DOCUMENT RESUME

ED 126 922 IR 003 837

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TITLE A Forecast of Events and Conditions That Might Affect Job and Training Requirements for Medical Librarians. Technical Report 73-30.
INSTITUTION Human Resources Research Organization, Alexandria, Va.
SPONS AGENCY National Library of Medicine (DHEW), Bethesda, Md. Extramural Program.
REPORT NO HumRRO-TR-73-30
PUB DATE Dec 73
CONTRACT NIH-72-4732
NOTE 70p.

EDRS PRICE MF-$0.83 HC-$3.50 Plus Postage.
DESCRIPTORS Change Strategies; Futures (of Society); Health Occupations Education; *Information Needs; Information Retrieval; Information Scientists; Information Storage; Job Analysis; *Librarians; Library Education; Library Science; Manpower Development; *Manpower Needs; Medical Record Librarians; Personnel Needs; Planning; *Prediction; Questionnaires; Technological Advancement
IDENTIFIERS Biocommunications; *Medical Librarians

ABSTRACT

The Delphi method was used to obtain estimates from 15 experts in medical education and biomedical communications of events and conditions which might occur in the next 20 years in biocommunications, health care services, and medical education that would effect the job and training requirements for future medical librarians. Ninety-five events and conditions were identified, and then information was gathered about the types of librarians and biocommunications personnel that might be affected by various events, and the probable effects, and training implications of each event. Most frequently mentioned events related to improvements in computer information storage and retrieval systems; systems for transmitting information; changes in future job duties, training, and manpower requirements of future libraries; development of special libraries and/or information centers; and increased involvement with cooperative efforts, especially standardization projects. (Author/CH)

Technical
Report
73-30

HumRRO-TR-73-30



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# A Forecast of Events and Conditions That Might Affect Job and Training Requirements for Medical Librarians

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December 1973



Prepared for

National Library of Medicine Extramural Programs
National Institutes of Health
Department of Health, Education, and Welfare
Bethesda, Maryland 20014

# SUMMARY

The National Library of Medicine Extramural Program has, through its training grant program, supported a number of training programs and post-Master's internships in medical librarianship. A matter of special interest under the Extramural Program is the promotion of innovative programs. In keeping with this interest, the Program is concerned with the early identification of those events or conditions that might affect the future training and manpower requirements for medical librarians.

## OBJECTIVE

The objective of this study was to identify those future developments, events, and conditions in biocommunications and the delivery of health care which, if they should occur, probably would have an impact on the job and training requirements of future medical librarians. A second objective was to gather information on the training implications of the occurrence of these future events.

## METHODOLOGY

The Delphi Method was used to obtain estimates from a group of experts currently involved with the operation of a medical library, the development of improved biocommunication systems or the education of medical students. (In the Delphi Method, used primarily to avoid undue effects of strong individual influence, the participants do not interact directly, but respond to data generated previously by the group.) A series of five questionnaires was employed.

## STUDY FINDINGS

The study participants identified a total of 95 events and conditions which might occur during the next 20 years. Twenty-six of these related to improvements in

computer-supported information storage and retrieval systems, or systems for transmitting information. Twelve events related to probable changes in the future job duties, training, and manpower requirements of future librarians. Twelve other events dealt with the probable development of special libraries and/or information centers. The remaining 15 events and conditions related to one or more of 14 different event categories. The training and job implications and suggestions provided by the participants of the Delphi Study have been compiled into a separate supplement to this report.

Also presented in this study is a summary of future training requirements as perceived by 131 directors of medical libraries. These persons emphasized the need for administrative and management skills, and the need for the ability to manage nonprint media, especially audio-visual instructional material.

## DISCUSSION

This section of the report presents the author's view on such topics as the need for more flexibility with respect to the training of medical librarians; the possible advantages of instituting BA-degree programs in librarianship; the sub-specialization of medical librarians, and the degree to which medical librarians should become specialists in a medical content area or in the field of educational technology.

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## Chapter 1

# STUDY OBJECTIVES

What will medical librarians have to know and be able to do in future years? How should training programs in medical librarianship be cast to prepare the graduates for future job requirements? The purpose of this study was to obtain information which could be used to formulate educated guesses regarding the future of medical librarianship. The general objective of the study was:

> To examine the current factors and impending changes in medical education, health care delivery, and biomedical communication systems as they will affect future biomedical information manpower training requirements.

Many government agencies, profit and nonprofit organizations, and individuals are now working on schemes, plans, and technological developments which will have an important impact on medical librarianship. It seems probable that in the not-too-distant future the mission of at least selected medical libraries will be changed or expanded.

It also seems probable that during the 1970s and 1980s various types of biocommunication networks will be developed. It has been suggested, for example, that the National Library of Medicine and its network of regional libraries may become heavily involved in providing additional services now available at a small number of special libraries or learning centers. For example, such libraries and centers can play an important role as learning resources centers. They can assume the responsibility for collecting and disseminating training material; through the auspices of a regional library, a network may be provided for the sharing of computer-assisted instruction.

Medical libraries and biocommunication networks may assume a wide variety of roles in order to meet various user requirements. Some of the roles which require examination include (a) the role of the library in an institution's educational program, (b) the relation of the library to biocommunication networks, and (c) the relation of the library to the delivery of health care information to clinicians in clinical settings.

In this study an attempt was made to:

- Identify the probable developments and/or events in medicine, information science, computer technology, and so on which probably will have an impact on the job activities of medical librarians and biomedical communication scientists.
- For each event, forecast the requirements for medical librarians and information scientists with respect to new skill and knowledge requirements and numbers of persons required.
- Suggest some of the various means by which appropriate kinds and numbers of persons can be trained for the new job requirements.

## Chapter 2

# METHODOLOGY

## THE DELPHI METHOD FOR EVENT PREDICTION

The Delphi Method was used to obtain information from a group of experts. The major advantage of this method is that the individual study participants never directly interact with one another. Thus, they cannot be unduly affected by dominant personalities. Rather, *each* participant in a Delphi Study reacts to group data—data which present a summary of how the group responded on a previous occasion. The following quotation from Belzer *et al.* (1) provides a brief description of the Delphi Method. For additional information the reader should refer to one or more of the articles (2-7) listed in the Reference section of this report.

> Whenever an effort is made to reach consensus in an open discussion among several experts, several psychological influences play a part in obtaining convergence. The bandwagon effect of majority opinion, imposing personalities, and tendencies to conform to publicly expressed opinions are some such influences which one might wish to avoid in reaching consensus. The Delphi Method is a systematic approach towards soliciting expert opinions without contaminating them with the effects and/or influences enumerated above. By means of a carefully designed program of sequential interrogations, interspersed with feedback information of the total participating group, so that each person knows exactly where he stands in relation to the group, achieving consensus over several iterations is not only possible, but is almost certain. Whenever an individual's opinion deviates greatly from the majority, he is requested to give a reason for his expressed opinion. A collection of such reasons is presented to each participant with an opportunity to reconsider and/or possibly revise his earlier opinion or estimate. The feedback consisting of say a mean or median of all the replies, a standard deviation, and a range of the replies together with reasons why participants deviated from the group averages, permits them to reconsider their previous estimates and/or opinions in lieu of new dimensions which they could have inadvertently overlooked. The fact that participants have to justify their responses whenever they deviate substantially from the group averages has the effect of forcing their responses to move closer to the average unless they had strong convictions to the contrary.

## DELPHI STUDY PARTICIPANTS

A total of 23 persons were selected to serve as participants for this study. Of these, 15 remained as participants throughout the study. The remainder dropped out from the study at various stages, primarily because of the workload imposed by the study.

Each participant was an expert in some area related to biomedical libraries or biomedical communication networks. Collectively, their areas of expertise included biomedical librarianship, information science, biomedical educational technology, and health care delivery systems. About half of the participants were Medical Doctors associated with a medical school.

The participants were selected according to the following procedure. Contractor personnel screened a variety of source documents to identify persons who were active in medical education and/or biomedical communication. In addition, the heads of various medically related government agencies and professional associations were apprised of the study and asked to submit names of potential study participants. The names obtained were then screened jointly by NLM and Contractor personnel. Some 35 persons then were informed by letter of the objectives and details of the study. Twenty-three persons agreed to participate in the project.

Each participant was informed that he would receive a $300 honorarium, to be paid upon completion and return of the fifth questionnaire of the study. Halfway through the study the honorarium was increased to $500 when it became obvious that the workload of the participants was greater than originally estimated.

The list of participants who completed all five of the questionnaires is contained in Appendix A.

## DEVELOPMENT AND ADMINISTRATION OF THE DELPHI QUESTIONNAIRES

Each respondent was asked to complete five questionnaires.[1] The first two were used to identify events which probably would occur within the next twenty years and

[1] The complete set of questionnaires used in this study were very voluminous. Therefore, they have been provided to the Sponsor under separate cover. Those interested should contact the Extramural Program of the National Library of Medicine for copies of these questionnaires.

which, if they occurred, would have a major impact on the operation of biomedical libraries and networks. The last three questionnaires were used to obtain information about training requirements which would be generated by the predicted events.

The first Delphi Questionnaire contained a list of events which, if they should occur, would or at least might have a major impact on the types and/or numbers of professional persons required to operate a biomedical library or biomedical communication network. This list (consisting of the first 20 descriptions contained in Table 1 at the end of this section) was developed as follows:

(1) Contractor personnel, after a study of recent literature bearing on biomedical librarianship and medical education developed a list of 75 statements describing probable future events related to biomedical librarianship.

(2) Contractor personnel summarized and combined the above statements to arrive at a refined list of 35 statements.

(3) Sponsor and contractor personnel reviewed each of the 35 statements and:

(a) Rewrote most statements to make them more precise.

(b) Deleted statements that were judged to describe events which had already occurred or were almost certain to occur.

(c) Added statements covering events of particular interest to the sponsor.

## The First Delphi Questionnaire

The first Delphi Questionnaire contained two parts. Part I contained the previously described list of 20 event/condition descriptions. The study participant responded to each description in accordance with the instructions shown in Figure 1. Figure 2 illustrates the response recording format.

Part I of the first questionnaire covered only a few of the possible future events and/or conditions which might have a major impact on biomedical communication systems and biomedical librarianships. Therefore, in Part II the participants were asked to "describe events or conditions not contained in Part I and which in your judgment have at least a moderate probability of occurrence within the next twenty years." For each event/condition listed, the participant was asked to provide the same information as described above for Part I descriptions.

