Developing Metrics Tools for a Medical Computing and Informatics Course
at Brody School of Medicine

Background
With the growing acceptance of evidence-based medicine and the use of technology in modern medical practice, the Brody School of Medicine recognizes the need to offer coursework in medical computing and informatics to its undergraduate medical students. In March-April 2006, Brody will offer a four-week elective, “Medical Computing and Informatics” to fourth-year medical students.

The faculty committee that developed this course over the past year determined that conducting a pre-test of student skill levels would serve two purposes: 1) to provide valuable information to instructors so that the curriculum could be adjusted before the course begins to accommodate what students know and what they don’t know, and 2) to provide a skills assessment that would serve as a baseline of what students learn in the course. The same test would be given as a post-test. Since this is a new course, the faculty also wanted to conduct exit interviews with the 2-10 students who would be enrolled in the class to “debrief” them on their experience. The results from these interviews would be used to evaluate the course. This project will develop instruments for these assessments and post them on BlackBoard.

Introduction
The nation’s medical schools have offered training in medical computing and informatics for more than two decades. In 1998, the Association of American Medical Colleges wrote that medical students needed training in medical informatics, a “particularly challenging contemporary issue that medical school deans and facilities must confront in order to align the content of their medical student education programs with evolving societal needs, practice patterns, and scientific developments” (Association of American Medical Colleges).

Advocates of training in evidence-based medicine contend physicians do a better job of caring for their patients when they base treatment on objective evidence. Traditionally, doctors facing a difficult case might call another physician to discuss treatment options. However, evidence-based medicine has emerged in recent years as a more effective means of informing treatment. Medical informatics, “the
rapidly developing scientific field that deals with resources, devices and formalized methods for optimizing the storage, retrieval and management of biomedical information for problem-solving and decision-making.” (Shortliffe et al.) plays a key role in this approach to medicine.

In its 1998 recommendations, the Association of American Medical Colleges (20) described nine key issues, including assessment, that schools might consider in establishing a curriculum in medical informatics. The three steps for assessment could include 1) “tests are specific to objectives,” 2) “assessment is built into overall evaluation schema,” and 3) “build questions addressing informatics objectives into course examinations. Develop ‘open computer’ (analogous to ‘open book’) examinations.” This research project seeks to meet the first step in the assessment process, which is “tests are specific to objectives.”

The literature on teaching evidence-based medicine and medical computing provides assessment artifacts that medical school librarians and other have developed over the years. The literature also includes reports on the methodology used to conduct debriefing interviews on medical students. Considering the rapid advances in evidence-based medicine and computer technology used in the medical school, the assessment tools in the literature reviewed for this project date from 2000 forward.

Researchers have described how they developed surveys on computer and medical informatics knowledge and skills by adapting basic computer and evidence-based medicine assessment tools. Examples of these tools include Florida State University’s survey of basic computer knowledge and skills in 13 areas using a 3-point Likert scale, as well as the Berlin Questionnaire developed for various short courses in medical informatics given in Germany (Florida State University College of Medicine; Fritsche et al.).

In 2000, the applied medical informatics and computer skills of first-year medical students, family practice residents, and family medicine faculty at the University of California-Davis were surveyed (Jerant and Lloyd). The survey was administered to the medical students during orientation and emailed to residents and faculty. The survey used 5- and 7-point Likert scales, which respondents used to rate access to computers, computer ownership, confidence and knowledge in using computers and computer applications, and attitudes toward computer training.

An Evidence-Based Medicine Skills Test was administered in 2000 to residents at Cook County Hospital and Rush Medical Center (Smith et al.). Responses to questions about cases and abstracts included fill-in-the-blank and multiple choice.
In 2002, a “Needs Assessment Survey” was administered during the development of a medical informatics curriculum for residents at the Cedar Rapids Medical Education Foundation (Zelnick and Nelson). This assessment tool combined Yes/No questions about computer usage, knowledge, and skills with 3-point Likert scale questions on medical informatics. Participants also provided “open responses” on the written form after training.

A 2005 report described the interviewing techniques used to debrief a group of randomly selected medical students at two northeastern medical schools on their “most memorable” patient deaths (Rhodes-Kropf et al.). Interviews of attending physicians and residents were conducted in 2004 at the Portland, Oregon, Veterans Affairs Medical Center for a study on the impact of computerized physician documentation in a teaching hospital (Embi et al.).

Problem
In offering a new course on medical computing and informatics, Brody School of Medicine needs pre- and post-course assessment tools to measure students’ skill levels, outcomes, and attitudes.

Research Question
What are the characteristics of effective pre- and post-course assessment tools that would measure skill levels, outcomes, and attitudes for a one-month course in medical computing and informatics at the Brody School of Medicine?

