

In preparation for a national study of the incidence of acute rheumatic fever, a preliminary methodological study was conducted in Pennsylvania to develop the most efficient and accurate methods for collection of such data from physicians. Findings and methods are presented and discussed.

MEASUREMENT OF THE INCIDENCE OF ACUTE RHEUMATIC FEVER: A METHODOLOGICAL STUDY

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INCREASED attention to measurement of health care, morbidity, and hospitalization has made it clear that medical examinations and physician and hospital records as sources of data involve conceptual and operational problems¹ that have thus far yielded data of only limited value to social scientists. For that reason, the National Center for Health Statistics not only conducts a continuing National Health Examination Survey, which entails physical examinations of members of sample households,² but also conducts the National Health Survey in which data are collected by personal interview in a sample of 42,000 households each year.³ Obviously, the physical examination can reveal current trends in morbidity, but only from the personal interview can one learn about the social aspects of illness, e.g., actions taken as a result of feeling ill, costs associated with medical care, effects of illness on normal routines, definitions of illness, days of bed care or hospital care. The collection of such data through oral and written reports of individuals provides the grist for much of social science knowledge and theory.

That there is some intraindividual variation in reporting of attitudes and

perceptions is common knowledge, but one might expect that an event so dramatic, unusual, and significant as hospitalization (for other than childbirth) would be well remembered and accurately reported. In a series of field experiments⁴ in which different methods were used to collect hospitalization data from households, underreporting of 9-17 per cent was found. Underreporting varied by amount of time between hospitalization and interview, number of hospitalizations experienced by the household, and seriousness of hospitalizations. The loss has been attributed to lack of motivation to report, suppression of unpleasant memories, forgetting over time, and so on.

In a study comparing HIP records with survey data collected from a sample of HIP enrollees, hospitalization was underreported by about 13 per cent but chronic and acute diseases were underreported by more than 40 per cent.⁵ On the other hand, many diseases were reported that were not found in the records.

When we were requested to conduct a study of the incidence of acute rheumatic fever (ARF), it was contended that completeness of reporting of cases

by physicians in a survey would be very high in view of the fact that ARF is not frequently seen and that it has such implications for patients that the physicians are likely to remember each case distinctly. In preparation for a national study, it was agreed that a preliminary methodological study would be conducted in the state of Pennsylvania in order to develop the most efficient and accurate methods for collection of the data from physicians.

Background

The incidence of acute rheumatic fever in the United States has long been a matter of speculation and debate. Estimates ranging from 60,000 to 129,000 have been offered from many forums, each estimate based on projections from local studies which used somewhat different technics of data collection.

Accurate estimates of national and regional incidence rates would serve many purposes, such as indicating the magnitude of the problem among the different populations at risk, identifying regions of the country where the problem is the greatest, providing a baseline against which to measure future progress, providing grounds for estimating how much time, money, and effort need to be directed toward preventive and remedial work on this problem.

Since acute rheumatic fever is not a reportable disease in most states, there are no records which will yield an estimate of its incidence nationally. In one state in which it is reportable, an attempt was made to verify the reported rate by sending a mail questionnaire to every physician in the state and then conducting personal interviews with a sample of the nonrespondents.⁶ The data suggest that only a small percentage of the cases actually seen were reported by physicians.

It seems clear that to collect the required data one must go directly to

physicians who see the rheumatic fever patient, but how this can be done most efficiently has not been shown by any previous studies. The Minnesota group used mail questionnaires and personal interviews with physicians, but relied upon the physicians' recall of cases over the entire previous year.⁶ Quinn⁷ had a physician and a medical student contact physicians and hospitals at three- and six-month intervals in the Nashville, Tenn., area. Saslaw⁸ personally visited hospitals to check records and had non-medical personnel make telephone calls to physicians in the Dade County area, to get reports of cases of acute rheumatic fever.

Unfortunately, the methods used by Quinn and Saslaw are not feasible for use on a state-wide or on a national basis, since the number of physicians required to carry out the procedures would far exceed the number and budget that would be available for any such study. A mail questionnaire that is returned by only half the sample leaves questions about the representativeness of the data which, if they were to be resolved, would require personal interviews with a sample of the nonrespondents. Thus the seeming economy of the mail questionnaire proves elusive because it should be coupled with a follow-up of nonrespondents.