## Instructions for Responding to Descriptions of Events and Conditions

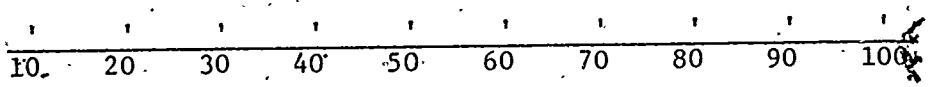
For each event/condition described in Part I please record in columns 1 through 4 the following judgments:

- in Column (1) -- Probability of Occurrence. Record the response option which best describes your estimate of the probability of occurrence for this event/condition sometime during the next twenty years.

  a. Never . . . . will not occur within the next twenty years, at least.
  b. Low . . . . . 5% to 30% probability of occurrence.
  c. Moderate. . . 31% to 70% probability of occurrence.
  d. High. . . . . 71+% probability of occurrence.
  e. Extant. . . . if you believe the event/condition now exists.

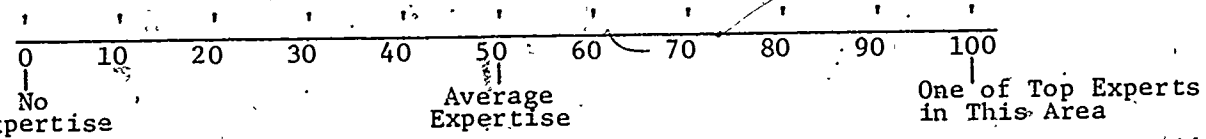
- in Column (2) -- Earliest Year of Occurrence. Predict the earliest year (up to 1994) by which, in your judgment, there is at least a moderate probability that the event/condition will have occurred and/or be commonplace. Record "extant" if you believe the event or condition already has occurred.

- in Column (3) -- Confidence Estimate. Using the scale below, select the number which best represents your confidence that the event will occur in accordance with your prediction in Column (2).




Confidence-of-Estimate Scale

- in Column (4) -- Expertise Evaluation. Using the scale below, select the number which best represents the degree to which you judge yourself to be an expert in areas related to this event.




NOTE: It is quite possible that you may strongly believe that an event will occur and yet not consider yourself an expert in the area represented by the event.

Figure 1

Response Recording Format Used in Part 1 of First Delphi Questionnaire

| | Col (1) Probability of Occurrence | Col (2) Earliest Year of Occurrence | Col (3) Confidence Estimate | Col (4) Expertise Evaluation | Col (5) Comments |
|---|---|---|---|---|---|
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |
| 4. | | | | | |
| 5. | | | | | |
| 6. | | | | | |
| 7. | | | | | |
| 8. | | | | | |
| 9. | | | | | |

Figure 2

The first Delphi Questionnaire, accompanied by a cover letter. was mailed to each participant along with a self-addressed return envelope. The participants were requested to complete and return the questionnaires within three weeks.

## The Second Delphi Questionnaire

The second Delphi Questionnaire contained four parts. Part I contained a summary[2] of the first Delphi Questionnaire. An example of the first page of Part I is shown as Figure 3.

For each of the 20 descriptions of event/condition the following information was provided:

(1) The median "probability of occurrence" for the group. (The probability of occurrence estimates provided by the group were converted to points on a numerical scale—1 = "never", 2 = "low", 3 = "moderate", 4 = "high", and 5 = "extant"—from which the median probability was determined.)

(2) The median "confidence estimate" for the group. These were the numbers provided in response to the instructions for filling in Column (3) (see Figure 1).

(3) The median and inter-quartile range for "predicted year of occurrence". This information was displayed as a line on a pivot point ( ——▲—— ), and was based on information provided in Column 2, Part I, of the first questionnaire (see Figure 1).

(4) From the comments to some of the event/condition descriptions, it was obvious that some of the respondents were not interpreting the questions as intended. Therefore, when it seemed appropriate, clarifying comments were provided. Figure 3 contains two illustrations.

(5) Many participants provided fairly elaborate comments in support of their estimates. Samples of these were fed back to the participants. When feasible, two comments were provided representing the views of those who predicted very early occurrence of the event/condition. Two other

[2]There were some special features to the data processing of this study. These will be discussed in detail later on in this report.

Illustration of Part 1 of Second Delphi Questionnaire

Part 1. Summary of Responses to Events and Conditions Listed in Part I of the First Delphi Questionnaire

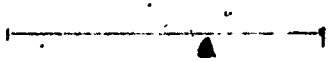
| Description of Event/Condition | Median "Probability of Occurrence" | Median "Confidence Estimate" | Median and Inter-Quartile Range for Predicted Year of Occurrence |
|---|---|---|---|
| 1. Use of computerized information banks such that health personnel (physicians, researchers, medical students, etc.) can retrieve specific answers to specific medical questions. | 4.0 | 78% |  |
| 2. Existence of a nation-wide medical document and information service (a la airlines reservations network) | 3.7 | 69% |  Assume that "medical document" refers to medical research literature, not to medical records. Will cover medical records later on in questionnaire. |
| 3. Use of universal medical nomenclature for organizing medical data and medically-related information regardless of format | 3.5 | 72% |  Assume "universal" means "worldwide." |



Figure 3

comments were provided to represent the views of those who predicted very late occurrence. Figure 4 contains illustrations of the comments provided to Event/Condition Descriptions 1, 2 and 3.

Part 2 of the second Delphi Questionnaire was a replication of Part I of the first Delphi Questionnaire. The respondents completed Part 2 in accordance with the instructions contained in Figure 1. The purpose of this replication was to provide an opportunity for the group to arrive at a closer consensus regarding the listed events and conditions.

In response to Part 2 of the first questionnaire, over 100 descriptions of events/conditions were provided. Duplicate statements were deleted. Descriptions which seemed to be highly related were combined into a single statement. A few statements were deleted because they bore no apparent relation to biocommunications and medical librarianship. The resulting 65 event/condition descriptions were incorporated into Part 3 of the second questionnaire. (These descriptions are shown as event/condition descriptions 21 through 90 in Table 1 at the end of this section.) The participants responded to these statements as they did to the statements contained in Part 2 of the first questionnaire. The instructions shown in Figure 1 were applicable.

Part 4 of the second Delphi Questionnaire contained space for the participants to record additional event/condition descriptions if they so desired. Not many did.

### The Third Delphi Questionnaire

The third Delphi Questionnaire was made up of five parts:

(1) Part 1 contained a summary of the results of the second questionnaire.

(2) Part 2 contained a summary of the group responses to the first 40 statements contained in Part 2 of the second questionnaire.

(3) Part 3 was a list of the 20 descriptions which first appeared in Part 1 of the first questionnaire; Figure 5 presents a sample page. The participants responded to each page in accordance with the instructions contained in Figure 6.

(4) In Part 4, the group was asked to indicate agreement or disagreement with the group consensus developed in response to Part 3 of the second

Illustration of Comments Provided for Event/Condition Descriptions 1, 2, and 3, Part 1 of Second Delphi Questionnaire

| | | COMMENTS |
|---|---|---|
| 1. Early occurrence: | a. | This already exists for many areas and will expand to others. |
| | b. | Indian health service now has an on-line medical record system. |
| Late occurrence: | a. | Too costly to develop and/or to convert to such a comprehensive system. |
| | b. | Subject material too poorly defined to develop a comprehensive system. |
| 2. Early occurrence: | a. | Already exists in the form of MEDLINE. |
| Late occurrence: | a. | Very difficult to get full MD cooperation if medical records are to be included. |
| | b. | Assume that "medical document" refers to medical records. |
| 3. Early occurrence: | a. | Partially extant now; see thesauri of WHO, UNESCO, MEDLARS. |
| | b. | Cannot have nation-wide or regional retrieval systems until this occurs. |
| Late occurrence: | a. | Have been many attempts at standardization, but total acceptance will require many years. |
| | b. | Specializations will continue to proliferate and new vocabularies developed. |

Figure 4

Response Recording Format Used in Part 3 of Third Delphi Questionnaire

IMPACT ON BIOMEDICAL LIBRARIANS

1. Use of computerized information banks such that health personnel (physicians, researchers, medical students, etc.) can retrieve specific answers to specific medical questions.

| Type of Person(s) or Job Position(s) Apt to be Affected by Event. (Record job-title-like name) | Predicted Changes in Job Duties and/or Responsibilities Should Event Occur |
|---|---|
| a. | a1. |
| | a2. |
| | a3. |
| b. | b1. |
| | b2. |
| | b3. |

Figure 5

## Instructions for Responding to Part 3 of the Third Delphi Questionnaire

At the top of each page is a description of one of the events you responded to on the 1st and 2nd Delphi Questionnaires. In Part 3 we would like your estimate of whether or not occurrence of this event would have an impact on the job duties of persons who might be found working in a medical library (university, hospital, professional society, etc.), a biomedical information center (profit or non-profit), or in some way associated with a biomedical information network. Of course, we are most interested in the effect an event might have on medical librarians. Complete each page of Part 3 as follows:

a. In the right-hand column -- for each event description, briefly describe what you think the impact of event occurrence would be on the duties, services and/or responsibilities of persons who work within a medical library.

b. In the left-hand column -- for each event description, is there a job position within a medical library which you think would be affected by the occurrence of the event? If so, please record the title of this job position in the left-hand column. Otherwise, leave this column blank.

Figure 6

Response Recording Format Used in Part 4 of Third Delphi Questionnaire

| | Probability of Occurrence | | | | Earliest Year of Occurrence | | | |
|---|---|---|---|---|---|---|---|---|
| | Group Consensus (Col. 1) | Do You Agree? Yes (Col.2) | No | If Not, Your Estimate (Col.3) | Group Consensus (Col.4) | Do You Agree? Yes (Col. 5) | No | If Not, Your Estimate (Col. 6) |
| 1. | 3.6 | ___ | ___ | _____ | 1978 | ___ | ___ | _____ |
| 2. | 3.9 | ___ | ___ | _____ | 1980 | ___ | ___ | _____ |
| 3. | 3.6 | ___ | ___ | _____ | 1980 | ___ | ___ | _____ |
| 4. | 3.7 | ___ | ___ | _____ | 1980 | ___ | ___ | _____ |
| 5. | 3.4 | ___ | ___ | _____ | 1980 | ___ | ___ | _____ |
| 6. | 3.3 | ___ | ___ | _____ | 1985 | ___ | ___ | _____ |
| 7. | 3.7 | ___ | ___ | _____ | 1980 | ___ | ___ | _____ |
| 8. | 3.8 | ___ | ___ | _____ | 1980 | ___ | ___ | _____ |

Figure 7

## Instructions for Responding to Part 4 of Third Delphi Questionnaire

Col. 1 -- contains the median value which represents the group consensus regarding "probability of occurrence."

Col. 2 -- in this column, indicate if you agree or disagree with the "probability of occurrence" value contained in Column 1. Check the "yes" or the "no" column.

Col. 3 -- if you disagree in Column 2, record your "probability of occurrence" estimate in Column 3.