Hypothesis
Pre- and post-course assessment tools can be developed to measure skill levels, outcomes, and attitudes for a one-month course in medical computing and informatics at the Brody School of Medicine.

Variables
- **Participants.** The 2-10 students who sign up for the medical computing and informatics elective during March-April 2006 will take the pre- and post-test, as well as participate in the post-course debriefing.
- **Treatment.** The assessment artifacts found during literature review will be developed using best practices for assessment found during literature review and feedback from faculty teaching Medical Computing and Informatics elective.
The purpose of this research is to develop: 1) a tool to measure fourth-year medical student knowledge of medical computing and informatics before and after four weeks of instruction in an elective course, and 2) a debriefing questionnaire to be used in an interview with students after they complete the course.

Key terms

Medical computing: Use of computers to inform medical decision-making.

Medical informatics: Scientific field dealing with systematic collection, storage, and use of biomedical information for use in problem-solving and decision-making.

Evidence-based medicine: Applies the scientific method to clinical practice.

Assessment tool: An instrument used to determine knowledge, skill level, and opinion.

Subsequent research

This work focuses on a self-selected group of 2-10 fourth-year students at Brody School of Medicine enrolled in the medical computing and informatics elective in 2006. Research using a control group of fourth-year medical school students who don’t take the computing and informatics course could help validate quantitatively how much progress students make in the course. Also, inherent weaknesses exist in using a written, self-assessment tool to determine computer knowledge and skill, as well as evidence-based medicine skills. A test that assesses students’ actual computer skills would provide a more accurate measure of what skills students have going into the course and what skills they learn during the course. A skills assessment using a simulator or actual patient cases could more accurately determine whether students improve their evidence-based medicine skills in patient care as a result of the course.

Design

The research is designed to develop two assessment tools using qualitative and quantitative data. This study will analyze and assess artifacts found in medical literature in order to identify the characteristics that make an assessment tool effective. This study also will incorporate relevant content from these artifacts, as well as the input from the stated course goals (Appendix A) and the faculty teaching the course in developing the assessment tools.

The research design for this project is divided into three phases:
Phase 1: Artifacts found during the literature review will be used to develop prototype assessment tools using the stated goals for the course and a heuristic developed for this project (Appendix B).

In 2003, a holistic approach to assessment at the University of Miami School of Medicine helped to shape that institution’s move from didactic instruction to an outcomes-based curriculum (Burrows et al.). The authors measured student progress, which involved “knowing, knowing how, showing how, and doing” (35) in this way:

<table>
<thead>
<tr>
<th>Skill tested</th>
<th>What is tested</th>
<th>How it is tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowing</td>
<td>Knowledge</td>
<td>Multiple choice questions, self-assessment questionnaires</td>
</tr>
<tr>
<td>Knowing how</td>
<td>Clinical skill</td>
<td>Practicals, essays, patient-management problems, orals</td>
</tr>
<tr>
<td>Showing how</td>
<td>Performance</td>
<td>Observation, standardized patients, objective structured clinical examinations</td>
</tr>
<tr>
<td>Doing</td>
<td>Practice</td>
<td>Real patients, videos, logs and portfolios</td>
</tr>
</tbody>
</table>

The assessment tools developed for this course will measure the “knowing” and “knowing how” skills using multiple-choice questions, self-assessment questionnaires, and patient-management problems found in the artifacts and provided by the faculty. The artifacts to be used in developing the assessment tools include a computer skills assessment tool used by the University of Florida (Appendix C) and the Berlin Questionnaire (Appendix D), an evidence-based medicine assessment tool used in Germany. The debriefing sessions will use a tool based on the methods described by Rhodes-Kropf and Embi for conducting interviews of medical school students. (Appendix E)

Phase 2: The faculty will be invited by email (Appendix F) to a discussion about the educational goals for the course, the instruments to be used for assessment, and changes they would suggest to tailor the instruments for the Brody course. The prototype assessment tools will be attached to the email. The feedback from these discussions will be used to refine the assessment tool content and design.

Phase 3: The questionnaire will be posted on BlackBoard. After the course, the interview tool will be used to debrief students on their experience.
Reference List

Ref Type: Report


Rhodes-Kropf, Jennifer, et al. ""This is just too awful; I just can't believe I experienced that...": Medical Students' Reactions to Their "Most Memorable" Patient Death." Academic Medicine 80.7 (2005): 634-40.


Appendix A

Medical Computing and Informatics Course Goals Developed by Faculty

On this foundation, students will be taken directly to the endpoint of the course: that data are largely meaningless until they are “synthesized” into information. In other words, information arises when seemingly unrelated facts are combined into a “bigger” picture. To achieve these and related goals, students need to refine their abilities at deductive reasoning. Information is often best conveyed in graphical formats. The process of converting data into information requires deductive reasoning, also known as inference. Several examples of the distinctions between data and information will be reviewed. As often as possible, students are expected to teach each other these skills.