Methods

The primary objective of this study was to assess the contribution of several variables to the efficiency and accuracy of data collection in an incidence study of acute rheumatic fever. Accordingly, we included as many variables as were practicable within time and budgetary limitations. The study as conducted was a 2 x 2 x 3 x 3 design on a sample of M.D.'s and O.D.'s practicing in the Commonwealth of Pennsylvania during 1963-1964.

In selecting the variables we took into

account a recent experience in another study of physicians in which we had sent a letter to a sample of physicians inviting them to participate in a study of the Pap smear. All of the letters were sent with a special delivery stamp. The rate of cooperation was so much higher than we had experienced with physicians in previous studies that we attributed the cooperation to the use of the special stamp.

Variable 1—Postage

In the present study we set out to measure the contribution of the stamps to the rate of cooperation. Special delivery stamps were affixed to envelopes sent to one-half of the physicians and a first class stamp to envelopes sent the other half.

Variable 2—Personal Visit versus Telephone Invitation

Since physicians were being asked to provide us with data in the study, it was necessary to explain the extent of the demand being placed upon them, and how, where, and what kinds of data would be requested of them. Inasmuch as their cooperation was so vital to the success of the study, it was decided to compare the effects of explaining this in a personal visit with the physician to the effects of explaining in a telephone call. It was expected that personal presentation would result in a higher rate of cooperation than would the telephone call.

Variable 3—Frequency of Calling Physicians

Data were to be collected by telephoning physicians regularly and asking them if they had seen a new case of acute rheumatic fever since the previous call. If the response was affirmative, the physician would be asked how many cases had been seen, and a complete history would then be obtained for each case.

To the best of our knowledge no research has been done addressed to the question of how frequently it is necessary to contact physicians in order to obtain accurate reports of incidence of such infrequent occurrences as acute rheumatic fever. Quinn phoned physicians at three- and six-month intervals, while Saslaw had no rigorous schedule for contacting physicians in his area. While it seemed reasonable to expect that physicians would readily recall any cases of acute rheumatic fever they had seen during the previous three months, it was decided to investigate this. The physicians were divided into three subsamples, one of which was phoned every month, the second was phoned every two months, and the third was phoned every three months. Naturally, physicians were asked to report on all cases they had seen during the period since they were last phoned.

Variable 4—Reminder Letter

In a busy practice physicians might appreciate receiving a letter several days before being telephoned, reminding them that a call would be placed in the next few days, thereby giving them an opportunity to assemble all of the data they would be asked to report. We prepared a reminder letter which summarized all of the questions we would ask about each case of ARF and sent this out to subsamples of physicians as follows: (1) to one-third of the physicians the reminder letter was sent just before every call was made, (2) to one-third of the physicians the reminder letter was sent out prior to every other call, (3) to the final third, the reminder letter was never sent.

Thus we had four variables: (1) type of postage, (2) type of call, (3) frequency of phoning physician, (4) frequency of reminder letter. The data were collected for the 12-month period between July 1, 1963 and June 30, 1964.

All data were collected and processed by National Analysts' own staff of interviewers.*

While the first two variables were introduced only at the beginning of the study and were expected to have effects only on the rate of cooperation of physicians, the latter two variables were introduced throughout the course of the one year and were expected to influence the physicians' recalling and reporting of cases they had seen.

Sampling

A two-stage stratified random sample of the state of Pennsylvania was the sample design employed for this study. Three primary strata were constructed: 1—cities over 50,000 in population; 2—suburban (metropolitan) counties (outside cities over 50,000 in population); and 3—nonmetropolitan counties.

The cities over 50,000 in population in the first stratum and the counties in the other two strata were defined as first-stage units (FSU's). Eighteen FSU's were selected in the sample with probabilities proportional to the number of households in each FSU. Names of all physicians in each of the 18 FSU's were obtained from a medical listing house. The second stage of the sample was a random draw of the physicians within each FSU.

The sample consisted of 711 M.D.'s and 77 O.D.'s in 18 sample points. Of the total 788 physicians selected in the sample to be screened for eligibility and cooperation, 12 had died and 34 had moved and could not be located in the state, leaving a total of 742 possible screenings. Of this number, 652 screening interviews were completed; 490 were

found to be eligible to participate in the study.

