Final Report

SCAMeL Speedy Startups—Pilot Season Grants--2017

Title: "Best Practices in Teaching Evidence-Based Medicine, Population Health, Informatics, and 'Big Data' in Medical Schools"

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Award: $5,000

Contents

Summary

This qualitative research project provides information and insight on best practices in teaching evidence-based medicine (EBM), population health, informatics, and big data from multiple academic institutions, and reports on the extent to which librarians are involved in teaching these skills in medical schools' curricula.

Purpose:

1. Describe methods of teaching evidence-based medicine, and of assessing EBM knowledge and skills, at various medical and health sciences schools.
2. Describe content, delivery, and assessment approaches of EBM in some medical, pharmacy, nursing, public health, and allied health curricula.
3. Identify challenges – and strategies for addressing those challenges – in teaching EBM.
4. Explain the value of teaching evidence-based practice within the context of the availability of sophisticated point-of-care tools, such as UpToDate.
5. Describe variations in librarian participation in EBM curricula and courses.

This report presents findings from data gathered from 90 interviews at 16 institutions in the West, Pacific Northwest, and Midwest areas of the country. Themes and subthemes were analyzed and future research and activities were defined. This research has been presented at several conferences, and won first prize in the research poster competition at the annual conference of Academies Collaborative for the Health Professions, Southeast Educational (TEACH-S) Symposium, held on May 11, 2018 at University of Texas Health Science Center-Houston, Rice University.

Introduction

Teaching evidence-based medicine (EBM) is generally a vital and substantial portion of medical libraries' instructional programs. Librarians in the South Central Chapter (SCC) of the Medical Library Association have presented numerous papers and posters at annual conferences, at both the chapter and MLA levels, on developing and implementing EBM teaching into the medical school curriculum, and have published numerous journal articles on the subject. However, prior to this study, an in-depth qualitative study on the specific content and delivery approaches, and on the perceptions of both health sciences faculty and medical librarians, of EBM teaching in medical school curricula has not been conducted. This study could benefit instruction librarians by identifying and recommending those educational strategies that result in better learner outcomes and knowledge and skills retention. Studying these strategies in libraries outside of the SCC five-state region could bring fresh perspectives to both academic and hospital librarians, both for SCC and for other chapters.

In addition, teaching (EBM) has been shown to be both an opportunity and a challenge for medical schools and medical librarians. EBM instruction represents an opportunity for medical librarians to become involved at various points in the curriculum, from teaching individual modules to designing and leading courses. Challenges range from finding time in the curriculum to faculty's lack of EBM knowledge and skills, and to librarians' struggles to find a role as EBM instructors. Maggio et al.[1] also identified learner-centered challenges, including suboptimal role models and students' difficulty in mastering EBM skills that may hinder the ultimate practice of EBM after students graduate, and analyzed several educational approaches that were common across all institutions in the study.

Some of these approaches, such as longitudinal courses that are integrated into the curriculum over several semesters, were implemented at the Texas A&M University College of Medicine (COM), with an acknowledged low level of success. As a result, COM faculty are concerned that students may arrive in residencies from A&M without demonstrating competency in the required Entrustable Professional Activities (EPA)[2] for EBM. We do not know how to ensure or to measure this, especially since no further EBM instruction occurs after the second year.

Therefore, it is reasonable to explore how other medical schools teach and assess EBM skills and competencies. As one of the COM EBMSR course directors has declared, "EBM is the foundation for clinical quality." It is imperative that we prepare our students properly for this foundation. Learning how to go about teaching and assessing this core competency was the focus of this investigation.

Method

Study design. Using a grounded theory approach, semi-structured interviews were conducted with medical librarians and health sciences school faculty to address project goals and objectives. Nine questions (some questions were multi-part) were asked of each interviewee:

1. How does your school define evidence-based medicine? How important is it that students learn these skills in comparison to other topics? At what points in the 4-year curriculum does your medical school introduce EBM topics, such as PICO, searching the literature, biostatistics, and critical appraisal of evidence? How often are these concepts reinforced?
2. How well does EBM translate to medical practice? With all the sophisticated tools available now, is there still value in students learning how to ask the clinical question, how to search the primary literature, and how to critically appraise a journal article?
3. What facets of EBM do you consider most important that students retain? How do faculty ensure that students retain what they have learned?
4. How do clinical clerkship faculty receive faculty development in EBM?
5. What barriers, and strategies to overcome these barriers, have been implemented, and what degree of success have these realized?
6. What methods are you using to teach EBM? What exercises and case studies have worked best to instill EBM knowledge and skills? How are students assessed on their learning of these concepts?
7. How are you incorporating population health, health systems science, and "big data" into the curriculum? What learning methods are you using, and how do you determine if they are effective?
8. To what extent are librarians involved in the curriculum, and why (or why not)? What skills and benefits do you or would you see in having librarians involved in EBM/P curriculum design and delivery?
9. What would you like to know about how other schools teach EBM?

