MODERN METHODOLOGY FOR THE SELF-ADMINISTERED AUTOMATED MEDICAL HISTORY

H. R. Oldfield, Jr.

MEDEQUIP CORPORATION
979 Rollins Ave., Rockville, MD. 20852

SUMMARY

The computer-patient dialog can take many forms. The most widely employed is that of generating a computer based patient medical history. This paper will describe the various modalities available for the purpose, ranging from paper-and-pencil histories which are basically one-way monologues to highly interactive histories employing CRT consoles. The advantages and disadvantages of each will be discussed.

INTRODUCTION

In Europe, the term medical history is not generally used, and in fact the connotation of the process is somewhat different than in the United States. The Viennese physician is more likely to use the word anamnesis, "the recalling of things past," to describe this particular medical procedure. In general, the physician trained in American medical schools uses the history taking process as the quickest means of approaching a diagnosis of the patient's present illness. The good diagnostician leaps quickly from one problem area to another in search of the key problem, and uses his powers of observation and of hearing to help him with his detective work. In the process he often fails to ask questions which might reveal information valuable in the future treatment of the patient. In addition, there are areas of questioning which are rather delicate, and which are very difficult to develop unless the physician and the patient have a long standing rapport.

Several years of experience with various methods of obtaining self-administered medical histories have shown clearly that the level of sophistication of patient-computer interaction is not yet close to the point where the computer-based history can substitute for the physician-patient interaction. Indeed, we have been too clever in creating output formats which have mimicked physician language and have thus given the impression that there was more information present than was really in the system. Many physicians, intrigued initially with phrases such as "patient complains of this and that" and "patient denies such and such," have become disenchanted with the computer when they realized that the words did not quite fit with the question and answer set presented to the patient.

Present thinking in the field of computer-based histories is that the computer interaction is the ideal way to develop a patient data base which can provide a rich fund of information to the physician; somewhat similar to the work-up of a conscientious intern in a teaching hospital. In addition, certain key questions may be asked (and answered gratefully) which would not be asked by the intern. It is difficult for the intern, and even for many experienced physicians, to probe into the sex life of a new patient, whereas the computer provides a polite and impersonal confession.

Using the data base history as a source of information on a new patient, the physician has been shown to be more productive in terms of the time required for his patient interview and in terms of the quality of the interview. The degree of enhancement of this interview process is of course greatest under circumstances where there would normally be little physician-patient interaction due to economics, language barriers, or simply lack of adequate physician availability.

In considering the implementation of an automated self-administered medical history protocol one may choose between a number of methodologies which have been developed and applied on a broad basis in the United States and Europe. These are listed below in ascending levels of sophistication:

- Paper and pencil questionnaires.
- Mark sense questionnaires.
- Optical projection history takers.
- Audio history takers.
- CRT console history takers.

The relative advantages and disadvantages of each of these methods of implementing the history taking process will be discussed in the following paragraphs.

AVAILABLE METHODOLOGIES

PAPER AND PENCIL QUESTIONNAIRES

Most clinics, all insurance companies, and a large percentage of health screening organizations utilize a paper and pencil questionnaire as the method of gathering the original patient data base. The paper and pencil questionnaire is quite inexpensive in terms of original "equipment" - a form which can be printed in high volume, plus a pencil. However, the subsequent labor cost of transcribing, typing, or transferring the answers on punched cards is quite high and is a potential source of error. This method of developing a patient history is slowly disappearing from the scene as more and more medical organizations install computers.
MARK SENSE HISTORY

The mark sense history is not interactive, as only limited "branching" is possible on a piece of paper. In addition, one must make the investment in a document reader such as the OPSCAN 17 utilized by MEDEQUIP. Having done so, there are some interesting advantages:

- Patient database histories can be developed at home. This is important in the case of illiterates (who can obtain help from a family) and users in the case of other patients who are in a position to fill out the mark sense questionnaires prior to their entry into the clinic or hospital process.
- The mark sense history form is an excellent translation device because the questions can be in any desired language while the pencil marks will be interpreted in the language of the system operator. For example, MEDEQUIP's mark sense medical history system in Taipai, Taiwan asks questions to the patients in the Mandarin language but presents the answers to the physician in his native English.
- The mark sense system can handle very high volumes, and becomes increasingly economical as volume expands.

OPTICAL PROJECTION HISTORY TAKERS

Time Shared to Minicomputer By far the most widely used of all self-administered automated medical history takers have been the optical projection console systems developed during the 1968-1973 era during which CRT consoles were expensive, CRT display formats were limited in terms both of resolution and character set. Times have changed, and the cost and performance advantage has swung away from the optical projection consoles as time shared systems are concerned.