An experimental design was imposed on the screening in order to test approaches to be used in national studies as previously described. Prior to the screening operation, all physicians were sent a letter describing the study and requesting their cooperation. One-half of these letters were sent by regular mail and one-half sent special delivery. In addition, one-half of the physicians were contacted by telephone and one-half by personal visit.

To be eligible, a physician had to be a general practitioner or a specialist in either internal medicine, pediatrics, cardiology, or pediatric cardiology at least half-time, in the state of Pennsylvania.

Among the 742, a total of 490 were found to be eligible and then were divided into three groups: one group was interviewed every month, one every other month, and the last every third month, reporting on the number of cases of rheumatic fever for the appropriate time period between interviews.

Results

Postage

The use of special delivery service rather than regular postage to deliver the original letter to the selected physicians requesting their cooperation, and the use of a personal visit by an interviewer rather than telephone calls to explain the purposes and procedures of this study, apparently had no effect on the cooperation of the physicians (Table 1). In fact, approximately 4 per cent fewer physicians cooperated after they received the special delivery letter than did those who received letters using regular postage, although this difference is not statistically significant. A test of significant differences in technics, using the analysis of variance approach, showed

*In all phases of this study we have been fortunate to have the full cooperation and assistance of Martin E. Levy, M.D., who was in the Section on Rheumatic Fever and Congenital Heart Disease, USPHS, when the study was conceived and who continued his association with the study after he became chief of the Congenital Heart Section.

Table 1—Effects of postage and type of call on cooperation of physicians

	Total	Special delivery	Regular mail
Telephone			
Contacted	367	182	185
Cooperated	332	163	169
Personal visit			
Contacted	375	192	183
Cooperated	320	165	155
% cooperated			
Total		0.88	
Regular mail		0.88	
Special delivery		0.88	
Telephone		0.90	
Personal visit		0.85	

no significant differences. Testing the differences between the 85.6 per cent cooperation with special delivery letters and 90.2 per cent with regular mail shows a difference that does not reach significance at the 0.05 level. Similarly, comparing the 87.5 per cent cooperation with personal visit to the 88.3 per cent cooperation with telephone communication shows no significant difference.

Prior to initiating the study, cooperation and support of the Secretary of Health, Pennsylvania State Department of Health, and the Pennsylvania State Medical Society were obtained. A letter was sent to each selected physician mentioning the endorsement of these agencies and requesting his cooperation. It is believed that their endorsement was instrumental in securing the fine cooperation of practicing physicians throughout the state of Pennsylvania.

Reminder Letter

A reminder letter, which contained a list of the questions we would ask if the physician had seen a case of acute rheumatic fever during the study period, was sent to one-third of the physicians prior to each time they were phoned, to

another third prior to every other call made to them, and was never sent to the remaining third of the physicians. The singular finding with regard to the reminder letter is that it made no difference in the number of cases reported whether a physician received a reminder letter every time he was called or whether he never received a reminder letter, but if he sometimes received a letter and sometimes did not receive one, it tended to reduce the number of cases he recalled (Table 2).

Frequency of Call

The variable of most interest in this study was the frequency with which physicians were phoned—monthly, bimonthly, or trimonthly. Table 3 shows that the 490 physicians in the study reported seeing 231 new cases of ARF during the study period. Striking, however, is the finding that physicians who were called each month reported almost twice as many cases as did physicians called bimonthly or trimonthly. Since physicians were assigned to a treatment strictly on a chance basis, there should have been equal numbers of cases reported among the three groups if the variance in frequency of calls had made no difference.

Before one can accept as fact the finding that calling physicians every two or three months results in underreporting of cases seen, it must first be demonstrated that there are no extraneous variables working to benefit the

Table 2—Number of ARF cases reported, by frequency of sending reminder letter

Reminder sent	Total physicians	ARF cases reported	
		N	%
Every call	160	79	50
Every second call	163	70	43
Never	166	82	50

Table 3—Number of ARF cases reported, by frequency of call

	Total	Frequency of call		
		Monthly	Bimonthly	Trimonthly
No. of physicians	490	160	164	166
No. of physicians reporting cases	220	105	56	59
No. of ARF cases reported	231	111	59	61

physicians called once a month. For example, the results might be biased if physicians who lived in metropolitan areas were disproportionately represented in the monthly group, or if the percentage of specialists versus general practitioners varied by group, or if the characteristics of patients in the monthly group made it easier for the physicians to recall these cases.