1 = "never"
2 = "low"
3 = "moderate"
4 = "high"
5 = "extant"

Col. 4 -- contains the median value which represents the group consensus regarding the "earliest year of occurrence."

Col. 5 -- in this column, indicate if you agree or disagree with the "earliest year of occurrence" value contained in Column 4. Check the "yes" or "no" column.

Col. 6 -- if you disagree in Column 5, record your "earliest year of occurrence" estimate in Column 6.

Figure 8

questionnaire. Figure 7 shows a sample page for Part 4; Figure 8 presents the responding instructions.

(5) Part 5 contained five new descriptions of events/conditions. These were provided in response to Part 4 of the second questionnaire. The responding instructions were as shown in Figure 1.

### The Fourth Delphi Questionnaire

The fourth Delphi Questionnaire contained only one part. On each of its pages was listed one of the event/condition descriptions 21 through 60 (see Table 1). The responding instructions were as shown in Figure 6 namely, to describe, for each event, what the impact of event occurrence might be on medical librarians and/or medical libraries.

### The Fifth Delphi Questionnaire

The fifth Delphi Questionnaire had two parts. Part 1 contained a summary of the responses obtained from Part 3 of the second questionnaire and Part 5 of the third questionnaire. Essentially, this information summarized the event occurrence predictions made by the participants for event/condition descriptions 57 through 95, Table 1.

The second part of this questionnaire was identical in format to the fourth questionnaire. On each page was listed one of the event/condition descriptions 61 through 95, Table 1. The responding instructions were as shown in Figure 6.

Table 1

## Description of Events and/or Conditions Which, If They Should Occur, Might Have a Major Impact on Biocommunication Specialists and Medical Librarians

| | Event Probability (%) | Year of Occurrence | Range[a] |
|---|---|---|---|
| 1. Use of computerized information banks such that health personnel (physicians, researchers, medical students, etc.) can retrieve specific answers to specific medical questions. | 79 | 1981 | 1978–84 |
| 2. Existence of a nation-wide medical document and information service (a la airlines reservations network). | 82 | 1982 | 1976–80 |
| 3. Use of universal medical nomenclature for organizing medical data and medically-related information regardless of format. | 55 | 1987 | 1980–90 |
| 4. Use of contractual agreements between a medical library and its user institutions. These contracts would specify the type, amounts, etc. of services to be provided by the library and the charges for each. | 78 | 1975 | 1975–80 |
| 5. Adoption of the general policy that whenever feasible the user will be directly charged for services provided by the library. | 50 | 1980 | 1977–90 |
| 6. Use of high-speed, low-cost facsimile transmission techniques to transmit printed material, illustrations, etc. from one location to another. | 78 | 1978 | 1976–83 |
| 7. Within a regional library network, selected libraries will be responsible for the selection, cataloging, indexing, providing storage and retrieval facilities, etc. of/for items related to a specific content area. | 76 | 1978 | 1977–80 |

(Continued)

[a]Range refers to the interquartile range, the range within which 50% of the predictions fall.

Table 1 *(Continued)*

| | Event Probability (%) | Year of Occurrence | Range |
|---|---|---|---|
| 8. Use of facsimile transmission techniques to transmit TV tapes and microforms from central storage facilities to libraries and/or to user facilities. | 71 | 1980 | 1978-83 |
| 9. Presence of a wide variety of easily accessible self-study programs (programmed instruction, computer-assisted instruction, etc.) for both the pre-service and in-service training of health personnel. | 82 | 1975 | 1974-78 |
| 10. Presence of a nation-wide performance-based certification system for all types of health service personnel. | 62 | 1985 | 1982-85 |
| 11. Presence of a number of recognized biomedical information specialities each of which is related to a specific or small set of medical specialties. | 57 | 1980 | 1977-90 |
| 12. Use of computer-assisted instruction to teach health service personnel how to use information networks to perform literature searches, use CAI (computer-assisted instruction) programs and related equipment, use dial access systems, and so on. | 80 | 1975 | 1974-78 |
| 13. Existence of inexpensive, high-quality microform readers for home, office, or library use. | 79 | 1975 | 1975-79 |
| 14. Existence of inexpensive and rapid procedures for converting microform material to hard copy. | 78 | 1976 | 1975-80 |
| 15. Existence of a variety of biomedical information centers for the purpose of collecting, analyzing, repackaging and disseminating a wide variety of data related to specific medical subject areas. | 77 | 1978 | 1976-80 |

*(Continued)*

Table 1 *(Continued)*

| | Event Probability (%) | Year of Occurrence | Range |
|---|---|---|---|
| 16. Existence of the "open school" concept at most universities and medical schools with the result that many students will be studying off campus and contacting the library for the home use of instructional equipment, instructional programs, etc. | 57 | 1984 | 1980-90 |
| 17. Active involvement of medical libraries in community health programs. | 57 | 1980 | 1979-80 |
| 18. Common use of librarians to help university/medical school instructors to plan courses and to select instructional material. | 53 | 1984 | 1980-90 |
| 19. Use of input/output terminals in a physician's office or in or near his area of practice so as to link him with an information network which provides access to a wide variety of medical data and information, and which provides access to a variety of continuing education programs. | 67 | 1980 | 1978-85 |
| 20. Medical practitioners will have the responsibility of ensuring that their patients are directed to information sources which will inform the patient about their illness(es) and what the patient should do to contribute to the care and management of his medical problem(s). | 63 | 1980 | 1977-85 |
| 21. Use of communication satellites for the two-way transmission of health care information to remote locations, especially to include the transmission of diagnostic and patient management information. | 71 | 1978 | 1976-84 |
| 22. Use of TV networks, based on either or both satellite and microwave transmission techniques, for the two-way communication of medical lectures, panel discussions, diagnostic consultations, disease management information, and so on. | 78 | 1980 | 1978-80 |

*(Continued)*

Table 1 (Continued)

| | Event Probability (%) | Year of Occurrence | Range |
|---|---|---|---|
| 23. Development of communication links between the hospital, doctor's office or medical research establishment so that selected laboratory tests can be quickly performed by automated laboratory equipment located remotely. | 71 | 1980 | 1978-85 |
| 24. Use of computer-based network(s) for the storage/retrieval/transmittal of medical records of patient to or from wherever the patient currently is being seen. | 73 | 1980 | 1978-85 |
| 25. Use of computer-based programs for evaluation of the quality and cost of medical health care. Procedures based on the use of "problem oriented records" and patient care appraisal (PCA) procedures. | 69 | 1980 | 1975-85 |
| 26. Widespread existence of logic-based computerized question-answering systems (e.g., artificial intelligence) for use as an aid when formulating a diagnosis, or for use in educational settings. | 66 | 1985 | 1980-85 |
| 27. Development of data banks containing medical records which can be used for medical education and research. (Assume adequate measures for preventing unauthorized usage or disclosure of patient identity). | 73 | 1980 | 1980-85 |
| 28. Development of computer-based systems for monitoring drug utilization patterns. | 76 | 1980 | 1977-80 |
| 29. Development of "quality control" procedures for monitoring medical services; procedures based on the use of clinician's audio diaries, semi-automatically transcribed. | 56 | 1980 | 1980-88 |
| 30. Widespread substitution of technical-level personnel for professional librarians in health science libraries to optimize manpower utilization. | 71 | 1980 | 1976-80 |

(Continued)

Table 1 *(Continued)*

| | Event Probability (%) | Year of Occurrence | Range |
|---|---|---|---|
| 31. Conversion of large portions of existing library holdings to microform to reduce space requirements. | 65 | 1980 | 1976-85 |
| 32. Establishment of MEDLINE terminals in all medical school and research establishment libraries. | 82 | 1976 | 1975-79 |
| 33. Development of on-line interactive dynamic medical encyclopedia or handbooks. | 65 | 1980 | 1980-85 |
| 34. Reorganization of library resources into two kinds of information--information for researchers and information for practitioners. | 62 | 1980 | 1976-90 |
| 35. Widespread utilization of equipment for rapidly retrieving selected information from stored microform material--computer-controlled searches. | 75 | 1985 | 1978-90 |
| 36. The capability of existing information retrieval networks, such as MEDLINE, will be improved to the point where data, tables, graphs, etc. can be retrieved from scientific publications. | 68 | 1985 | 1980-86 |
| 37. Existence of a number of information centers and networks each providing access to literature and data related to a fairly specific medical subject area, e.g., a drug information network, cancer information network. | 83 | 1978 | 1975-80 |
| 38. The principal means of accessing health science literature will be through the use of on-line interactive terminals, such as those planned for MEDLINE. | 64 | 1984 | 1980-90 |
| 39. Common use of picture telephones, located at library facilities, to gain access to data banks such as card catalogs, technical abstract bulletins, and so on. | 53 | 1986 | 1980-90 |

*(Continued)*

Table 1 *(Continued)*

| | Event Probability (%) | Year of Occurrence | Range |
|---|---|---|---|
| 40. Existence of a national computer-based union list of serials providing rapid access to location information. | 62 | 1978 | 1975–85 |
| 41. Achievement of agreements on standard elements, formats, contents, etc. in biomedical computer-accessed data banks. | 67 | 1980 | 1980–84 |
| 42. Establishment of cooperation between Index Medicus and Excerpta Medica. | 40 | 1984 | 1979–90 |
| 43. Acceptance of NLM book classification and MESH headings as a national standard for use by all medical libraries. | 72 | 1984 | 1980–85 |
| 44. Existence of a nation-wide system for cataloging and indexing medical documents, e.g., medical records. | 66 | 1985 | 1980–85 |
| 45. Identification of specific medical libraries as centers for the location and use of independent study materials in selected medical content areas. | 70 | 1980 | 1978–84 |
| 46. Existence of computer-based regional catalogs providing access, at any individual library, to the holdings of all libraries within a region. | 79 | 1977 | 1975–80 |
| 47. Medical libraries, in cooperation with biomedical communication centers and educators, will assist in the design, production and presentation of instructional material. | 66 | 1980 | 1977–85 |
| 48. Medical libraries actively will be involved in supporting continuing education programs in the health sciences, and supporting adult educational programs in such areas as preventive medicine. | 78 | 1978 | 1975–80 |
| 49. Libraries at health profession schools be converted to dynamic "learning resources centers" providing wide variety of multi-media instructional material. | 87 | 1980 | 1975–80 |