This course relates to the work of the preceding 4 years of medical school by

- helping students develop the skills to organize and integrate the vast fund of medical knowledge they have already acquired and will continue to build on;
- continuing practical exposure to statistics introduced in the Introduction to Medicine and the Biostatistics courses;
- generalizing the experience students have developed with ECU and PCMH versions to the electronic medical record in preparation of work on different platforms, in other environments.

Objectives:

The skill set students are expected to be at least acquainted with by the end of the course includes

- conducting literature searches;
- evidence-based medical decision making;
- scientific literature review;
- understanding association and causation;
- hypothesis development;
- analyzing the diagnostic performance of clinical tests;
- validation, particularly of instruments [not just the electronic variety] used in clinical settings;
- database creation, database management, data extraction, data collection, data scrubbing, and data aggregation;
- statistical inference;
- hypothesis testing;
- the graphical display of data;
- how to use commonly accessible software to complete these tasks.

**Student Experience:**
Roughly a week before the elective, students will be given a test to assess their skills in related computing areas. The course will be tailored to the average level of student expertise. More advanced students are expected to teach necessary skills to their colleagues.

**Evaluation of Student Performance:**
Students will engage in 3 structured projects throughout the course. Faculty will use their performance during these sessions to assess their progress. The goal of each of these projects is to develop in students the skill set necessary to complete the fourth (and final) project. The fourth project will be developed from the very beginning, throughout the 4 weeks of the elective. During the last week of the elective, nearly all the time will be for students to develop this project. Faculty will be supervising to assure that proper progress is made. On the morning of the last day, students will present their findings in a formal slide presentation, accompanied by a full-sized scientific poster. Faculty will assess this final presentation to determine to what extent students were able to develop the computing and deductive reasoning skills using a standard set of questions / metrics. Students will be given the evaluation tool at the beginning of the course. It is expected the products of these projects may be of sufficient quality to be presented in other settings in the Brody School of Medicine (summer and/or departmental research programs), possibly elsewhere.
Appendix B
Assessment Tools Heuristic

(adapted from “Usability Heuristic for User Interface” (Nielsen) and “Heuristic Evaluation - A System Checklist” (Xerox Corporation)

Content
Reflect the stated learning goals for the medical computing and informatics elective. (Appendix A) Ask students to apply knowledge they have learned, rather than what they have memorized.

Ability level
Based on the medical computing and informatics knowledge and skill levels of fourth-year medical students.

Consistency and standards
Available for students to access on BlackBoard before the course begins in March 2006. Questionnaires follow the BlackBoard conventions familiar to the medical students at Brody. Interview follows the conventions of debriefing interviews conducted on medical students and residents found in the literature. (Rhodes-Kropf et al.; Embi et al.) Students take all assessments at their own pace.

Match between assessment tools and the real world
Use the language of the American medical school, with words, phrases and concepts familiar to the students. The tools follow real-world conventions, making information appear in a natural and logical order.

Recognition rather than recall
Minimize the student’s memory load by making objects, actions, and options visible. Students do not have to remember information from one part of the dialogue to another. Instructions for using the assessment tools are visible or easily retrievable whenever appropriate.

Aesthetic and minimalist design
Dialogues within the tools do not contain information which is irrelevant or rarely needed.
Appendix C
Florida State University College of Medicine
Computer Skills Comfort Survey Form

Name ___________________________________________________ Date ___________

Faculty___ Student___ Resident___ Staff____ Preceptor ___ Other______________

Specialty ________________________________________  Age _____  Gender _____

E-Mail Address ________________________________________________

To more accurately assess your computer competency, the following survey will ask you to identify specific skills and knowledge which you feel you have mastered in specific areas of computer usage.

Please use the following scale to rate your competency level (circle level for each question):

1 = Not familiar
2 = Familiar, but not competent
3 = Competent
Circle M (for More) if you would like to learn more on that topic

