Barriers to rural physician use of a digital health sciences library*

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Background: Rural physicians need access to quality medical information, but accessing information is difficult in rural settings. Digital health sciences libraries (DHSLs) offer the potential to make information more accessible to rural physicians. A telemedicine network was deployed to six rural hospitals in Iowa. Computers were installed allowing access to a DHSL and training sessions were held. The purpose of this study was to examine the barriers to use of a DHSL by rural physicians. Methods: Approximately one year after deployment of the telemedicine network, physicians were surveyed using a modified critical incident technique. Results: Seventy percent of the eligible physicians responded and 33% had used the DHSL. Primary barriers included insufficient training, being too time consuming to use, and distance of computers from physicians' practice sites. Non-DHSL users cited the difficulty of using the DHSL as their greatest barrier, while DHSL users cited the quality of the information resources. Conclusions: This study identifies a number of barriers that exist to rural physicians use of a DHSL. Potential solutions to these barriers are discussed. DHSLs will finally reach their potential when they can be delivered by easy to use handheld computers seamlessly integrated into the rural physician's workflow.

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INTRODUCTION

The information needs of primary care physicians are well documented [1–6]. Studies in the primary care setting consistently find that physicians need information on a daily basis. Furthermore, studies in the primary care setting show that only 33% of patient care related questions are pursued and answered even after the patient encounter. When seeking answers, physicians consider how accessible the information source is and how easily it can be searched. Most physicians choose to ask a colleague and the accessibility of information is given more weight than the credibility of the source.

Electronic information sources show promise in providing easily accessible and searchable quality information relevant to primary care physicians. Dee and Blazek have studied the information needs of rural physicians and concluded that a computerized expert system in conjunction with searchable, computerized textbooks would best meet practitioners needs [7]. However, results with electronic information sources to date have not been favorable. MEDLINE searching has limited usefulness in the outpatient setting because an average search by an experienced user takes about twenty-seven minutes, yields only abstracts [8] and retrieves only a portion of the relevant information [9]. An effectiveness evaluation of electronic resources using stand-alone computers with CD-ROM information sources shows that only 40% of practitioners clinical questions are answered, but the information sources are limited and the computers are difficult to use [10]. Today, the difficulties of stand-alone computers can be improved using the Internet and the Web.

Until recently, access to electronic information sources for rural physicians was extremely limited. This situation has been improving with the development and widespread use of the Internet and the Web, which has allowed the creation of digital health sciences libraries (DHSLs) that contain high quality, current information in many document types that are easy to use and search. The purpose of this study was to examine the barriers to use of a DHSL by rural physicians.

BACKGROUND

The Virtual Hospital®‡ is a prototype DHSL that has been in operation on the Internet since 1992. It is implemented using Web technology [11]. Its content currently consists of hundreds of medical booklets and books, evenly divided between content created primarily for use by practitioners and content created primarily for use by patients. The content is created by staff clinicians in the health sciences center, professional health care societies, nonprofit health care organizations, state and government health care agencies, and professional publishers. Copyright permission is obtained from the content authors in all cases. All content is in English and is clearly marked with the name, credentials, and affiliation of its author; whether it has been peer reviewed; and its date of last modification. Content is organized in three ways: by organ system, by specialty department that created it, and by type of information (textbook, guideline, lecture, etc.). The entire DHSL is indexed, made free-text searchable, and is free to use.

A telemedicine test bed network was established within the state of Iowa with the goal of providing patient care support and distance learning to practicing physicians and other health care professionals. Six hospitals serving rural populations were connected to The University of Iowa Hospitals and Clinics using high speed T-1 and frame relay connections. The six hospitals ranged in size from 40 to 250 beds. Access to the DHSL was supplied by forty Macintosh 7100AV computers deployed on the test bed network. The number of computers in each hospital ranged from two to six and they were located in areas where physicians worked within the hospital including emergency rooms, inpatient nursing stations, libraries, and doctors' lounges.

