

How Exemplary Inpatient Teaching Physicians Foster Clinical Reasoning



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ABSTRACT

BACKGROUND: Clinical reasoning is a crucial component of training in health professions. These cognitive skills are necessary to provide quality care and avoid diagnostic error. Much previous literature has focused on teaching clinical reasoning in nonclinical environments and does not include learner reflections. The authors sought to explore, through multiple perspectives including learners, techniques used by exemplary inpatient clinician-educators for explicitly cultivating clinical reasoning.

METHODS: The authors conducted (2014-2015) a multisite, exploratory qualitative study examining how excellent clinician-educators foster clinical reasoning during general medicine rounds. This was accomplished through interviews of educators, focus group discussions with learners, and direct observations of clinical teaching. The authors reviewed field notes and transcripts using techniques of thematic analysis.

RESULTS: Twelve clinician-educators, 57 current learners, and 26 former learners participated in observations and interviews. The techniques and behaviors of educators were categorized into 4 themes, including 1) emphasizing organization and prioritization, 2) accessing prior knowledge, 3) thinking aloud, and 4) analyzing the literature.

CONCLUSIONS: The findings of this comprehensive study both confirm strategies found in previous literature and provide novel approaches. This is the first study to incorporate the perspectives of learners. Educators' techniques and behaviors, identified through direct observation and supported by reflections from the entire team, can inform best practices for the teaching of clinical reasoning.

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Sound clinical reasoning is essential for quality patient care. Diagnostic error is found in 5%-15% of cases in medicine,¹ and three-fourths of these are cognitive errors.² These statistics underscore the importance of developing the cognitive processes necessary for effective problem solving and diagnostic accuracy.³ Clinical reasoning therefore is a

critical component of professional training.⁴ These skills must be emphasized to all levels of learners to promote development and refinement with practice.^{5,6} Principles of adult learning theory suggest that medical students and house officers learn clinical reasoning skills most effectively within real-world clinical environments and contexts.^{7,8}

Techniques for teaching clinical reasoning in the patient care environment lack empirical evidence-based approaches and thus rely on educational theory, opinion, and experience.⁹ Much of the literature to date regarding the teaching and learning of clinical reasoning has focused on the classroom as well as reflections from clinician-educators and educational theorists, though this represents only a subset of the environments and stakeholders involved.¹⁰⁻¹²

The purpose of this qualitative study was to explore, through multiple perspectives including learners, 12 exemplary inpatient clinician-educators and their specific

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techniques for cultivating clinical reasoning within teams during general medicine rounds.

METHODS

Study Approach and Participant Sampling

We conducted a multisite, qualitative study in 2014 and 2015 to examine the teaching and learning within inpatient general medicine rounds. We specifically sought to gather 1) observable techniques clinician-educators use to explicitly foster learners' clinical reasoning skills; and 2) reflections of all team members on the efficacy of these techniques.

We used a modified snowball sampling approach¹³ in which individuals known to one member of the research team were contacted and asked to identify clinician-educators (also referred to as "attendings") for potential inclusion in the study. We also recruited from hospitals listed in "2015 U.S. News & World Report top medical schools: research" rankings,¹⁴ as well as historically black medical schools to improve sample variation. Finally, we contacted department and division leadership at these schools and asked for recommendations of attendings they considered to be great inpatient teachers.

We identified 59 potential participants. Sixteen attendings who represented a range of organizations and backgrounds were invited via e-mail. Interested participants provided a list of their current team members and 6-10 former learners we could contact. A total of 12 attendings and 83 current and former learners agreed to participate. This sample size was sufficient to identify common themes and reach data saturation.¹⁵ Nine of the participating attendings were male, and 9 were from medical schools in the top 25 of the U.S. News & World Report rankings.¹⁴ A list of the institutions represented is provided in [Table 1](#).

Data Collection

Observations. A 1-day site visit was conducted with each attending. Two research team members observed attendings (n = 12) and current learners (n = 57) during rounds. Observers used field notes to record their own observations, with particular attention to group interactions, teaching approaches, and conversations. To observe without disrupting, research team members stood outside of the circle and remained silent. At the conclusion of each visit, research observers compared and combined field notes.

Interviews and Focus Groups. To supplement field notes, we also conducted individual, semi-structured interviews with attendings, focus groups with their current team (n = 46), and interviews or focus groups with their former learners (n = 26) ([Supplement](#), available online). Former learners who were not local or were unavailable participated in individual phone interviews at a later date. All interviews and focus groups were audio-recorded and transcribed.

This study was determined to be exempt by the University of Michigan Institutional Review Board. Participation was completely voluntary and could be ceased at any time. We offered no incentives for participation.