*(Continued)*

Table 1 *(Continued)*

| | Event Probability(%) | Year of Occurrence | Range |
|---|---|---|---|
| 50. As part of a national educational network certain libraries and/or biocommunication centers will be selected to catalog and distribute multi-media instructional packages in selected content areas. | 77 | 1979 | 1976-80 |
| 51. Many, if not all, medical schools will employ an individual trained in "Educational Communications" who will function as an educational advisor to the faculty, and who will be considered a highly respected member of the faculty. | 81 | 1976 | 1975-80 |
| 52. Common use, for medical education, of computerized clinical encounter teaching systems, or on-line diagnostic games. | 75 | 1978 | 1976-80 |
| 53. Widespread use of video disks and/or cassettes for medical education, to include both the education of medical professionals and the lay public. | 81 | 1980 | 1978-80 |
| 54. Common use of dial access systems as a means of supplying information to health care consumers. | 70 | 1980 | 1978-85 |
| 55. Use of mini-computers in many medical libraries as a dedicated, stand-alone teaching machine. | 64 | 1980 | 1978-85 |
| 56. Development of a universal programming language for computer-assisted instruction. Would run on processors of different size and manufacturers. | 54 | 1980 | 1980-85 |
| 57. Development of a universal graphics package for computer-assisted education. | 57 | 1984 | 1979-85 |
| 58. Much more formal training of the practitioner after the MD degree, conducted through a variety of channels from audiotape/cassette, closed-circuit TV to office and to special extension classes. | 80 | 1978 | 1975-80 |

*(Continued)*

Table 1 *(Continued)*

| | Event Probability (%) | Year of Occurrence | Range |
|---|---|---|---|
| 59. A steady increase in the supply of librarians in relation to a fairly fixed supply of jobs will result in an excess of manpower for health science librarians. | 58 | 1985 | 1975-85 |
| 60. At most, if not all, medical schools students will be taught the contemporary modes of access to all biomedical/health information. | 77 | 1980 | 1975-80 |
| 61. Continued diversification of health-care vocations, including more paramedics, after the Chinese model. | 78 | 1978 | 1976-80 |
| 62. Medical librarians will become more like-high-grade research librarians. | 74 | 1980 | 1975-85 |
| 63. More emphasis on medical sociology and biological science content in programs for medical librarians. | 74 | 1978 | 1976-85 |
| 64. Common acceptance of the requirement of a PhD degree to become the director of a large medical library. | 71 | 1980 | 1980-80 |
| 65. More comprehensive and specialized training programs for health science librarians and other communication specialists. | 81 | 1978 | 1976-80 |
| 66. Development of more extensive continuing education programs for health science librarians. | 79 | 1976 | 1975-80 |
| 67. The medical education faculty will be trained in the use and preparation of multi-media materials. | 76 | 1978 | 1975-80 |
| 68. Programs of library instruction will be expanded to include information/computer system, instructional technology, communication media. | 78 | 1976 | 1975-79 |
| 69. The concept of self-paced, self-instructional training will become common to medical education. | 79 | 1980 | 1975-80 |

*(Continued)*

Table 1 *(Continued)*

| | Event Probability (%) | Year of Occurrence | Range |
|---|---|---|---|
| 70. A variety of programs, computer-based and otherwise, will exist for self-examination, and will be for use by both students and practitioners. These will be available through the library. | 80 | 1980 | 1978-80 |
| 71. Greatly increased demand for continuing education material by practicing health professional. | 79 | 1976 | 1975-80 |
| 72. At many universities, the development of a coordinated curriculum for physicians specializing in medical information science; for librarians to support clinical practice; for medical record administration; and for medically oriented communication scientists. | 65 | 1980 | 1978-80 |
| 73. Hospitals will take on an increasingly more important role in the education of all types of health science personnel. | 72 | 1978 | 1976-80 |
| 74. There will be a widespread development and upgrading of hospital librarians. | 71 | 1978 | 1976-80 |
| 75. Common use at local hospitals of information systems for medical records, locally-produced data, and biomedical information of concern to the various professional specialities at that hospital. | 74 | 1980 | 1978-80 |
| 76. More direct participation of information specialists in the clinical consultative process, particularly in hospital settings, as in the form of daily or periodic ward conferences. | 54 | 1982 | 1980-85 |
| 77. Establishment of one or more nationwide computer-based medical advisory services which make health care information and selected forms of diagnostic/treatment information directly accessible to the public. | 60 | 1990 | 1980-90 |

*(Continued)*

Table 1 *(Continued)*

| | Event Probability (%) | Year of Occurrence | Range |
|---|---|---|---|
| 78. Establishment of a variety of media-oriented health care programs for use in public schools, libraries, home use, and so on. | 76 | 1981 | 1980-85 |
| 79. Certain types of learning resource material, especially patient records, will be machine cataloged and later on reviewed and evaluated for their value if incorporated into a course of instruction. | 63 | 1980 | 1980-85 |
| 80. Existence of biocommunication centers which have the mission of repackaging medical and research literature into a few high quality documents -- involved in the compression and integration of research findings. | 77 | 1980 | 1978-85 |
| 81. Coordination of curriculum and instructional material development so that locally produced material can be used at other health science institutions. | 89 | 1980 | 1977-80 |
| 82. Establishment of a nationally known "stable" of authors in medical information who will be responsible for producing high quality texts, reviews, etc. in their specialty area. | 51 | 1985 | 1980-90 |
| 83. Establishment of regional or even national cooperative groups to prepare "pools" of questions which can be used with self-instructional and self-examination programs. | 81 | 1980 | 1975-82 |
| 84. Publishers will support the development of computer-assisted education courses, as they now support the development of textbooks. | 68 | 1980 | 1978-85 |
| 85. The journal will be replaced by a system of distribution of separates -- individual journal-like articles. | 48 | 1990 | 1983-90 |

*(Continued)*

Table 1 *(Continued)*

| | Event Probability (%) | Year of Occurrence | Range |
|---|---|---|---|
| 86. The journal will be replaced by microfiche editions. | 47 | 1990 | 1983-90 |
| 87. Research scientists will depend primarily on "selective dissemination of information" (SDI) systems for keeping up with the literature in their field(s). | 68 | 1983 | 1977-90 |
| 88. The "reward systems" in schools of health science will change to give more recognition to faculty who devel ef- fective education media in suppc of curriculum. | 70 | 1979 | 1977-80 |
| 89. Most medical school curriculums will be shortened to three years, or, entrance criteria will be lowered to something less than a four-year college degree. | 72 | 1980 | 1980-80 |
| 90. A change in the present (American) attitude towards health and medicine such that there will be a drastically lower requirement for and interest in access to medical information. | 30 | 1994 | 1990-00 |
| 91. Breakdown of state boundaries for education with regional centers of learning developed. Little duplication of departments, faculties, etc. within educational regions. | 52 | 1985 | 1980-88 |
| 92. U.S. biomedical research will require informational inputs from other countries (e.g., translations, abstracts, international conferences) which in magnitude will be at least equal to that produced within the USA. | 70 | 1980 | 1978-85 |

*(Continued)*

Table 1 *(Continued)*

| | Event Probability(%) | Year of Occurrence | Range |
|---|---|---|---|
| 93. Since English will the primary international language in science, US-trained researchers will no longer be required to learn one or more foreign languages. | 85 | 1978 | 1975-82 |
| 94. Training programs and/or internship programs will be developed to train medical librarians to be library administrators. | 66 | 1978 | 1977-78 |
| 95. Yet to be known factors will ameliorate the increasing financial crisis caused by the high cost of journals and index-abstracting tools. | 48 | 1985 | 1980-85 |

## RESPONSE WEIGHTING

It is almost inevitable that, with respect to certain of the topics addressed in a Delphi Study, certain of the participants will be less knowledgeable than others. The present study covered a wide variety of topics. Therefore, it was imperative that a means be found for weighting the estimates provided by each participant. This was done by using the confidence and expertise evaluations provided by each participant.

With reference to Figure 1, for each event/condition description, the respondent provided an estimate of probability of occurrence and estimated year of occurrence. Then, using a 100-point scale, the respondent provided a confidence estimate and an expertise evaluation. The product of the two scale values provided was used to weight the probability of occurrence and the earliest year of occurrence responses.

The procedure was as follows:

(1) Multiply confidence estimate times expertise evaluation and assign the following weights to the product:

| | |
|---|---|
| 0 - 100 = 0 | 2001 - 3000 = 3 |
| 101 - 1000 = 1 | 3001 - 4000 = 4 |
| 1001 - 2000 = 2 | 4001 - 5000 = 5 |

5001 - 6000 = 6 | 8001 - 9000 = 9

6001 - 7000 = 7 | 9001 - 10000 = 10

7001 - 8000 = 8

(2) Weight probability of occurrence estimates by:

Converting the letter (a, b, . . . etc.) or verbal response (never, low, etc.) to a numerical value (1, 2, 3, 4, 5); weight that value by the weight determined above.

Example: Assume probability of occurrence is 3.

Assume confidence estimate is 60%.

Assume expertise evaluation is 70%.

60% x 70% = 4200 = weight of 5.

Probability of Occurrence of 3 is treated as though *there had been five respondents, each providing a probability of occurrence estimate of 3.*

(3) Weight earliest year of occurrence by:

(a) Determining the weight to assign to the product of confidence estimate and expertise evaluation. Assume weight of 5 as in above illustration.

(b) Treating the estimated year of occurrence (e.g., 1985) as though it had been provided by five respondents.

(c) Calculating the median estimated year of occurrence on bases of weighted number of respondents (for most statements this was about 20).

Use of the above weighting procedures can lead to a substantial shift in the median estimate developed for a group of respondents. The sample data presented on the following page demonstrate how this can happen.

| Respondents | Earliest Year of Occurrence | Confidence Estimate | Expertise Evaluation | Weight |
|---|---|---|---|---|
| 1 | 1975 | 60 | 50 | 3 |
| 2 | 1980 | 75 | 60 | 5 |
| 3 | 1978 | 70 | 30 | 3 |
| 4 | 1990 | 40 | 55 | 3 |
| 5 | 1985 | 100 | 95 | 10 |
| | | | Sum | 24 |

Unweighted Median–1980 (the estimate provided by the middle respondent)

Weighted Median–1985 (the year in which the 12.5th estimate falls)

For 24 weighted estimates, the 24 estimated years of occurrence are: 1975 (3 times); 1978 (3 times); (1980 (5 times); 1985 (10 times); 1990 (3 times). The median estimate falls within the year 1985.

## Chapter 3

# STUDY FINDINGS

## FUTURE EVENTS IN BIOCOMMUNICATIONS AND MEDICAL CARE DELIVERY

The major objective of this study was to identify probable events and conditions which, if they should occur, might affect the future job duties of and/or training programs for medical librarians. A total of 95 events and conditions were identified. Table 1 contains a brief description of each.

For each event or condition, information was obtained regarding the probability of its occurrence, and the probable year by which the event would have occurred or the condition would have become commonplace. In Table 1, the following data have been presented to the right of each event/condition description:

- The median probability of event occurrence.
- The median year of occurrence, or year when the condition would have become commonplace.
- The interquartile range of the "year of occurrence" estimates—the range within which the middle 50% of the estimates fell.