With Self-Contained Logic & Printer Keltron Corporation furnishes an optical projection history console which is completely self-contained. The device uses microfilm as the storage medium for history questions and includes a microprocessor and floppy disc for history logic and intermediate storage of history answers. A built-in thermal printer provides the patient profile print-out. This version of the optical projection history taken has been designed especially for individual physician offices and small group situations requiring either one or two history takers. The operating characteristics are similar to those of the computer time shared consoles mentioned previously, with the exception that the thermal printer gives a somewhat less elegant print-out than the average computer printer.

A hybrid version of this console is available incorporating the self-contained history taking logic but transmitting the final results to a computer for formatting and print-out.

AUDIO HISTORY TAKERS

Both Pelam and Westinghouse have developed branched audio history takers in which the questions are asked by voice in any desired language and the patient answers by pressing "yes" - "no" buttons. This technique is especially appealing for situations involving illiterate or semi-illiterate patients.

The audio history takers are complex in an electro-mechanical sense, as it is clumsy to branch from one tape track to another. Improvements in the technology are to be expected, and this may bring the audio approach into wider use in the future.

CRT CONSOLE HISTORY TAKERS

MEDEQUIP has chosen the CRT console as the primary display device for automated self-administered history taking. The CRT console has totally replaced the optical projection consoles furnished with early MEDEQUIP computer based systems. It is technically compatible with the mark sense history and its companion document reader. Indeed, the two can be used in parallel in the same system as, for example, the MEDEQUIP system in Taiwan where the mark sense history is in Mandarin and the console history is in English.
Modern CRT consoles are both reliable and flexible. Displays are available in a variety of languages. The market is a high volume one and is very competitive, so that prices are most reasonable. Hence, there seems no reason to remain with the more complex optical projection devices.

There are also some very special advantages to CRT consoles in implementing a highly branched interactive medical history protocol. The most important advantage is that the history question format can be modified via the console keyboard at the will of the programmer. Actually, one can go a step further and can modify the wording of a question in response to the answer to a prior question or series of questions. This type of interaction is now utilized primarily by researchers such as Dr. Warner Slack, but we can foresee early applications in production-type history taker systems.

Another subtle advantage of the CRT console is the ease of providing numerical input. With a "yes - no" or "multiple choices" approach as used in optical projection consoles it is not a practical possibility to provide a rapid and exact answer to a question such as, "How old were you when you had your first child?" One must play the game of "20 Questions" by providing alternates for the patient's selection. This is a time consuming process, and the only practical solution is to narrow it down into ranges such as, "Between 25 and 28" . . . . . . with the CRT console, the patient can immediately answer the exact numerical value.

The CRT console is immediately adaptable to remote operation using ordinary telephone lines and standard modems. Remote operation is clumsy and comparatively expensive in the case of optical projection consoles.

COST CONSIDERATIONS

It is rather difficult to compare the various alternate techniques in terms of "cost per history" because this will depend to a great extent on the environment in which the history systems are used. For example, the CRT console will cost about 75 cents per history at a level of 5 histories per day providing it is coupled to a computer which is already largely paid for through providing other data processing services. The free-standing optical projection console will cost about $2 per history, but it does not require coupling to a separate computer. Both figures are so low that they are not difficult to justify from a cost effectiveness standpoint.

The mark sense document reader is a relatively expensive device, and the cost would be about $5 per history at 5 patients per day. However, one document reader can handle the same volume as a dozen consoles, so that it will become much cheaper at high volume. Simply to provide an order of magnitude comparison of original equipment investments, and ignoring programming costs, the various alternate methodologies compare as follows:

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT Console &amp; Associated Computer Memory</td>
<td>$5,000</td>
</tr>
<tr>
<td>Computer-Shared Optical Projection Console</td>
<td>$8,000</td>
</tr>
<tr>
<td>Free-Standing Optical Projection Console Without Printer</td>
<td>$9,000</td>
</tr>
<tr>
<td>Free-Standing Optical Projection Console With Printer</td>
<td>$12,000</td>
</tr>
<tr>
<td>Audio History Console</td>
<td>$18,000</td>
</tr>
<tr>
<td>Document Reader and Tape Controller</td>
<td>$23,000</td>
</tr>
</tbody>
</table>

CONCLUSIONS

Techniques are available to apply self-administered medical history protocols to a wide spectrum of medical environments. These techniques are cost effective when tailored to the specific application. The CRT console operating in an interactive mode with a properly programmed computer is the choice of the writer from considerations of cost, flexibility, and adaptability to new patient interactive processes now emerging from the researchers.

H. R. Oldfield, Jr., President; MEDEQUIP CORPORATION; 979 Rollins Ave.; Rockville, MD. 20852