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Journal of Health and Social Behavior, Vol. 42, No. 4. (Dec., 2001), pp. 342-359.

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Journal of Health and Social Behavior is currently published by American Sociological Association.

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Evidence-Based Medicine, Clinical Uncertainty, and Learning to Doctor*

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Journal of Health and Social Behavior 2001, Vol 42 (December): 342–359

For the past two decades, evidence-based medicine (EBM), or the reliance on current scientific evidence to reach medical decisions, has been embraced as a new paradigm to standardize clinical care. Drawing from in-depth interviews with seventeen pediatric residents in two residency programs, we evaluate the extent to which the medical sociology scholarship on uncertainty analytically elucidates the recent influx of EBM during residency training. Our findings suggest that residents interpret EBM in varying ways to match their work practices: “Librarians” consult the literature while “researchers” evaluate it critically. For both groups, EBM might generate new uncertainties due to the increased reliance on information technologies and epidemiology. Whether EBM reduces uncertainty depends upon the residents’ understanding of standardized knowledge and consequent incorporation of EBM in their clinical practice. Contrary to the predictions of some sociologists, EBM does not lead to a diminishment of humanitarian values in medical care. Nor does EBM lead to a science-based meritocracy on the patient ward, as claimed by some EBM advocates. Our conceptual updating of uncertainty emphasizes the continuous management of uncertainty during the medical socialization process. We argue that managing uncertainty develops along with what we term evidence-based clinical judgment.

During the past two decades, the health care field has embarked on a standardization movement under the banner of “evidence-based medicine” (EBM). Evidence-based medicine refers to “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients” (Sackett et al. 1996:71). According to the proponents of EBM, every decision a physician makes on behalf of a patient should be sup-

ported with scientific evidence. The reliance on scientific evidence in medicine goes back at least two centuries to the Parisian schools of medicine (Foucault 1973), and standardization has been used repeatedly in the past to consolidate the medical profession (Starr 1982).

Yet the scale and scope of standardizing medical practice on scientific grounds is new. Evidence-based medicine relies largely on clinical practice guidelines and research protocols¹ to disseminate “proven” (i.e., supported with randomized clinical trials) diagnostic and therapeutic knowledge. Such guidelines offer step-by-step instructions on the most intimate details of medical care. For example, the World Health Organization and the U.S. National Heart, Lung, and Blood Institute provide a guideline for asthma (National Heart 1998). The guideline explains how to diagnose asthma, how to control asthma episodes, how to manage asthma long-term, and even how to

*We would like to thank Libby Bradshaw, for her help in accessing one of the two pediatric programs for our study, and Peter Conrad, three anonymous reviewers, and the editors for helpful comments. This project was supported by a Mazer faculty research grant from Brandeis University. Address correspondence to: Sociology Department, MS 071, Brandeis University, Waltham, MA 02454-9110, E-mail: Timmermans@brandeis.edu, Aangell@brandeis.edu. Phone: (781) 736-2634, Fax: (781) 736-2653

educate patients. Every recommendation is split up in detailed steps that are scored based on the strength of the available evidence.

Most players in health care currently support some form of EBM. The medical profession is concerned about the widespread variation exposed by public health researcher John E. Wennberg (1999) in the subsequent editions of his medical practice atlas. For example, Wennberg found that a Medicare patient in the early stages of prostate cancer was eight times more likely to have his prostate gland removed if he lived in Baton Rouge, Louisiana than if he lived in Tuscaloosa, Alabama. In some parts of the country radical breast cancer surgery was performed 33 times as often as breast-saving lumpectomies. Such a widespread variation questions the legitimacy of the medical profession. What is the medical indication of invasive surgery if it is closely correlated with geography and physician preferences? Once the problem of practice variation was publicized, the importation of "systems thinking"² from other industries into the health care field and the widespread adoption of clinical improvement theory to enhance health care quality further boosted the development of standardized guidelines (Batalden and Stoltz 1993; Deming 1986; Nelson, Batalden, and Ryer 1998). These approaches focused on developing scientific methodologies to continuously evaluate the clinical and non-clinical aspects of health care, anchoring the formalization of EBM on a managerial level.

In addition, professional organizations convene expert committees to create guidelines and summarize the scientific literature in review articles as a service to their members. Government agencies and insurance companies use EBM-based quality-of-care instruments to calculate the cost-effectiveness of alternative interventions (Eddy 1996). Evidence-based medicine also plays a role in defining the legal standard of care (Havighurst 1995). These converging interests have fueled a cottage industry of guideline development in the U.S., Canada, Europe, Australia, and increasingly in developing countries (Woolf et al. 1999). Nurses, dentists, and particularly mental health professionals have also joined the EBM bandwagon (Kitson 1997; McCloskey and Bulechek 2000; Sutherland 2001). Evidence-based guidelines are expected to be developed through formal organizations, supported by evidence, include estimates of

outcomes, and present the reasoning behind recommendations (Eddy 1996).

Because EBM centers on information gathering and evaluation, several medical educators have suggested an evidence-based curriculum and training to teach students medicine (e.g., Ghali et al. 2000; Green 1999; Welch and Lurie 2000). Such curricula rest on a simple principle: Instead of relying on how experienced clinicians order them to treat patients, "students of health professions should be encouraged to ask every day, 'What's the evidence?'" (Eisenberg 1999:1868). Educators define EBM as a "paradigm" shift with three tenets: (1) the integration of research based information in clinical practice, (2) the realization that pathophysiology is insufficient for the practice of clinical medicine, and (3) the acquisition of methodological and statistical skills to evaluate studies. These three premises contrast with past training practices where medical knowledge transfer depended on the teacher's individual clinical experience and authority, where pathophysiology provided the foundation for clinical practice, and gaps in knowledge were filled with an experience-generated "common sense" (Friedland 1999).

Social researchers have only recently paid attention to EBM (e.g., Waitzkin 1998; Weir and Habib 1997) and the role of EBM in medical education. In the 2000 edition of *The Handbook of Medical Sociology*, Frederic Hafferty (2000) notes that the rise of EBM might have repercussions for the study of uncertainty:

We might want to revisit the writings of Renée Fox, Donald Light, Jack Haas, and William Shaffir, and others on the nature and impact of uncertainty in medical work and question whether the deployment of research protocols and the use of report cards is generating a new definition of uncertainty in medical practice. (P. 252)

Indeed, from a sociological perspective the widespread dissemination of EBM in medical education could be regarded as a means to alleviate the uncertainty inherent in medical knowledge (Good 1998). In her landmark article on training for uncertainty, Fox (1957) argued that students were overwhelmed by the vast amounts of knowledge to master and the many unknowns in the medical knowledge base. Clinical practice guidelines and other standardized research-based learning tools not only summarize the literature in an easily

accessible format but also guide the budding physician through the clinical encounter. Standardized instruments could then be the definitive answer to the problem of clinical uncertainty. Yet the scant preliminary evidence shows that the link between EBM and residency training is not obvious (Bazarian et al. 1999). Although medical students might benefit somewhat from an EBM based medical curriculum (Barnett et al. 2000), the immediate demands of residents on the ward seem to make critically appraising the literature before decision making unrealistic (Norman and Shannon 1998).

What, then, does this flow of EBM mean for medical socialization and the acquisition of medical knowledge? In this paper, we investigate how residents understand EBM and whether it applies to their own daily practice of managing the uncertainty of medicine. The paper consists of three parts: first, we explain residents' understanding and practice of EBM; second, we discuss how EBM relates to clinical uncertainty; and finally, we investigate the relationship between research-based and experience-based knowledge. Besides contributing to the sparse sociological literature on EBM, our purpose in this paper is mainly conceptual: We evaluate the extent to which the medical sociology writings on uncertainty analytically elucidate the recent influx of evidence-based medicine during residency training. This paper does not constitute a theory extension (Glaser and Strauss 1967) but a conceptual update of "uncertainty" during medical socialization.