As an aid to the reader, the descriptions contained in Table 1 have been grouped into 17 categories. Table 2 contains a brief description of each category along with the number of each event/condition description subsumed under each category. Eighteen event/condition descriptions dealt with the development of improved systems for the storage and retrieval of data or information; 12 related to changes in the job duties, the training of, or the manpower requirements for medical librarians; 8 related to the development of improved systems for transmitting information or documents; 12 concerned the development of special libraries and/or information centers; and 6 descriptions concerned the increased use of non-print media to store information and instructional material.

Table 2

## Categories of Events and Conditions Which May Occur in Areas Related to Biomedical Communications, Medical Training, or the Delivery of Health Care[a]

1. Improved techniques and systems for transmitting information. (6,8,10,21,22,23,24,39)

2. Improved computer-supported ISR systems for education. (12,26,52,55,57)

3. Improved networks for the storage and retrieval of information. (2,3,36,38,40,46.77)

4. Improved general-purpose storage and retrieval system and equipment. (1,27,28,33,35,75)

5. Increased use of non-print media and associated presentation devices. (13,14,31,53,54,86)

6. Reorganization and reclassification of medical information and data. (3,34,43)

7. Development of special libraries and information centers. (7,15,17,41,42,44,45,50,60,81,91,95)

8. Increased involvement in standardization and cooperative developments. (18,47,48,49,51,83)

9. Development of computer-based medical support and evaluation systems. (10,25,29,56,70)

10. Development of "pay for services" procedures. (4,5)

11. Increased involvement with continuing education programs. (9,58,71)

12. Increased demand for health care information by the public. (17,20,78,90)

13. Adoption of new educational techniques and procedures. (16,50,69)

(Continued)

Table 2 *(Continued)*

14. Job duty, training and manpower requirement changes.
(11,30,59,62,63,64,65,66,68,74,76,94)

15. Changes in the manner health care professionals are trained.
(17,47,60,67,72,73,89,93)

16. Development of new procedures for producing training material.
(79,82,84,88)

17. Development of new sources of information.
(85,87,92)

[a] The numbers in parentheses refer to the descriptions contained in Table 1.

The events identified in this study undoubtedly are a biased sample of those which might have been developed had the study participants been drawn from other populations. For the most part, the participants were either directors of large libraries, or persons responsible for some major aspect of medical education at their institution. (The names and addresses of the participants are listed in Appendix A.) Thus, the future events and conditions identified were ones that are more apt to occur at a large university or medical complex.

## FUTURE JOB AND TRAINING REQUIREMENTS FOR MEDICAL LIBRARIANS

A second objective of this study was to identify some of the future job duties and training requirements of medical librarians. Toward this end, for each event/condition description listed in Table 1, the study participants were asked to describe what they thought the impact of event occurrence "would be on the duties, services and/or responsibilities of persons who work within a medical library." Also, for each description the participants listed, by job position or by job title, those persons whom they believed would be affected by event/condition occurrence.

In response to this request more than 95 pages of single-spaced typewritten comments were obtained. An almost verbatim compilation of these comments is contained in a supplement to this report. A summary of the comments provided for each event/condition description is presented in Appendix B.

The information developed during this study is extremely diverse and cannot be precisely summarized. The 95 events/conditions that were identified during the study are ones which for the most part probably will occur in the not too distant future.

However, there was considerable disagreement regarding the impact of these events on the field of medical librarianship. Those respondents who were optimistic thought that the skills and knowledges of the typical medical librarian could be upgraded, that they could become rather proficient in such areas as media management, educational technology, and the application of computer-supported techniques to the processing and transmission of information and data. Those respondents who were pessimistic believed that most events would have little or no impact on medical librarians, except that eventually the librarian might become more of a technician.

The summary comments are presented in Appendix B to provide a basis on which readers can develop their own judgments regarding the future of medical librarianship. Those who are concerned with the training implications of these events will be particularly interested in the Supplement to this report. That Supplement contains, for each event/condition description, a listing of the verbatim comments provided by the study respondents. These comments contain many ideas which should be of use to the faculty of a program in librarianship.

## LIBRARY DIRECTOR TRAINING SUGGESTIONS

In a recently completed NLM-supported study (8) that was a companion to the one reported here, recent graduates of NLM and non-NLM-supported training and internship programs were surveyed. As part of that study, a number of library directors were

contacted and asked to complete a short form concerned with the "Identification of Recent Graduates." One question contained on that form was as follows:

> Would you please list five content areas and/or skill or knowledge areas which in your judgment should receive special emphasis during the next ten years in programs of medical librarianship. You may list either or both areas which should be emphasized to correct employee deficiencies, or, to prepare employees for anticipated future job requirements.

A total of 519 responses to the above question were provided by 135 library directors. These responses have been categorized as shown in Table 3. A response category is reported only when at least 5% of the directors listed a training need related to that category.

Table 3

**Skill and Content Areas Which, According to Library Directors, Should Receive More Training Emphasis in Future Programs of Medical Librarianship**

| Skill/Content Area | Percent of Respondents Who Mentioned Area |
|---|---|
| Administration/Management | 41% |
| Analysis/Research Skills | 18% |
| Automation/Computer Application | 43% |
| Communication Skills | 6% |
| Content/Subject Matter Expertise | 21% |
| Educational Technology | 10% |
| Health Care Delivery Systems | 7% |
| Information Organization and Analysis | 19% |
| Information Retrieval Systems/Information Science | 31% |
| Library Networks/Consortiums | 14% |
| Library Services | 9% |
| Non-Book Materials/Multi-Media | 42% |
| Reference/Bibliography | 21% |
| Technical Services | 11% |
| Terminology (Medical) | 13% |

### Administration/Management

Most of the respondents were directors of medium-sized or large university-based libraries. Not surprisingly, therefore, they emphasized the need for more training in administration and management skills. They indicated that a chief librarian does much more than interact with books, audio-visual material, and patrons. Rather, chief librarians are concerned with budgets, library and institutional staffs, and the incorporation of new techniques and procedures into the library setting which were not necessarily designed by librarians. A number of respondents mentioned that a library is a "business" and that librarians must take a more businesslike attitude toward librarianship.

Prominently mentioned also was the need for more skills related to the supervision and management of library personnel. Included here were comments referring to hiring and firing, personnel counseling, and the training of aides.

### Automation/Computer Application

Forty-three percent of the respondents stressed the need for more instruction in automatic data processing and its application to library operations. The acquisition of skills related to application was heavily stressed. Very few respondents listed a need for programmer skills as such. They seemed more interested in the ability to use automation techniques, to adapt a set of procedures to one's own library. A few respondents specifically mentioned that knowing how a computer worked or how to program it were not useful skills for a librarian.

### Information Retrieval Systems/Information Science

The respondents almost always made a clear distinction between automation as applied to library operations and computer-supported information retrieval techniques. The points emphasized were practical ones. They expressed a desire for librarians with knowledge about existing systems and sources of data and information, and how to use them effectively.

### Non-Book Materials/Multi-Media

Forty-two percent of the respondents listed a need for more training in these areas. Prominently mentioned was the need for skills related to the management of audiovisual materials—their acquisition, selection, cataloging, storing, and so on.

For some time, education—especially medical education—has made increasing use of multi-media instructional material. In addition to closed-circuit TV and dial-access systems, increasing use is being made of slide-tape programs and programmed instructional texts. Within the next few years video tape cassettes may become the dominant instructional device. If so, librarians may be needed who are specialists in the management of video tape libraries and their associated hardware.

### Reference/Bibliography

Although broken out as a separate category, the statements contained in this category often were closely related to those contained in the "Information Retrieval Systems" and/or the "Content/Subject Matter Expertise" categories. A desire was expressed for persons more knowledgeable about the types of aids available to the reference librarian, and the types of books, information sources, and content areas covered by the typical medical library.

## Chapter 4

# DISCUSSION

One cannot conduct such a study without formulating some opinions about the future of medical librarianship. In this section the author gives his interpretation of some of the opinions expressed by the participants of this study.

## LIBRARY OPERATORS, CONTENT EXPERTS, AND "INTERFACERS"

Much of the day-to-day operation of a library involves providing some type of service to library patrons. These operations are rather routine in nature. Certain services may require considerable technical skill, but may not require much, if any, knowledge in a particular content area. For the most part, a library can be operated by skilled library technicians, assuming they are supervised properly by a professional librarian. But who trains and supervises the technicians? This is a legitimate job for the professional librarian, a person who has been trained as a specialist in the management and supervision of the various library departments.

There are library positions, especially within a large medical library, where detailed knowledge about one or more content areas is a necessity. It is desirable, for example, for a medical reference librarian to be knowledgeable in certain medical content areas. Depending upon the requirements of the particular job, the need for content expertise may be slight or it may be extensive.

Within large libraries, and especially within learning centers, there is a need for a third group of people. This group can be called the "interface" group. It consists of system analysts, instructional technologists, communication specialists, and so on—persons whose jobs link together library operations and content experts. These "interfacers" seldom begin their career as librarians. Rather, they first train as content experts in a particular field, then acquire appropriate cross-training in some area of librarianship or information processing and transmission.

The point is that, with rare exceptions, a librarian need not and often cannot be both a skilled operator or technician and a skilled content expert. The time required to acquire both sets of skills is too long for most persons to undertake, and there are few jobs that require the possession, to a high degree, of both sets of skills.

Many participants in this study seem to suggest that the impact of many future events in biomedical communication will not be severe on those persons who "operate" a library. Also, the impact may not be too great on those who are experts within some particular medical specialty. However, the impact may be rather noticeable on the interface group, those persons who must link together the content expert and the library operator in order to solve whatever problems are brought about by the occurrence of a particular event Some examples are in order.

For the most part, librarians are only minimally involved in the development or implementation of new or improved information and data storage and retrieval systems. Usually these are developed by hardware-oriented communications engineers with the support of systems analysts and/or information scientists. Content experts, in conjunction with information scientists, may be called upon to develop new indexing and accessing procedures in order to make the systems work.

Eventually a new system gets incorporated into the library. The librarian then must function as an intermediary between the library and the public. This function can be performed adequately to the extent that the librarian understands the content of the system's data base, masters the system's accessing procedures, and masters the question negotiation and search formulation procedures developed for the system. The foregoing are all generic forms of the standard skills and knowledges which must be acquired by any person who serves as an intermediary between a user and an information storage and retrieval system. The librarian must learn to effectively use and teach the use of whatever systems and equipments are incorporated into the library.

The events described in this study often deal with new forms of reference aids. As with past and present aids, the librarian would have little to do with their development, but would have to master their usage and learn how to instruct others in their use.