Site and interviewee selection. Three criteria were used to select institutions:

1. At least two NNLM (National Network of Libraries of Medicine) regions outside of the South Central Region. (https://nnlm.gov/). Visits included four NNLM regions outside of the South Central Region: Mid-Continental (2), Pacific Southwest (2), Pacific Northwest (4), and Greater Midwest (3).
2. A diverse representation of institutions in terms of size, administrative structure, experience in teaching evidence-based medicine, and type/extent of library service.

   Institutions ranged in size from large academic medical centers to smaller medical schools whose curricula are administered by an academic medical center in another state. One medical school was just getting started. Three libraries serve as their regions' Regional Medical Libraries, others formerly served as NNLM Resource Libraries, and a couple are Affiliated or are not NNLM members. One library in particular, Lane Medical Library at Stanford, is well-known for its EBM curriculum, and others are in various stages of EBM instruction.

2. Clustered in a geographic region to allow visits within a reasonable time frame.

   For this many sites, it is more time- and cost-effective to drive rather than to fly, so I selected institutions within a large area that could encompass the first two criteria, and which could be reached within a two-month period. While creating the Route Map (Fig. 1), I discovered three more sites that could be visited, for the same cost and time expenditure—which increased the efficiency and reach of my original proposal. Additionally, several interviewees suggested potential sites and people to include in the study, and they reached out to these colleagues on my behalf. Driving times occurred on weekends as much as possible, to optimize time spent at sites.

Several months of planning logistics and feasibility occurred prior to departure, but a good portion of the project grew organically, while "on the road". While several of the sites and interviewees were confirmed and scheduled in advance, quite a few more were set up during the trip. Prior to departing, I had reached out to several colleagues in the targeted region who are either friends or acquaintances to request their participation. I am grateful to them and to new contacts whom I met along the way for their enthusiastic welcomes and for their efforts in contacting their health sciences faculty and librarians to set up interviews.

IRB Review. The Texas A&M University Division of Research reviewed the Initial Review Submission and determined that this activity "is not research involving human subjects as defined by DHHS and FDA regulations. Further IRB review and approval by this organization is not required because this is not human research." IRB2017-0900

Results

Data Collection. Data collection took place over a 9-week period: July 29 – October 5. Ninety interviews were conducted at sixteen sites (Tables 1 and 2). The PI drove from home base in Austin to all sites within this time period, spending from 1 to 4 days at each site (Figure 1). Interviews lasted an average of 45 minutes, with one outlier taking nearly two hours (this was an interviewee who was extremely interested in the project and who was very enthusiastic)! No recording device was used, in order to lower any potential stress from interviewees and to promote greater candor. The investigator typed notes from each interview into Word documents, and took care to maintain eye contact with subjects to optimize a conversational feel, with the aim of putting the participant more at ease, thus resulting in richer detail. Indeed, one interviewee remarked, "I never even noticed that you were typing, it felt like we were just talking!" Each document was numbered, labeled with either "L" (Librarian) or "F" (Faculty), and dated. Librarians and Faculty accounted for almost equal proportions of interviews (n=90). Besides medical/health sciences libraries, five health sciences disciplines were represented by interviewed faculty: medicine, pharmacy, nursing, public health, and physical therapy/kinesiology (Table 1).

Table 1. Summary of Data Collection Activities, July 29-October 5, 2017.

No. sites	16	
No. interviews	90	
Ave. duration of interviews	45 minutes	
No. pages of data	400+	
Health sciences represented	Medical libraries Medical schools Pharmacy schools Nursing schools Public health schools Physical therapy schools Hospital nursing program	15 14 6 8 3 2 1
No. miles traveled	11,000k+	

Table 2. Institutions Visited, July 29-October 5, 2017

Institution	City
University of Colorado	Denver
University of Utah	Salt Lake City, UT
Stanford University	Stanford, CA
University of San Francisco	San Francisco, CA
Oregon Health & Science University	Portland, OR
Oregon State University	Portland, OR
University of Washington	Seattle, WA
Idaho State University	Boise, Pocatello, ID
Idaho College of Osteopathic Medicine (Idaho's first medical school)	Meridian, ID
Kalispell Regional Medical Center	Kalispell, MT
Montana State University, WWAMI Program	Bozeman, MT
University of Montana	Missoula, MT
University of North Dakota	Grand Forks, ND
University of Wisconsin	Madison, WI
University of Iowa	Iowa City, IA
Washington University	St. Louis, MO