Drawing from recent scholarship on standardization by science and technology scholars, we ask how residents acquire and apply standardized protocols when faced with uncertain medical knowledge. Standardization has become an attractive but contested solution to manage uncertain knowledge as is apparent from countless initiatives in education (e.g., standardized tests), high risk and accident-prone industries (Perrow 1984; Vaughan 1996), the health care field and other industries (Batalden and Stoltz 1993; Deming 2000; Senge 1990a), the military (O'Connell 1993), and economics (Krislov 1997). The politically sensitive nature of standardization (Bowker and Star 1999) renders it mandatory to evaluate how standardization affects knowledge acquisition and implementation.

METHODOLOGY

We interviewed seventeen pediatric residents from two medical programs about their experiences with EBM. Brandeis University's institutional review board approved this project (HEX 00 06 073). Both programs were part of large, urban hospitals affiliated with academic institutions. As residents, our respondents had finished four years of medical school and were at different stages of three years of rotations in different clinical pediatric specialties. Most of the respondents were in their mid-twenties and white (3 Asian respondents). The gender distribution was nine male and eight female residents. Eight respondents were in their first year of residency, two in the second year, five in the third year, and two chief residents were in their fourth year. Their rotations at the time of the interview varied from the newborn unit, to endocrinology, to hematology-oncology, to pediatric intensive care, to pediatric surgery, to the emergency department.

Potential respondents received a notice about the study from the chief resident. They then contacted the researchers and set-up an interview time. Even with the blessing of the attending physician, it remained difficult and time-consuming to access the residency programs. Chief residents remained protective of the residents' time. We managed to interview 45 percent of the residents in both programs. No one refused the interview after contacting us. The interviews were tape-recorded and lasted about an hour, with a couple interviews lasting two and a half hours. All respondents were asked similar questions aimed at generating detailed stories, but not necessarily in the same wording and sequence (see the Appendix). Wording and sequence depended on the flow of the interview and the responses provided. The interviews were transcribed and went through successive rounds of open, selective, and axial coding (Strauss 1987). Throughout the paper, we have used pseudonyms in place of the resident's actual names in order to protect their confidentiality and anonymity.

This study is limited in two important ways. First, the use of in-depth interviews limits the understanding of the role of EBM. Because we were interested in how EBM has permeated the trainees' practice we would have preferred to observe residents in their clinical decision-

making and patient contacts. Unfortunately because of the above mentioned access issues, such a study was not feasible. To compensate for our lack of observational data, we probed repeatedly for specific and detailed instances of clinical problem solving. Still, interview data do not allow us to assess with the same precision as observational data how common, for example, computer searches are in the residents' workdays.

A second limitation is our small sample size and our deliberate choice to limit our study to one of the most EBM saturated medical sub-disciplines: pediatrics. The small sample size does not allow us to make fine distinctions along the lines of gender, race, medical sub-discipline, and year of residency—all potentially relevant independent variables. Instead of fragmenting the data and providing speculative interpretations based on one or two residents, we decided to analyze our data on the level of pediatric residents and make distinctions on analytical grounds. This methodological strategy fits in with grounded theory's principle of theoretical sampling: interviewing and analysis is guided by emerging conceptual categories until data saturation is reached (Glaser and Strauss 1967). In this approach, the size of the study matters for the conceptual density of the findings but not necessarily for generalizability across populations. Since the practice of EBM is still evolving and varies across medical settings, we hope that future researchers will further refine our concepts.

PRACTICING EVIDENCE-BASED MEDICINE

The role of evidence-based medicine during resident training is defined by where a resident seeks information and how confident he or she feels to act on that information. In most rotations the residents have some autonomy about patient care: They are required to diagnose and work-up patients, monitor their hospital stay, and order laboratory tests and medications. Since a resident has a M.D. degree and wears the clothes and paraphernalia of a hospital physician, patients expect medical competence (Freidson 1994; Hughes 1971). How does EBM feature in the socialization of doctoring?

All residents we interviewed stated that, in Dr. Weiss³ words, "the new age of medicine is going toward EBM." The two training pro-

grams reflected that trend. They had an active lecture series, and had recently retooled their traditional journal clubs to make EBM more central. Chief residents, supervising attendings, and even pharmaceutical representatives recommended EBM. In one of the programs, for example, an attending physician proposed having a librarian-researcher armed with an on-line computer present at morning meetings to provide EBM on the spot. As we will explore in more detail below, EBM was integrated in a hierarchical supervisory relationship: attending physicians would routinely request evidence before decision-making. Pharmaceutical representatives would try to convince residents to use their drug for new applications while showing them research evidence published in major medical journals. Certain subspecialties including newborn nursing were already heavily protocolized. In the newborn nurseries, dilemmas center on which clinical practice guideline to use and on how closely to follow it.

Steeped in an EBM environment, all residents reported that, at least occasionally, they "did" EBM. They agreed that practicing EBM implied coming up with the best answer to a clinical diagnostic or treatment question. The "best" solution entailed patient management that was backed up with recently published research by authorities in the field. Evidence-based medicine offers the resident *a written rationale for patient decisions* and this justification is viewed as an alternative to choosing treatments based on anecdotal evidence and personal experience. Importantly, the respondents sharply bifurcated based on what kinds of literature they considered evidence and what should be done with it. We identified two key orientations to EBM: Eleven residents relied on the evidence as *librarians*, and six others utilized the literature more as *researchers* (see Table 1).⁴

Librarian residents expanded the source material that qualifies for EBM. For the majority of residents, doing EBM meant consulting *any* published resource, including using computerized research databases. The information became authoritative from its text format, the institutional affiliation of its author, and the journal. When asked for an instance of EBM, Dr. Di Maio gave an example of checking the literature for a young patient bit by a parrot. He wondered whether parrot bites warrant special antibiotic treatment. A review article explained

TABLE 1. Librarian and Researcher Residents' Use of the Literature

	Librarian Resident	Researcher Resident
Main Characteristic	<i>Consulting any literature</i>	<i>Evaluating research</i>
Evaluation Criteria	Author, Publication Date, Journal	Double-blind Clinical Trials Statistics
Sources of Evidence	"Cheat" Books General Textbooks Review Articles and Protocols	Review Articles and Protocols Primary Research
Focus of Reading	Abstract, Conclusion	Methodology, Findings
Time Commitment	Secondary	Priority
Database Preference	MD Consult	MD Consult and others

that, in contrast to dog bites, no antibiotic treatment is required for avian bites, but that the doctor should check for some typical infections. Although the article provided Dr. Di Maio with guidance on a topic he did not know much about, it was not based on a systematic review of epidemiological literature.

In line with their broad criteria for EBM, librarian residents relied largely on "cheat books," textbooks, guidelines, and review articles. Several residents pulled dog-eared copies of *The Harriet Lane Handbook: A Manual for Pediatric House Officers* (Siberry and Iannone 2000) out of their pockets. One resident lauded the book as "the Bible for pediatric residents." *Harriet Lane* was mainly used to check medication dosages for children but it also contained a number of elementary protocols on how to treat common ailments. In a pinch, a resident could quickly glance over such protocols or double-check their initial ideas. The next lines of defense for librarians were the thick general textbooks that are strewn over the different pediatric wards. The 600 plus pages of the *Manual of Pediatric Therapeutics* (Graef 1997), for example, provides a basic orientation on how to handle most common disorders with some general explanation, but it is less up-to-date and comprehensive than some of the other sources. Because residents have consulted those or similar textbooks throughout medical school, they are familiar with their organization and know that a textbook can "get them by." The most sophisticated literature sources consulted by librarians consisted of on-line protocols provided by professional organizations such as the American Academy of Pediatrics.⁵ On a similar level were review articles published in leading pediatric journals

that critically assessed the state of the field and the strength of the evidence. When reading such articles, librarians skimmed the methodology and focused on the conclusion and findings.

