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Medical History Questionnaire

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SOME EXPERIENCE WITH AN AUTOMATED MEDICAL HISTORY QUESTIONNAIRE

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The need to expand the supply of physicians' services in the United States is well documented¹ and many methods have been suggested to provide this needed expansion. In general, they have taken one of two approaches — efforts to increase the number of physicians or attempts to improve the productivity of physicians.²

Given the existing constraints on medical education and the difficulty of achieving any immediate increase in the number of graduate doctors, the need to focus on productivity — at least in the short term — is evident. However, although many man-years of effort have been expended by management researchers on problems of industrial productivity, the task of increasing the effectiveness of resource utilization in the medical setting has, by contrast, been left relatively untouched. Yet there are some fairly easily discernible opportunities. When one begins to analyze the tasks the physician must perform, one obvious target for improvement is the time-consuming job of extracting and recording the many details about the patient's medical history.

One project to make such an improvement has been proceeding at the Lahey Clinic in Boston, Massachusetts, since early 1968. Now in its fourth major revision, the Lahey Clinic Automated Medical History Questionnaire (AMHQ) has been given to more than 20,000 patients and is currently being administered to new patients who come to the clinic. Some results of the experience with this questionnaire are reported here.

Initial Considerations and Objectives

Founded in 1923 by Dr. Frank H. Lahey, the Lahey Clinic Foundation now consists of approximately 100 physicians who practice in one of 25 medical specialties. Since its founding, the clinic has grown to serve an international patient population through its emphasis on specialized, diagnostic practice. Many new techniques of delivering improved patient care have been developed within the clinic's policy of maintaining close physician-patient relationships coupled with high quality specialized care. Working within the framework of this type of practice, the Lahey AMHQ was developed.

Originally based on a questionnaire devised at Massachusetts General Hospital, the Lahey AMHQ has been developed with the widespread participation of a significant portion of the Lahey Clinic staff, both professional and administrative. This has included a specially formed Automated Medical History Committee, headed by Dr. George O. Bell, former chief of the Clinic's Department of Internal Medicine, an informal advisory group of other physicians chosen to represent the various specialties at the Clinic, and members of the Clinic's Systems Department, consisting of both medical and lay personnel. In addition, members of the faculty of M.I.T.'s Sloan School of Management have participated in the development. New versions of the AMHQ have benefitted from the formal and informal comments of numerous other doctors. Thus the current version of the questionnaire is composed of the ideas and suggestions of a number of individuals, but primarily it is the product of the Clinic's medical staff.

The computer-processed questionnaire was originated with three major goals in mind. It was felt that the questionnaire could increase the productivity of the physician by (1) providing him with a patient-prepared summary of the patient's medical history as a base for the doctor's own questioning, (2) using the questionnaire-provided symptoms as a basis for more effective scheduling of patients to the correct specialists, and (3) utilizing this data, recorded in computer-readable form for the first time, as a research tool for the further improvement of the dual processes of scheduling and medical care.

In looking at the first of these goals, there were two areas where significant productivity increases were anticipated through the use of the patient-prepared, computer-processed medical history summary. First, it was felt that some physicians would be able to save time on each appointment by being able to reduce the number of questions actually asked of the patient, and by reducing the amount of writing and recording necessary. Second, it was felt that even if the time necessary for each visit could not be shortened, it might still be possible for it to be used more effectively. For example, the physician, having considerable information about the patient before him even before he began his questioning, might be able to inquire more broadly about the patient's condition or delve in greater depth into specific areas, thereby increasing the amount accomplished during each appointment.

The second goal, that of more effective patient scheduling, is related closely to the clinic's particular outlook on

¹Report of the National Advisory Commission on Health Manpower, U.S. Government Printing Office, Washington, D.C. Nov. 1967.

²Rashi, Fein *The Doctor Shortage: An Economic Diagnosis*, The Brookings Institution, Washington, D. C., May 1967.

patient care. In line with its policy of attempting to keep to a minimum the total amount of time that each patient must spend waiting for and undergoing treatment, the Lahey Clinic appointment office preschedules each patient for those specialist appointments that appear to be necessary. In this way, long waiting times between appointments and the necessity for multiple visits to the clinic are kept to a minimum. An earlier study of this system had indicated that many necessary specialist appointments were not made merely because some simple information about the patient's condition had not been obtained by the appointment secretary.³ An analysis of the scheduling errors showed that approximately 40% of the unscheduled, but necessary, specialist appointments were caused by the failure of the appointment secretary to elicit this basic pertinent information from the patient. When this missing information was finally obtained by the physician during the patient's initial appointment, the problem of then finding appointment time in the schedule of the indicated specialist was often very difficult. It is important to note, however, that in most of these cases, the gathering of this information required only the asking of a few routine questions by the physician rather than the exercise of any diagnostic ability on his part. The same questions could have been asked just as easily by the appointment secretary.

As for the last objective, it was felt that the availability of the data which could be provided by the AMHQ could provide a "data base" which could be useful for further research on the underlying problems of patient scheduling and for improving the basic understanding of the physician's method of gathering patient information.

The remainder of this paper will focus on the first goal — the experience of the clinic physicians with the patient-recorded medical history. The scheduling and data base goals will be discussed only briefly.

Previous Work in the Field

Medical history questionnaires, in one form or another, have been in use on the American medical scene for the past two decades. Recently, there have been a number of reports on this growing body of work. At the present time, according to one survey, there are at least 18 general medical history questionnaires which have been developed and used.⁴

In general, these questionnaires take one of three forms: paper questionnaires, computer batch-processed paper questionnaires, or online computer history-taking systems.