Each computer was configured as a Virtual Hospital kiosk using Netscape Navigator as the Web browser. This arrangement made the computer easier to use for novice patrons, who would always start their digital library navigation from the same point. At Ease was installed as a security precaution. This program prevents patrons from accessing the hard drive, allowing them to run only Netscape navigator and its helper applications. The browsers continue to display the Virtual Hospital home page when the computer was not in use.

After computer installation, every physician in each hospital was invited to an initial on-site training session conducted by The University of Iowa health sciences library staff. Subsequent follow-up on-site training sessions were held in each hospital on a regular basis and the physicians were again invited. Thirty-four percent of the total number of physicians attended a training session over a one-year period.

A technical support person was identified at each site and received additional training to diagnose and fix common software and hardware problems. Off-site support was provided by the National Laboratory for the Study of Rural Telemedicine staff, who could be reached by a toll free telephone number. The off-site support staff also visited the hospitals on a regular basis to update hardware and software, and perform preventive maintenance. Brief instructions on how to

‡ The Virtual Hospital Web site is available at http://www.uh.org.

Table 1
Number of physician respondents by hospital

Hospital	Total physicians	Physicians receiving survey*	Survey† responses	Percentage of physicians surveyed
Davenport	230	36	40	111
Grinnell	25	25	5	20
Keosaqua	4	4	2	50
Muscatine	29	22	13	59
Ottumwa	46	35	22	63
Washington	11	11	11	100
Total	345	133	93	70

* Professional meeting attendance was determined from sign in sheets.
† More physicians attended the professional meeting than signed in.

Table 2
Number of physicians by medical school graduation date

	Years since graduation	Total physicians (N)	DHSL users (N)	Non-DHSL users (N)
Younger physicians	<5	1	0	1
	6–10	14	3	11
	11–15	21	8	13
	16–20	9	2	7
Older physicians	21–25	32	12	20
	26–30	5	3	2
	31–35	8	2	6
	36–40	2	1	1
	41+	1	0	1
	Total	93	31	62

DHSL = digital health science library.
N = Number range was 3–41 years.

use the computer and the toll free telephone number were affixed to each computer. The DHSL also had an online help manual that could be reached from any Web page in the DHSL.

METHODOLOGY

An eleven-item survey (Appendix A) was developed by physicians and medical informaticians. The survey was modified based on comments from resident physicians familiar with the DHSL. Data was collected by fill-in-the-blank and Likert-scale items and included gender, medical school graduation date, medical specialty, and personal comfort with using computers. Data concerning DHSL use were collected by Likert scale, fill-in-the-blank, and written responses using an adaptation of the critical incident technique. The critical incident technique is a systematic approach for analyzing "behaviors leading to successful or unsuccessful outcomes on a task or process" [12, 13]. Following the technique, respondents recalled a past incident and related their answers accordingly. An example question was "Thinking back to the last time you personally used the Virtual Hospital, what was the question you wanted answered?" Barriers to use data were collected by written responses to questions such as "In your opinion, what is your greatest barrier to overcome for using the Virtual Hospital?" and "What other barriers do you see to using the Virtual Hospital?"

Approximately one year after initial computer installation and training, the anonymous survey was distributed to the physicians in attendance at a professional staff meeting at each of the hospitals between July 1996 and March 1997. This means of sampling was chosen because an attempt was being made to maximize obtaining information from DHSL and non-DHSL users.

Data from the survey form (Appendix B) was abstracted onto a separate abstraction form aiding data entry. A coding categorization scheme was developed from a review of the literature [14–17]. A coding manual was prepared and used during the data abstraction process (Appendix C). Survey forms were coded by one investigator and fifteen randomly selected abstraction forms were reviewed by another investigator to verify accurate coding. All data was entered and analyzed using Microsoft Excel software running on an Apple Macintosh computer.