Librarians consulted review articles, textbooks, and guidelines because they provided quick answers to clinical questions. Most admitted that evaluating a primary study took too much time. Library residents frequently asked an attending for advice before approaching the literature as a principle time saving strategy. Dr. Cole explained, "Unfortunately, the way it works on the floor most of the time, because we are so busy, we can't fully research a topic. A more efficient way is to reach for help." Library residents reserved literature searches for rare cases and for presentations in front of superiors. They stressed that time in the library was time spent away from the patient. Librarians found much evidence via the database "MD Consult."⁶ This user-friendly database offered the advantage of providing full-text, on-line accessibility and was also linked to some major textbooks.

The core of EBM for librarian residents was the pragmatic reliance on literature to quickly solve the dilemma at hand. For that reason, librarians thought that medicine had always been steeped in EBM. Dr. Cole noted, "I think it is like a new term for what medicine is and always has been—using the literature to come up with the best intervention. It is just that things have gotten sloppy, in that people are just going off their own experience and not using the literature to look critically. I feel like this new movement is a reinstatement of this whole idea."

In contrast to the residents who used the lit-

erature as a *librarian*, a minority of residents took the core of EBM to mean that the physician acted more as a *researcher* who actively evaluates and interprets the literature. Residents who professed to be more familiar with EBM specified that merely checking published literature is insufficient but that EBM implies a critical assessment of available evidence in a meta-analysis. Ideally, recommended treatments should have been tested and then replicated in large, prospective, randomized, double-blind, controlled clinical trials by authorities in the field. For researcher residents, the persuasive strength of recommendations does not depend on where findings are published. Two doctors pointed out that the authoritative American Academy of Pediatrics regularly publishes guidelines that are not backed up with statistical evidence but only express the consensus of experts in the field. Such recommendations merely take the problem of basing medicine on routines to a professional level (Eddy 1996).

Researcher residents would not consider the parrot bite literature search an instance of EBM. Because of small numbers, the evidence of rare conditions did not meet epidemiological norms but remained necessarily anecdotal. For researcher users of EBM, statistical criteria provide standards for evaluating recommendations, and while applying statistical measures it is possible to make fine distinctions between studies. Researchers did not look in the scientific literature for pragmatic guidance to treat the patient at hand but for a variety of factors to take into consideration during decision-making.

Researchers struggled to make literature searches part of their daily practice. Because of the ease of access they frequently used review articles and MD Consult to keep abreast of the literature on common conditions. With rare conditions, however, many preferred to take the extra time to evaluate the primary literature, and they frequented additional medical databases such as PubMed, Grateful Med, OVID, the Cochrane Library, and Medline. While researchers admitted that they might rely on a review article or a guideline for an on the spot dilemma, they acknowledged that they went back and assessed the literature more critically when they had the free time. Researchers stressed that the only way to keep in touch with the constant changes in medicine and provide

the “best” clinical care was to continually keep up with the literature.

In sum, pediatric residents in both programs reported that the use of evidence was actively encouraged and positively valued and that their involvement in EBM was inevitable. Yet they defined EBM flexibly to match their own work approaches. From an EBM definition as “the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients” (Sackett et al. 1996:71), librarians highlighted the practice of checking the literature when diagnostic or treatment problems arose. Researcher residents emphasized the scientific evaluation of research but they questioned the value of EBM’s main instruments: clinical practice guidelines and research protocols. Researchers considered EBM a new epidemiology infused paradigm for medicine. Residents thus define EBM in two different ways, and those varying definitions help explain how they appreciate EBM’s potential to reduce the uncertainty of a clinical knowledge base.

UNCERTAINTY AND EVIDENCE-BASED MEDICINE

Sociological Scholarship

The concept of “uncertainty” plays a central role in medical sociology scholarship that addresses the question of how medical knowledge is acquired. Based on research in Cornell medical school during the early 1950s, René Fox argued that medical knowledge is inherently uncertain because it is riddled with gaps and unknowns and, second, because the amount of medical facts is ever-expanding and impossible to completely master (Fox 1957). The dilemma for students in medical school consists of managing the limitations of their own cognitive ability and the vast medical literature. During residents’ clinical years, medical uncertainty emerges when students apply text knowledge to clinical situations and handle both the physiological and psychological aspects of patient care. Fox’s sociology of knowledge consists of a gradual socialization in medical confidence; instead of blaming oneself for clinical mistakes, the aspiring doctor learns to successfully manage the limitations of medicine. Training for uncertainty serves to imprint a professional attitude of objective

expertise and detached concern on the next generation of physicians. In later writings, Fox argued that uncertainty has become the hallmark of the entire field of medicine (Fox 1980; Fox 2000). The recent influx of advanced medical technologies has created a skeptical attitude towards medicine's modernist promise to cure all, and this has culminated in a "culture of uncertainty."

Other authors have questioned the primacy of "uncertainty" and instead highlighted that "training for control" closely follows "training for uncertainty" (Atkinson 1984; Katz 1984; Light 1979). Based on fieldwork among psychiatrists during their residency years, Donald Light proposed that the goal of medical training is to teach young physicians how to control their uncertainties in order to become professional experts within their field (Light 1979). Light fine-tuned Fox's sources of clinical uncertainty in medical training and noted that aspiring physicians master medicine and gain control by "psyching out" their instructors, limiting learning to relevant knowledge, acquiring clinical experience, focusing on technique, and gradually gaining autonomy. Light warns against an overconfident medical attitude centered in technique and disregarding patient-centered notions of health and illness.

Paul Atkinson's (1984) criticism runs along the same lines but focuses more on the functionalist heritage of Fox's writing and her alleged conceptual muddling. His main disagreement is that medical sociology's emphasis on uncertainty downplays the learned dogmatism of medical practice. Instead of being imbued with scientific skepticism, Atkinson portrays medical students as pragmatists, "content to work within the conceptual bounds of a given 'paradigm'" (p. 954). Following Alfred Schutz, Atkinson argues that certainty and uncertainty are two different phenomenological attitudes of the same medical discourse, reflecting different practical and theoretical interests. Only emphasizing uncertainty downplays medicine's dogmatic character. Finally, psychiatrist Jay Katz (1984) also argued that, propelled by uncertainty, the pendulum can swing too far in the opposite direction. The strategies that physicians develop for coping with uncertainty lead them to disregard and avoid uncertainty. The consequence of handling the many uncertainties in medicine is an attitude of overcertainty that negatively impacts the interactions with patients.

While most sociologists—and most medical practitioners—agree that the medical knowledge base is marred by various uncertainties, scholarly disagreements persist on the dominance of uncertainty. Because EBM relies on a standardization of medical knowledge and technique, it can be seen as a catalyst for these opposing viewpoints.⁷ In her most recent update of the "uncertainty" literature, Fox addresses the surge of EBM. Fox contends that EBM reinforces collective-oriented approaches in medicine at the expense of individualized patient-doctor interactions (Fox 2000). Siding with the critics of EBM, Fox remains apprehensive of EBM's narrow biomedical positivism and its threat to clinical expertise. Fox does not address the way EBM would impact medical socialization, but based on the central message of her earlier work, we would expect that the rise of EBM perpetuates scientific skepticism, a critical attitude of questioning evidence.

With Light and Atkinson we would expect that EBM brings about a dogmatic, control-centered form of medicine in resident's daily clinical practice, validating the power of medicine while accentuating the strengths and weaknesses of its scientific basis. Light, for example, notes that emphasizing technique serves as a major form of professional control, providing a technical understanding of competence.

Research-based Uncertainty

The residents we interviewed, however, noted that the most immediate effect of the increased reliance on guidelines or protocols and medical literature was a new source of uncertainty to be managed. Residents not only need to know how to diagnose and treat patients but need to acquire epidemiological research skills as well. *Research-based uncertainty* deals with the actual practice of conducting literature searches and evaluating studies. Even residents who rarely consulted primary research acknowledged that such critical assessment skills were expected of them. This form of uncertainty is closely aligned with the recent influx of information technologies and epidemiology in medicine. We found three instances of this novel uncertainty.