Items in bold are included in the AAMC definition of computer literacy

<table>
<thead>
<tr>
<th>Knowledge/Skill</th>
<th>Circle one</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware</td>
<td></td>
</tr>
<tr>
<td>In shopping for a computer, I would know what processor, speed, memory, hard drive, printer, and monitor I want.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I would feel comfortable taking a new computer and printer out of their boxes and setting them up.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I would feel comfortable opening up my computer and adding a modem card or more memory to it.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I would feel comfortable setting up a peer to peer network of two or more computers and a printer.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>Keyboarding</td>
<td></td>
</tr>
<tr>
<td>I can type comfortably at a reasonable speed without looking at my hands.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I feel comfortable using a mouse to run programs, highlight text and select menu items.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>Software -- General</td>
<td></td>
</tr>
<tr>
<td>I know what systems software like Windows does.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I know the uses of personal scheduling/organizing software.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I know the uses of word processing software and can name a word processing software package.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I know the uses of spreadsheet software and can name a spreadsheet software package.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I know the uses of database software and can name a database software package.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I know the uses of presentation and graphics software and can name an example software package.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I understand the purpose of a web browser and can name one.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>Systems Software -- Graphical User Interfaces</td>
<td></td>
</tr>
<tr>
<td>I can launch (run) a program that has already been installed on a computer.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I can install a new software package on a computer.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I can download software or files from the internet and save them on my computer.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I can unzip compressed files I have downloaded from the web and install them on my computer.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I can remove a program from my hard-drive and delete it from the program list.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I can organize my files into folders.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I can find a file that I need to open, move, or rename.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I can store files on floppy disks or on the hard drive and move them back and forth.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I can set the time and date on my computer.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I can control my display colors, background, and resolution.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I can run several programs at once, going from one to the other.</td>
<td>1 2 3 M</td>
</tr>
<tr>
<td>I know how to properly shut down a computer and can restart it without killing the power.</td>
<td>1 2 3 M</td>
</tr>
</tbody>
</table>
I can backup my files to a disk or CD.

**Personal Productivity Software**

- I can keep my addresses and information about friends, family and business acquaintances in an electronic format.
- I can keep my appointments in an electronic format using a program like Outlook or a PDA
- I can download and install programs to my PDA
- I use a PDA as a medical reference on a regular basis.
- I can the information on my PDA to my laptop or desktop computer.

**Word Processing Software**

- I can create, save and print a new word-processing document.
- I can format the text in the document using different fonts, font sizes, bold, italics and underline.
- I can align paragraphs to be left, centered, right or justified.
- I can create bulleted lists or numbered lists.
- I can cut, copy and paste words, sentences or paragraphs.
- I can set margins and page orientation (portrait or landscape).
- I can add headers and footers to include page numbers.

**Spreadsheets**

- I can create, save and print a new spreadsheet document that does calculations.
- I understand cell addresses.
- I can change the width, height, and font format of cells.
- I can format a number in a cell to be currency, percent or a number with a particular number of decimal places.

**Knowledge/Skill**

- I can write a formula which will add a row of cells in a spreadsheet.
- I can write a formula which will use functions like AVERAGE or COUNT in a spreadsheet.
- I can create a chart or graph from a spreadsheet using spreadsheet software.

**Presentation Graphics**

- I can create an entire slide presentation using presentation software.
- I can add transitions to the slides.
- I can add build effects or animation to the bulleted lists in a slide presentation.
- I can add clipart or graphics to the presentation.
- I can use design templates to make the slides colorful.
- I can print out slides or handouts using presentation software.
- I can use Data Projection equipment to present my slide presentation from a computer.
- I can draw geometric figures like organization charts with a graphics or paint program.

**Graphics**

- I can take a picture with a digital camera and save it to my computer.
- I can crop and resize the image.
- I can adjust the color, brightness, and contrast of the image.
- I can insert the image in word processing document or presentation.

**Databases**

- I can define the fields I need in a database table.
| I can design a simple form for data entry into the table of my database. | 1 2 3 M |
| I can design a simple report of the data in my database for printing. | 1 2 3 M |
| I can design a query to limit the data presented in that report. | 1 2 3 M |
| I can perform a search of the data for a specific item. | 1 2 3 M |

**E-Mail/Telecommunications**

| I can use a dial-up service to connect to e-mail. | 1 2 3 M |
| I feel comfortable using e-mail software. | 1 2 3 M |
| I know my e-mail address, user ID and password. | 1 2 3 M |
| Given a friend's e-mail address, I can send them a message. | 1 2 3 M |
| I can read and reply to an e-mail message. | 1 2 3 M |
| I can forward an e-mail message to other addresses. | 1 2 3 M |
| I can set up distribution lists to send emails to a group of addresses. | 1 2 3 M |
| I can save an e-mail message to a folder that I have created. | 1 2 3 M |
| I can attach files to e-mail messages. | 1 2 3 M |
| I can use a web browser like Netscape to access the World Wide Web. | 1 2 3 M |
| I can use an internet service provider like AOL to access the web from home using phone lines. | 1 2 3 M |
| I can use a web search engine like Google or Yahoo to find information on the web. | 1 2 3 M |
| I can open a web site from an address (www.dell.com) that I have seen in a magazine or on TV. | 1 2 3 M |
| I can add websites to my list of bookmarks/favorites. | 1 2 3 M |
| I can organize my list of favorites. | 1 2 3 M |
| I can capture pictures from web pages and save them. | 1 2 3 M |
| I can create my own web page using web development software like Front Page. | 1 2 3 M |
| I can publish my web page on a web server. | 1 2 3 M |