As part of the coding categorization scheme, the following definitions were used. DHSL users were physicians who stated that they had used the Virtual Hospital. Non-DHSL users were physicians who stated that they had not used the Virtual Hospital. Younger physicians were physicians in practice twenty years or less. Older physicians were physicians in practice for more than twenty years. Respondents were physicians who answered an individual question. Personal barriers were issues relating to personal qualities an individual perceived (e.g., "I'm not interested," "I'm scared to use computers," "I don't have enough training," "Computers are too impersonal," etc.). Access barriers were issues relating to an individuals' ability to access the computers physically (e.g., "It costs too much to use," "The computer is in a bad location," etc.). Resource barriers were issues relating to the information sources (e.g., "There's not enough information," "The information is not credible," "It's to difficult to search the information," etc.).

RESULTS

A total of 345 physicians were staff members of the 6 hospitals. A total of 133 physicians attended a professional staff meeting where the surveys were distributed (39%) and 93 survey forms were returned for a response rate of 70% overall. Table 1 shows the numbers from each hospital.

The survey respondents were 95% male (n = 88). They had been in practice between three and forty-one years (Table 2). The number of younger physicians and

Table 3
Greatest barriers noted by physicians to digital health science library use

Barrier type	Total physicians N (%)	DHSL users N (%)	Non-DHSL users N (%)	Younger physicians N (%)	Older physicians N (%)
Personal	42 (45)	7 (22)	30 (48)	16 (35)	22 (46)
Access	20 (21)	5 (16)	15 (24)	11 (24)	9 (19)
Resource	9 (9)	6 (19)	3 (5)	5 (11)	9 (19)
Other	11 (11)	6 (19)	5 (8)	8 (17)	3 (6)
No barriers	3 (2)	2 (6)	1 (2)	0 (0)	3 (6)
No answer	13 (13)	5 (16)	8 (13)	6 (13)	7 (15)
Total	93 (101)	31 (98)	62 (100)	45 (100)	48 (100)

DHSL = digital health science library.
N = Number.
% = Percentage.
Younger physicians = physicians in practice <20 years.
Older physicians = physicians in practice >20 years.

Table 4
Other barriers noted by physicians to digital health science library use

Barrier type	Total physicians N (%)	DHSL users N (%)	Non-DHSL users N (%)	Younger physicians N (%)	Older physicians N (%)
Personal	13 (28)	1 (7)	12 (38)	7 (28)	6 (29)
Access	10 (22)	2 (14)	8 (25)	7 (28)	3 (14)
Resource	10 (22)	5 (36)	5 (15)	7 (28)	3 (14)
Other	10 (22)	4 (29)	6 (18)	4 (16)	6 (29)
No barriers	3 (6)	2 (14)	1 (3)	0 (0)	3 (14)
Total	45 (100)	14 (100)	32 (99)	25 (100)	21 (100)

DHSL = digital health science library.
N = Number.
% = Percentage.
Younger physicians = physicians in practice <20 years.
Older physicians = physicians in practice >20 years.

older physicians were forty-five and forty-eight respectively. Family Practice (n = 19 or 20%) and Internal Medicine (n = 13 or 14%) were the most common specialties. Nineteen other specialties were represented in the study sample.

The respondents self-reported their computer comfort level on a five point Likert scale with one being Very Comfortable and five being Very Uncomfortable. The average comfort rating was 2.6 for all respondents. DHSL users had a higher average comfort rating than non-DHSL users (1.8 versus 3.1 respectively). There was no significant difference between younger and older physicians (2.6 versus 2.7 average comfort rating).

Thirty-three percent of the ninety-three respondents reported using the DHSL (n = 31). Younger and older physicians had similar usage rates (31% and 35% respectively). When the physicians were asked what was the question they wanted answered the last time they used the DHSL, twenty-five respondents stated that their questions primarily concerned general medical knowledge (n = 15 or 60%, e.g., overview of a disease or health state, pathophysiology, or therapy). Three questions (12%) concerned medical services such as database queries or The University of Iowa services. Seven questions (28%) concerned general science and non-medical topics. Physicians were then asked if they had found an answer to their question. Of the twenty-six physicians that responded, 58% had found an answer (n = 15). Those physicians who did not find an answer stated the reason was not enough information (n = 2), information was not relevant (n = 1), and the information was not credible (n = 2).