The Cornell Medical Index, the forerunner of most medical history systems, is an example of a simple paper questionnaire.⁵ Developed in 1949, it is currently com-

posed of approximately 150 "yes-no" questions, to be filled out by the patient at the doctor's office. The questionnaire is then given to the attending physician, without further processing, to be used by him as a diagnostic aid.

A prime example of a batch-processed questionnaire is the symptom-gathering system used at the Kaiser-Permanente Medical Center in Oakland, California.⁶ Symptom information is obtained from the patient as he proceeds through Kaiser's multiphasic screening laboratory before a physician appointment. At the medical history station, the patient sorts approximately 200 prepunched IBM cards, each bearing a different symptom, into yes and no categories. Positive answers are then printed from the cards by a computer for the examining physician's review.

The third major approach consists of the online computer history-taking systems such as those developed by Slack at Wisconsin,⁷ Barnett and Grossman at the Massachusetts General Hospital,⁸ and Mayne at the Mayo Clinic.⁹ Here the patient sits at a computer terminal and responds to the questions presented to him by the computer. At the end of the session, a summary of the patient's answers are printed by the computer for the use of the physician. Although it is the most sophisticated and flexible of the three approaches, it is also by far the most costly.

Accompanying each of these efforts to devise a better medical symptom-gathering system, there has been significant research done in order to evaluate their effectiveness, efficiency, and acceptance. It is important to note, however, that almost all of these studies are based upon experimental, research-oriented samples rather than full-scale, multiple-physician, "production runs." The fact that the AMHQ is now being administered to new patients (with some, primarily mail turnabout time, limitations) who come to the Lahey Clinic — and that all funds expended for its development came from internal clinic sources — make this medical history system distinctively unique.

The Lahey Clinic AMHQ

The Lahey Clinic Automated Medical History Questionnaire is now in its fourth version. The first two of these were preliminary in nature and were only used for a short period of time. Versions III and IV, on the other hand, have had significant usage and so will be described in some detail.

⁶ Morris, M. Collen, "Periodic Health Examinations Using an Automated Multitest Laboratory," *JAMA*, CVC, No. 10, March 7, 1966, 830-833.

⁷ W. V. Slack, G. P. Hicks, C. E. Reed, and L. J. Van Cura, "A Computer Based Medical History System," *New England Journal of Medicine*, CCLXXIV, January 27, 1966, 194-198.

⁸ J. Grossman, G. O. Barnett, D. Smedlow, M. McGuire, "The Collection of Medical History Data Using a Real-Time Computer System," *Proceedings of the Annual Conference on Engineering in Medicine and Biology*, Houston, Texas, 1968.

⁹ J. G. Mayne, W. Weksel, and P. N. Sholtz, "Toward Automating the Medical History," *Mayo Clinic Proceedings*, XLIII, No. 1, January 1968, 1-25.

John F. Rockart, "Scheduling in a Multiple-Specialist Group Medical Practice," unpublished Ph.D. dissertation, Sloan School of Management, M.I.T., Cambridge, Mass., 1968.

M. Budd, et al., *Survey of Automated Medical History Acquisition and Administering Devices*, Harvard Medical School, Boston Mass., December 31, 1969.

K. Brodman, A. J. Erdmann, Jr., I. Large, and H. G. Wolff, "The Cornell Medical Index: An Adjunct to Medical Interview," *JAMA*, CXL, June 11, 1949, 530-534.

The current version is a 160-question, 619-answer, paper questionnaire, which is sent to new patients at the time they request an appointment. It is to be completed by them at home and returned to the clinic for processing in order to be available to the physicians by the time of the patient's first appointments at the clinic. Since new patients are generally scheduled from two to three weeks in advance, the patient usually has ample time to return the questionnaire for computer processing before he arrives at the clinic.

The questionnaire consists of two major parts. The first part is a short form on which the patient lists, in his own handwriting, his chief complaint or reason for coming to the clinic, along with other pertinent medical data such as allergic drug reactions, data on previous hospitalizations, current medications, and so forth. The second, and more extensive part, is a series of multiple-choice questions. By marking the appropriate responses, the patient is able to give a fairly detailed picture of his family medical history, his personal habits (for example, smoking, drinking, etc.), and the current state of his health (that is, review of systems).

When the questionnaire booklet is returned to the clinic, the affirmative answers are converted into machine-readable form and then summarized into a concise report for the physician. This is accomplished through a simple computer program which converts the patient responses into medical terminology by means of a response-symptom dictionary.

In review, the main features of the various versions of the Lahey Questionnaire are that it:

Allows the patient to fill in the questionnaire in the quiet of his own home, where he has access to information about his past family medical history, medical reports from other doctors, names of drugs he is currently taking, and so forth

Has a limited amount of branching, which enables the patient to skip questions not applicable to him

Allows the patient to describe his most important problem — his chief complaint — in his own words, as well as allowing him to add other items of interest not easily includible in a check list format.

Can supply data about the patient before his arrival at the clinic, so that more accurate scheduling can be performed

Is relatively inexpensive since a paper questionnaire booklet and computer batch-processing are used

Is computer processed and can, therefore, provide the capability to selectively print out those items which the physicians feel are necessary to see, format this output in any manner deemed desirable, and store symptom data in machine-readable form for subsequent research purposes.

A final item which has accompanied all versions of the questionnaire has been a firm research commitment that has sought to establish the value of the questionnaire for both the patient and the physician. With each major version there have been studies with regard to patient acceptance, the validity of questionnaire findings, and acceptance and use of the questionnaire by physicians. The findings of these studies are discussed below. Version III will be discussed extensively because these studies are complete; those in connection with version IV are still in process and the conclusions are, therefore, only tentative.