First, some residents felt uncomfortable about their ability to search for primary or

review articles. Their concerns were focused on the skills required to effectively navigate the computer search engines. To conduct a good search, residents had to know which search engines existed, what kinds of information each source held, and how to search each one with appropriate "key terms." Dr. Cole described the difficulty he encountered when trying to master new search engines, "[The library] has a number of other evidence-based programs that I am not even familiar with, like the Cochrane data base and Best Evidence. I have tried to use them, but they are not so easy to just log-on and use. I have tried to just throw in a couple of terms, thinking it would be self-evident how it worked. It wasn't." Not only the medical literature but also the databases keep changing.

Second, librarians and researcher residents expressed similar doubts about their abilities to effectively evaluate a primary research article. Even Dr. Mouton, who had worked for several years in biomedical research, acknowledged that she was "not a very good statistician." Other residents who had taken biostatistics or epidemiology courses still felt unsure about their abilities to distinguish between a good and a bad sample, and statistical significance and confidence intervals. Dr. McNair expressed her confusion: "I know the word is to power a study, but I have no idea how to calculate that. I know you reach a statistical significance that is accepted in clinical medicine where the p value is less than .05; you assume that there is less than a 5 percent chance that the results are due to chance alone. That is pretty much the extent of my statistics."

Third, residents questioned the interests behind conducting studies and expressed suspicion about effects of economical incentives on the quality of medical knowledge. Dr. Weiss noted that "studies follow money; where money is will be many studies. But at the same time, no one is going to do research on common things that we don't have any questions about." The available research funding might thus sway the entire medical field. Pediatricians were particularly attuned to this inequity because comparatively little research exists on treatments and drug dosages for children.

The new research-based uncertainty leads to new forms of managing the uncertainty. Chief residents and attending physicians would organize journal clubs, where residents presented

and critiqued articles, statistics refresher courses, and tutorials on how to effectively use Medline. Guest speakers would tour departments and lecture on the primary research they had conducted. And, consistent with the spirit of EBM, medical journals would publish guidelines on how to master the medical literature. Learning how to deal with the specific uncertainty of research thus led to a new kind of research infused-skill, an additional dimension of learning to doctor.

Does Managing Uncertainty Reinforce Dogmatism or Skepticism?

While earlier sociologists might have underestimated that a solution for dealing with uncertainty in itself creates new uncertainties calling in turn for new forms of uncertainty management, the issue at stake is the net result of the infusion of EBM: Do residents display an attitude of scientific doubting as Fox predicted, or does EBM confirm medical dogmatism as Atkinson, Katz, and Light feared? The answer to that question depends on the different approaches of "librarian" and "researcher" residents towards the different sources of EBM. In short, librarians act more along the lines set out by Atkinson, Katz, and Light, while researchers follow Fox's predictions (see Table 2. Residents and the Management of Uncertainty).

For librarians, practicing EBM with guidelines and review articles provided some comfort within the chaos of their clinical training. Residents suggested that a literature search allowed them to orient themselves when they had a diagnostic or a treatment question. They used the literature to make sure they were "in the ball park" before addressing the attending physician or their colleagues about a patient. Dr. Cole gave an example of how EBM reduces clinical uncertainty. He talked about a patient with abnormal lab results possibly indicating hepatitis or myositis:

People are still calling it a hepatitis/myositis, but I think that the only reason we are calling it hepatitis is because some of her liver function tests are abnormal, but it is only some of them, and it is the ones that could be elevated in skeletal-muscle disease. I think it is just going to be obvious to everyone when I tell them this afternoon. It has sort of been thrown around, but no one has said for sure. But now I have these

TABLE 2. Residents and the Management of Uncertainty

	Librarian Resident	Researcher Resident
Guidelines and Protocols	Comfortable Authoritative Legal Protection	False Sense of Security
Clinical Trials	Insufficiently Directive	Render Decisions Complex
Consequence for Medical Practice	Follow Guidelines Avoid Research	Disregard Guidelines Interpret Research
Applying EBM in General	Too Standardized to Qualify as "Real Medicine"	"Real Medicine" Supposes Understanding Uncertainty
Uncertainty Attitude	Tendency to Dogmatism	Tendency to Skepticism

papers that say the [test results] can go up with skeletal-muscle disease. Boom! Now when I take it to them, I am more confident in my diagnosis.

The literature boosted Dr. Cole’s hunches. To find this type of comfort, however, librarian residents tended to search prepackaged EBM: review articles and guidelines where experts in the field had already sorted through the evidence. Dr. McNair commented how a review article helped her determine the typical treatment for a diabetic child: “I know a lot of pathophysiology, but I don’t know how to do the work-up and treat the child. I use a lot of articles, especially review articles, large group studies, to figure out what my steps should be.”

Librarians mentioned that guidelines provided an additional kind of legal comfort that has become accentuated recently in North American health care. Following a guideline approved by the American Academy of Pediatrics might provide some protection from malpractice suits. Dr. McDougall explained the benefit, “You always have clinical liability on your side. I follow the guidelines that the AAP has set. They can’t fault you when you have done everything you can for that person.” In contrast, consulting clinical trials might present legal pitfalls.

A lot of times the primary literature is very much like ‘well some studies suggest this, some studies suggest that,’ and then you don’t know what the hell to do with this. Do I want to do anything because I read it in an article that I am not familiar with? Will that get me sued or kill a patient because just some study told me so? (Interview with Dr. Tomassi)

Researchers, however, were hesitant about

using the authority of guidelines to make themselves feel more comfortable or to provide legal protections. Dr. Mouton suggested that guidelines might make residents feel too complacent:

One of the things that I think is wrong is if you go into medical school and grasp whatever bit of guidelines you can get to cover your insecurities. If you do that than you stop thinking. People stop using their common sense. [A guideline] doesn’t mean that you shouldn’t examine the baby.

To avoid a false sense of security, researchers tended to critically question the directives of guidelines and review articles instead of taking it as medical gospel.

With clinical trials and other forms of primary research, the opinions ran opposite. Librarian residents remarked that primary studies inevitably generated contradictions and confusions. Dr. Fletcher stressed her frustration:

This is probably a little too honest, but you spend all this time reading that stinking study and then you come up with one thing at the very end. The result was maybe this or maybe that, and sometimes it is equivocal [She throws up her arms]. I just want to know what is done. What is the result? And typically the thing you pull is not even the question you are asking.

Dr. Mouton, more of a researcher, stressed instead that the contradictions revealed in primary research do not necessarily lead to worse clinical practice:

It is very hard to find certain truths. The literature doesn’t help you to find those kinds of securities. *The literature makes you aware of all the little edges. When you go to the literature you always find something*

that makes you think: 'Oh, I shouldn't forget that' or 'Oh, I should think about this.' When you do a literature search it makes you more knowledgeable. Being more knowledgeable makes you more certain where you stand. (Italics used for emphasis)

While for librarians the primary literature perpetuated confusion and led to an avoidance of such studies, researchers acknowledged the conflicting picture of different studies and stressed—in Dr. Mouton's words—that “controversy is part of life, part of research, part of science.” Primary research alerted researcher residents to factors and variations of clinical practice that they should not take for granted. The result was a more complex decision-making process in which uncertainties within medical knowledge were incorporated.

When applying EBM to clinical dilemmas they face in their practice, librarians and researchers were again at odds about the merits of evidence. For librarians, any literature search was fundamentally incomplete. Dr. Tomassi put the problem simply: “Guidelines cannot diagnose the patient for me.” Librarians reacted against the widespread perception that EBM would take the place of clinical judgment, reducing them to mere short-order cooks who followed “cookbook-recipe” medicine. Librarian residents pointed out that EBM only touched on the “real work” of managing patients and could never take the place of clinical judgment.

For librarians, the ultimate litmus test of reducing uncertainty and gaining certitude is having done things repeatedly in the past, i.e., accumulating clinical judgment. Whether such judgment was grounded in the “attending physician's standard of care” or in the literature did not matter much. Because the attending physician's advice was likely to be tailored to the individual patient's situation, it might have an edge for residents in training. One resident noted that he seemed to get clinical results, regardless of the source he used, and if he did not obtain expected results, he would try something different the next time. The basic issue was not to kill your patients and not to get sued. This philosophy led librarian residents to avoid doing too many literature searches.