Figure 1. Route Map--Interview Sites

Data analysis. For the first-round coding, a sample of 16 transcripts was independently analyzed by two raters. Raters had a very high level (0.95) of agreement on the themes that emerged and on the statements that were assigned to those themes; discussions on variability resulted in 100% concurrence. Five themes emerged: ***Current State and Existing Practices***; ***Importance and Value***; ***Barriers***; ***Strategies***; and ***Recommendations***. Raters then performed a second-round coding of three themes—***Barriers***, ***Strategies***, and ***Recommendations***--on **all** remaining transcripts. Sub-themes within each of these three themes were identified, and mentions of sub-themes by interviewees were counted. (Table 3)

Table 3. Themes and Subthemes: Numbers of times mentioned by health sciences school faculty and medical librarians. Highlights indicate most-frequently-mentioned subthemes in the respondent categories.

Theme: Barriers								
Subthemes	Value	Structure	Assessment	Time	Student Engagement	Student Skill	Stat/Bio/ Math	**TOTALS**
Faculty	21	20	20	18	19	20	11	129
Librarians	27	31	28	20	22	19	5	152
								281

Theme: Strategies									
Sub-themes	Relation-ships	Skills assessment	Relevance	Reinforce EBM concepts/ skills (integrated curriculum)	Standardization of EBM course content	Small groups/ active learning	Embedded medical librarians	Faculty engagement	**TOTALS**
Faculty	22	26	35	32	20	15	22	29	201
Librarians	26	24	32	26	15	13	21	27	184
									385

Theme: Recommendations									
Sub-themes	Integrated content delivery including simulations	Program evaluation	Standardiza-tion	Resource network/ repository	Name change from "EBM"	Relevance	Emphasize the process over quick answers (Teach students to be consumers of data)	Increase (or sustain) role of librarian	**TOTALS**
Faculty	27	24	23	10	5	34	31	28	182
Librarians	26	18	18	11	6	29	25	21	154
									336

There was a grand total of 1002 mentions of all sub-themes. **Strategies** led the three theme categories, with 385 mentions, followed by 336 **Recommendations** and 281 **Barriers**. The highest-mentioned subthemes, by both faculty and librarians, in the **Barriers** category were *Value*, *Structure*, and *Assessment*. Both faculty and librarians indicated that *Relevance* and *Reinforcing EBM Concepts and Skills* throughout the curriculum were **Strategies** that had been used or were being planned for use. Other frequently-mentioned **Strategies** were *Faculty Engagement*, *Skills Assessment*, and *Relationships*. *Relevance* also was identified as a highly-mentioned **Recommendation** subtheme by both faculty and librarians, as was *Integrated Curriculum*. Faculty also made frequent mention of *Emphasizing EBM as Process* and of *Increasing the Role of the Librarian* in teaching EBM.

Two topics that emerged from nearly all the interviews deserve special attention: *The "UpToDate" Factor* and *Librarian Involvement*. UpToDate (UTD) is a popular point-of-care clinical tool used by clinicians for information on diagnosis and treatment. The tool has been controversial among both medical librarians and medical school educators for several reasons, including its cost. Interviewees were divided on their views of UTD, which ranged from firm support, to "useful, but limited", to outright dislike and disdain. (Table 4).

Table 4. Perceptions of UpToDate by Faculty and Librarians

Like UTD	UTD Useful, but limited	Dislike UTD
"I trust that these tools paid attention to validity, outcomes, so that I don't have to; I don't have bandwidth to calculate confidence intervals. Good shortcut for me. This idea that every doctor is going to look up, do critical appraisal, isn't practical but has given us a framework for us to evolve into where somebody is doing these summaries, and build systems of care, not shooting form the hip, or loudest voice in room wins. " "UTD—gone a long way to making what they say evidence-based. UTD is pretty good. But doctors have to know how to discern--more important than ever that you know how to critically think; how do you appraise any information that you get."	"Useful tool, but not always up to date." "May not be as applicable for certain populations, but helpful for background information." "We make it a point to call out UTD, we point out its limitations. Explain that these are reasonable summaries, but may not be as rigorously researched." "Some of the UTD articles are very good, but varies in quality. So encourage them that shouldn't be your final answer, need to look at primary literature." 80% of questions are things you can look up in tertiary sources. But 20% you're going to have to dig out from primary literature.	"UTD—perfect example of why students and some residents don't think they need EBM." "Any time I watch resident give GR, I see UTD as reference, I want to smack them, this is not primary evidence--how to push students to be efficient and yet critical. They're not seeing it modeled by their faculty." "We do not buy or recommend UTD for students; we don't support it at all. UTD assumes a context that many students do not have. We don't let our students use UTD for because we want them to do it themselves." "UTD is their source for everything, rare to see them tell residents to bring article, maybe guidelines. Something's gone wrong between basics of EBM and what's happening now. Where have we gone astray with EBM?"