Data Analysis

Data were analyzed using a thematic analysis approach,¹⁶ and NVivo 10 software (QSR International, Doncaster, Victoria, Australia) was used to manage the data. After each site visit, corresponding transcripts and field notes were read and coded. When new codes were added, previously coded data were reviewed and

refined as necessary to apply the new code. Codes were then grouped into salient themes.

RESULTS

Coded interview data and field notes were categorized into 4 themes describing behaviors and techniques used by exemplary attendings to explicitly foster clinical reasoning skills during inpatient teaching rounds. These themes were 1) emphasizing organization and prioritization, 2) accessing prior knowledge, 3) thinking aloud, and 4) analyzing the literature. We present reflections from learners within the text and supporting quotes from attendings in [Table 2](#).

Emphasizing Organization and Prioritization

Learners identified ways in which their attendings simplified the myriad details from the patient's history, physical examination, and diagnostic data into manageable frameworks. Learners reported that attendings demonstrated strategies for organizing information rather than relying on memorization, to ensure lasting recall.

Several learners noted that exemplary attendings combined explanations of complex topics with helpful visual aids. One learner stated, "I love how he has like the same picture that he draws, no matter what like pathophys we are talking about. It makes things that are somewhat esoteric so much more accessible." Another noted this technique was

CLINICAL SIGNIFICANCE

- Much previous literature has focused on teaching clinical reasoning in nonclinical environments and does not include learner reflections.
- Qualitative methods, including observation of clinical teaching and learner interviews, revealed several key behaviors and techniques used by exemplary inpatient educators to explicitly foster clinical reasoning.
- Exemplary educators emphasized organization and prioritization rather than memorization, and they encouraged learners to harness prior knowledge, provide rationale for decision making, and critically analyze the literature.

Table 1 Affiliated Institutions of Participant Attendings (N = 12)

| Institution Represented | Region |
|--|-----------|
| Baylor College of Medicine | South |
| Cleveland Clinic | Midwest |
| Massachusetts General Hospital | Northeast |
| Northwestern University; Jesse Brown | Midwest |
| Veterans Affairs (VA) Medical Center | |
| Rush University; Cook County Chicago | Midwest |
| Tulane University | South |
| University of California, San Francisco; | West |
| San Francisco VA Medical Center* | |
| University of Chicago Pritzker School of | Midwest |
| Medicine | |
| University of Michigan | Midwest |
| University of Washington; Seattle VA | West |
| Medical Center | |
| University of Wisconsin-Madison | Midwest |

*Two attendings participated from this institution.

not relegated to pictures but also organized drawings and schemas.

It's structured and you can tell that in the way that he will speak. He will introduce something as having a branch point here... or there are three things to think about, and the use of multiple [colors] on the whiteboard, the way he will map out or outline something so that there is kind of a way to make sense of it all and to organize it.

Learners also described how attendings organized and simplified complex patient information by prioritizing the essential elements of a patient's hospitalization.

It's easy to get overloaded.... You've got 10 or 12 different things going on—and sometimes in just 1 patient. And for her to come in and say when you get down to the bottom of this, here is the 1 or 2 things that absolutely have to happen or fall in place for this person to do well or to be able to get out of here and go home. You know, that really was, I mean, reassuring when you are the intern, taking it down and simplifying it.

Accessing Prior Knowledge

Learners reported that their attendings used several strategies that helped them access prior medical knowledge. Specifically, these strategies fostered learners' thinking across their experiences within medical school and patient care.

For instance, learners reported that attendings asked them to draw on their experiences of prior patient cases and apply lessons learned to address current patient needs.

...The things I felt like I learned from him were...a deeper knowledge base and richer ability to pull on old cases and relate them to new ones and be able to take those learnings and be able to apply them.

Attendings inspired learners to access prior knowledge by facilitating compare-and-contrast cognitive strategies to examine how and why patients were managed with similar or different approaches than patients previously encountered. Because not even master clinicians are able to recall all details of every condition, one goal of clinical reasoning is to build and hone illness scripts. These scripts—the predictable details of the condition such as predisposing factors, clinical presentation, and complications—form mental prototypes of diseases for more rapid recall and use in reasoning.^{17,18} Attendings assisted this process by asking relevant questions of their learners. These questions encouraged learners to propose differential diagnoses, prioritize these lists and modify them as new information is learned, and reflect on previous patients with similar conditions or symptoms.

...or she'll take the same problem and say so how is this patient different type thing. So they may both come out as a-fib or an arrhythmia and then, "well why are we treating this patient differently?"

Thinking Aloud

Attendings used think-aloud strategies to foster learners' clinical reasoning skills. These took several forms, including prompting the learners to verbalize their thought processes and reflect on their decision making, as well as modeling the attendings' own thought processes.