**Bibliographic/Educational**

| I can do a Medline search using Boolean operators (and, or, not). | 1 2 3 M |
| I can use a site like MDConsult to access textbooks and full text journals online. | 1 2 3 M |
| I feel comfortable taking a test online. | 1 2 3 M |
| I feel comfortable using computer-based educational packages. | 1 2 3 M |
| I feel comfortable using computer-based textbooks and full-text journals like SAM-CD or the PDR. | 1 2 3 M |

| 1. Have you used or do you own a PDA (i.e. Palm or CE)? No____ Yes____ Specify: |
| 2. With which computer(s) do you have experience? IBM Compatible____ Macintosh____ Other____ |
| 3. Do you have access to a computer at home? No____ Yes____ Type____________ |
| 4. How often do you use a computer? Never____ Rarely____ Occasionally____ Often____ |
| 5. Do you have access to the internet at your clinic? No____ Yes____ NA____ |
| 6. If yes, indicate the frequency that you access the Internet in your clinic to look up medical information to help you with a case? Never____ Rarely____ Occasionally____ Often____ |
| 7. How would you rate yourself in your attitude towards adopting new technology? At Ease ____+-----+-----+-----+-----+ Terrified (circle your place) |
8. Do you feel you need more training in basic computer literacy skills? Yes ____ No _____

9. How would you rate your comfort level when faced with learning a new computer application?
   At Ease  +-----+++++-----+++++  Terrified  (circle your place)

10. How do you like to be taught to use a new computer application? (pick as many as are applicable)
    On the Job Training _____ Hands-on small group training _____ Hands-on One-on-One training _____
    Give me instructions and I will teach myself _____
    Other, please specify _________________________________________________________________

10. When would you be available for a computer training workshop?
    Saturday AM _____ Saturday PM _____ Weeknights _____ Weekdays specify morning or
        afternoon ____________________
    (Other (please specify) ____________________________)
Appendix D
Berlin Questionnaire

EVIDENCE-BASED MEDICINE

NAME:________________________________________________________

NUMBER: ________ GROUP:__________

Age: _____ Sex:

☐ Female
☐ Male

Previous education (chose one or more)

☐ Medical school ☐ Dentistry ☐ Nursing ☐ Physiotherapy ☐ Other health profession

☐ Additional degree (Public health, epidemiology, or ________________)

☐ Have read a book on EBM

☐ Previous participation in an EBM-session (less than one day)

☐ Previous participation in another EBM-workshop (one day or more)

☐ Have already served as tutor/facilitator/trainer in another EBM-workshop

Self-rating of EBM-knowledge

☐ None at all ☐ Little ☐ Average ☐ Advanced ☐ Expert

Years since graduation from university: ______ Years or .. not applicable

Present occupation (main occupation – choose only one)

☐ Direct patient care (Hospital, clinic, office based practice, private practice)

☐ surgical ☐ medical ☐ other:______________

☐ Administration

☐ Academic career (Epidemiology, public health etc.)

☐ Industry (Pharmaceutical etc.)

☐ Medical publishing (Editor etc.)

☐ Other: ______________________________________

Present Position (choose only one)

☐ Student ☐ Nurse ☐ Physiotherapist

☐ Intern / Junior House Officer

☐ Resident / Senior House Officer

☐ Registrar / Fellow

☐ Attending Physician / Consultant

☐ General practice / office-based specialist / private practice

☐ Other:_________________
Data protection statement:

- I agree to details of my name and score being kept on a database for the purposes of this study
- I do not agree – instead of my name only a number will be entered into the database
- Prior to After EBM-workshop 4

**QUESTION 1:** (A Fagan nomogramm without legend is enclosed)

You are a doctor on call in the emergency department and are asked to see a patient with pain in the right lower abdomen that has been continuous for the last 24 hours. Physical examination does not reveal typical signs of appendicitis. However, you know that in this age group, about 1 in 10 patients with these complaints has appendicitis without typical signs. You order an ultrasound test as you know that the sonographer on duty has reached high scores in diagnosing appendicitis at the recent internal quality assessment. (Likelihood ratio for positive findings 1.8, for negative findings 0.2). The sonographer is sure that your patient has appendicitis. When you call the surgeon to see the patient, he asks you about your estimate of the likelihood that appendicitis is truly present in this case. You answer

A. about 2 %
B. about 7 %
C. about 15 %
D. about 30 %
E. A statement is impossible before the arrival of the lab results

**Answer 1:** ____ (A Fagan nomogramm without legend is enclosed)
QUESTION 2:
The fourth year medical student, who currently attends A&E, is impressed by your answer and asks you how to calculate the likelihood ratio. You explain to him that the results from ultrasound were compared to the true results (from histology or follow-up) over a certain period of time. Because you do not remember the figures from the paper you demonstrate your calculations with the following example:

