaOH (made up in distilled water) drop by drop until it is slightly purple (pH 7.4 to 7.8). A deep purple indicates that the pH is too high. Adjust back to light purple with 0.2N HCl because too high a pH may cause nonspecific cross-reactions. Try to avoid having to readjust.
9) Clarify by centrifugation and decant supernatant fluid into a small screwcap vial. Store at 4° C to preserve the extract, prepare a 1:100 dilution of Merthiolate solution in 1.4% Na borate, and dilute up to 1:500. Add one drop of the 1:500 solution to the extract.
10) React with grouping antisera.

(b) Fuller's hot formamide extraction.

1) Strains for extraction are grown in 5 ml of Todd-Hewitt or other suitable broth. The broth is inoculated and incubated overnight (16-24 hours) at 35-37° C.
2) Pack the cells by centrifugation.
3) Discard the supernatant fluid; save the cells.
4) Add 0.1 ml formamide; mix by shaking.