Researcher residents were also aware of the gap between the literature and clinical practice in the immediate pressures of residency life. Dr. Weiss articulated the tensions:

The limitations [of EBM] are that it is tough to access unless you have the time to do it all the time . . . unless you are really up on the literature. It is kind of like surfing. Once you are on the board and going down the wave it is easy; but you have to paddle and get up on the board first. I guess as a resident you are too busy just trying to make sure the board doesn't come crashing down on you to do that.

But where librarians considered literature searches, at best, a dubious tool for reducing clinical uncertainty and more commonly a source of extra frustration, researchers embraced dealing with the contradictions and confounding variables of both patient care and the literature as real medical work. Teasing out protocols and research findings was as important as managing a blood pressure. One of the surprising findings in our interviews was that the clinical examples provided by the most EBM knowledgeable residents *centered on disregarding research, adapting protocols and guidelines, or filling gaps in the literature.* Researchers argued that EBM might lead to better physicians who know when *not* to follow research-based guidelines and recommendations. For example, Dr. Morris told us that in a pediatric resuscitation, she had ordered the nurses to give the sodium bicarbonate drug all at once instead of giving it at time intervals as the Advanced Cardiac Life Support protocol recommended.

In conclusion, librarians look to the research literature for ready answers but are disappointed with the uncertainty inherent in medical knowledge. Researchers, on the other hand, trust that uncertainty produced by the literature and clinical practice creates a positive flux of increased knowledge. Librarians' instrumentalist use of the literature is more likely to confirm a dogmatic clinical practice. Librarians might overstate the certainty of research and take recommendations at face value, or, more commonly, they might get frustrated with the residual uncertainty of research findings and avoid researching altogether. Researchers approach the literature from a more relativist perspective. They do not expect clear answers but a sharpening of discriminatory power that will aid them in patient decision-making. Researchers apply the critical assessment skills touted by EBM advocates to EBM itself, leading to a skeptical research attitude and disregarding of EBM. Fox's analysis seems thus to

be more geared towards a minority group of researcher residents who adopt uncertainty as their clinical leitmotiv, while Atkinson and Light quite accurately predicted the attitude of librarians for whom the urge to dominate clinical uncertainty with ready-made knowledge prevails.

EBM and the Humanitarian Critique

None of these scholars, however, predicted the counterintuitive extent to which the turn to standardized techniques might actually validate "humanitarian" medicine. Within the sociological discussion of uncertainty resides a strong critique that technological values and incentives push medicine to abandon open-minded, holistic caring for patients: The "science of biomedicine" threatens the "art of caring."⁸ Standardization leads to technological hubris—overconfidence at the expense of appropriate patient care. For Fox, the culture of uncertainty spawns ethical dilemmas and ambivalence in medicine. The issue about uncertainty is not even whether doctors know enough to heal but, more profoundly, whether physicians truly have the interest of their patients in mind (Fox 1980; Fox 2000). According to Atkinson and Light, the turn away from caring is fueled by medicine's inability to deal with uncertainty and urge to over-control. Physicians seek refuge in techniques to sidestep more confounding issues about equity, pain, sorrow, grief, and patient satisfaction.

Neither librarians nor researchers expressed an abandonment of "humanitarian" values due to EBM. Librarian's tendency for dogmatism with regard to literature findings did not extend to their attitude toward patients. Librarians generally rejected a technological or scientific mindset and instead highlighted the importance of being attuned to patient needs. Dr. Fletcher, for example, ran a laboratory test with little hope that it would get at the root of a patient's obesity, because testing would appease the patient's mother. Researchers' critical assessment of the literature resulted in questioning the strength of any research recommendation and often also in disregarding or adapting recommendations. As a result, researchers reported to opt for less aggressive care (e.g., not to over-prescribe antibiotics), a stronger emphasis on listening

and observing patients, and even paying attention to one's "gut feeling."

The residents largely interpreted the perceived shortcomings of EBM as redemption of clinical judgment. Research did not constitute a final "technologized" directive but a suggestion to evaluate with a patient in mind (Timmermans and Berg 1997). Senior resident Dr. Brown articulated this idea: "The real uncertainty comes at the end of the day when you're at home thinking, did I do the right thing or did I not do the right thing. That is not when you are having Medline at the corner of your eye." Dr. Brown added, "A lot of medicine is dealing with social, psychological, emotional stuff that impacts the physical and there is not much literature about that. That is not something you can read about; that is something you have to learn and do." Based on residents' own assessment,⁹ EBM thus leads paradoxically to a re-appreciation of clinical judgment and listening to patients.

The Social Context of EBM and the Politics of Uncertainty

Forging a tight link between knowledge and power, EBM advocates also promise a new meritocratic political order on the hospital ward: Power differences should be based on familiarity with the literature instead of institutionalized seniority. New residents of a San Francisco hospital, for example, receive a written manifesto about EBM. Evidence "levels the intellectual playing field: Everyone's clinical opinion counts equally, regardless of rank or experience. We value opinions only to the extent that they are supported by scientific evidence" (Grimes 1995:453). Other authors concur: "Gone are the days when the seasoned, elder, authoritarian clinician was the only one able to make complex decisions. Now, with the rules of evidence in hand, even the most novice clinician can enter into complex decision-making processes" (Bazarian et al. 1999:152).

The democratization politics of EBM could take away an important source of uncertainty during medical socialization. Because of the vagueness of evaluation criteria during medical training, residents constantly wonder what their instructors are looking for. The solution to this problem in the past has been to "psych out" instructors by asking them directly what they want and by observing them to infer

expectations (Davis 1960; Light 1979; Olesen and Whittaker 1968). Evidence-based medicine might take the guess work out of the education process and at the same time subvert the power relationships away from local conformity, requiring a revision of this aspect of the socialization scholarship.

Regardless of whether they used the literature as researchers or librarians, the respondents strongly emphasized, however, that EBM has not democratized the resident-attending relationship. The reality of the pediatric residency training is that most residents only in emergency situations decide upon their own treatments without previously consulting a senior resident or attending. Sociologist Charles Bosk has noted that attending physicians also consult with colleagues to diminish uncertainty (Bosk 1980:73), but the difference is that residents are required to always consult. Within a supervisory apprenticeship, the aim of residency is to build a "foundation" in a variety of pediatric cases. Dr. Weiss explained: "The idea of residency is to get in there first, find out what your gut feeling is, what you think it is, and then present it to somebody else and bounce it off them. They will say, 'I disagree with this. You forgot this. You might want to look into this.'" Almost all examples of medical decision making provided by the residents included checking ideas with senior residents or attending physicians.

As a consequence, residents denied an increase in knowledge-based egalitarianism. Dr. Mouton acknowledged that regardless of her familiarity with the literature she was "the lowest on the whole ladder here." Dr. Abraham added, "I don't feel like I am on the same level with anybody right now." Because residents reside at the bottom of a steep authority ladder, few residents actively challenged attending physicians or pointed out that their superior's recommendations were outdated, even when their own critical literature and research review suggested alternative patient management. At best they might engage in a polite, face-saving discussion about what might be most beneficial for the patient, or ask the attending physician what they thought of a particular alternative. Even in such exchanges when residents cautiously questioned an attending physician based on evidence from the literature, most residents reported that they and the literature would likely loose out. Dr. Wilson noted that "at those times it tends to fall back on experi-

ence. [The attending physician would say], 'Well that may work, but I have seen in this case, this works better. So we are going this way.'" The attending physician would qualify the study's findings with some reason why the recommendations did not apply in this particular case (Anspach 1993; Collins 1985).

Residents noted that they were unlikely to know as much about the patient or the literature, and that they lacked the thirty years of experience to engage in a discussion among equals. The attending physician was not only likely to have more experience with patients but, particularly in teaching hospitals, were likely to keep up with the literature. In addition, the attending physician might have inside knowledge to qualify the reading, such as the reputation of a particular hospital for orthopedics, the extent to which a particular author opts for "unnecessary" tests, or the kind of publishing criteria used in a particular journal.