Version III

Because of the development nature of the first two versions, version III of the questionnaire was the first real test for the Automated Medical History System. It was designed to be sent to a limited number of new patients, approximately 20 to 30 daily, whose initial appointments were to be with members of the clinic's internal medicine or gastroenterology departments. It consisted of a one-page "free form" answer sheet (Exhibit 1) and 392 yes - no questions (a sample page is shown in Exhibit 2). Upon being returned to the clinic, the checkmarks made by the patient were reviewed by a clinic control clerk who checked for completeness and consistency. The numbers of all positive responses were then keypunched and verified. From these cards a printout (Exhibit 3) was produced which, together with the free form sheet, was placed in the patient's medical record folder to await the day of his arrival.

The use of this printout and answer sheet by the examining physician was optional; but, as will be discussed below, it has been used rather extensively. Before examining this all-important matter of physician acceptance and use, however, the issues of patient acceptance and question validity for version III will be discussed.

Patient Acceptance

In the area of patient reaction to the questionnaire, the Lahey Clinic's experience has been similar to that reported by Slack,¹⁰ Grossman,¹¹ and Mayne.¹² By far a majority of the patients have commented favorably on the questionnaire as a means of collecting medical history information. Only a tiny minority did not like the questionnaire. They were either annoyed by the time it took to fill it out or they felt it was not appropriate due to the nature of their problem. (For example, "Why ask all these questions about my chest and stomach? I came here because of a back pain.")

The much larger group of patients whose responses were favorable reported many and varying reasons for liking the questionnaire. Some said that it gave them even more confidence in the thoroughness of the treatment

¹⁰Slack et al., *op. cit.*

¹¹Grossman et al., *op. cit.*

¹²Mayne et al., *op. cit.*

that they expected to receive at the clinic. Others appreciated the opportunity to think about their problems in the unhurried atmosphere of their home and the ability to consult family records if necessary. In this way patients felt they were less likely to overlook or forget problems in the unfamiliar atmosphere of the doctor's office and thus neglect to mention them. Finally, a significant number of patients mentioned the benefits discussed earlier in this paper, namely the potential of the questionnaire to save time and assist the physician in practicing more complete medicine.

Question Validity

As Mayne and his colleagues at Mayo have pointed out,¹³ the problem of evaluating the effectiveness and efficiency of medical history questionnaires in gathering medical history information is a difficult one. At the heart of this problem is the difficulty of finding a standard against which to compare the automated medical history. Many attempts have been made to evaluate questionnaire accuracy. On a negative note, in addition to Mayne, Ashford¹⁴ and Collen¹⁵ have shown that the reproducibility of information given by patients by means of medical history questionnaires has been less than perfect. However, many physicians have reported that when they themselves have asked certain questions of the same patient, they have received conflicting answers. Therefore, it is probably unreasonable to expect a questionnaire to be free from such problems.

One way that has been suggested for the ranking of computer questionnaires is a comparison between the history a physician would take from a patient and that he would get from a medical history questionnaire. This approach, however, has certain shortcomings. Feinstein¹⁶ has shown that the type and amount of patient data collected by different physicians is highly variable. Variations in physician training, personal characteristics, and time available to see each patient all tend to cause this variation. Yet, in spite of these difficulties, the physician-taken medical history is still perhaps the best standard available to serve as a basis for making a judgment about the value of an automated medical history questionnaire.

Using this standard, Brodman, in a study conducted in 1949, came to the conclusion that the Cornell Medical Index collected more information than the physician and that "these data were collected as accurately as in oral interview."¹⁷ Mayne, reporting on a study at the Mayo Clinic, found that "comparisons made between the traditional record and the AMH summary with respect to 'Past

Surgery' and 'Past Illness' information suggests that, given the total set of patient responses, AMH performance in data collection was significantly better than the physician's."¹⁸

Grossman, in a review of 56 cases, also found that the automated medical history recorded more findings than the physician.¹⁹ He noted there was an average of two false positives (findings recorded by the automated medical history but not by the physician) and three false negatives (items recorded as negative by the automated medical history but positive by the physician) in each automated medical history examined.

Using this physician-taken history as a standard, the completeness and accuracy of the Lahey AMHQ was investigated. Forty patients' questionnaires were selected at random and analyzed by a team of physicians and systems analysts. The information on each computer summary was compared, item by item, with the data recorded on the medical record by the physician. It should be noted that in each case the physician had the AMHQ data available to him when he was conducting his examination. An average of 46 items was recorded on each AMHQ. The physician, on the average, agreed with (noted) 21 of these. On the average, the physician also noted two additional findings not present in the AMHQ while denying (recording an entry to the contrary of) only one of the AMHQ findings. These figures are summarized in Table 1.

Table 1. Numbers of items recorded by AMHQ and by physicians in a sample of 40 patient records

Items reported by both the AMHQ and the physician	21
Items reported by the AMHQ only	24
Items denied by the physician	1
Total items in the AMHQ	46
Items reported by the physician only	2
Total items reported concerning the patient	48

In general, these statistics on false positives and false negatives are comparable with those reported by Mayne and Grossman. It is evident that there will always be some false positives and false negatives connected with automated medical history questionnaires. As was previously noted, the problem of obtaining consistent patient responses from one test or interview to another is present regardless of the means used to elicit the information. This problem of test-retest reliability will probably ensure that some differences will always exist between a questionnaire's findings and those of the physician.