<table>
<thead>
<tr>
<th>Ultrasound diagnosis</th>
<th>Appendicitis truly present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>90</td>
</tr>
<tr>
<td>No</td>
<td>20</td>
</tr>
<tr>
<td>Appendicitis</td>
<td>10</td>
</tr>
</tbody>
</table>

In this example, the likelihood ratio for a positive result is:

A. \[ 0.09 = \frac{10}{1 - \frac{20}{110 + 90}} \]

B. \[ 0.10 = \frac{10}{110 + 10} \]

C. \[ 1.54 = \frac{20}{1 - \frac{90}{20 + 110}} \]

D. \[ 0.82 = \frac{90}{10 + 20} \]

E. It is not possible to calculate the likelihood ratio from these data

Answer 2: ____

QUESTION 3:
The student is enthusiastic about your answer and makes the following statements about the patients in your example:

1) You can conclude about the patients in the example, that each patient with a pathological ultrasound result has a 90% probability of really having appendicitis
2) You can conclude about the patients in the example, that for each patient with a normal ultrasound result the probability that this result is wrong is 18% \( \frac{20}{20+90} \)
3) The positive predictive value of the ultrasound investigation can be calculated directly from the ratio of the likelihood ratios \( 0.09/0.01 \)

You tell him

A. All statements (1,2,3) are incorrect
B. The first statement (1) is correct, the second and third statements (2,3) are incorrect
C. The second and third statements (2,3) are correct, the first statement (1) is incorrect
D. The first and third statements (1,3) are correct, the second statement (2) is incorrect
E. All statements (1,2,3) are correct
QUESTION 4:
A drug representative pays you a visit in your office and presents to you a new study on the most recent lipid lowering drug which, in a large blinded randomized controlled trial on healthy employees of the drug company, has led to a 50% reduction in the risk of dying from myocardial infarction. 4000 employees were treated with the drug, 4 (0,1%) of whom died from myocardial infarction. In the untreated control group, 8 (0,2%) died. The drug rep therefore recommends you to treat all your patients with the new drug. You want to save the life of at least one of your patients, however, you notice that on the basis of the information given, to achieve this goal you will need to treat
A. 1000 people ( = 1 / (0,2% - 0,1%))
B. 2000 people ( = 8000 / 4)
C. 4000 people ( = 4 * (1 / 0,1%))
D. 8000 people ( = 4000 x 2)
E. The number of people required to treat cannot be calculated from the data provided
Answer 4: ____

QUESTION 5:
You are delighted with this opportunity to help humankind, and you phone your colleague to tell him this exciting news. Your colleague, however, has already read the report of the study from which the data in question 4 were taken. She points out that there was an excess of pulmonary edema of unknown origin in the treatment group: 7 cases in the treatment group compared to 2 cases in the control group. You recalculate the figures and find that one additional case of pulmonary edema can be expected
A. for every 100 patients treated (= 2000 * 0,2%).
B. for every 571 patients treated (= 4000 / 7).
C. for every 800 patients treated (= 1 / ( 5 / 4000 ) ).
D. for every 2000 patients treated (= 2 * ( 1 / 0,1%)).
E. That value cannot be calculated on the basis of the information provided.
Answer 5(SetA): ____

QUESTION 6
A patient with chronic headache has recently read in a women’s magazine that living in flats with raised levels of formaldehyde causes chronic headache. She would like to persuade her health insurance company to pay for her moving to a different location. She therefore wonders whether the relationship
between chronic headache and the formaldehyde concentration in room air is scientifically proven. You perform a literature search on this topic and find several relevant studies:

Which study design do you regard as most appropriate for this question?

A. Prevalence study
B. Ecological study
C. Case control study
D. Prospective randomized controlled study
E. Case series

Answer 6(SetA): __________

QUESTION 7:

The following approaches were chosen in the studies you retrieved. Which one do you think is most appropriate to examine whether there really is a relationship between chronic headache and formaldehyde in room air?

A. One hundred patients with headache from a specialist headache clinic and 100 patients without headache (who are comparable to the headache patients in terms of gender, age and income) are recruited from GP practices. The formaldehyde concentration is measured in the homes of both groups. The mean concentration of formaldehyde are compared.

B. Five hundred patients from a clinic for environmental medicine are interviewed as to a) whether they suffer from headache and b) whether they think their homes are contaminated with formaldehyde. The frequency of the answer to question 2 (homes contaminated with formaldehyde) in patients with headache is compared to those without headache.

C. A headache questionnaire is sent to all tenants of a housing project. At the same time a skin-test for formaldehyde allergy is performed. The frequency of headache is compared between those with and without formaldehyde allergy.

D. The formaldehyde concentration in the blood of patients with chronic headache from a pain clinic is measured twice within one year. The concentration of the first measurement is compared to the second one.