## MANAGEMENT AND ADMINISTRATIVE SKILLS

Increasingly, libraries are being incorporated into learning centers, or a department within a learning center. Either way, an educational service facility of major proportions has been or is now being developed at many universities and medical centers. These centers employ a wide variety of persons—librarians, educational specialists, equipment operators, and maintenance personnel. It is doubtful that librarians will be asked to assume these non-librarian duties. However, the top job position in such organizations, the position of director, will or at least should be open to librarians as well as to the other professionals employed within the learning center. Therefore, to perhaps an even greater extent than now, those librarians with management skills should have the opportunity to advance.

## SPECIALIZATION WITHIN THE FIELD OF MEDICAL LIBRARIANSHIP

Many of the events considered during this study dealt with the consolidation of library activities. In addition to the development of learning centers, it was thought that library consortiums would be developed, and designated libraries within that consortium would be assigned responsibility for one or more medical content areas. There seems to be a trend in this direction and in all probability it will continue. This should create the need for people who are highly skilled in content areas and/or in particular procedures associated with the development and processing of information and/or educational material.

Using the learning center as a model, there probably will be a need for large numbers of persons to perform in the traditional librarian fashion. However, these activities may not be performed with respect to print media—audio-visual media may be much more prevalent. At the larger learning centers there probably will be need for specialists in the management of audio-visual material. At many points throughout this study, the need was expressed for librarians who are more skilled in this aspect.

Many study participants described the need for persons who are expert in a particular content area. In particular, these persons would be required to extract,

abstract, summarize, and repackage information. To handle certain jobs, it might take two to four years of post-BA training to acquire the appropriate content knowledge. Persons so trained can and indeed do, via continuing education, acquire whatever additional library-related skills are needed for their job. Persons now used to index medical documents at the National Library of Medicine were for the most part trained as content experts, not as librarians. Their job requires them to use MESH headings, and this they were able to learn to do.

To be a highly skilled reference librarian or a medical bibliographer might require a Master's degree or even a Ph.D. degree in some particular content area. If they need to, such persons can learn quite readily to index, abstract, extract, formulate search formulas, and so on. Indeed, as part of their content training, they learned to do much of this. If the job requires content expertise, and the salary is adequate, there will be content-trained persons available for the job. Persons trained as librarians seldom can compete for such jobs.

There now are and will continue to be certain library positions that require some familiarity with a content area or with instructional technology, but that do not require extensive expertise in these areas. These will continue to be suitable job positions for medical librarians.

## THE NEED FOR IN-DEPTH INDEXING AND CATALOGING

Many of the activities of a librarian involve the classifying and tagging of information so that it can be rather precisely and rapidly retrieved. The degree to which these activities must be performed with great precision relates to the form in which the information is stored, the time demands of the user, and whether or not the user wishes to retrieve specific data as opposed to information.

Certain users of a library are "in a hurry"; other users have more time. Libraries now can best serve persons who have the time to search through a list of titles, a package of abstracts, or a shelf which "probably contains the book you want." On the other hand, business and industry often have an aversion to seeing their workers "reading in the

library." Such organizations have been willing to develop "information centers" and to staff them with information scientists and/or content experts who are supposed to be able to accurately index, store, and retrieve the data and information requested by the typical user.

To the extent that information can be displayed before a user, the user can, and now does, compensate for misclassification. With the increased use of microforms and computer-based systems, it may be less easy for the user to "see for himself" what is in the information bank. Therefore it will become more critical that information and data be accurately tagged. This suggests that subject matter experts, not librarians as such, will be more involved with the cataloging and indexing of items of information.

Data and information can be indexed accurately to the extent that they have been pre-coded. Currently, subject matter experts are required to index a medical article, using MESH headings. The data in the typical medical record cannot be accurately indexed because the same types of data do not appear in the same locations in all medical records. As persons have become more interested in data retrieval, attempts have been made to restructure data collecting forms so that a certain amount of precoding can be performed while collecting and recording the data. To the extent that this can be done, non-content experts can be used to index data and information.

## INFORMATION REQUIREMENTS AND EVALUATION STUDIES

It would appear that the library will be the site where inereasing use will be made of self-instructional material and self-testing programs. The developers of these materials and programs may or may not coordinate with librarians. However, such developers are under an obligation to collect information about how well their products are meeting user requirements. It would seem natural that future librarians would be heavily involved with the evaluation of self-instructional and testing programs.

Future librarians may be occupied with the conduct of user studies, the purpose of which would be to identify the information requirements for certain types of decision makers. For example, curriculum experts responsible for selecting from among various

instructional packages would want to know, for each package, its contents, form, and length, who it is suited for, and so on. Students who are responsible for programming their own sequence of educational experiences would need a somewhat similar constellation of information.

## NEW GROUPS OF LIBRARY PATRONS

If certain of the events discussed in this report were to occur, the library would become heavily involved with providing health care information to the public. This is an entirely new service. New collections of information would have to be acquired. The information needs of the general public with respect to health care would have to be identified, and in cooperation with the medical profession, rules would have to be established for providing such information. In the larger libraries there probably would be a need for specially trained persons to handle these demands. If implemented effectively, such public health educational programs could markedly expand the need for medical librarians.

## TRAINING OF MEDICAL LIBRARIANS

It is not difficult to find persons who feel that the profession of medical librarianship is in danger of becoming extinct. These persons view the job of the typical librarian as one which can be effectively held by sub-professionals. Perhaps this is so, but it need not be.

The typical medical librarian, who has a BA degree plus one year of training at the Master's degree level, cannot hope to perform very skillfully or effectively. During a Master's degree program, the future librarian becomes familiar with many areas of librarianship but masters few, if any. This is not too damaging because many of their future activities can be easily learned on the job. Little wonder, then, that people ask why a librarian needs to be specially trained in librarianship.

There are many areas where a librarian should be more knowledgeable and skillful. A practical problem is one of how to rearrange the typical librarian training program so that its graduates can learn more and become more skillful. As a partial solution to this problem, recent advances in educational technology have shown us how to reduce the length of a training program while maintaining its effectiveness. However, despite these advances, it still usually takes additional training time to master additional skills and knowledges. Any of the following four general approaches can be adopted to provide this additional training time.

(1) Librarianship Programs at the Bachelor's Degree Level. For most professions, the Bachelor's-degree program is one where a student receives a basic grounding in the profession's content areas, obtains a broad overview of the profession, and perhaps becomes proficient in a few procedural or content areas. It would seem appropriate for the librarianship profession to adopt this educational model. Along with such undergraduate training, which would provide the baseline training for all types of librarians, the aspiring medical librarian might be required to take a minor in a field such as biology or business administration. Persons so trained should be quite capable of performing the routine operations required of a librarian. Indeed, they might be more capable than present librarians, because they would have had a longer period of time to acquire the skills of librarianship.

Adoption of the above approach need not and should not be at the expense of programs at the Master's degree level. Rather, those portions of current Master's degree programs which can be placed in a Bachelor's-degree-level program should be placed there. This would free academic time for the presentation of more sophisticated courses at the Master's degree-level. Thus, Bachelor's-degree-level programs in librarianship could be used to provide a source of library sub-professions, and to prepare persons for further study and for specialization at the Master's degree level.

(2) Cross-Training at the Master's Degree Level. In the immediate future, medical librarians will be trained as they are now. They will receive librarianship training at the Master's degree level. Then, many will attend a more specialized program, also at the Master's degree level, in order to become skilled in a medical content area, library management, application of computer technology, and so on. Although, presumably, two Master's degrees are better than one, this approach doubles the required amount of

professional training, and greatly increases the economic burden of acquiring a professional education. However, it probably does not greatly increase one's marketability from a salary standpoint.

(3) Doctoral Programs in Medical Librarianship. Attention has been given to the notion that there should be doctoral-level programs in medical librarianship. Following this approach, one would keep present Master's-degree-level programs, but develop a variety of doctoral-level follow-on programs. Certainly this approach would provide more time for the acquisition of needed skills and knowledges. However, as presently constituted, doctoral programs are oriented toward the acquisition of research skills. It is doubtful that large numbers of research-oriented librarians will be in demand in the future. It would be possible, however, to develop Doctor-of-Arts-degree programs, wherein research-related skills are down-played and a research project is not a program requirement.

The development of more doctoral-level programs is an attractive approach in that it would provide a means for placing professional librarians on a more equal status footing with the holders of Ph.D or M.D. degrees. This approach has certain disadvantages, which lowers its probability of acceptance as the terminal educational program for large numbers of medical librarians. First, it would have a tendency to downgrade librarianship at the Master's degree level. Second, it would add two or more years to the training of many librarians. This would impose an economic hardship on many students, from which they would hope to recover via higher salaries once they became employed. However, it is doubtful that libraries, in their present financial conditions, would be able to obtain the funds required to pay doctoral-level salaries to large numbers of employees.

(4) Continuing Education. For some time Continuing Education programs in librarianship have been in demand. This author would predict that this demand will increase rather markedly. There is increasing acceptance of the view that one's formal training should prepare one for future learning on the job. In most instances it is not possible, or even desireable, to educate students to such an extent that they can immediately perform skillfully on their first job. Rather, academicians and employers are increasingly interested in programs which teach the rapid acquisition of new skills in response to changes in job requirements. Thus, there is increasing recognition that continuing education will be an important part of our future professional lives.

Most medical librarians work in or near a large university or medical complex; if not, they are linked via a communication network. An increased variety of Continuing Education programs will be available in the form of self-instructional programs. Many will be packaged as computer-assisted instruction and will be available, via a communication network, at one's station of work. In addition, it would seem appropriate for library schools to develop mini-courses which could be presented within specific libraries via communication networks. The reader should note that by Continuing Education programs we do not refer to one or two-day workshops, which undoubtedly, still will be in demand. Rather, we refer to courses of two weeks or more to an academic quarter in length.

This author believes that the establishment of librarianship programs at the Bachelor's degree level has considerable merit. Properly implemented, it could lead to a general upgrading of librarianship, especially medical librarianship, at all levels. It could provide large numbers of persons who could perform well as library technicians. It would allow for the restructuring of Master's-degree-level programs so that instead of being mere survey courses, they could become advanced courses in some specialty of librarianship or concentrate on some particular subject area. Appropriate areas of specialization would include library management for those aspiring to be library directors, audio-visual materials management, reference and bibliographic skills development in some particular content area, instructional technology, and so on. These programs could have the added benefit of considerably upgrading the status of those librarians holding a Master's degree in librarianship. Master's-degree-level programs would produce graduates with clearly advanced skills and knowledges in their professional area. This should make them much more acceptable to the typical academic community. This approach also is open-ended enough to be articulated with doctoral programs in librarianship and information science.