It is also evident that the AMHQ tends to "over-report" in relation to the physician. This, too, can be expected. From the standpoint of the physician, the task of recording medical history data is essentially an unproductive,

¹³Ibid.
¹⁴J. R. Ashford, "Comparison of Two Symptom Questionnaires," *Comparability in International Epidemiology*, Milbank, 1964, 90-106.

¹⁵M. F. Collen, Cutler, Sieglau, Cella, "Reliability of a Self-Administered Medical Questionnaire," *Archives on Internal Medicine* CXXIII 1969, 664-681.

¹⁶A. R. Feinstein, *Clinical Judgement*, Williams & Wilkins, 1967.
¹⁷Brodman et al., *op. cit.*, p. 534.

¹⁸Mayne et al., *op. cit.*, p. 23.

¹⁹Grossman et al., *op. cit.*

somewhat boring, and sometimes disliked activity. As a result, it is done in a highly selective manner. Most often, only those facts that are felt to be of real significance to the patient's current or future condition are recorded.

A further insight can be gained, moreover, by looking beneath the general statistics on AMHQ over-reporting. In particular, two interesting findings come to light: one concerning the nature of the patient, and the other concerning the nature of the items reported.

As discussed above, on average the physician reported 44% of the items noted on the AMHQ. However, this percentage looks quite different when the patients are classified into two groups according to whether or not their problems are of a functional or organic origin. It should be noted that for the purposes of this split, the judgment as to whether the patient's problem is functional or not is made by the patient, not by the physician.

On the AMHQ, question 713 asks "Do you feel that many of your complaints are a result of your being anxious or nervous?" This question has been found to be a very good indicator of those patients whose problems are of a functional nature.

Of the 18 patients who answered yes to this question, all but five were found to have no significant ailments; that is, their final diagnoses were essentially functional. Of the other 22 patients, there were only three essentially functional diagnoses. Therefore, question 713 was used to divide the sample into two groups, those that answered yes were placed in one group and those that answered no in the other. For the functional patients (those who answered yes), physicians recorded only 38% of the items noted by the patient. For the other group, however, the physicians recorded 50% of the items noted by the patient on the AMHQ (see Table 2). This increase in the percentage recorded by the physician is significant at the 1% level on a test of proportions. Thus the tendency of the AMHQ to over-report — or, perhaps, of the physician to under-report — is more pronounced for this particular class of patient than for other patients.

Turning from this analysis of the patients in the sample to an examination of the nature of the items reported, a

question-by-question look at the 1,033 items not recorded by the physicians points to a second possible explanation of the AMHQ's over-reporting in comparison with the physician-recorded history. Of all the items reported by the AMHQ but not by the physician, more than 60% of them were replies which could be classed as "qualifiers" — items that add additional detail to a major symptom or to items in the family or social history.

An example of such a qualifier is the question in the social history section which asks, for those patients who have indicated that they smoke cigarettes, "What is the total number of years you have smoked cigarettes?" Twenty-four patients responded to this question and noted a time span; only one physician made such a notation in the medical record.

In another example, after having noted "pains in the stomach or abdomen," nine patients provided the additional description on the AMHQ that these pains were "crampy" and eleven noted that the pains "occurred at no particular time." One physician did record the patient's report that the onset of his pains was at irregular times, but in none of the medical records could a reference (either exact or synonymous) be found to "crampy" pains.

It is questions such as these that account for the majority of the over-recording which appears in the AMHQ. As noted above, these are essentially qualifiers (noting location, time duration, etc.) of major symptoms, and, as such, they are most often recorded by the physician only when he believes that both the major symptom and the qualifiers are of some current importance with regard to the patient's condition. Whether it is useful to have these on the AMHQ is a matter of conjecture. The inclusion of these qualifiers does make the printout wordy, thus requiring more time to read. However, members of the Clinic Automated Medical History Committee believe that the qualifiers are of positive value. A majority of them feel that the small penalty paid in increased reading time is more than offset by the improved picture of the patient's condition. Also, the committee is unanimous in its agreement that the patient's indication of these qualifiers should be saved for research purposes.

Table 2. Comparison of number of items recorded by AMHQ and by physicians classified according to probable functional nature of medical complaint

	"Functional" group (question 713 answered yes)	"Organic" group (question 713 answered no)	Total of sample
Number of patients in sample	18	22	40
Total number of items reported by AMHQ	877	976	1853
Total number of items recorded by physicians	333	487	820
Percentage of AMHQ-reported items recorded by physicians	38%	50%	44%

Physician Acceptance and Use

After the AMHQ had been in use for about a year and a half, a survey was conducted of all those physicians whose patients were receiving the questionnaire.²⁰ In all, 47 clinic physicians were interviewed. Among the various questions asked, three are of particular interest in evaluating the doctors' feelings about this means of collecting medical history data. (Other questions were used as a basis for making improvements in the AMHQ itself. These suggestions were incorporated in version IV.)

Two of these three questions asked the physician about his opinion of the usefulness of the AMHQ and the extent to which he actually used it in his own practice. The results of these two questions are combined and shown in Figure 1. As can be seen, a majority of those interviewed felt that the questionnaire was reasonably useful.

The other question concerned the nature of the physicians' attitudes toward the AMHQ (see Figure 2). Not surprisingly, the answers to this question were similar to those reported above, with most physicians stating that their attitude was "somewhat favorable." It should be pointed out, however, that it is not unreasonable to expect some differences to exist between the reports concerning current use and the statements regarding attitudes, for the latter includes not only an estimate of how good the AMHQ is at present, but also some feelings about how good it may become in the future.