Physicians were asked what was their greatest barrier to DHSL use. The results are shown in Table 3. The greatest barriers were personal (45%) such as "I don't have enough training," "It's too time consuming," and "I don't like computers." Accessibility barriers were next (21%) with inconvenient location of the computer being the most common barrier in this category. Resource barriers were less common (9%) with not enough information and information credibility being the most common barriers in this category. Overall, the three most common greatest barriers noted by the respondents were not enough training (n = 22), inconvenient location of computers (n = 19), and too time consuming to use (n = 10), which account for 64% of the total responses. Other barriers noted were slow movement between screens; software and printing problems; difficulties with local access to the Internet; security concerns; and compatibility between computer systems.

DHSL and non-DHSL users reported different greatest barriers. Non-DHSL users reported many more personal barriers (48% versus 22% for DHSL users), and fewer resource barriers (5% versus 19%). Older physicians also noted more personal barriers (46% versus 35% for younger physicians). The physicians were asked what other barriers they saw to DHSL use (Table 4). All categories (e.g., personal, access, resource, or other) had approximately the same number of responses (range 22–28%). Again, non-DHSL users reported more personal barriers (38% versus 7% for DHSL users) and fewer resource issues; DHSL users reported more resources barriers (15% versus 36%).

Physicians were asked how much they would use the DHSL if their greatest barriers were eliminated. Their responses ranged from "never" to "daily" with an overall respondent mean of 8.5 days per month. Physicians who already used the DHSL reported that they would use the DHSL more than non-DHSL users (9.5 versus 8 days per month respectively). Older physicians reported they also would use the DHSL more than younger physicians (9.6 versus 6.5 days per month respectively).

Physicians were asked for their suggestions for in-

formation to be added to the DHSL. Of the twenty individual suggestions, eight regarded medical content (e.g., abstracts of current research, treatment outcome data, practice guidelines, online textbooks, and personalized views to the information), six regarded services (e.g., case consultations, peer review of information, Medicare information, search engines of only medically-related sites, and access to laboratory information), three regarded training (e.g., more terminals and more training), one regarded location of computers, and two regarded other suggestions (quality of images).

DISCUSSION

DHSLs such as the Virtual Hospital are a new way to make information more accessible to rural physicians in isolated settings. This study identified a number of barriers that currently prevent rural physicians from realizing the potential of DHSLs. Respondents cited inadequate training, the time consuming nature of DHSL use, and computer location as barriers. Non-DHSL users cited the perceived difficulty of using the DHSL and DHSL users cited the quality of the information resources in the DHSL as barriers.

The finding of inadequate training raises a number of critical issues. For this project, the training teams traveled long distances and conducted multiple training sessions at each site, which were well publicized in advance to physicians. A centralized training session was also held at the health sciences campus. For this session, interested users were bused in from their hospitals. The on-site technical support person was encouraged to hold local training sessions and many did so. Nonetheless, only 34% of the eligible physicians were trained in the use of the DHSL.

Unfortunately, all this training was provided in an artificial context, separated from the physician's clinical practice. In the future, situated training will be offered to physicians. In situated training, a DHSL staff member will be assigned to work with physicians in their actual clinical settings. When clinical questions arise in the physician's practice, the trainer will teach the physician how to find answers using the DHSL. Coupling training to the clinical encounter and making it relevant to physicians' practice, should motivate physicians to learn to use the DHSL and hopefully will show them the value of the DHSL in their practice.

While physicians may only need to be trained once, they will need access to ongoing technical assistance. The resources needed to support users as well as hardware and software should not be underestimated. High-quality, courteous, readily available technical support is crucial to the continued successful use of a DHSL by physicians. In the long term, such a strategy, focused on intensive training and support of users, has been found to be the most effective means for successfully ensuring that practicing physicians adopt new technologies [18–21].