Despite the lack of democratization with science, EBM impacted the relationship between attending physicians and residents because it restructured the knowledge exchange. Evidence-based medicine offered residents and attending physicians an external criterion to evaluate the knowledge base of the other. In contrast to their image in the EBM literature, most attending physicians are not keepers of outdated traditions but instead "guarantors" of EBM usage, ensuring continuous reminders and consistency (Latour 1999:46). Evidence-based medicine became integrated in a hierarchical relationship where superiors asked residents to conduct literature searches when questions arose. Dr. Wilson explained, "it is not uncommon to have your attending [physician] ask you, 'Why don't you check that out?' or 'Why don't you see if you can find some information about that?'" Once the resident comes up with the most recent literature, an attending physician might sit down with them and discuss the strengths and weaknesses of the evidence.

The literature can also be used as a benchmark to evaluate the competency of an attending physician. Several residents mentioned that they "checked-up" on an attending by comparing his or her standard treatments with what the literature recommended. Dr. Gross stated, "I usually look up articles so I can understand where they (attending physicians) are coming from, to see if what they say agrees with the articles or not. If it doesn't at all, then I would

probably ask another attending [physician]." Residents preferred attending physicians that admitted their own knowledge gaps and encouraged residents to check the literature.

When residents encounter a dilemma or new situation, a literature review allows them to channel their ignorance before they approach the attending physicians. Dr. Weiss put it this way: "Guidelines ensure that you are not totally in left field. It gives you a chance of not missing something that you shouldn't have missed, but you don't have the experience to know that yet. So it buys you somebody else's experience, I guess." The protocols and research recommendations gave the resident an idea about the patient's condition, but whether clues translated into treatment depended on whether the attending physician would go along with the recommendations or instead suggest alternatives. It was often simpler and easier to ask than to research. Occasionally, the literature also offered the resident an alternative to directly interacting with an unpopular attending physician.

Attending physicians and residents who take EBM's democratization promise seriously are thus in for a rude awakening. Residents overwhelmingly acknowledged that even with clinical practice guidelines and research protocols, hierarchy differences are real and cannot be ignored. Attending physicians function not only as more experienced colleagues but also as supervisors whose evaluations carry much weight. Even when protocols and guidelines spell out "best practices," residents still need to decipher—in Dr. Chambliss words—"the attending's best practice." The influx of EBM thus does not require a revision of the power differences in the sociological socialization literature. This does not mean that EBM has no political effects in medical training: Within the context of the resident-attending relationship, EBM forms an external validation criterion for both resident and attending physician to check the other's knowledge base. In light of these changes, Dr. Rosenberg granted that instead of leveling the playing field, EBM "brings the field a little bit closer."

EVIDENCE-BASED CLINICAL JUDGEMENT

Wherever we turn, EBM seems to run into a barrier of clinical judgment and experience.

Research-based knowledge seems to perpetually fall short in clinical decision making. Residents refer to the extra quality needed for practicing medicine as "experience," "competence," or "confidence." Even EBM advocates add the caveat that EBM should never be interpreted as a substitute for clinical judgment (Sackett et al. 1996). Sociologists seem to agree with medical practitioners when they stress that control over uncertainty is achieved with a growing sense of confidence. Concepts such as confidence, certitude, and experience are crucial in socialization theory, but they remain difficult to articulate and most sociologists attribute experience simply to the resident's seniority (Fox 1957; Haas and Shaffir 1987; Merton, Reader, and Kendall 1957). After some time, the resident somehow has acquired experience and gained confidence. Part of the conceptual difficulty is that experience and evidence continue to be viewed as distinct and even opposite entities.

Residents' encounters with EBM show that pure "experience" and "evidence" do not really exist. Any consultation of written research is already pre-structured by the overall diagnostic or treatment goal and informed by other research and accumulated clinical observations. Similarly, any experience is grounded in the hierarchy of written research evidence, anecdotes, consensus, and hunches of generations of clinicians and basic researchers. "Evidence" and "experience" constitute complementary resources that help residents in learning treatment options and patient management (Freidson 1986). The point of EBM in residency training is not to impose simplistic rule following but to offer a justification for clinical decision making. As we have seen, librarians will check ready-made evidence while researchers are more likely to assess primary literature. But those findings are filtered through the attending physician who, in turn, has accumulated an amalgam of patient experiences and research findings. The quality that guides clinical decision making, then, is not the tradition bound experience put up as a straw person in the medical and sociological literature but a mixture of skills and uncertainties grounded in medical knowledge that could be more accurately called *evidence-based clinical judgment*.

Evidence-based clinical judgment has five important characteristics. First, it cannot be reduced to either "evidence" or "experience"

but inevitably contains a mixture of the two, albeit not necessarily in equal proportions. Librarian residents as a group tend to prefer the hands-on handling of patients and the visual instruction of attending physicians while researcher residents ground their expertise in the literature. However, librarians still need to acquire evidence to back up their practice, while researchers fall back on hands-on patient handling to decide how the literature applies. Second, residents exhibiting good evidence-based clinical judgment do not necessarily use more literature, but exhibit an awareness of all the factors necessary to reach a satisfactory medical decision. A competent resident knows when literature reviews will likely lead to better patient care, how to evaluate research findings effectively, how to check the findings with the attending in a way that preserves the senior's authority, and how to communicate the proposed decision plan with the patient to ensure adequate compliance. Evidence-based clinical judgment thus includes epidemiological and social skills. Third, it also is not a quality that residents aspire and attending physicians possess. Both act based on evidence-based clinical judgment. The difference between residents and attending physicians is not simply a matter of seniority or more hands-on work but is also influenced by the scope of their responsibility and their institutionalized power advantage. Fourth, evidence-based clinical judgment is part of the process of managing uncertainties during residency training. Evidence-based judgement evolves as new contingencies in patient care crop up, when mistakes are made, or when previous recommendations are reconsidered. Finally, evidence-based clinical judgment is ultimately grounded in a Western allopathic, and professionalized approach to medicine.

Although rooted in research and literature, evidence-based clinical judgment moves the resident away from a strict interpretation of the literature. A physician starts with a recommendation and adds qualifications to consider whether the guideline applies to a particular patient, ward, attending physician, time-frame, and resources. The generation of evidence-based clinical judgment allows residents to apply protocols to patients for whom they were not intended because they gained insights into the rationale behind the evidence. It also facilitates skipping or substituting steps, working around the protocols, and appropriating them.

The resident interacts with the protocols and guidelines. More than the mere passing of time, the relative value of factors to be taken into consideration marks the accumulation of evidence-based clinical judgment.

UNCERTAINTY DURING MEDICAL TRAINING RECONCEPTUALIZED

The introduction of EBM during residency training reveals weaknesses with the concept of uncertainty in the socialization literature. The reason why uncertainty still makes sense as a sensitizing concept (Strauss 1987) for medical socialization is that medicine is one of the most heterogeneous—in the sense of blending social, symbolic, and technical aspects into new configurations—disciplines, and managing uncertainty is particularly accentuated during medical socialization and training. Uncertainties emerge when students and residents¹⁰ generate, retrieve, and evaluate knowledge and when they apply knowledge in diagnosis, treatment, patient response, and prognosis. “Research-based uncertainty” is a new subset of uncertainty originating from the implementation of information technologies and epidemiology.

Within the sociological literature, uncertainty is viewed as a *personal condition* moving from one polar extreme (uncertainty) to the other (control), instead of as a *process* of gaining expertise. For Fox, residents gain confidence in an increasingly uncertain medical field. Light and Atkinson argue that residents move from uncertainty to control to maintain professional expertise. Turning uncertainty and control into opposing personal characteristics individualizes knowledge acquisition and reifies the concepts as fixed states. Evidence-based medicine accentuates the open-ended nature of dealing with a variety of knowledge-related uncertainties. Residents might thus repeatedly experience uncertainty, but they are not necessarily uncertain. Throughout their education and their career, physicians need to *continuously manage the uncertainty of medical knowledge*. The contingent nature of medicine makes completely controlling uncertainties impossible.