It is also interesting to look behind the overall attitudes and see some of the specific reasons given by the physicians for their use of the AMHQ. One major reason is the potential for saving time. Twenty of the 47 physicians felt that the questionnaire saved them at least some time on each patient visit (Figure 3). These figures are, of course, only approximate for it was not possible to measure the exact decrease in the duration of each visit. But these estimates on the part of the clinic physicians still serve as a good indication of their appraisal of the worth of the questionnaire. Several other reasons were volunteered by the doctors in support of the AMHQ's; these are summarized in Table 3.

Version IV

The current version of the Lahey AMHQ includes several significant changes from version III. These changes were partially the result of the above-reported experience, and partially the desire to work with a larger group of patients and physicians on a full "production" basis. Although experience with version III answered many questions, several new ones arose. Among these were questions such as the following:

How would specialists in areas other than internal medicine and gastroenterology react to the questionnaire?

²⁰Ephraim R. McLean, "A Computer-Based Medical History System: Factors Affecting Its Acceptance and Use by Physicians," unpublished Ph.D. dissertation, Sloan School of Management, M.I.T., Cambridge, Mass., 1969.

Table 3. Reasons volunteered by physicians in support of the AMHQ

Reason	No. of times mentioned
Provides a "head start," a "jumping-off point," or a "pertinent place to begin my history taking"	18
Provides a "check on my own history"	15
Is helpful on the family and social history	10
Directs attention to specialities other than my own	10
Allows a "more complete" history	5
Makes the patient a better historian	3

Could the AMHQ be implemented on a production basis, rather than the previous experimental one?

Would the previously reported data on physician acceptance, question validity, and patient acceptance change as the result of greater exposure to the AMHQ — and if so, in what direction would these changes be?

Would patients fill in an optically-scannable questionnaire correctly, so that the costs of data conversion could be kept low?

With the introduction of version IV, attempts are being made to provide answers to these questions. The questionnaire is now sent out to all new patients, regardless of the initial specialty to be seen. The only patients who do not receive it are those whose appointments are less than seven days away. The questionnaire's free form part has been abbreviated to reduce the space taken in the record, while the yes - no and multiple-choice part has been redesigned to be read by an optical scanner. Despite some initial apprehension about the feasibility of this method, optical scanning has proven to be quite satisfactory. Although approximately 5% of the questionnaires have to be remarked by the control section personnel, the cost savings and increased accuracy of the new system, in comparison to key-punching, are significant.

The program used to process the patient's answers, and the format of the printouts have also been substantially modified. As a compromise between "the availability of a full picture" and "over-reporting of useless detail," some decision rules have been introduced to eliminate from the printout some of the symptom qualifiers that seem to be of little use. For example, a patient reporting "abdominal pain," "only occasionally," which was "crampy" with an "onset after eating" would have the last two qualifiers omitted from his printout. At the present time there are only a few such decision rules which are in effect on version IV, but more may be added.

At this time, the new version has been in use for approximately five months. The data is preliminary — but it points