E. A headache questionnaire is administered to all new tenants of a housing project who move into a flat suspected to be contaminated with formaldehyde. The same questionnaire is administered to longterm tenants of suspicious flats. The frequency of headache between new and long term tenants is compared.

Answer 7: ______
QUESTION 8:
A large study investigated the question of whether a new diet pill reduces cardiovascular mortality. One thousand overweight people participated in the study. Participants were randomly allocated to a treatment (500 participants) and a control group (500 participants). For one year, the treatment group received the diet pill, and the control group a starch pill of the same shape, colour and taste. Every month, the patients in the treatment group were investigated for side effects; the patients in the control group were only seen every 6 months. In the treatment group there were 10 fewer cardiovascular deaths than occurred in the control group. You wonder whether the quality of the study is convincing. Which of the following statements is correct?
A. The study was not prospective
B. The study was not randomised
C. The study was not double blind
D. The study assessed a surrogate endpoint rather than the outcome of interest
E. This prospective randomised controlled double blind study examined the outcome that was relevant to the study question.
Answer 8: ____

QUESTION 9:
1) Using the information from question 8, it is possible to calculate how many patients like those in the study need to be treated with diet pills to prevent one additional cardiovascular death
2) For the calculation of the number of patients needed to treat to prevent one additional cardiovascular death, the relative reduction in risk between treatment and control group must be known.
3) In the information for question 8 the relative reduction in risk between treatment group and control group is stated
A. All statements (1,2,3) are incorrect
B. The first statement (1) is correct, the second and third statement (2,3) are incorrect
C. The second and third statements (2,3) are correct, the first statement (1) is incorrect
D. The first and third statements (1,3) are correct, the second statement (2) is incorrect
E. All statements (1,2,3) are correct
Answer 9: ____
QUESTION 10:
You are practising general medicine. You detect as an incidental finding a 70% stenosis of the left carotid artery in a 63 year old patient of yours and wonder whether this is an indication to refer her to a neurosurgeon for endarterectomy. You search the literature and find a study on asymptomatic patients with a 70% stenosis (comparable to your patient) which does not show a treatment benefit for surgery compared to conservative management at 5 year follow up.
A subgroup analysis (of 13 subgroups) was performed, and after adjustment for other risk factors, only women who had no stroke or TIA in the first year had a statistically significant benefit from surgery during a subsequent four year follow up.
Which statement is true?
A. The significant result proves the surgical benefit in women and is sufficient to justify the indication for surgery
B. The subgroup analysis was corrected for other risk factors which results in misleading conclusions most of the times
C. The yield of reliable results from RCTs can be maximised by subgroup analyses.
D. With an increasing number of subgroup analyses, the risk of finding a benefit that does not exist in reality also increases.
E. The subgroup analysis of this study proves that asymptomatic carotid stenosis is more dangerous in women than in men.
Answer 10: ___

QUESTION 11:
In a postgraduate training session on the effect of lipid lowering drugs on myocardial infarction, the following randomised controlled trials are presented, all of which tested a drug against placebo over five years in middle aged women (average 55 yrs.) with controlled hypertension (average 155/98 mmHg ) and obesity.
1.) In the Bolivian study, drug II reduced the risk of fatal myocardial infarction by 25%.
2.) In the Argentinian study, drug I reduced the risk of fatal myocardial infarction by 30%
3.) In the Chilean study, 3% of patients in the treatment group (drug III) and 4 % in the control group died of myocardial infarction.
Which of the following statements is true?
A. Drug I is preferable as this therapy leads to the largest reduction in myocardial infarction
B. Drug III is preferable as the proportion of patients who benefit from treatment is largest with this treatment
C. The relative reduction in the risk of myocardial infarction is the same for drug II and drug III
D. The relative reduction in the risk of myocardial infarction is the same for drug I and III
E. There is no information about the risk of untreated patients (control event rate) for any of the treatments

Answer 11: ____

QUESTION 12:
At the local outpatient clinic of the department of gastroenterology, the prevalence of carcinoma of the colon is 30%. One thousand consecutive patients are included in a study for a new non-invasive diagnostic test for detection of carcinoma of the colon. 630 patients are recognised as truly negative, i.e. truly free of tumor. The number of false positive and false negative patients is identical.
QUESTION 13:

Some time ago, you referred a 40yr. old woman with a palpable lump in her breast to the gynaecologist who performs a biopsy. The histological specimen of the lump was judged benign. The lady brings along the result and asks you whether having a cyst means that she especially in danger of developing breast cancer. You perform a literature search and you find the following studies:

Which study is most suitable to assess the prognostic relevance of benign cysts in women in the normal population?

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**Table E:**

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A. Study A was performed in a gynaecological outpatient department of a university hospital in Paris. From 1996-1998, all women with breast cancer were interviewed for previous findings of palpable breast cysts. In comparison, women without breast cancer were examined for palpable breast cysts. Women with breast cancer had 20% fewer cysts than women without breast cancer.