To assert that any extraneous variable had a differential effect favoring recall by the monthly physicians, it must be shown that the bi- and trimonthly physicians measured equally on that variable and that both differed from the monthly physicians. Since the bi- and trimonthly physicians recalled about the same number of ARF cases, any variable causally related to this recall should be found equally in the two groups, but should be significantly different in these groups and the monthly physicians.

Location of Physicians

In Table 4, Central City refers to cities over 50,000, Suburban-metro is the balance of the metropolitan area with the cities over 50,000 excluded, while Nonmetro includes everything else, such as rural areas. Inspection of this table shows an equal percentage of physicians in the three experimental groups living in each area.

First Physician

It is conceivable that being the first physician to see a given case may have

a differential effect on the recall of that case. Respondents were asked "Are you the first physician seen for the current attack?" to which 21 per cent of the monthly physicians replied "no," while 16 per cent and 10 per cent of the bi-monthly and trimonthly, respectively, said "no" (Table 5). Although the

Table 4—Location of physicians, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
No. of physicians	160	164	166
	100%	100%	100%
Location			
Central City	24	25	22
Suburban-metro	54	52	52
Nonmetro	23	23	26

Table 5—"Are you the first physician seen for the current attack?" by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
No. of physicians	111	59	61
	100%	100%	100%
First physician?			
Yes	76	83	90
No	21	16	10
Case was reported by both initial and referred physician	3	2	—
Don't know	1	—	—

Table 6—Type of practice, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
No. of physicians	160	164	166
	100%	100%	100%
Practice			
General practitioner	65	74	72
Specialist	26	20	19
Both	9	6	9

monthly had 11 per cent more “no’s” than did the trimonthly, it had only 5 per cent more “no’s” than did the bimonthly group. Since the percentage of “no” in the bimonthly group is as close to the percentage in the monthly group as it is to the trimonthly, it is doubtful that this variable accounts for the underreporting of both the bimonthly and trimonthly groups.

Whenever a physician reported that he was not the first one to see the patient, the entire list of ARF cases reported was screened to assure that no patient was reported by more than one sample physician. Such multiple reported cases were assigned to the first physician who had seen the patient.

Type of Practice

When physicians were screened for eligibility for the study, they were asked whether they were in general practice, a specialty, or both. Table 6 shows a somewhat higher percentage of specialists among the monthly physicians as compared to either of the other two groups. Relatively speaking, the monthly group has about 25 per cent more specialists than either of the other two groups but in absolute terms this only amounts to 10 additional physicians out of a total 160. Even so, it remains to be demonstrated that specialists contribute more cases to the study than do general practitioners.

Cases Reported by General Practitioners and Specialists

While specialists represent 26 per cent of the sample of physicians in the monthly group (Table 6), they contribute 30 per cent of the cases (Table 7). Specialists represent 20 per cent of the physicians in the bimonthly group and reported 25 per cent of cases, while in the trimonthly group they represent 19 per cent of the physicians but only 17 per cent of the cases. In two groups, specialists accounted for more than their share of cases, but in the third their contribution of cases was lower. In brief, the data do not consistently show that specialists report a disproportionately high percentage of cases.

As a matter of general interest it may be noted that 64 per cent of the cases were reported by general practitioners, 14 per cent by specialists in internal medicine, 12 per cent by pediatricians, 4 per cent by cardiologists, 1 per cent by physicians specializing in both internal medicine and cardiology, and 1 per cent by specialists in both internal medicine and pediatrics.

Patient Characteristics Affecting Recall

There appears to be no reason why the group of physicians who were called more frequently than the others should have had patients who tended to delay

Table 7—Percentage of cases reported, by type of practice and by frequency of call

	Frequency of call and cases reported		
	Monthly	Bimonthly	Trimonthly
No. of cases	108	57	60
	100%	100%	100%
Practice			
General practitioner	59	61	73
Specialist	30	25	17
Both	11	14	10

Table 8—Number of days elapsed between the onset of symptoms and first visit to a physician, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
No. of cases	111	59	61
	100%	100%	100%
Days elapsed			
Five or less	54	42	55
Six to ten	28	38	21
Eleven and over	18	20	25