The continuous process of managing uncertainty does not mean that residents do not get better at dealing with uncertain knowledge over time. They and many observers report the

development of a quality described as “clinical judgment,” an almost intuitive way of knowing how to doctor. We contend that such judgment develops out of managing an uncertain knowledge base, but not in opposition to it. Our distinction of “librarian” and “researcher” residents indicates that the strength of a doctor’s clinical judgment depends on the extent that they are willing to engage with the many uncertainties of the knowledge base.

What is the effect of a broadly supported standardization movement for resident’s work? While critics consider guidelines and protocols one more nail in the coffin of humanized health care and advocates hail standardization as the means to render medicine scientific, we notice a more moderate effect. Protocols and guidelines do not replace but reorient judgment. Evidence-based medicine allows residents to approach attending physicians and patients with comfort in certain circumstances, and with renewed trepidation in other situations (because the literature is not conclusive or univocal). The influx of EBM shifts residents’ attention to a more elaborate set of biomedical and epidemiological variables.

Yet it would be wrong to conclude that such a reorientation renders medicine less “human-

istic” or diminishes residents’ faith in the overall purpose of medicine. If the research on uncertainty validates any functionalist premise, it is the premise of unintended consequences. Scholars studying the introduction of new medical technologies have noted that the consequences of such technologies are multiple and often contradictory (Timmermans 2000). New medical technologies might as well lead to increased choice, access, equity, and patient autonomy as to objectification, overspecialization, and bureaucratization. Managing uncertainty similarly has a myriad of consequences that cannot be decided a priori. Our research suggests that the perceived inadequacy of available evidence might lead to a validation of “humanistic” concerns.

In sum, our retooling of the uncertainty concept in light of EBM centers it in the sociology of knowledge and technology. Our conclusion is that EBM’s standardization urge neither eradicated nor reinforced but transformed uncertain medical knowledge. Evidence-based medicine’s legacy crystallizes in the honing of evidence-based clinical judgment and is as apparent in disregarding and avoiding research as it is in protocol following and routine research consultations.

APPENDIX. Interview Questions

1. Pseudonym³: _____
2. Year in residency: _____
3. Location of residency: _____
4. Describe your current rotation as a resident. What responsibilities do you hold?
5. Describe your daily/weekly work schedule. What was your schedule yesterday?
6. Describe a diagnostic dilemma you faced in the last week. How did you reach a decision about the appropriate diagnosis? How did you know what tests to order?
7. Describe a treatment dilemma you faced in the last week. How did you reach a decision about the appropriate treatment? How did you know what medications to prescribe?
8. How would you define the term “evidence-based medicine (EBM)?”
9. What tools do you have on the ward to conduct a literature search? How accessible are those tools? Do you have enough time to practice EBM?
10. How important is EBM in your residency? Where is it most prominent: morning reports, bedside rounds, journal clubs, conferences, workshops, etc? When are you most likely to conduct a literature search?
11. Describe a typical journal club meeting. Have you presented an article or topic in a recent meeting? If so, what kinds of information did you discuss? How did you prepare for your presentation?
12. What criteria do you use when evaluating medical literature? Do you feel you have the skills to adequately evaluate an article?
13. Have you ever contradicted an attending physician based on the evidence? Has a medical student ever contradicted you based on the evidence?
14. Describe a recent experience where you found a gap in the literature or conflicting evidence. How did you handle the situation?
15. Describe the last time you approached an attending with a diagnostic or treatment question. How did you choose whom to approach? How did you evaluate the information they provided?
16. Do you treat asthma patients? Are you familiar with the National Heart, Lung, and Blood Institute Asthma Practice Guidelines? If you were making a diagnosis about the severity of an asthma condition would you follow these guidelines? How closely would you follow them?
17. How frequently do you use guidelines in your everyday practice? How frequently do you conduct literature searches?

APPENDIX. (Continued)

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18. In your experience, has EBM reduced the uncertainty of clinical decision making? Why or why not?
 19. Do you conduct research? Explain.
 20. Do you see yourself using EBM once your residency is finished? What are your career plans post-residency?
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NOTES

1. Research protocols offer pre-defined, step-wise, optimal paths through complex or troublesome medical situations. Clinical practice guidelines bring empirical evidence (with applied statistical techniques) to bear on problems concerning individual patients (Berg 1997).
2. The concept of “systems thinking” describes an organization as a whole rather than a sum of parts. Deming (1986) stresses that harmful variation in organizational practices result primarily from flaws in the “system,” not the faults of individual workers. Real improvements in organizations can be made through scientific investigation of the systemic causes of variation. Senge (1990b) adds that systems best function when they are “learning organizations.” Analysis of the system should be continual such that standards are constantly investigated and revised in a “feedback” loop.
3. All names of residents are pseudonyms to protect confidentiality and anonymity.
4. Although our sample is too small to make a definite determination, some first-year residents were researchers while some older residents used the literature as librarians. Some first-year students expressed their need to look-up and check virtually everything, and therefore likened the practice of EBM to research. We also did not find that librarians eventually would turn into researchers or vice versa. We present the categories as distinct approaches to information usage.
5. See article on the web at: www.aap.org/policy/paramtoc.html
6. See article on the web at: www.mdconsult.com
7. Only Light (1979) and Katz (1984) focus their writing on the socialization of residents, but Fox (1957, 1980, 2000) and Atkinson (1984) imply that uncertainty and control has relevance for residency training.
8. For a critique of this dichotomy, see Berg (1997).
9. To settle this issue conclusively, patient reports should complement the self assessments. Such data fall beyond the scope of this project.
10. The process might also apply to patients gathering medical knowledge.

REFERENCES

- Anspach, Renee. 1993. *Deciding Who Lives: Fateful Choices in the Intensive Care Nursery*. Berkeley, CA: University of California Press.
- Atkinson, Paul. 1984. “Training for Certainty.” *Social Science and Medicine* 19:949–56.
- Barnett, Scott H., Susan Kaiser, Kasner Lynn Morgan, Jean Sullivant, Albert Sie, David Rose, Marta Rico, Lawrence Smith, Clyde Schechter, Myron Miller, and Alex Stagnaro-Green. 2000. “An Integrated Program for Evidence-Based Medicine in Medical School.” *The Mount Sinai Journal of Medicine* 67:163–68.
- Batalden, Paul B. and Patricia K. Stoltz. 1993. “A Framework for the Continual Improvement of Health Care: Building and Applying Professional and Improvement Knowledge to Test Changes in Daily Work.” *Joint Commission Journal on Quality Improvement* 19:424–47.
- Bazarian, Jeffrey J., Colleen O. Davis, Linda L. Spillane, Howard Blumstein, and Sandra M. Schneider. 1999. “Teaching Emergency Medicine Residents Evidence-Based Critical Appraisal Skills: A Controlled Trial.” *Annals of Emergency Medicine* 34:148–54.
- Berg, Marc. 1997. *Rationalizing Medical Work: Decision Support Techniques and Medical Practices*. Cambridge, MA: Massachusetts Institute of Technology Press.
- Bosk, Charles L. 1980. “Occupational Rituals in Patient Management.” *New England Journal of Medicine* 303:71–76.
- Bowker, Geoffrey and S. Leigh Star. 1999. *Sorting Things Out*. Cambridge, MA: Massachusetts Institute of Technology Press.
- Collins, Harry. 1985. *Changing Order: Replication and Induction in Scientific Practice*. London: SAGE.
- Davis, Fred. 1960. “Uncertainty in Medical Prognosis, Clinical and Functional.” *American Journal of Sociology* 66:41–47.
- Deming, W. Edward. 1986. *Out of the Crisis*. Cambridge, MA: Massachusetts Institute of