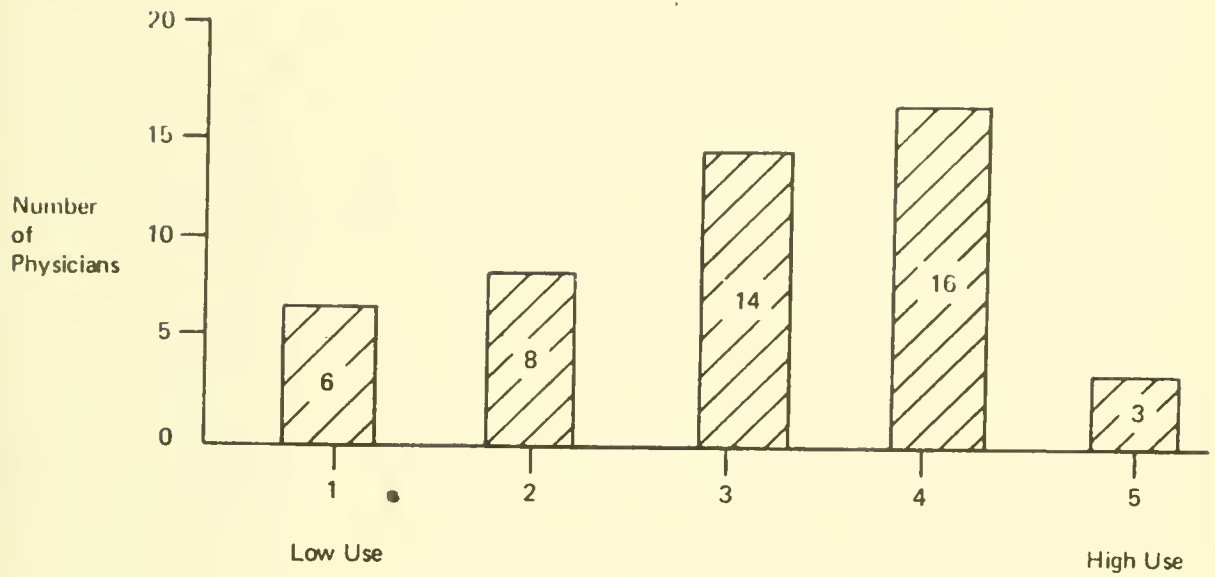


Figure 1. Reported use by physicians of AMHQ

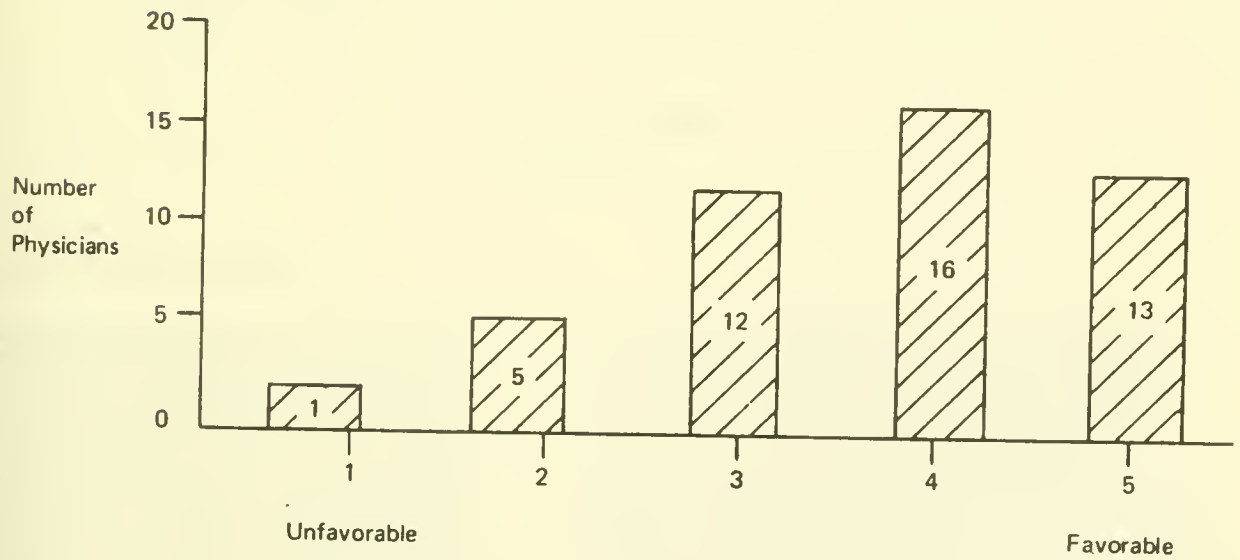


Figure 2. Reported attitude of physicians toward AMHQ



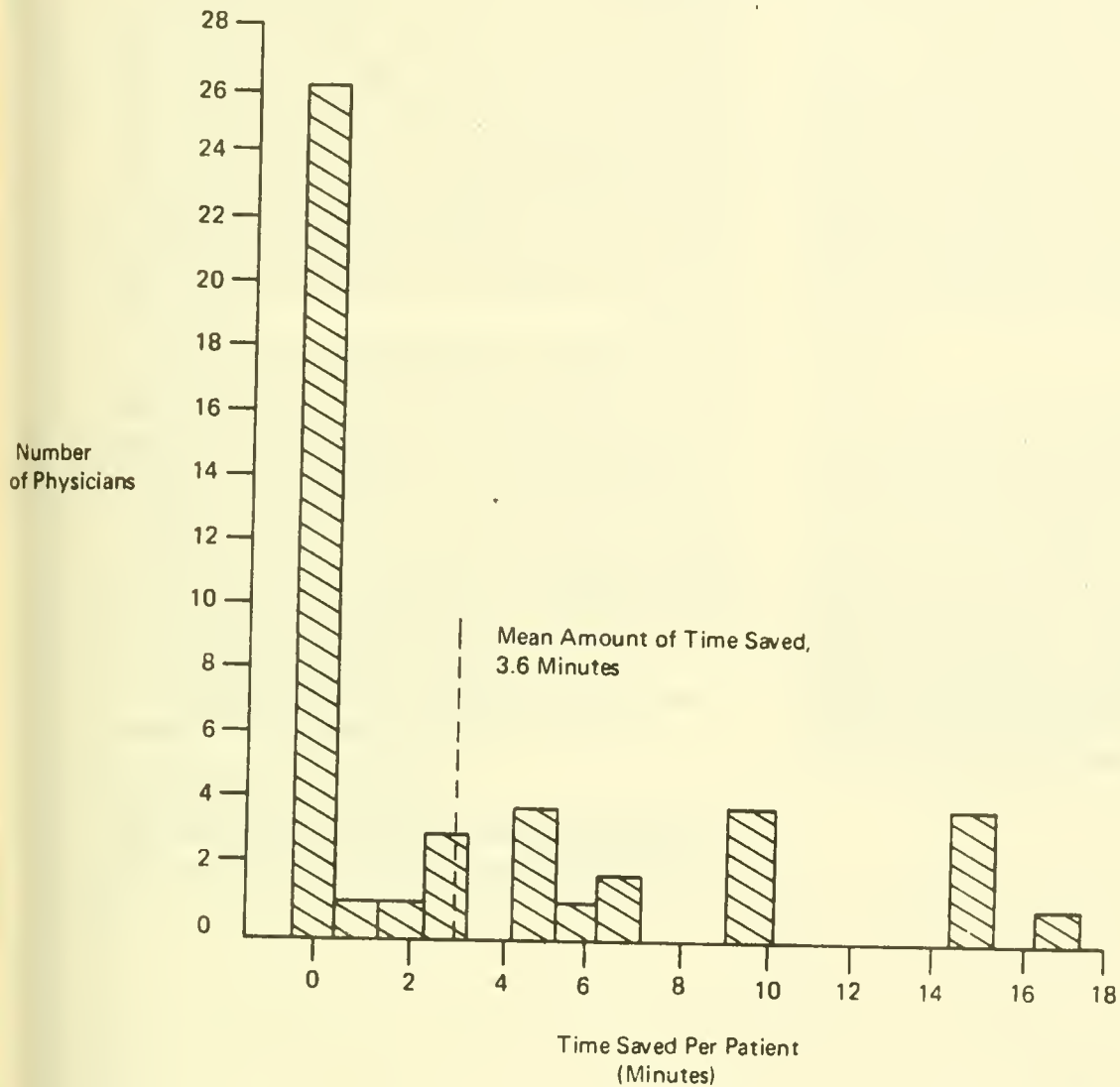


Figure 3. Reported time saved by physicians

to some interesting conclusions, the most important of which is that it takes a full production run to reveal some facts about the system. Some interesting differences between the present and past versions have already been noted.