Table 9—Per cent of patients who had a previous history of rheumatic fever, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
Total	111	59	61
	100%	100%	100%
Yes	16	16	13
No	80	78	82
Don't know	2	4	3
Possibly	2	2	2

longer between onset of symptoms and the seeking of medical advice. Nevertheless, this might have occurred by chance and resulted in heightened recall by this group. It may be seen (Table 8) that approximately half of all the patients delayed five days or less, about one-fourth delayed six to ten days, and the balance 11 days or more. If this variable were differentially affecting the recall of the groups of physicians, Table 8 should show that the bi- and trimonthly groups are more alike on this variable than either one is like the monthly group. However, this table shows no such findings consistently—in the “five days or less” period, the monthly and trimonthly groups are almost identical, while in the “six to ten” day period the monthly group is almost exactly between bi- and trimonthly groups, and in the longest time period the bimonthly is closer to the monthly

than it is to the trimonthly group. Thus the number of days that elapsed between the onset of symptoms and the first visit to a physician cannot account for the underreporting by physicians in the bi- and trimonthly groups.

Previous History

If the patient had previously had acute rheumatic fever, the physician might have seen the patient during previous attacks and, therefore, might be better able to recall having seen this case during the study period. Table 9 shows only minor variations between the patients of the three groups of physicians.

Family History

Even though the patient did not have a previous history of rheumatic fever, the physician's concern, and recall of the case, might have been heightened if he had known that the patient's family had a previous history of rheumatic fever. In Table 10 one again sees differences between the groups that may be attributable only to chance variations.

Patient on Prophylaxis

The data indicate that only 40 patients were reported to be on prophylaxis at the time of the attack, a number too small to serve as a base of any differential statistical analysis. Among the cases reported, however, there does not

Table 10—Per cent of patients with family member who had rheumatic fever, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
Total	111	59	61
	100%	100%	100%
Yes	19	15	18
No	74	72	71
Don't know	8	13	12

Table 11—Per cent of patients on prophylaxis at the time of the present attack, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
Total	27	21	12
	100%	100%	100%
Yes	28	27	18
No	67	73	73
Don't know	6	—	9

Table 12—Per cent of patients who previously had rheumatic heart disease, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
Total	111	59	61
	100%	100%	100%
Yes	13	6	10
No	87	80	87
Don't know	—	15	3

seem to be any difference between the three groups—the monthly physicians and the bimonthly reported 28 per cent and 27 per cent, respectively, and the trimonthly 18 per cent (Table 11).

Rheumatic Heart Disease

In Table 12 there is a slightly higher percentage of rheumatic heart disease reported in the monthly group than among the other two groups, but the differences are too small to be either meaningfully or statistically significant.

Carditis

In Table 13 it is shown that physicians who were called monthly reported a smaller percentage of cases having carditis than did physicians in either of the other two groups. This suggests three possibilities. (1) If carditis in a patient leads to better recall of the case, the bimonthly and trimonthly physicians

should have reported more cases than did the monthly. (2) Carditis in a patient leads to the physician's suppressing recall of the case. (3) Presence of carditis is independent of recall. The latter appears the most reasonable.

Murmur

Tables 13 and 14 are similar in that physicians in the monthly group reported a smaller percentage of the cases having murmurs than did either of the other two groups of physicians. As with carditis, it is probable that the patient's heart murmur did not affect the physician's recall of the case.

Hospitalization of Patient

A physician's recall may be more acute for dramatic cases, for cases where hospitalization is planned or hospital visits involved. Physicians who reported a case were asked, "Has he been hospitalized, or will he be hospitalized for

Table 13—Per cent of patients who had evidence of carditis, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
Total	111	59	61
	100%	100%	100%
Yes	29	43	36
No	67	50	59
Don't know	4	7	5

Table 14—Per cent of patients who had a murmur present, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
Total	111	59	61
	100%	100%	100%
Yes	46	56	49
No	50	41	49
Don't know	5	4	2

this attack?" Table 15 shows a clearly and consistently higher percentage of the cases that have been or will be hospitalized for the monthly group rather than for either the bimonthly or trimonthly, ranging from 22 per cent to 25 per cent.

There are no further data on which to test the hypothesis that hospitalization leads to better recall of cases, but it may be noted that, even if one were to assume a perfect relationship between hospitalization and recall, this still could not account for the entire difference in recall between the three groups. At best the monthly group had, on a relative basis, less than 50 per cent more cases hospitalized than did either of the other two groups, but on an average the monthly physicians reported 85 per cent more cases than did the physicians in the other two groups.