A wide range of librarian involvement in teaching EBM was described, and varying perceptions on the value and role of librarians in teaching EBM were expressed. (Table 5).

Table 5. Perceptions of Librarian Involvement in EBM Curriculum

Involvement	Value
"We haven't known how to operationalize them. Haven't thought to ask them."	"Not sure. Depends on librarians' individual backgrounds and experience. Try to instill this as a quick thing to do. Steered to pragmatic trying to use it in daily workflow. Nice to have librarian around; but in practice they have to do without librarian."
"Should be involved in everything. Our librarians were linchpins because they got everything; understand medicine enough."	"Whether or not they're appreciated and how should be real partners; with other teaching faculty. Having faculty status definitely helps their credibility."
"[Librarians involved in] practical application piece—small group, exercises, PBL, and how gets articulated in new language."	"Our librarians are incredibly helpful and incredibly underutilized."
"We're doing something better somewhere – younger doctors are different, in making clinical decisions. I think there is a change happening. People want to have good info to help patients make good decisions, care as partnership model is fostering, and people going to internet and getting information should be a motivation—you need to know what you're talking about. That should be a reason [for librarians' involvement]."	"Final paper is to write Drug Information question, a lot struggled with search strategy…if they asked for librarians' help they did better."
"In course we're planning, almost no librarian role. Will they appear again in clerkship phase? Librarians have been cut out, sidelined."	"Librarians and clinicians co-teaching increases searching skills and improves relevance. I bring clinical impact stuff to table, and librarian colleague brings richer knowledge of tools."
"Not very much. We have a librarian liaison; I work with her, took students to library last week, instruction on website, RefWorks. Students rely heavily on online. Not on expertise of librarian."	"There's a disconnect now, residents would email previous librarian for help. Now they feel like 'ok I've met them but don't see demo of value added.'"
"Never even occurred to me, then found out what librarians do, trying to get her to go to meetings, but I tend to fill that role. She could maybe help to assess their searching skills, but time is big issue."	"Not very much. We have a librarian liaison; I work with her, took students to library last week, instruction on website, refworks. Students rely heavily on online. Not on expertise of librarian."
"In course we're planning, almost no librarian role. Will they appear again in clerkship phase? Librarians have been cut out, sidelined."	"Trying to create solution for viability of education that librarians need to be actively involved; if I let it go it would wither away."
"Librarians did session on finding information: They went through all 13 case-based learning sessions, actively looked for places where they could link to information from ClinicalKey."	
"Tried to make sure they know about resources at [library]; last year had them go work with librarians, but feedback was that it wasn't very effective."	

"Library down a third of staff; have to make another slash to collections and services. Feel bad because this affects entire university." "Every student meets with librarian for scholarly project." "Librarians are involved in clerkships." "We have several campuses, librarians on all campuses, our librarians here also teach, some are small group facilitators. And they are embedded everywhere." "Involved in curriculum design, on curriculum committees. Trying to get them involved in information management regarding the curriculum. Colossal nightmare for people whose profession is medicine; so we thought of who is it who organizes information, so let's get them involved in doing that. We love our librarians!"	"It's ok: Same pat speech for each group of students, don't advance beyond don't do google. We would like other strategies to use case studies, to show them where would you go to find good patient teaching information, so that examples that she uses are based on real life stories than just getting up with powerpoint and having them search along with her." "Worry that there will be a generation that hasn't worked with librarians."

Building a New EBM Curriculum. One of the most enlightening discussions was with the dean and planning faculty for the new Idaho medical school near Boise, the Idaho College of Osteopathic Medicine. In essence, they are starting a medical school "from scratch", and the inaugural class started this Fall (2018). The leadership and faculty are taking a systems-based approach to teaching. In each of the systems, they'll be doing a lot of case work, which should drive them to what are current best practices, which in turn will be integrated into those cases in each of the systems. Their philosophy is to instill lifelong learning habits in students and a "thirst to not be complacent". The curriculum building is based on learning theory, using research that emphasizes contextualization as the best way to learn, since it integrates cognitive and meta-cognitive skills within the context of the actual practice of medicine. To that end, a portion of each Friday will be devoted to teaching EBM, and they are actively investigating how to get students excited about it.

Continual evaluation is a key component of the new program. They will not only evaluate EBM skills of students--assessment will be embedded in OSCEs and courses--they will also evaluate their faculty—including clinical faculty--in how they are incorporating EBM into their teaching. Assessment of teaching EBM will be built in to faculty evaluation, allowing them to "close the loop" and go back to curriculum committee with data on how faculty have performed.

The new Idaho medical school recognizes that faculty need training in EBM and in methods of teaching EBM. They will provide support for professional development. "If we say something's' important, we will give teaching and resources to support them, then evaluate them."