B. Study B was performed in a university hospital in Boston. The mammograms of 1500 women with breast cancer from the last 10 years were examined retrospectively for the presence of cysts. Thirty percent of women also had larger cysts.

C. Study C was performed in the gynecological outpatient department of the university hospital in Edinburgh, the only referral center for women with breast problems in East Scotland. All women that had been investigated for palpable cysts were re-examined 10 years later or searched for in cancer registries or death registries. The frequency of breast cancer was twice the frequency observed in the general population.

D. Study D was performed in the department of pathology in a specialised hospital in London. All histological specimens of breast tissue from the last 10 years were assessed. For 11% of women with the diagnosis of a benign cyst, histologically proven breast cancer was present, too.

E. Study E was performed as a multi-center study in several district hospitals. Experienced breast surgeons were interviewed as to how often women with breast cancer had a history of benign cysts according to their experience. The mean value given in their responses was 37%.

Answer 13: ____

QUESTION 14:
In the German language medical literature, the so-called „floating thrombus“ in deep vein thrombosis is particularly feared because of its presumed higher risk of embolism. You want to know whether patients with a floating thrombus have a higher risk of pulmonary embolism than patients with a adherent thrombus.

1. This is a question about prognosis
2. This is a question about side effects
3. This question is best assessed using a case control design
4. This question is best assessed using a cohort design
5. This question is best assessed in a randomised controlled trial

Which statements are correct?
A. 1 and 3 are correct
B. 1 and 4 are correct
C. 1 and 5 are correct
D. 2 and 4 are correct
E. 2 and 5 are correct
Answer 14: ____

QUESTION 15:
Meta-analysis has gained increasing importance over the last few years. Which statement is true?
A. The introduction of meta-analyses means that large research trials with many participants have become less important.
B. Systematic investigations have shown that studies originally published in the language of the respective country (other than English) are of lower quality than studies published in English language journals. Therefore it is sufficient to include only literature published in English in metaanalyses.
C. Studies with a larger number of patients generally show a larger treatment effect than studies with a smaller number of patients.
D. A meta-analysis of randomised controlled trials which includes a large number of participants can give a more precise estimate of the efficacy of an intervention than a single study with a small number of patients.
E. In a meta-analysis, differences in the primary studies (e.g. in the study question or the patient population) can be corrected by statistical techniques.
Answer 15: ____
Appendix E
Debriefing Tool

(Adapted from interviews of medical students conducted by Rhodes-Kropf and Embi, and American Institutes for Research Web Access Initiative Usability Testing Draft Usability Plan)

The interview sessions will take 60-90 minutes, depending on the students’ responses. Semistructured probes will be used to inquire about details of the students’ experience. The idea is to allow participants to provide their views and perceptions in their own words, while providing an opportunity for exploration and clarification through follow-up questions. Interviews will be audiotaped and transcribed. Responses will be transcribed verbatim and provided anonymously to the faculty.

Introduction

Thank you very much for coming in today. My name is __________ and I work for the Brody School of Medicine. I am assisting the faculty who taught the medical informatics course as they assess the course. Since this is the first time this course has been offered, we want to know about your experience so we can improve the course experience for future students.

I'll guide you through today's session, and interview you about your experiences with the course. Keep in mind, we are not evaluating you in any way, we are only interested in your evaluation of the course. Throughout the session, I will encourage you to freely express your opinions, to comment on what is clear and what is unclear to you, and in particular, what you find confusing or difficult to understand.

This session will be recorded so we can transcribe your comments verbatim. Your responses will be provided to the faculty anonymously in a collective transcript. I will be the only person who knows how individual students responded in the interview.

Do you have any questions before we begin?

Questions

1) What is your impression of this course overall? Please give it a grade from A to F.
2) Grade: ______
3) Why?
4) Name three words or characteristics that describe this course.
5) What were the 3 things you liked best about this course?
6) What were the 3 things you liked least about this course?
7) Would you take other informatics courses on your own in the future?
8) What would entice you to take another course?
9) Would you recommend this course to a fellow student?
10) Were the course materials and instruction relevant to your practice of medicine?
11) How might they be more relevant?
12) Are there materials or instruction you would like added to the course? Which ones?
13) What other thoughts do you have about the course?
Appendix F
Email to Course Faculty

To: Medical Computing and Informatics Elective Faculty

From: Julie Martin

At our next meeting, we will discuss the proposed assessment tools to be used in the course and how they might fit with the educational goals you have established. I have attached the tools: 1) a computer skills and usage self-assessment from Florida State University College of Medicine, 2) the Berlin Questionnaire on evidence-based medicine, and 3) an interview tool for the debriefing session.

Please bring your ideas for changes, additions, deletions you would like to make. If you have any questions, you may reach me at 744-3451.