For purposes of clarity it would have been better if there had been two questions asked: (1) has he been hospitalized? (2) will he be hospitalized? As the question was actually phrased, one can not tell whether the physician meant that his patient had been hospitalized, or that he merely intended to hospitalize him. It is conceivable that the monthly group included those they intended to hospitalize, but in the weeks following the telephone call these physicians decided not to hospitalize some of them. On the other hand, the bimonthly and trimonthly groups might have reported only cases they had actually hospitalized, while the monthly group included some cases they thought about hospitalizing, but actually never did hospitalize.

Conclusions

Neither the characteristics of the physicians, their geographical location nor the characteristics of their patients can explain the loss in recall of almost 50 per cent of the acute rheumatic fever patients among the physicians called bimonthly and trimonthly. On the basis

of these data the only factor to which the loss in recall of cases can be attributed is the length of time intervening between telephone calls. A delay of two or three months results in a loss of approximately 50 per cent of the cases in that time period.

While not shown in tables cited above, these results were true not only upon summation of the data over the course of the entire year but were found consistently in every reporting period throughout the year. This loss showed up even in the first two- and three-month periods and then continued. One can only conclude that a study of the incidence of acute rheumatic fever in which the data are collected from physicians less frequently than once per month is bound to underestimate the true incidence of this disease.

Still unclear, however, is the amount of loss, if any, suffered by collecting data only once a month. Should the data be collected biweekly, or perhaps daily? Would the gain in statistical accuracy be worth the costs in annoyance to physicians and additional efforts required to collect data so frequently? Or, would the total error increase if physicians refused to cooperate in a study where they are to be bothered daily or biweekly? These questions can be answered empirically and should not be left to conjecture. After all, it was claimed before the study started that physicians would

Table 15—Per cent of patients who had been hospitalized or expected to be hospitalized for this attack, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
Total	111	59	61
	100%	100%	100%
Yes	76	54	51
No	22	46	49
Don't know	3	—	—

have no trouble, even after three months, in recalling the cases of acute rheumatic fever they had seen.

Further Evaluation of the Research Design

In conducting this study, National Analysts' interviewers telephoned physicians regularly at the assigned times, and asked each if he had seen a new case of acute rheumatic fever since the last call, one month, two months, or three months before. If he had seen a case, the interviewer then continued by asking the questions on the Diagnostic Data Sheet about each new case the physician reported.*

It was hoped that the physicians would report sufficient information about each case so that judgments could be made as to whether or not it clearly met the requirements of the Jones criteria. It was found, however, that in many instances the physicians did not report data because they had not conducted certain tests, or they did not have the results available in their office records although they were available in hospital records, or else they misunderstood our question. In other instances one could not tell clearly whether a murmur had or had not been present before the current attack, or whether prophylaxis had been given for this attack or for a previous strep infection. Consequently, it was necessary to have a follow-up phase in which some physicians received letters and others were telephoned to clarify the data on the case reported.

Completeness of Data

Table 16 shows that 44 per cent of the bimonthly group required no follow-up, while 35 per cent and 38 per cent

of the monthly and trimonthly groups, respectively, required no follow-up. In other words, if one were to wait three months between telephone calls in order to give the physician ample opportunity to conduct all of his tests and to have his data in order, the results would be practically the same as for a one-month follow-up and only slightly poorer than for a two-month follow-up. On the other hand, the one-month group of physicians seemed to cooperate a little better in the follow-up calls.

Jones Criteria

On the basis of all of the available data, it was found that in the monthly and bimonthly groups approximately the same percentage of cases satisfied the Jones criteria (Table 17) but a considerably higher percentage of the trimonthly group (90 per cent versus 78 per cent and 76 per cent) met the Jones criteria. On the other hand, if one adds together those cases that definitely met the Jones criteria with those that "probably" were rheumatic fever, al-

Table 16—Results of follow-up, by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
Total	111	59	61
No follow-up indicated	100%	100%	100%
Follow-up, no data obtained, no change necessary	35	44	38
Follow-up, new data obtained	5	—	8
Attempted follow-up, no data supplied	55	51	49
Attempted follow-up, no name, could not remember patient	2	3	3
	4	2	2

* The Diagnostic Data Sheet was constructed by Martin Levy, M.D., Heart Control Program, US Public Health Service, and Aaron J. Spector, Ph.D., National Analysts, Inc.