There will continue to be a need for a wide variety of content experts, persons skilled in the application of computers, the development of improved information systems, and persons knowledgeable in one or more areas of medicine. It seems appropriate that such persons continue to be trained as content experts, and receive their training in departments other than the school of librarianship. However, such persons may need to be cross-trained in certain areas of librarianship. It would seem appropriate,

therefore, for library schools to increase their production of continuing education programs, programs which could be used both for in-service training and for the cross-training of persons from other professions.

It should be obvious that this author believes that the whole field of librarianship should take advantage of the apparent trend toward specialization. There always will be a need for large numbers of persons who might be considered para-professionals. Baccalureate programs in librarianship would provide a large group of persons who could quite capably perform most library functions.

To successfully compete with members of other professions who have decided to seek employment within a library setting, there would seem to be a need for programs at the Master's level. Such programs could produce people highly skilled in certain areas of librarianship. Graduates of some of these programs might be required to serve as interns for a period of time.

It is quite reasonable to hypothesize that there are certain librarianship positions where Ph.D.-level training would be the appropriate educational prerequisite. A Ph.D.-level program which produces information scientists seems to be one natural terminal point in the education of librarians. Certainly there must be other such points.

This writer does not believe that it is prudent for medical librarians to try to compete with sophisticated medical content experts or instructional technologists. There will be a few positions within libraries, and especially within learning centers, where the Ph.D. degree in education or psychology, or even the M.D. degree may be the appropriate educational requirement. Persons in such positions are apt to be involved full-time with the processing or reformatting of information and/or the development of instructional material. For certain jobs medical librarians should be familiar with, and perhaps even have a fair amount of expertise in, such areas. However, they need not be content experts.

## REQUIREMENT FOR PERIODIC MANPOWER SURVEYS

Most professions are associated with self-perpetuating programs of instruction which keep turning out graduates in the same obsolete mold. Currently, for example, there.

seems to be a glut on the market of teachers, particularly those with a Ph.D. degree who wish to teach in colleges or universities. University-based programs seem to be the last to learn about changes and new job requirements that are occurring in the job market. For this reason it seem imperative that each profession establish procedures for conducting periodic job surveys.

A companion study to the one reported here was concerned with evaluating the impact of training and internship programs supported by the National Library of Medicine (8). The findings suggested that, at least in some sections of the country, the job market for medical librarians is saturated. This present study developed information to suggest that this job market may either expand or contract depending on which potential events and conditions occur in the near future. It would seem advisable, therefore, for some organization such as the American Medical Library Association or the National Library of Medicine to conduct a job market survey every two or three years.

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## Appendix A

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## Appendix B

# SUMMARY OF COMMENTS PERTAINING TO THE IMPACT ON MEDICAL LIBRARIES AND/OR LIBRARIANS OF OCCURRENCE OF THE EVENTS LISTED IN TABLE 1 OF THIS REPORT

Statement

1. Would have to function as an expert on the use of the information banks, to include the training of users, the formulation of requests, the screening of outputs, and so on. Also, would have to learn an accessing vocabulary.

2. Would function as an expert on the use of information services, to include the training of users and the formulation of requests. Might have to input data. Might be more copying and packaging requirements at the local library, e.g., convert system displays into hard copy.

3. Would guide formulation of search formulas; maintain cross-reference files for translating old into new nomenclature.

4. Would have to acquire more business skills. Would be more involved in cost-benefit analysis, costing studies, evaluation of service studies. Might be increased trend towards development of specialized libraries and librarians.

5. Would have to become more service oriented and more "hard boiled" about the cost-benefit relationship of each service. Libraries would become more like a business and would have to adopt business practices.

6. Fewer documents would be stored locally and more procurred via facsimile transmission. Cost-benefit decision rules would be developed based on local conditions. Might have special department within library for making hard copies.

7. Might decrease the need for general librarians while at the same time increasing the need for a few content specialists. Library management would become more concerned with cooperative efforts.

8. Similar to #6 above. In addition, might need communications engineer or at least a technician on the library staff. More reproduction equipment would be needed.

Statement

9. Would have to become familiar with self-study equipment and techniques, and with the data required to help faculty make knowledgeable decisions about them. Probably librarians would not become educational technologists. Rather, they would be responsible for obtaining and packaging information which decision makers would use to decide what instructional packages and equipment to select.

10. Might become even more involved with continuing education. Might be asked to collect "continuing education" data which could be used to corrobrate a persons' claim that they had put in so many hours of study. Libraries could become involved in test administration.

11. Would have to become content experts in selected areas, or, such experts could be obtained from the medical profession. This latter is the current practice and probably would be continued.

12. Would spend less time formulating and conducting searches, and more time serving as a consultant to users who are performing the search operation. Might become involved in evaluating the effectiveness of CAI programs, i.e., gather information on program effectiveness.

13. Would necessitate the establishment of procedures for purchasing, lending and reproducing microforms. Distribution of non-returnable documents would become common. Should decrease material storage problems -- bulk problems -- in the library. A "return of deposit" system might be developed at some libraries.

14. Might result in more distribution (sale?) of non-returnable hard copies, assuming that copyright problems could be solved. Would be involved in the development of decision rules regarding what information should be stored at the local library, and the media which should be used to store it.

15. Related to #7 and #11. Would have to become more of a content expert. More likely, such centers would be staffed by content experts who came from a non-library background.

16. Would increase the load on the library's circulation department, especially for multi-media packages. Would have to develop improved indexing and searching procedures for instructional programs presented in a variety of modes and media. Large libraries would need an equipment repair department.

Statement

17. Would provide instructional materials to public, possibly based on a prescription provided by a health care professional. Might become involved in the evaluation of material usage. Would have to deal with a new group of users, and would have to learn to identify their information needs.

18. Probably would have little impact on librarians. Rather, some such person as a "biomedical communications specialist" or an "educational technologist" would serve as an educational consultant to the school faculty. Librarians might have to become more familiar with curriculum development, presentation and evaluation. Might function as a team member and be responsible for locating instructional packages to be considered for selection by curriculum experts.

19. Would teach users how to operate system. Doubtful if librarians would be greatly affected by this event. Engineers, content experts, maintenance men more apt to be involved.

20. Would increase the demand for materials on a variety of illnesses, prepared for various types of users. Would require greater cooperation between library and health care personnel in order to help library identify what holdings to acquire, the location of certain types of health care information, and so on.

21. Little if any affect on medical librarians. However, Medical Records Librarians would be affected.

22. Little if any affect on medical librarians. Might increase their involvement with: cataloging A/V materials, publicizing facilities, disseminating lists of available materials and/or schedules of lectures, and so on.

23. Little if any impact on medical librarians.

24. Little if any impact on medical librarians. However, occurrence of the event would have a major impact on Medical Records Librarian.

25. Little if any impact on medical librarians.

26. Might have some responsibility for training system users. Otherwise event should have no great impact on medical librarians.

27. Probably little impact on medical librarians. Might be involved with training users.

Statement

28. Drug information centers are becoming part of a medical library. This might impact on the library management, but not the typical medical librarian. Pharmacists might join library staff.

29. Most respondents doubted the occurrence of this event. If it did occur, its impact on medical librarianship would be minimal. Medical Records Librarians might be affected.

30. Librarians would be less involved with the technical operations and more involved with the training and supervision of sub-professionals. Would require more standardization of certain library operations so that they could be reliably performed by technical-level personnel.

31. Probably little impact on medical librarians. They might have to deal more with microforms. Catalogers and indexers probably would have to acquire some new skills.

32. More librarians would have to become skilled users of MEDLINE. Would have to know how system works, how to train users, how to interact with users to clarify requests and to formulate searches. Might have to develop new or improved procedures for assuring document delivery.

33. Would require librarians to learn how to use and to teach the use of another computer-supported information storage and retrieval system. Content experts, system analysts, communications engineers, etc. would be the ones to design, develop and maintain the encyclopedias.

34. Two sub-specialties of medical reference librarians would develop. Each would have to become more familiar with the information needs of their particular group of users. There would be a considerable need for cooperation and coordination between the groups. Also, would have to develop procedures so that researchers could access clinical data, and vice versa.

35. Another information retrieval system for the librarian to master. Would have to learn how to use system, instruct users, and so on.

36. Would have to learn to use and to teach use of system. Probably would need considerably more skills regarding the negotiation of questions, since the development of search formulas might be complicated.

Statement

37. Librarians would have to become more expert in specific content areas. This could lead to considerable sub-specialization of reference librarians. As a probable alternative, content specialists from appropriate areas would be employed by information centers. Librarians might be involved in more referral work.

38. Would have to be knowledgeable in how system worked; what information they contained; how they are accessed. In short, would have to acquire the typical skills and knowledges required of one who uses a computer-supported information retrieval system.

39. Would be required to teach users how to use the equipment. Might have to clean up the catalog (make data accurate) and reformat it so that it could more easily be scanned.

40. Same as summary for #39 above.

41. Would have little affect on medical librarians. Might reduce the number of systems the librarian had to work with.

42. Probably would have little or no impact. Many respondents doubted that this event would occur.

43. Eventually this might simplify the librarian's job. In the meantime, it would complicate it. Probably would require much recataloging, and barring a complete retro-fit, would require the librarian to work with a multi-structured collection. More persons would have to become familiar with MESH headings.

44. This would affect Medical Records Librarians, but not necessarily Medical Librarians. Might have to learn more about procedures for processing medical records. (Some respondents misinterpreted the question and answered in terms of medical literature instead of medical records.)

45. Librarian would need more in-depth knowledge of one or more medical specialties. In addition, would have to know how to access and to refer persons to appropriate specialty centers. Might increase ILL requirements. Quite possibly could put a strain on library's storage facilities--might have to reserve a wide variety of instructional materials.

46. Impact might not be too great. Should lessen the need for cataloging skills; should increase, perhaps greatly, the amount of ILL traffic. Would necessitate a more cooperative approach, especially with respect to what resources should be acquired by any particular library.

Statement

47. Librarians would have to know much more about the design, use and evaluation of instructional material. Would have to serve as advisors regarding curriculum planning, especially the use of media. Many respondents thought this event would not affect medical librarians. They were of the view that instructional technologists and/or information specialists would perform as educational advisors, not the librarians.

48. Would be an increase in the activities and problems associated with the storage, retrieval and cataloging of AV material. Probably would have to increase library holdings. Sub-specialization of librarians in terms of medical disciplines might occur.

49. Impact would depend on whether or not the library became part of the school's Learning Center. If so, librarians would have to know more about educational processes. Might also be an increased demand for the indexing, cataloging, retrieval, etc. of AV materials. Media specialists would be in more demand.

50. Certain "specialized" libraries would be heavily involved in the distribution of materials in selected content areas. Would be involved with more ILL activities. Would require catalog specialists, and this might lead to the sub-specialization of librarians along content lines. Would require more interaction with medical content and instructional experts.