Interestingly, at the time of my visit, the new school was in the process of hiring a librarian—who was also one of my interviewees at Idaho State University the previous day! The dean of the new school emphatically asserted that the librarian would have faculty status, and was regarded as a vital member of the teaching and curriculum

planning team. "Big time, she's looped in, because information is so vital; she's the keeper of databases. We're integrating faculty/staff, we don't want any outliers, one culture, librarian is part of team. She is Faculty."

Questions. In answer to the open question, "What would you like to know about how other schools teach EBM?" nearly all interviewees had similar questions, centering around how to teach EBM and how to teach it in more meaningful way. **The most frequent question asked was about how to assess EBM skills**. Other common questions included:

- How do others teach EBM--specifically?
- What interactive methods are used?
- I want to see actual assignments from other institutions
- How do they motivate students to apply EBM concepts?
- Are we having the same struggles?
- How can medical librarians become more involved in curriculum?
- How to integrate EBM over 4 years?
- What are the perspectives of different disciplines?
- How do they motivate students to apply EBM concepts?
- Where does EBM fit into residencies?

Discussion

This study achieved eight of the nine objectives in the proposal to SCAMeL:

Objective	Findings (Selected)
1. Describe EBM structure, teaching methods, and curriculum placement at other medical schools.	• In transition at most schools • Some threaded, some stand-alone • Ranged from 1st year to 3rd year • Three schools used student-led active learning • Variations according to clerkships—depends on specialty; some teach it "on the fly", others have lectures • "Competencies on wards—I ask students to present, take a topic related to one of their px, have them pull relevant article, not a review article. Multiple choice doesn't work".
2. Describe the extent and type of librarians' involvement with teaching EBM.	Wide variation in librarians' participation and leadership/teaching roles; see Table 5.
3. Identify common challenges in teaching and learning EBM.	• Students, faculty, and/or institutions do not place value on EBM ➢ "Long history of disliking EBM here…" ➢ "EBM gets lip service from leadership right down to clerkships." ➢ "Our best solution is just to *give up* in this topic" ➢ "Lots of perception of EBM not being relevant" ➢ ***"Many use UpToDate as single resource"*** • EBM curriculum ill defined; faculty not formally trained ➢ "Never thought about the fact that faculty aren't trained" ➢ "We discuss EBM briefly"

3. Identify common challenges in teaching and learning EBM. (cont.)	➢ "Haven't standardized approach for wards; not all attendings use PICO" • Students and/or faculty intimidated by mathematical/ statistical component of EBM ➢ Statistics commonly taught (odds ratios, NNT, etc.), "but boards have more broad concepts and they're not getting it." ➢ "They don't know how to search, nervous about stats." ➢ "Everybody feels like they're maxed—doesn't matter; EBM is an afterthought—so math? I hate that stuff. That's the hidden side of it." ➢ "Such a gap in med students--they can memorize, but have no stat understanding; not rigorous, going through motions, all a canned experience that they don't learn anything from it." ➢ "Death knell—having statistician teach." • Difficulty in assessing student competency and/or curriculum effectiveness ➢ "Most students get varied according to faculty happen to be working with. Don't know how to evaluate it." ➢ "Assessments haven't been formalized" ➢ "Don't know how to evaluate it. How do we tell? We are supposed to assess all this stuff so we know they can do it" • Teaching/practicing EBM is time consuming ➢ "Need to have time set aside … hard to do during clerkships" ➢ "… time is a big issue" ➢ "Biggest barriers are *attitude and time*" ➢ "Accessibility—"when we do get face time with students it is very short" (Librarian) • Timing—"important to think about readiness to learn: at what stage are you ready to learn; give right intervention for each stage someone is at. So med student, what's their readiness; where are they, let's deliver curriculum that's appropriate to that. For example, this content is very well received by residents. That's a testament to fact that attitude and need for that content depends on context--we need to rethink how we do that for students, they're not ready for this content, but they need it." • Students demonstrate lack of interest in EBM curriculum • "Students recognize there's been a huge sea change in world since their teachers have been trained; students believe that faculty haven't kept up, so there's this level of mistrust and disbelief." • Students display little to no understanding of EBM skills • Incoming residents display wide range of EBM knowledge & skills • "I find a lack of rigor in how they read a research article" • "They'll read a lit rev and think that's all they need for synthesis" • "I get annoyed with questions, like they ask you definitions or questions without any effort to figure it out themselves" • "They are tech savvy, but are they information literate? No."