The time consuming nature of DHSL use can be attributed to the DHSL's user interface design. To be useful to a physician in a clinical setting, the DHSL must be organized to allow users to find answers to questions quickly. The clinically active physician simply does not have the time to browse casually.

Although a user information needs analysis was conducted at the time of initial DHSL creation, the information obtained was used to determine what information should be placed into the DHSL, as opposed to how to design the information architecture of the DHSL. The DHSL information architecture was organized from a librarian's perspective (by organ system, department, and information type) rather than from a user's perspective (by problem). This realization has led to the creation of a new problem-based interface that has been added to the DHSL's information architecture that allows DHSL users quickly to access information on fifty common problems encountered in the clinic from a single page in the DHSL.§ This page of "pre-browsed" information substantially has sped up the physician's interaction with the DHSL.

The relationship of the computer's location to the physician's place of work is crucial. Cost constraints demanded the central installation of the computers in the hospitals. In addition, although a list of suggested computer locations was given to each hospital, the final decision about computer placement was left to the hospital administrators rather than the physicians. The end result was that the computers were not located where the rural physicians spent most of their time. Clearly, to be relevant to a physician's practice, the computer needs to be located where they see their patients. To be of the greatest use to physicians, the computer ultimately needs to be with them continuously, at the point-of-care, where it can be integrated into their daily workflow.

Non-DHSL users comprised 66% of respondents, and they shied away from the DHSL due to its perceived difficulty of use. In a time when the computer industry has taken tremendous strides in making computers easy to use, observing how far they have yet to go to convince physicians of this fact is sobering. In reality, computer software and hardware are still too difficult to use and maintain, and "user-friendly" interfaces are still rather non-intuitive to computer novices. While librarians have little control over the user interface of the software used to access their DHSL, they do have tremendous control over the user interface, or information architecture, used to navigate through their DHSLs. User-centered design principles

§ The problem-based interface is available at http://www.vh.org/Beyond/PeerReviews/PeerReviewHomePage.html.

should be employed to create a clear, intuitive information architecture that novice users can easily and quickly navigate [22].

DHSL users cited the quality of the information resources in the DHSL as one of their greatest barriers. During this study, the DHSL contained a large amount of content, the majority has been peer reviewed and covered a broad variety of topics. Still, the DHSL contained only an extremely small percentage of the medical literature, and undoubtedly most of the users' preferred information sources were not found on it. This barrier showed that although physician's appreciate the ability of a DHSL to make information more accessible, they would not compromise over the quality of the information they wished to use within it. The commercial marketplace has been solving this problem over time, as more and more of the medical literature has been made available in Internet-accessible format.

This study also examined physicians' queries. Physicians reported finding answers to their questions 58% of the time, an increase from 40% in a study using stand-alone computers with CD-ROM information sources [23]. This study only surveyed a small number of physicians and a larger study that includes all users of the DHSL is currently underway to determine what percentage of questions are answered by a DHSL.

This study was a sample of rural physicians who attended a professional staff meeting at their local hospitals. Surveys were anonymous and no attempt was made to contact physicians who had not attended the meeting. This means of sampling was chosen because an attempt was being made to maximize obtaining information from DHSL and non-DHSL users. Surveying by mail or telephone with poorly motivated persons would be expected to have a very low response rate. The physicians surveyed were representative of their respective hospital physician staff and the State of Iowa as a whole [24]. A limitation of this approach was that physicians had to be at the meeting in order to be surveyed. As noted earlier, only 39% were in attendance.