One major similarity between the two versions is that patients remain overwhelmingly in favor of the AMHQ. To measure their reactions to version IV, a separate sheet requesting comments on the questionnaire was sent to the first 2,000 patients. Three-quarters of them made no comment at all, but of the 489 patients who did, only six were unfavorable. The remaining 483 comments ranged from mildly favorable to extremely favorable.

There are some differences, however. In particular, two points have come to light. First, it appears that the statistics on false positives will be quite different for this "production" version than was the case for the preceding experimental one. On version III, the AMHQ printout was a supplemental item in the medical record, and it was not convenient for the physician to make entries on it. With version IV, the printout is the only history in the record, so if the physician wishes to take his own history or make additional entries, he must write directly on the printout. Thus, for the first time, there is the ability to study the percentages of false positives and false negatives as recorded by the AMHQ

and then verified by the physician. As he strikes out symptoms or adds data to the printout, the physician is essentially doing the research job of identifying the false positives and false negatives. Many of the more meticulous physicians, concerned that each item of data in the record be correct, have marked up the printout in such a way that a much different picture of the number of false positives is emerging than was the case with the preceding version. In particular, false positives are being noted by some physicians at three to four times the former rate. Although this might suggest that the current version is less accurate than the preceding one, a more likely explanation is that the number of false positives previously uncovered was artificially low. With the much greater scrutiny that version IV is receiving from the physicians, it is felt that the current measures are much closer to the truth.

The second interesting difference in the data is what appears to be a shift in the attitudes of staff members toward the AMHQ as they become more familiar with it. In a few cases, increased familiarity has bred a less positive attitude toward the questionnaire and consequently less use of it. There are several possible explanations, but this decline in attitude on the part of a few may be the result of initial expectations which were unrealistically high. On the whole, however, the increased exposure to the AMHQ has tended to be translated into a better insight into what the questionnaire is — and what it is not — with the result that there is a more positive general attitude toward it.

It is expected that the complete data on the studies on version IV will be available by the end of the year.

Scheduling and Data Base Goals

The initial results of a simulated test of the utilization of the questionnaire for scheduling purposes has been re-

ported elsewhere.²¹ In brief, it appears that the additional information made available by the AMHQ does lead to more accurate patient scheduling. Current, more pragmatic, efforts have also proved somewhat encouraging, but are not yet ready to be reported upon. The availability of the data from the AMHQ is nevertheless beginning to prove useful. In one instance, a study of the chief complaints reported by a thousand patients is being used to prepare an instruction manual for the appointment office secretaries. It will contain two columns: one will list "reporting symptom/or complaints" and the other the specialties to which these patients should be scheduled based upon these complaints. This approach appears to be of particular value in scheduling those patients who telephone for relatively urgent near-term appointments.

Summary

Use of an automated medical history questionnaire at the Lahey Clinic has been an evolutionary process — with research performed in each version pointing toward improvements which can be incorporated into a subsequent version of the AMHQ. In general, patient acceptance has been very good and physician acceptance and use of the AMHQ has been positive. For many reasons, the questionnaire reports more items of information about a patient than the physician records in actual practice in the medical history. In addition, the AMHQ has been shown to miss some items of information and to report some incorrect data. Additional research is taking place at present to further refine the Lahey AMHQ.

²¹John F. Rockart, Philip I. Hershberg, Jerome Grossman, and Richard Harrison, "A Symptom-Scoring Technique for Scheduling Patients in a Group Practice," *Proceedings of the Institute of Electrical and Electronic Engineers*, LVII, No. 11, November 1969, 1926-1933.

LAHEY CLINIC FOUNDATION
MEDICAL HISTORY QUESTIONNAIRE

1. NAME Dee Mary _____
(Last) (First) (Middle)

2. CHIEF COMPLAINT
What is your reason for coming to the Lahey Clinic?
My feet swell and bother me.

3. SPECIALIST REQUEST
Has a specialist(s) been suggested by your doctor? No.
Is there a specialist(s) whom you would like to see? No.

4. MEDICATIONS
What medicines or drugs are you taking at present? None.

For what condition(s), and how often? _____

5. ALLERGIES AND REACTIONS
List allergies and/or reactions to drugs. allergy to cosmetics.

6. ADDITIONAL COMPLAINTS AND INFORMATION
List in order of their importance to you any other facts or problems which you think might be significant, or relate to your current condition.
Fatigue and nervousness.