	• "They're still college students: think that this question has an answer--but medicine isn't certain. The fantasy is that they're going to know what to do when they start seeing patients." • Clinical faculty do not model EBM in practice
4. Identify successful and unsuccessful strategies and approaches to overcome EBM teaching and learning challenges.	• De-emphasize lecture--More active learning, peer instruction: "Even if have two people stop and do peer to peer pairs, works better than for straight lecture. The application piece is better when it's a few people; when you get to 6 people, one will look stuff up and others just sit there." • "Feedback over last year is that *small group is where learning occurs.*" • "They take roles: Evaluator, Discussant, Presenter; have to do all 3" • Instructors should be enthusiastic about subject matter ➢ Cultivate "spirit of inquiry" ➢ Deliver content in emotionally compelling way • Tie to real patients and problems • Weave EBM concepts and skills throughout the entire educational experience. • Differentiate levels of instruction: "Doers" (Researchers) versus "Users" (Consumers). • Faculty status for librarians: "Having faculty status definitely helps their credibility." • Clinician-Librarian team: "I bring clinical impact stuff to table, and librarian colleague brings richer knowledge of tools." • Faculty emphasis on librarians as information professionals • Build relationships to encourage collaboration & resource utilization • Faculty & med librarian--curriculum design & evaluation • Faculty & student – clarify role of med librarian in EBM process • Med librarian & student—Establish expertise • Clerkship faculty model EBM behavior • Assess student skill to determine where/how/which level to begin EBM instruction: "Everyone thinks they can do it--until they do" • Include EBM in OSCEs: "Evaluate skills like you would any other skill/competency: Can they apply in a clinical setting? Evaluation of their preceptors"
5. Describe evaluation measures to determine degree of success of these strategies and approaches.	• "The key to evaluation piece—evaluate skills like you would any other skill/competency; can they apply it in a clinical setting, either by evaluation of their preceptors. Because just being able to do one article appraisal and move on doesn't tell you that they are going to—or can—apply it." • Focus groups at end of semester for every course; about 20 students. Course directors come in and talk 15m; town hall: how course went. • "Incorporate JAMA Evidence into biostats section. NNT or NNH; how to interpret stat results. Use short answer questions to make them write. Multiple choice easier to grade but with short answer then you know that they know."

	• NAPLEX does test on literature evaluation--ability based outcomes; USMLE does not have critical appraisal questions. • When EBM not graded, students think it's not important. • "Exams were hard. Course evaluation scores were negative".
6. Validate survey or interview questions and data analysis methods for other medical librarians who wish to investigate the state of EBM teaching and learning at their institutions.	• Initial interview questions were modified after peer review by three medical school faculty, one of whom was an evaluation expert. • None of the interviewees asked for clarification when asked these questions; all responded appropriately. • Data analysis was performed by a qualitative research expert.
7. Describe how and where concepts and methods of population health, informatics, systems thinking, and "Big Data" are incorporated into medical schools' curricula.	• Ranged from "not much" to threads in curriculum that provide certificate available to med students—personalized medicine certificate, one of four different pathways could take: Pop Health, Value, Wellness; launched this year." • New department of pop health; part of Arts and Humanities course, Y1 and Y2. • Yes. Lifelong Learning—includes Health Systems Science, pop health, covered in intersession weeks. • Included in masters/doctoral programs (Nursing) • One course on population health (Medicine) • Objectives—adherence and compliance, getting px engagement with clinical decision making. • Trying to create advanced clerkships; many will focus on pop health; will start next academic year, will have medical home, everyone will get some basic knowledge, if more interested can go further.
8. Develop a rationale for teaching EBM in the third-year clerkships.	• "The more you can make it applicable for students. When EBM felt more relevant to me was in the clerkship years." • Many incoming residents weren't aware of, or competent in, some key EBM elements: PICO, searching PubMed critical appraisal tools, recognizing difference between surrogate and composite outcomes. Result was off-base conclusions in Journal Club. • Residencies request PubMed training from librarians. • Residencies give basic EBM instruction. • Clerkship faculty do not model EBM in practice.
9. Increase COM students' satisfaction with the EBMSR course.	This objective has been rendered moot: Since this project began (Spring 2018), the 3-semester EBMSR course at TAMU was discontinued. Students now attend a 1-week EBM course during Fall Intersession of Year 2. Two librarians are among faculty facilitators, but do not have any leadership or teaching role in this course.

This study found consensus, discordance, and questions about teaching EBM. Health sciences school faculty and medical librarians agreed that Evidence Based Medicine (EBM) skills are important and should be incorporated throughout the educational experience. However, they recognized many limitations in teaching EBM and in practicing EBM:

- EBM is still important in clinical practice. Sophisticated tools are resources that can support but not replace asking the clinical question and critical appraisal of the evidence.
- There is not enough time to practice EBM on every patient.
- Residents agree that evidence should guide practice decisions; however, residents' decision making lacks the rigor of critical appraisal (the third step of EBM).
- Faculty agree that physicians must clearly know what they are looking for; therefore an understanding of EBM is important.
- EBM must be relevant to assure that it will be practiced: "Keep it real, people they're working with are patients, they need to be able to find best information, make it about the person."