Many of the barriers cited above are technical in nature and are due to the relatively immature nature of the current state of the art in computer technology. Hopefully as computer technology advances, these barriers will fade away. Computers will fit into rural physician's pockets and communicate with DHSLs containing the world's medical literature by wireless network connections using an intuitive user interface. Giving rural physicians such easy access to information will not by itself guarantee that they use it. Instead, rural physicians will have to be given a compelling reason to depend on DHSLs. This compelling reason may come from improved linkages between DHSLs to computer-based patient record systems and computer-based continuing medical education (CME) systems [25–28]. Such linkages will allow physicians who are using a computer-based patient record system to view patient information with a seamless link to a DHSL to review reference information regarding the patient's problems and to receive CME credit for it. In this manner, patient care, medical reference information, and CME can all be integrated into the physician's daily workflow and the use of the DHSL will become transparent to the user.

CONCLUSION

Although DHSLs make information more accessible to rural physicians, this study identifies a number of barriers that currently exist to rural physicians use. The accessibility barriers can be diminished by moving computers to the point of patient care. The personal barriers can be overcome by personalized, intuitive user interfaces and long term physician education and support for DHSL adoption into the physicians' workflow. The DHSL's information quality must remain paramount as more information becomes available online. DHSLs will reach their full potential when they can be delivered by inexpensive, easy-to-use handheld computers that can be seamlessly integrated into the rural physician's workflow.

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APPENDIX A

Community provider survey

1. Gender: ____ Male ____ Female
2. Medical specialty: _____
3. Year of medical school graduation: _____
4. How comfortable are you using computers?

Very Comfortable	Comfortable	Neither Comfortable Nor Uncomfortable	Very Uncomfortable	Uncomfortable
1	2	3	4	5

5. Have you ever personally used the Virtual Hospital?
   ____ Yes **(Continue with Question 6)**
   ____ No **(Skip to Question 8)**
6. Thinking back to the last time you personally used the Virtual Hospital, what was the question you wanted answered?
7. Did you find the answer to the question you asked in question 6?
   ____ Yes ____ No If No, why not?
8. In your opinion, what is your greatest barrier to overcome for using the Virtual Hospital?
9. What other barriers do you see to using the Virtual Hospital?
10. If your greatest barrier was eliminated, how much would you use the Virtual Hospital? (Fill in blank)
    ____ Day(s) per Week ____ Day(s) per Year
    ____ Day(s) per Month ____ Never
11. What suggestions do you have for information that could/should be added to the Virtual Hospital? (please use back of page if necessary)

Thank you. Your comments will allow us to provide better services to you.

APPENDIX B

Data abstraction form

____ **Subject number**
three digits (ex. 001, 010, 100)

____ **Hospital**
1=Davenport 2=Grinnell 3=Muscatine
4=Ottumwa 5=Keosaqua 6=Washington

____ **Date survey form filled out**
mm/dd/1996

____ **Date abstraction form filled out**
mm/dd/1996
____ **Initials of abstractor**
XX or XXX
____ **Gender**
1=Male 2=Female 99=Left Blank
____ **Specialty**
See coding sheet 99=Left Blank
____ **MedSchool graduation**
19YY 99=Left Blank
____ **How comfortable using computers**
1–5 or 99=Left Blank
____ **Ever used VH?**
1=Yes 2=No 99=Left Blank
____ **Question wanted answered—content area**
See coding sheet
____ **Question wanted answered—medical area**
See coding sheet
____ **Found Answer**
1=Yes 2=No 3=Don't Remember/Know
99=Left Blank
____ **If No to found answer, why not**
See coding sheet

____ **Greatest barrier**
See coding sheet 99=Left Blank
____ **Other barrier**
See coding sheet 99=Left Blank
____ **Other barrier**
See coding sheet 99=Left Blank
____ **Other barrier**
See coding sheet 99=Left Blank
____ **Other barrier**
See coding sheet 99=Left Blank
____ **Other barrier**
See coding sheet 99=Left Blank

How often would use VH
____ Days per Week No. if listed 99=Left Blank
____ Days per Month No. if listed 99=Left Blank
____ Days per Year No. if listed 99=Left Blank
____ Never No. if listed 99=Left Blank
____ **Had other suggestions**
1=Yes 99=Left Blank
____ **Content of other suggestions**
1–6 or 99=Left Blank