51. Would have little impact on medical librarians. Librarian would have a new person or group to support. Persons trained in "educational communications" might take over from librarians certain of their "educational" functions. If so, this would have the affect of downgrading the status of librarians.

52. Would have little or no impact on medical librarians. They might be required to learn how to teach use of system equipment.

53. Librarians would have to learn how to catalog, store, distribute, repair, etc. non-print media.

54. Assuming that such systems are operated out of the library, librarians might have to operate the systems. More likely, librarian would be involved with typical cataloging, indexing and "notification of availability" functions. System technicians would operate and maintain the systems.

55. Would need to catalog training programs; advise students on program availability; teach use of teaching machines; interact with programmers.

Statement

56. Probably little, if any, impact on librarians. There might be more CAI programs for use in training library patrons.

57. Probably little if any impact. Might be more CAI programs for orienting library patrons.

58. Development of a large collection of CE material which would be managed by the library -- select, catalog, store, distribute, and so on. Burden on circulation and reference librarians would increase. Probably would have to learn how to advise students regarding the selection and use of such material.

59. Greater sub-specialization within field of medical librarianship. Those persons who wished to grow with the field would retrain in areas related to education and biomedical communication; they then would be able to take on new educational responsibilities. For the traditional librarian, their job status and pay would be lowered relatively, and eventually they would become sub-professional librarians.

60. Librarians would become heavily involved in the educational process, teaching medical students how to access library resources. There would be less need for the librarian to train and advise library patrons since many patrons would be trained regarding library usage. Librarians would have to keep up with new advances in biomedical communication.

61. Would increase the volume and diversity of material handled by the library. Would have to become familiar with jobs of various types of paramedics, and their information requirements. Would become more concerned with acquisition of clinically-oriented materials. Might become actively involved in the education of paramedics.

62. Would do more work as a member of a research team, especially literature searches, transformation of information (as opposed to mere item identification). Would need more content expertise and research skills. Would need some capability to screen and evaluate information. Status would be upgraded.

63. Would have a better understanding of the context of medical librarianship--greater sensitivity to users and their information needs. Should be able to more effectively acquire materials and act as reference librarians. Ability to catalog medical documents should improve. Should develop increased interest in providing medical care information to the public. Might be given increased responsibility for assisting faculty in their research and curriculum planning.

Statement

64. Library directors would be more involved in the educational process of their institution. They would be given a faculty position, but in turn would have to enlarge their scholarly pursuits. There would be more doctoral-level programs, with a resultant increase in the requirement for senior instructors. Many more librarians would collaborate in the planning, development, design, etc. of information systems and educational material. Would pass on their day-to-day library activities to para-professionals.

65. Would result in greater involvement with educational, clinical and research activities. Might have more responsibility for CE programs; in turn, probably would have to enroll in CE programs--would have to acquire additional skills relating to educational technology, the process of communication, and so on.

66. Participation in CE may become a requirement, and might serve as the basis for periodic recertification. Would need more persons to teach CE courses. Library schools would have to develop new programs to train persons in the "information professions". Librarians then would be able to perform many of the jobs now held by information scientists, systems analysts, and educational technologists, persons who are now taking over the "professional" activities of the librarian.

67. Library would have considerably more multi-media material to manage. This would include a large portion of locally-produced material. Library might become involved in providing instruction in the preparation of multi-media material, and assist the faculty in the preparation of such material. A more knowledgeable faculty should result in increased expectations on their part regarding the performance of media specialists. There would be considerable need for counseling students regarding the availability, selection and use of multi-media materials.

68. Basic philosophy of most library schools would have to change to incorporate new technologies into their curricula. Librarians would develop an increased capability in instructional technology and supporting communication systems. This should advance their status in the academic community and put them in a position where they could more closely cooperate with, and provide assistance to the academic faculty. Each school would have to define lines of responsibility between the library and other departments such as the Departments of Education and of Computer Sciences. Librarians would be able to assume jobs now held by persons trained in other disciplines.

Statement

69. Textbooks would play a diminished role, and CAI programs an expanded role in higher education. Libraries would have to manage collections of CAI programs. Librarians would be involved in the selection, storage, retrieval, evaluation, and so on, of such programs. They would be heavily involved in instructing and advising students regarding the use of CAI materials. Librarians would have to become much more knowledgeable in CAI as an instructional technique.

70. Librarians would have a new collection of materials to manage and to provide advice and instruction regarding its use. New techniques of cataloging might have to be developed in cooperation with the developers of the test material. Would have to become skilled at scheduling terminal access, especially immediately before standard written examination periods. Might become an important source of feedback information to test developers--gather student reaction to examination material and pass on this information to test developers. New, more rigid procedures for material control might have to be developed.

71. A new collection of material would have to be developed and maintained. This would increase the workload for acquisition, reference and circulation librarians. Such persons would have to be familiar with the general information needs of medical practitioners Also, they would have to become familiar with current sources of information--drug house material, conference proceedings, government pamphlets, and so on. There probably would be a need for learning how to manage various communication systems (other than the library) for the dissemination of information. More librarians might be employed by professional organization, which is where most continuing education materials would originate.

72. Would be more intermingling of library personnel with health care delivery personnel. Library people would have to "get out" of the confines of the library proper. Librarians would be much more involved with medical education. Also, they would have to learn more about the practice of medicine and medical research. They could become more involved in research and development activities relating to biomedical communications research and the development and evaluation of training programs. The perspective of the medical librarian should be broadened considerably.

Statement

73. Would be an increased demand for and use of hospital library facilities. The size, quality and diversity of the hospital library and its staff would have to grow. Hospital library directors would work more closely with the Director of Medical Education, the Director of Nursing Education, and so forth. Many respondents doubted this condition ever would occur.

74. Medical librarians would be required to participate in a number of continuing education programs, possibly being re-certified every five years or so. Librarians, especially library directors, would participate more effectively in the operation of the medical library resources, and would have more responsibility for supporting the school's educational program. Might be more involved in the design and development of instructional material.

75. Would increase the workload for the local librarian. Would require closer collaboration with information specialists and hospital professional personnel. Librarians would have to know how to operate, and to teach the use of, whatever information systems exist at the hospital. This event would impact most directly on medical records librarians. It could increase their status to a point where the status of the medical librarian would be downgraded.

76. Might support clinican with information much as nurses supply surgeons with instruments. Would have to be much more knowledgeable regarding clinical practices, and have a substantive knowledge of one or more areas of clinical medicine. Should be an expert at accessing information systems via local terminals, and be fully aware of resources which can be tapped via information and data networks. Might do some literature searching and/or data collecting for practitioners.

77. Specially trained librarians would participate in the task of identifying public information needs, collecting sources for this information and helping organize its presentation. They would advise public on how to access the system. Demands for health care information should increase markedly and the public should make increasing use of health science libraries.

78. Would have to acquire more knowledge regarding preventive medicine, media techniques and health education. The librarian would have to become more of an instructional technologist. They might participate in the tasks of identifying public information needs, selecting sources for this information and helping organize its presentation. They would have to catalog, store and distribute multi-media program material to an "increased" audience. Standards for material selection probably would be much more severe.

Statement

79. Librarians might have the task of coordinating the storage, review and retrieval of such learning source material. They would require a familiarity with patient records and the process of evaluating them. They might be involved in a collaborative effort with medical records librarians to develop cataloging procedures and machine storing and retrieval systems.

80. Would have a new group of experts, biomedical information specialists, to provide services for. Services would be in the form of acquisition and reference work. Those librarians who had some familiarity with the appropriate content area might be involved in the process of extracting and summarizing.

81. Librarians might provide the inter-institutional mechanism of exchange. They would be required to cooperatively set standards, define needs, and design and implement procedures for the ILL exchange of instructional material. Would produce catalogs and listings of available material. Would advise faculty and students regarding use, availability and construction of instructional material.

82. Librarians and other information specialists may have a new role in guiding and assisting the authors. Essentially, the job would be to make relevant reference material available to them and, as required, to perform literature searches.

83. Might participate in the committee work to gain familiarity with the content output so they could serve as coordinators of the cataloging and dissemination of the test item pools. Might help faculty select testing material; would instruct students regarding how to use video and computer materials. Might counsel students regarding the identification of their educational needs and how to develop an educational prescription to correct these needs.

84. Would be involved in advising users regarding the availability of programs, how to gain access to them, and how to identify those programs which would meet particular needs. The librarian would require much more extensive familiarity with CAI programs and techniques. Also, they might be involved in the selection and evaluation of such programs.

Statement

85. Cataloging and indexing activities would increase. The difficulty of tracking down specific items would increase, and new accessing procedures would have to be developed so that one could retrieve specific articles from periodicals. Modified procedures for storing separates would have to be developed. New procedures for controlling the organization and dissemination of "separates" might have to be developed.

86. Rules of material selection would be changed to include form as well as content. Would be heavily involved in filing and cataloging microform material. Might be heavily involved in the maintenance of microfiche readers.

87. Librarians would become "profile counselors" and would help the user describe more accurately their information needs. Might be more in-depth indexing and referencing of materials. Some form of pre-sorting of incoming material along user profile lines might be required. A catalog of "interest profiles" would be established with procedures devised for keeping it up to date. A document delivery system would have to be developed.

88. Would be a lessening in demand for bibliographic searches but and increased demand for multi-media material. Librarians might be more closely involved with the development of educational material, particularly in the effective development and use of instructional media. Many respondants doubted that this event would occur.

89. Would increase the librarian's workload. In particular, there would be an increased demand for multi-media packages and for better and faster systems for delivering informational and instructional materials.

90. Most respondants did not believe that this event would occur. If it did, it would lead to a general downgrading of the librarian's status. Remaining librarians would have to acquire a better understanding of the sociology of medicine in order to predict information needs in a reduced market.

91. Would reduce duplication and enhance collaborative activities of librarians. Would require development of systems for assuring access to regional facilities. Specialization of libraries with respect to collections, learning materials, and so on would seem to follow. ILL activities should increase.

Statement

92. Would need more librarians with foreign language skills. Would have an increased load of information to catalog, index, etc. Would place one more strain on the library's budget. Probably would need procedures for coordinating local access to national depository of international materials.

93. Would be much less of a need to carry foreign language journals. Non-English publications would not be selected for incorporation into the library's collection. Some respondents predicted no impact, pointing out that this event already has occurred in medicine.

94. Library Directors would become more skilled at allocating scarce resources, employing modern management techniques, conducting research, and so on. Tasks of medical librarian might become more specific, e.g., administrator, researcher, educational specialist. Might be appropriate to integrate academic and internship training.

95. Would have little if any impact on the medical librarian. It might, however, reduce the cost of library operations to a point where the library could afford to hire better personnel. Also, might allow for a wider range in choice of acquisitions. Most respondents doubted that this event would occur.