Many participants, primarily in undergraduate and graduate medical education, were confused as to how and when EBM concepts should be introduced to students. Multiple participants agreed that an EBM emphasis in the latter phases of medical student education made sense for knowledge retention and practical application. However, participants also discussed the conundrum that upper level students were frequently confused and lacked a true understanding of EBM skills, particularly the value of statistical insight. This suggests that EBM concepts should weave throughout the educational experience in order for students to hone EBM skills that will assist them with critical thinking in the clinical setting. On the other hand, the fact that first- and second-year students are focused on passing the USMLE Step 1 board exam, which has little to no EBM content, was identified as a crucial element in lack of student interest and attitude to EBM, and explains the absence of retention in later years. Most interviewees agreed that third-year medical students were "much more receptive, attentive to 'show me how you did that.'" However, few institutions train faculty in teaching EBM, and several acknowledged that they are unaware as to whether EBM is included in clinical clerkships. Several schools have "switched from knowledge objective to attitude objective", to "get students to the place where they want to know how to do it." Nearly all interviewees, regardless of discipline, expressed a desire to have better assessment methods for measuring levels of EBM competence.

It appeared that different disciplines approached teaching EBM in different ways and valued it differently. Pharmacy faculty and students tended to be more enthusiastic and accepting of the appropriateness of EBM in the curriculum, while medical school faculty and students struggled with teaching methods, negative attitudes, and how—or whether--to incorporate EBM into clinical education. Multiple speakers noted that nursing

programs place great emphasis on EBM concepts. Graduate level nurses demonstrated a high level of EBM skills and clear understanding of the practical application of EBM to clinical practice. A wide variability of course content and format, as well as who taught EBM segments, was observed between institutions and among individual disciplines within an institution.

The following assumptions and realities were among those revealed by these findings:

Assumptions

- Clinical faculty know EBM
- Clinical faculty incorporate EBM into teaching
- Graduating MDs possess EBM competencies

Realities:

- EBM is not consistently modeled in clinical teaching
- Faculty are not held accountable for incorporating EBM into teaching
- Wide range of competencies/knowledge exists in interns
- UpToDate has supplanted perceived need for EBM skills in practice
- Yet faculty and librarians still believe there is high value in teaching EBM
- Medical schools could improve EBM learning by talking with other health sciences schools
- Few EBM instructors know how to assess all EBM competencies
- Step 2 of EBM, Finding the Evidence (searching PubMed) is often not recognized as a competency that can or should be assessed

This study showed that it is too early to be able to identify "best practices" in teaching evidence-based medicine, primarily because there is not yet a consensus of how to figure out what best practices are in terms of student readiness for residencies. Faculty are passionate about improving EBM learning, but many are frustrated by the barriers. Medical schools can improve EBM learning by talking with other health sciences disciplines--but organizational commitment must support this effort from the top down. Librarians should be included in curriculum design and delivery. There should be objective assessments of all 5 steps of the EBM process, and faculty should be evaluated on their EBM teaching.

This exploratory study has led to more questions, primarily:

- What would an ideal EBM teaching program look like?
- Why is EBM not included on USMLE exams, e.g., PICO, PubMed searching, critical appraisal of articles)? Why is assessment the most commonly-expressed question among EBM instructors?
- If EBM is one of the EPAs, why are these competencies not assessed as other EPAs are?
- Why do EBM competencies of incoming residents range from "zero" to "proficient"? How does this range compare with other EPA competencies?

These answers are currently unknown, but they form the basis for my next research focus. Its aim will be to reach out to the accrediting agencies for both undergraduate and graduate medical education, to bring them together for an in-depth discussion, and to identify the disconnect between them in their competencies and assurances that these competencies have been gained, as well as their assumptions surrounding the educational experience in EBM from the first year of medical school to the final year of residency. This next study will explore reasons why there is a seeming lack of communication between these accrediting bodies about EBM teaching and will seek to align their competencies with each other and to come up with valid assessment instruments to cover variations in teaching methods. In doing this gap analysis, combined with data from this study and further consultation, the vision is to develop a standardized model for teaching EBM, which can be adopted and adapted by all health sciences schools.