APPENDIX C

Manual of operations

1. If **unable to code or unsure about the coding,** leave the blank empty and circle in contrasting color. Let investigator know that there is a problem the same day that it occurs.
2. Always **use black ball point pen** to code forms.
3. Make **legible numbers and letters**.
4. **If a mistake is made,** cross out the error with a single horizontal line and make a balloon with the correct coding, your initials, and the date.
   ex. XXXX
5. **Original data will be kept** in a manila folder with a label with the information as below. The original data will be kept in the file cabinet.
   ex: Community provider survey
   Name of the hospital
   Date the forms were filled out
6. **Abstraction forms will be kept** in a separate manila folder in numerical order by subject number.
7. Each survey will be assigned a three digit **subject number** in consecutive order. This subject number will be written on the top right corner of the original survey and on the data abstraction form.
   ex. 001, 002, . . . , 010,011, . . . , 101, 102, . . .
8. Each survey will be assigned a **hospital number** from 1–6. This hospital number will be written on the top right corner of the original survey under the subject number. This number will also be written on the data abstraction form.
   ex. 001
   1
   1=Davenport
   2=Grinnell
   3=Muscatine
   4=Ottumwa
   5=Keosaqua
   6=Washington
9. Each survey will have a **date that the form is filled out** (mm/dd/1996). The month and day will have two digits and the year will have four digits. This will be written on the top right corner of the original survey under the subject number and hospital number. This number will also be written on the data abstraction form.
   ex. 001
   1
   05/13/1996
10. **This subject number, hospital, and date form was filled out, written on the original surveys should be completed in batches to minimize errors.**

11. **Date data abstraction form** was filled out (mm/dd/1996). The months and day will have two digits and the year will have four digits as above.
12. Initials of the **person doing the abstraction** with first and last, or first, middle, and last.
13. **Gender** will be encoded on the abstraction form as follows:
    1=Male
    2=Female
    99=Left blank by respondent
14. **Medical Specialty** will be encoded on the abstraction form as follows:
    1=Allergy/Immunology
    2=Alternative Medicine
    3=Anatomy
    4=Anesthesiology
    5=Bioethics and Medical Humanities
    6=Biochemistry
    7=Cardiology/CardioThoracic Surgery
    8=Chiropractics
    9=Community Medicine/Preventive Medicine/Environmental Health
    10=Critical Care
    11=Dentistry/Orthodontics
    12=Dermatology
    13=Dietetics/Nutrition
    14=Emergency Medicine
    15=Endocrinology
    16=Family Practice
    17=Gastroenterology
    18=General Practice
    19=Genetics/Molecular Biology
    20=Health Care Administration
    21=Hematology/Oncology
    22=Infectious Diseases
    23=Internal Medicine
    24=Microbiology
    25=Nephrology
    26=Neurology
    27=Nuclear Medicine
    28=Nursing
    29=Obstetrics/Gynecology/Women's Health
    30=Occupational Therapy
    31=Ophthamology
    32=Orthopaedics
    33=Otolaryngology
    34=Neurosurgery
    35=Nephrology
    36=Pathology
    37=Pediatrics
    38=Pharmacology
    39=Physical Medicine and Rehabilitation/Physical Therapy
    40=Physiology
    41=Podiatry
    42=Preventive Medicine
    43=Psychiatry
    44=Pulmonology
    45=Radiology/Nuclear Medicine
    46=Rheumatology
    47=Social Work
    48=Speech and Language Pathology
    49=Surgery
    50=Urology/Men's Health
    51=Veterinary Medicine
    99=Left Blank by Respondent
15. **Year of Medical School Graduation** will be encoded with a four digit year.
    ex. 1979

16. **How comfortable are you using computers?** will be encoded as follows:
    1–5 as circled by the respondent
    99=Left blank by respondent
17. **Have you ever personally used the Virtual Hospital?** will be encoded as follows:
    1=Yes
    2=No
    99=Left blank by respondent
18. **Thinking back to the last time you personally used the Virtual Hospital, what was the question you wanted answered?** the written answer will be encoded as follows:

    Medical

    Information Regarding a Specific Patient
    1=Specific patient symptoms
    2=Specific patient physical examination findings
    3=Specific patient test results (including laboratory, pathology, radiology, etc).