7. HOSPITALIZATIONS
List hospitalizations for any illnesses, operations, or accidents.

<u>YEAR</u>	<u>REASON</u>
<u>1954</u>	<u>appendectomy.</u>
<u>1962</u>	<u>Childbirth.</u>

HAVE YOU HAD ANY OF THE FOLLOWING CONDITIONS IN THE LAST 5 YEARS

- Frequent night sweats that completely drench your clothes YES 155 NO
- Hay fever, or frequent sneezing spells YES 156 NO
- Pneumonia YES 157 NO
- Frequent Bronchitis YES 158 NO
- Pleurisy YES 159 NO
- Bronchial asthma YES 160 NO
- Emphysema YES 161 NO

HAVE YOU HAD ANY OF THE FOLLOWING

- Tuberculosis YES 167 NO
- Close contact with people who had tuberculosis (including anyone in your family) YES 168 NO
- A positive tuberculosis skin test YES 169 NO
- A chest x-ray within the last two years that was reported as being abnormal YES 170 NO

DO YOU GET PAIN, DISCOMFORT, TIGHTNESS, OR PRESSURE IN YOUR CHEST WHICH REOCCURS AT LEAST EVERY MONTH YES 191 NO

xx 190

THEN OMIT QUESTIONS 192-215

HOW OFTEN DOES IT OCCUR

- Once a month YES 192 NO
- Every 2 or 3 weeks YES 193 NO
- More than once a week YES 194 NO
- Every day YES 195 NO

IS THE CHEST PAIN OR DISCOMFORT LOCATED

- In the middle of your chest, under the breastbone YES 198 NO
- On the left side only YES 199 NO
- On the right side only YES 200 NO
- On both sides YES 201 NO

IS THE PAIN OR DISCOMFORT MADE WORSE BY BREATHING DEEPLY YES 202 NO

DO YOU USUALLY HAVE A SINUS INFECTION, YES 117 NO

IS YOUR NOSE ALWAYS STUFFY OR RUNNING YES 119 NO

THEN OMIT QUESTION 120

DO YOU USUALLY HAVE INFECTED DRAINAGE FROM YOUR NOSE YES 120 NO

HAS YOUR VOICE CHANGED (Become Rough, Scratchy or Hoarse) DURING THE PAST YEAR YES 121 NO

THEN OMIT QUESTION 122

DID YOUR VOICE CHANGE ONLY WHEN YOU HAD A COLD OR MINOR THROAT INFECTION YES 122 NO

DO YOU USUALLY HAVE A COUGH YES ^{XX} 140 141 NO

DO YOU BRING UP ANY MATERIAL (Such as Sputum, Phlegm, or Mucus) FROM YOUR CHEST YES 142 NO

HAVE YOU EVER COUGHED UP BLOOD YES 143 NO

DO YOU GET SHORTNESS OF BREATH SUCH THAT IT REQUIRES YOU TO STOP TO REST

When you are walking on level ground YES 144 NO

When you are climbing a flight of stairs YES 145 NO

When you are shoveling snow, or changing the sheets on a bed YES 146 NO

DO YOU GET SHORTNESS OF BREATH

Which causes you to wake from sleeping YES 148 NO

When you are lying quietly YES 149 NO

HAVE YOU HAD WHEEZING OR WHISTLING IN YOUR CHEST IN THE PAST 2 YEARS YES 150 NO

THEN OMIT QUESTIONS 151-152

DID THE WHEEZING START LESS THAN 3 MONTHS AGO YES 151 NO

DO YOU STILL GET PERIODS OF WHEEZING YES 152 NO

PHYSICIAN PRINT-OUT

PATIENT NO PATIENT NAME M.O. 5/68 RUN DATE
T000273 DOE, MARY 03/03/69

AGE - 32 YEARS SEX - F

FAMILY HISTORY
UNLISTED FAMILIAL DISEASE.

SOCIAL HISTORY
MARRIED. HIGH SCHOOL GRADUATE. HOUSEWIFE. PT HAS SMOKED CIGARETTES-
MORE THAN 10 YRS. 1 TO 2 PKS/DAY. ALCOHOLIC CONSUMPTION-
A DRINK OR TWO A DAY.

RECENT WEIGHT LOSS.

HEENT SYSTEM
NOTES SINUSITIS.

RESPIRATORY SYSTEM
TUBERCULOSIS CONTACT.

CARDIOVASCULAR SYSTEM
NOTES CHEST PAIN EVERY DAY, LOCATED SUBSTERNALLY, IN RIGHT CHEST ONLY,
PALPITATIONS AT REST. NOTES PEDAL EDEMA. LEG PAINS WITH WALKS.
REMIT UPON RESTING. NOTES VARICOSE VEINS. FINGER COLD REACTION.
HISTORY HEART MURMUR.

GASTROINTESTINAL SYSTEM
INDIGESTION ONCE/MONTH. HISTORY BLACK STOOLS, WHILE ON IRON THERAPY.
HX OTHER ABD. SURG.

MUSCULOSKELETAL SYSTEM
HAS JOINT STIFFNESS.

GENITOURINARY SYSTEM
NOTES INCONTINENCE. NOCTURIA FOR AT LEAST 1 YR.

HEMATOLOGY

ENDOCRINE SYSTEM
SKIN TEXTURE CHANGE. HX HYPOTHYROIDISM.

DERMATOLOGY
HX HIVES. HAS NEW SKIN GROWTH. ALLERGY TO COSMETICS.

NEUROLOGICAL SYSTEM
PT. NERVOUS. PT. THINKS COMPLAINTS FUNCTIONAL. INSOMNIA NOTED.

FEMALE SYSTEMS
HAD BREAST PAIN. HX OF PREGNANCY.



DATE DUE

DEC 05 '76

APR 18 '76

May 15, '76

~~June 14, '76~~

FEB 3 '84

Lib-26-67

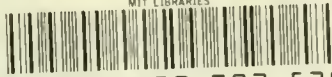
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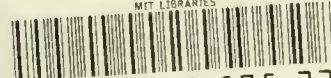
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