- Technology Center for Advanced Engineering Study.
- Deming, Edward. 2000. *The New Economics: For Industry, Government, and Education*. Cambridge, MA: Massachusetts Institute of Technology Press.
- Eddy, David. 1996. *Clinical Decision Making: From Theory to Practice*. Boston: Jones and Bartlett Publishers.
- Eisenberg, John M. 1999. "Ten Lessons for Evidence-Based Technology Assessment." *Journal of the American Medical Association (JAMA)* 282:1865-69.
- Foucault, Michel. 1973. *The Birth of the Clinic*. New York: Vintage Books.
- Fox, Renee. 1957. "Training for Uncertainty." Pp. 207-241 in *The Student Physician*, edited by Robert K. Merton, G. Reader, and P. L. Kendall. Cambridge, MA: Harvard University Press.
- Fox, Renee. 1980. "The Evolution of Medical Uncertainty." *Milbank Memorial Fund Quarterly* 58:1-49.
- Fox, Renee C. 2000. "Medical Uncertainty Revisited." Pp. 409-25 in *The Handbook of Social Studies in Health and Medicine*, edited by Gary L. Albrecht, Ray Fitzpatrick, and Susan C. Scrimshaw. London: SAGE Publications.
- Freidson, Eliot. 1986. *Professional Powers: A Study of the Institutionalization of Formal Knowledge*. Chicago, IL: Chicago University Press.
- Freidson, Eliot. 1994. *Professionalism Reborn: Theory, Prophecy, and Policy*. Chicago, IL: University of Chicago Press.
- Friedland, Daniel J. 1999. *Evidence Based Medicine: A Framework for Clinical Practice*. Stamford, CT: Appleton & Lange.
- Ghali, William A., Richard Saitz, Arthur H. Eskew, Mukund Gupta, Hude Quan, and Warren Y. Hershman. 2000. "Successful Teaching in Evidence-Based Medicine." *Medical Education* 34:18-22.
- Glaser, Barney and Anselm Strauss. 1967. *The Discovery of Grounded Theory*. New York: Aldine de Gruyter.
- Good, Mary-Jo Del Vecchio. 1998. *American Medicine: The Quest for Competence*. Berkeley, CA: California University Press.
- Graef, John W. 1997. *Manual of Pediatric Therapeutics*. Philadelphia: Lippincott Raven.
- Green, Michael L. 1999. "Graduate Medical Education Training in Clinical Epidemiology, Critical Appraisal and Evidence-Based Medicine: A Critical Review of Curricula." *Academic Medicine* 74:686-94.
- Grimes, David A. 1995. "Introducing Evidence-Based Medicine into a Department of Obstetrics and Gynecology." *Obstetrics and Gynecology* 86:451-57.
- Haas, Jack and William Shaffir. 1987. *Becoming Doctors: The Adoption of a Cloak of Competence*. Greenwich, CT: JAI Press.
- Hafferty, Frederic. 2000. "Reconfiguring the Sociology of Medical Education: Emerging Topics and Pressing Issues." Pp. 238-57 in *Handbook of Medical Sociology*, edited by Chloe E. Bird, Peter E. Conrad, and Allen M. Fremont. Upper Saddle River, NJ: Prentice Hall.
- Havighurst, Clark C. 1995. *Health Care Choices: Private Contracts as Instruments of Health Reform*. Washington, DC: The AEI Press.
- Hughes, Everett. 1971. *The Sociological Eye: Selected Papers*. Chicago, IL: Aldine-Atherton.
- Katz, Jay. 1984. *The Silent World of Doctor and Patient*. New York: Free Press.
- Kitson, A. 1997. "Using Evidence to Demonstrate the Value of Nursing." *Nursing Standard* 11:34-39.
- Krislov, Samuel. 1997. *How Nations Choose Product Standards and Standards Change Nations*. Pittsburgh, PA: University of Pittsburgh Press.
- Latour, Bruno. 1999. *Pandora's Hope: Essays on the Reality of Science Studies*. Cambridge, MA: Harvard University Press.
- Light, Donald. 1979. "Uncertainty and Control in Professional Training." *Journal of Health and Social Behavior* 20:310-22.
- McCloskey, Joanne and Gloria Bulechek. 2000. *Nursing Interventions Classification (NIC)*. St. Louis, MO: Mosby-Year Book.
- Merton, Robert, G.G. Reader and P.L. Kendall. 1957. *The Student-Physician: Introductory Studies in the Sociology of Medical Education*. Cambridge, MA: The Harvard University Press for the Commonwealth Fund.
- National Heart, Lung, and Blood Institute. 1998. *Global Initiative for Asthma*. Bethesda, MD: National Heart, Lung, and Blood Institute.
- Nelson, Eugene C., Paul B. Batalden, and Jeanne C. Ryer. 1998. *Clinical Improvement Action Guide*. Oakbrook Terrace, IL: Joint Commission on Accreditation of Healthcare Organizations.
- Norman, Geoffrey R. and Susan I. Shannon. 1998. "Effectiveness of Instruction in Critical Appraisal (Evidence-Based Medicine) Skills: A Critical Appraisal." *Canadian Medical Association Journal* 158:177-81.
- O'Connell, Joseph. 1993. "Metrology: The Creation of Universality by the Circulation of Particulars." *Social Studies of Science* 23:129-73.
- Olesen, Virginia and Elvi Waik Whittaker. 1968. *The Silent Dialogue*. San Francisco, CA: Jossey-Bass.
- Perrow, Charles. 1984. *Normal Accidents: Living with High Risk Technologies*. New York, NY: Basic Books.
- Sackett, David L., William M.C. Rosenberg, J.A. Gray, Brian R. Haynes, and W. Scott Richardson. 1996. "Evidence Based Medicine: What It Is And What It Isn't." *British Medical Journal* 312:71-72.

- Senge, Peter. 1990a. *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York, NY: Doubleday Currency.
- Senge, Pete M. 1990b. "The Leader's New Work: Building Learning Organizations." *Sloan Management Review* 32:7-23.
- Siberry, George K. and Robert Iannone, eds. 2000. *The Harriet Lane Handbook: A Manual for Pediatric House Officers*. St. Louis, MO: Mosby.
- Starr, Paul. 1982. *The Social Transformation of Medicine*. New York, NY: Basic Books.
- Strauss, Anselm. 1987. *Qualitative Analysis for Social Scientists*. Cambridge, UK: Cambridge University Press.
- Sutherland, S.E. 2001. "Evidence-Based Dentistry." *Journal of the Canadian Dental Association* 67:277-80.
- Timmermans, Stefan. 2000. "Technology and Medical Practice." Pp. 309-21 in *Handbook of Medical Sociology*, edited by Chloe Bird, Peter Conrad, and Allen Fremont. Upper Saddle River, NJ: Prentice Hall, Inc.
- Timmermans, Stefan and Marc Berg. 1997. "Standardization in Action: Achieving Local Universality through Medical Protocols." *Social Studies of Science* 26:769-99.
- Vaughan, Diane. 1996. *The Challenger Launch Decision: Risky Technology, Culture and Deviance at NASA*. Chicago, IL: University of Chicago Press.
- Waitzkin, Howard. 1998. "Is Our Work Dangerous? Should it Be?" *Journal of Health and Social Behavior* 39:7-17.
- Weir, Lorna and Jasmin Habib. 1997. "A Critical Feminist Analysis of the Final Report of the Royal Commission on New Reproductive Technologies." *Studies in Political Economy* 52:137-54.
- Welch, Gilbert H. and Jon D. Lurie. 2000. "Teaching Evidence-Based Medicine: Caveats and Challenges." *Academic Medicine* 75:235-40.
- Wennberg, John E. 1999. *The Dartmouth Atlas of Health Care 1999*. Chicago, IL: American Hospital Publishing.
- Woolf, Steven H., Richard Grol, Allen Hutchinson, Martin Eccles, and Jeremy Grimshaw. 1999. "Potential Benefits, Limitations, and Harms of Clinical Guidelines." *British Medical Journal* 318:527-30.

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