    Medical Knowledge
    4=General overview of disease/Health states
    5=Epidemiology of disease/Health states
    6=Pathophysiology of disease/Health states
    7=Effects of clinical findings of disease/Health states
    8=Differential diagnosis of disease/Health states
    9=Therapy of disease/Health states
    10=Diagnostic testing

    Medical Services
    11=Health-related resources, i.e., database query, journals
    12=UIHC personal, services, and referral

    Technical

    13=Technical questions about computers or VH

    General

    14=Science-related topic, non-medical
    15=Other non-medical topic
    16=Subject not otherwise specified (please list)

    Other

    17=Don't remember/Don't know
    99=Left blank by respondent
19. **Did you find the answer to the question you asked in question 6?** will be coded as follows:
    1=Yes
    2=No
    3=Don't remember/Don't know
    99=Left blank by respondent
20. If answer is **No,** to **Did you find the answer to the question in question 6?,** the written answer will be encoded as follows:

    Resource Qualities

    1=Being unfamiliar with the information sources
    2=It's too difficult to search
    3=There's no/not enough information
    4=Information is not relevant
    5=Information is not credible
    6=Information not applicable
    7=Information confusing
    8=Don't remember/Don't know
    9=Other reason
    99=Left blank by respondent
21. **In your opinion, what is your greatest barrier to overcome to use the Virtual Hospital?** will be encoded as follows:

    Personal Qualities

    1=Didn't know about it
    2=I'm not interested
    3=I don't like using computers/I'm scared to use computers
    4=Computers are too impersonal

5=I don't need to look things up
6=I use other resources to answer my questions
7=Too time consuming to do/I don't have enough time
8=I don't have enough training/I don't know how to use computers

General Qualities

9=Costs to much
10=Computers are difficult to use
11=Inconvenient location

Resource Qualities

12=Being unfamiliar with the information sources
13=It's too difficult to search
14=There's no/not enough information
15=Information is not relevant
16=Information is not credible
17=Information not applicable
18=Information confusing
19=Other reason
99=Left blank by respondent

22. **What other barriers do you see to using the Virtual Hospital?** will have up to 5 barriers coded using the same coding schema for the greatest barrier (see above). If less than 5 are listed, then code as many as are listed and code all other blanks on the data abstraction form as 99.
    answer was: xx, xx, xx
    coding will be: ex. 3
    5
    6
    99
    99
23. **If your greatest barrier was eliminated, how much would you use the Virtual Hospital?** will have the number listed in the blank coded. All other blanks will be coded as 99. If no answer was given, all blanks will be coded as 99.
    ex. ___ 99 Days per week
    ___ 6 Days per month
    ___ 99 Days per year
    ___ 99 Never
24. **What suggestion do you have for information that could/should be added to the Virtual Hospital?** will be coded if had suggestions or not as follows:
    1=Yes
    99=Left blank by respondent
25. Content of the **suggestions** offered will be encoded as follows:
    1=Content (disease, specialty, problem information, etc.)
    2=Services (wants services such as MEDLINE, data retrieval, consultation services, etc.)
    3=Training (wants training or education to use computer, software, etc.)
    4=Equipment (wants other equipment such as printer)
    5=Location (wants to change the location of the computer in some manner, i.e., lighting is poor)
    6=Other not listed above
    99=Left blank by respondent
26. **If data abstraction is reviewed,** the reviewer will place his/her initials and the date at the top right corner of the data abstraction sheet.