Conclusion

This study hit a nerve. It quickly became obvious that EBM is a "hot topic" that has been emerging among health sciences schools as curriculum reform has unfolded. This study has helped to articulate the need for the development among stakeholders for a "blueprint" for teaching EBM. It supports a nationwide call for a consensus on the structure, delivery, value, and assessment of skills in teaching and of practicing EBM. To that end, further research and work will go toward building a shared repository and forum for all EBM teaching faculty and medical librarians, where no one discipline is regarded as "the leader," to include teaching materials, assessments, and an area for posing questions to a community of practice, and providing experiences, outcomes, materials. It is now time to build on the research and go to the next level: Engage all stakeholders, resolve identified common issues, and act to ensure that EBM competencies are completely and effectively integrated into health sciences education.

References

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2. Association of American Medical Colleges (AAMC). The Core Entrustable Professional Activities for Entering Residency. May 2014. https://www.aamc.org/initiatives/coreepas/

Outputs

Several presentations, oral papers, one poster, and two manuscripts have resulted from this research. *(cont. on next page)*.

Title	Type	Organization	Date
Teaching Evidence-Based Medicine: Perspectives from Other Schools	Oral Presentation: Educational Grand Rounds	College of Medicine Texas A&M University Health Science Center	12/5/2017
Teaching Evidence-Based Medicine: Perspectives of Academic Health Science Institutions	Oral Presentation: Monthly CONNECTions Webinar **NOTE: This webinar broke the record for attendance—more than 180 attendees (previous record was 118)!** https://youtu.be/RRvLKBeZhgM	National Network of Libraries of Medicine (NNLM)/South Central Region	4/11/2018
Searching for Best Practices in Teaching Evidence-Based Medicine: Findings of a Qualitative Study	Poster: Annual Conference **NOTE: This poster won First Prize in the Research Competition! (See Appendix)**	Academies Collaborative for the Health Professions, Southeast Educational (TEACH-S) Symposium University of Texas Health Science Center-Houston, Rice University	5/11/2018
Best Practices in Teaching Evidence-Based Medicine: A Qualitative, Multi-Site Study	Oral Presentation: Annual Conference	Medical Library Association Atlanta, GA	5/21/2018
Roles, Methods, and Values in Teaching Evidence-Based Medicine: Roaring or Silent Librarians?	Oral Presentation: Annual Conference	Canada Health Libraries Assn. St. John's, Newfoundland	7/17/2018
Mission Critical: Perceptions of Faculty and Librarians in Teaching Evidence-Based Medicine—A Qualitative, Multi-Site Study	Oral Presentation: Annual Conference	South Central Chapter of the Medical Library Association (SCC/MLA) San Antonio, TX.	10/23/2018
Best Practices in Teaching Evidence-Based Practice: Perceptions, Questions, and Recommendations from Health Sciences Faculty	Oral Presentation: Annual Conference	American Public Health Assn. San Diego, CA	11/13/2018

Working title: [Best Practices in Teaching Evidence-Based medicine: A Qualitative, Multi-Site Study]	Article	*J Medical Library Assoc.*	To be submitted November 2018
Working title: [Best Practices in Teaching Evidence-Based medicine: A Qualitative, Multi-Site Study]	Article	*Academic Medicine*	To be submitted December 2018

Expense Report

The entire $5,000 was expended for the categories identified in the proposal: Lodging, Gasoline, and Meals. This trip was supplemented by the 2017 David A. Kronick Traveling Fellowship ($2000) and by the PI's personal contributions.

Recognition of Funding Support

The PI and the Director of the Texas A&M University Medical Sciences Library wish to express our sincere gratitude to the South Central Academic Medical Libraries Consortium (SCAMeL) for its grant from the SCAMeL Speedy Startups: The Pilot Season 2017 program. It should be mentioned that this report represents only a fraction of the analysis that is yet to be performed on these data. The information gleaned is so robust and complex that it can be sifted and viewed from many different angles and at different levels. We plan to continue data analysis for additional findings and conclusions.

I would also like to note that these project results would not be as voluminous, in-depth, or robust had the data not been collected in face-to-face interviews. While there is some evidence that telephone interviews—and, more recently, interviews using Skype or web meeting software—provide results that are just as valid as in-person interviews, traditionalists in qualitative research insist that one does not get the same kind of quality with those methods. Making these visits in person impressed upon the interviewees that this study was of high enough importance that the investigator took the trouble and expense to travel to their sites, which increased the meaningfulness and perceived value of the conversations, and which provided a context that encouraged relationship-building—which, in turn, increased trust levels and led to potential future collaborations. I also got to attend several classes and sessions, and gained valuable insights into the delivery, processes, and content of EBM teaching. It is not possible to overemphasize the value of sitting down with each individual to ask for their perspectives and expertise in this area that is little understood by those outside of it. Therefore, we reiterate our sincere and profound gratitude to SCAMeL for helping to fund this unusual, slightly "out-of-the box" study, which has resulted in a sound evidence base upon which to build a second phase of research, and ultimately, impact on practice.

Respectfully submitted,

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