Table 17—Judgment (after edit), by frequency of call

	Frequency of call		
	Monthly	Bimonthly	Trimonthly
Total	111	59	61
	100%	100%	100%
Jones criteria	76	78	90
Probable	12	9	5
Possible or uncertain	5	5	2
Not rheumatic fever	7	3	2
Insufficient data	—	5	2

though the data furnished to us did not strictly meet the criteria, the total for the monthly and bimonthly groups each was 87 per cent, while the trimonthly group was 95 per cent. Or, to look at it another way, in the once-a-month group, 7 per cent of the cases were definitely not rheumatic fever (most often this was the physician's report in his follow-up call), while 3 per cent of the bimonthly and 2 per cent of the trimonthly groups were definitely not rheumatic fever.

Obviously there is some loss in precision in calling physicians monthly because a small percentage of the cases they suspect of being rheumatic fever they later decide, on the basis of tests and of referral to other physicians, are in fact not rheumatic fever. In view of the relatively small number of cases reported, this error could easily be reduced by a brief call one month after the case is reported.

Estimates of Incidence

It may be recalled that a major reason for conducting this particular study is that estimates of incidence that are currently available are based upon conjecture, personal experience, and projection from local studies. In this study an attempt was made to learn more about the personal estimates that are made by practicing physicians. During the pre-

liminary screening to determine the eligibility of physicians, each one was asked how many cases of rheumatic fever he had seen in the past 12 months (1962-1963).

Table 18 shows that 220 of the 488 physicians who answered this question responded that they had seen no cases in 1962. The total group of 488 physicians reportedly had seen an average of 1.56 cases during the 12-month period. Among those who actually reported having seen a case (excluding the 220) there was an average of 3.0 cases per physician.

At the conclusion of the last telephone call in June, 1964, each physician was asked to estimate how many new cases of rheumatic fever he had seen during the past 12 months. After participating in the study for a year, there was a marked difference in the number of cases reported seen during the previous 12 months—a considerably higher percentage reported no cases seen during the study period (1963-1964) than in 1962-1963 (57 per cent versus 44 per cent). Among those who claimed they had seen a case during the study period, an average of 1.9 cases reportedly was

Table 18—Number of cases of rheumatic fever reported seen in 1962

No. of cases recalled	No. of physicians reporting	Total cases reported
00	220	00
01	86	86
02	60	120
03	59	177
04	19	76
05	14	70
06	10	60
07-25	20	214
No answer	02	—
	490	803
Total average=1.6		
Average among those reporting a case=3.0		

Table 19—Number of cases of rheumatic fever reported seen in past 12 months (estimated 1963-1964)

No. of cases recalled	No. of physicians reporting	Total cases reported
00	266	00
01	98	98
02	29	58
03	22	66
04-12	18	87
Don't know	11	—
No answer	23	—
	467	309
Total average=0.71		
Average among those reporting a case=1.85		

seen (Table 19), as contrasted with 3.0 the previous year. For the total sample of physicians, the average number of cases per physician who reported cases was 0.71.

While the above data suggest that participation in the study resulted in a lower and more accurate estimate of the number of ARF cases seen during the previous year, an alternative explanation might lie in the fact that they had actually seen fewer cases during the study period. At the conclusion of the final telephone calls, the sample of physicians were asked the following question: "In the past 12 months do you feel you have had more, the same, or fewer cases of rheumatic fever?" While 2 per cent did not know, 6 per cent said more, 54 per cent said the same amount, and 30 per cent replied that they had seen fewer cases of rheumatic fever during the past year. Accordingly, the smaller number of cases they estimated they had seen during the previous year may reflect the fact that 30 per cent of the physicians had indeed seen fewer cases. Thus one might conclude that the number of cases reported for both years was accurate, were it not for the fact that their year-end estimates for 1963-1964 were far higher than the number

of cases they actually reported during that year.

Among the physicians in the monthly group who actually reported a case during the study period, the average number of cases reported per physician was 0.96. Taking all three groups of physicians together, the average number of cases reported per physician (among those who actually reported a case) was 1.05. Accordingly, we can not be far off if we assume that the average number of cases any physician might see in a given year is about one. Contrasted to this was the 1.85 estimated at the end of 1963-1964, and the 3.0 estimated for the year 1962 (estimated by all physicians before the study began). Using a physician's best estimate of the previous year's experience, after stimulating his recall during that year or asking him without such stimulation, would yield an average estimate two to three times the number actually experienced.

If we can assume that the physicians who were called monthly actually gave us the best reporting of acute rheumatic fever during the year, then we can divide the total number of physicians in that group by the number of cases they reported, to obtain an estimate of the average number of cases per physician in the monthly sample. This arithmetic yields approximately 66 per cent, suggesting that two of every three physicians in that sample had seen a case during the previous year.

Again, taking the group of physicians who were called monthly as yielding the most accurate report of the number of new cases of acute rheumatic fever seen during the study year, we project the cases they reported to an estimated incidence of 9,041 cases seen by the entire universe of M.D.'s and O.D.'s in Pennsylvania who meet the criteria specified in our Sampling Plan.

Taking this incidence figure, we project it to the Pennsylvania population to arrive at a rate of approximately 79

cases per 100,000 population that are *known* by physicians.

Discussion

Measurement of the incidence of acute rheumatic fever on either a state-wide or a national basis requires efficient data collection from a reliable and representative source of information. When physicians are the source of information, it is imperative to obtain the cooperation of an unbiased sample of the physicians selected for study. The experience in the current research tends to indicate that the form of the initial approach to obtain the physician's cooperation does not significantly affect cooperation as long as the endorsement of the State Medical Society and the State Department of Health has previously been obtained. We are quite confident that without their endorsement we would not have had as much success in inducing physicians to cooperate.

A reminder letter did not seem to enhance the recall of physicians to whom it was sent regularly, but it did appear to impede recall if it was sent only before every other telephone call. Aside from the number of cases recalled, there are some intangible effects that the reminder letter may have induced, which were not measured, namely, the amount of data provided when a case was reported, and the rapport maintained with the physicians in question. On the face of it, one might suppose that these intangibles alone are worth the cost of sending a reminder letter and, therefore, the lack of effect upon recall is of secondary importance. If this be the case, the data clearly recommend that in future studies the reminder letter be sent prior to each and every call.

Undoubtedly the most interesting finding of this study was the fact that there was a substantial loss in recall of cases when physicians were phoned only bi-monthly or trimonthly, as compared

with monthly calls. The implications of this finding extend far beyond this incidence study of acute rheumatic fever: any incidence or prevalence studies that are based upon recall of cases for a period longer than one month may be suspected of yielding underestimates. This is not surprising in view of the National Health Survey's experience with underreporting of hospitalization in households that are interviewed more than two weeks after a household member was discharged from the hospital.

The data suggest the possibility of obtaining an even higher report of acute rheumatic fever if physicians are phoned every two weeks rather than every month. If calls were made as frequently as every two weeks, it is entirely possible that there would be a high dropout rate among the physicians in the sample. This, however, is an empirical question and should not be left to speculation. If speculation were accepted as fact, we would not have bothered telephoning physicians every month or every two months, but would have assumed that calling physicians every three months would yield perfectly reliable data.

Another methodological study might well be in order, in which samples of physicians would be phoned every two weeks, every month, two months, and three months. Replicating the methodological study should be considered because the budget required for contacting physicians every month in a national study is so great that money spent to verify these findings in a replicated study might be a wise investment.

In a replicated study it might also be well to experiment with the use of two or three physicians to make telephone calls to obtain case data after lay interviewers have found a physician who has seen a case during the reporting period. In the present study it was necessary to telephone or to write to a number of the physicians to clarify the reports they had given to the inter-

viewer. If a physician had been conducting the interview, he might have collected better data initially. On the other hand, with an improved questionnaire lay interviewers may be able to obtain sufficient detail so that follow-up calls by physicians would not be needed.

An experiment can be designed to test the efficacy of using lay interviewers with an improved questionnaire to collect the incidence data, to compare with other data collected by a small number of physicians. It will be remembered that it required many thousands of telephone calls to the sample of physicians in order to identify the 231 cases reported. The preliminary calls are more economically made by lay interviewers than by physicians.

Additionally, it was found that 7 per cent of the cases reported by the physicians phoned monthly were later classified as "not rheumatic fever," while only 3 per cent and 2 per cent of the bi- and trimonthly groups, respectively, were reclassified. It seems that, given an additional month to see the case, the physi-

cians reclassify a small per cent of the cases. Thus in the next study each physician in the monthly group who reports a case would be asked during the next regular call whether he has any additional information about the case he previously reported.

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