Learners appreciated attendings who encouraged them to think aloud and provide rationale for their management plans. By articulating their thinking, learners were able to clarify and felt that their understanding was deepened.

I had to actually think about why I wanted to do things, and then I was allowed to do them.... I remember specifically wanting to do a cosyntropin stim test on a patient and he told me I had to explain why I needed to do that before we proceeded with ordering the test and actually doing it myself. So, in that regard, he was very invested in me trying to learn.

A key skill in clinical medicine is the ability to anticipate potential pitfalls or deviations in the patient's expected clinical course. The attendings we observed encouraged learners to practice anticipatory medicine; that is, to predict these deviations and prepare for them appropriately.

He uses a Wayne Gretzky quote about skating 'to where the puck is going to be' versus skating to where the puck is.... A lot of the things he teaches us are about predicting changes and predicting things. So on rounds, he is always referring this might happen, we are going to prepare for this; things like that.

Attendings also modeled their own thought processes as a teaching method. This strategy could best be summarized

Table 2 Themes, Techniques, and Representative Quotes from Exemplary Attendings

| Theme | Example Technique | Attending Quote |
|---|--|--|
| Emphasizing Organization and Prioritization | Simplify complex medical topics; teach how to synthesize and approach problems | So I'm pushed to make things clear, simple, and constantly be reprioritizing, reassessing... And so it's one thing to try and memorize everything that is going on with your patients; it's another thing to synthesize and say like this is the big picture, these are the major points, the big decisions. |
| Accessing Prior Knowledge | Ask learners to draw on their experiences of prior cases and apply lessons learned to current patients | With pathophysiology you can sometimes back up and say, well, let's think back to how would this work from what you learned in medical school, and can we start to build on something here? |
| | Facilitate compare-and-contrast cognitive strategies for different patients | I'm focused on today's patients but I'm probably more focused on the patients that aren't sick yet, that these people are going to see 5, 10 years down.... I try to address the question for that patient but then quickly spin to a generic approach, which would encompass lots of different types of patients that would have this same sort of problem. |
| Thinking Aloud | Encourage learners to articulate their thought processes out loud in order to clarify and check for their understanding | I often have to talk out loud to colleagues about it, and it becomes more clear as you talk through it for yourself. |
| | Demonstrate humility and recognize your own uncertainty and prior mistakes; use this humility to inspire lifelong learning | And if you don't know, the only problem with not knowing is if you don't ever go look it up so that you know the next time. Because the biggest challenge for us—and the biggest danger to our patients, I think—is if we don't admit what we don't know. And I don't know that medicine always allows us to do that but I think it's a good way to sort of poke holes in your own fund of knowledge to go find the answers, so I tell them that, it's fine. I don't promise you that I'm going to know either but if we don't know and we don't go look it up, that's where we've done wrong; not the not knowing part. |
| Analyzing the Literature | Prompt learners to design hypothetical research studies to address gaps in literature | This is a generalizable strategy of teaching in the ward environment where you're looking at a question that comes up and then you can say how would we study that question? And so it would be, I don't know, frequency of a diagnosis, what kind of study would you do to figure that out? Or a therapy, how would we evaluate a therapy like what you saw this morning? |

by one learner who noted that, for the attending, “his thinking was his teaching.”

For instance, learners especially appreciated the humility attendings demonstrated in identifying their own uncertainty or prior mistakes.

You know the typical stories they tell. “Nobody was able to figure it out, but then I came in and figured it out and everything was good.” Well, the stories my attending tells are mostly about the cases where he got the thing wrong. He wants to share his mistakes with you so you can learn from them.

One learner reflected on the ways in which her attending's thought processes were conveyed, not only through

verbal interactions at the point of care, but also through his documentation in the patient's medical record.

He's one of the only attendings that I have worked with that documents every day...and he doesn't *only* rely on what you have done, he has his own perception and he writes it down. So then this allows you...to know and see what's going on in his mind, what's his thought process, what it's like.

Analyzing the Literature

Finally, learners reported that their attendings found a variety of ways to critically analyze and connect medical scholarship with the care of the patients. Their methods

reiterate the value of not simply assigning reading to learners, but rather demonstrating how to read research to support clinical reasoning. Attendings utilized active learning strategies, even when clinical questions could not be answered by existing scholarship.

Specifically, attendings modeled how to critically analyze rather than simply accept research findings.

But I think having somebody who really stands out and their interpretation of the literature—not just their knowledge but how they interpret it, I think that’s something unique. And [the attending] is like that. Yeah, he’s somebody who will bring up these kind of bread and butter medicine topics like IVC filters and he’s always got his opinion on the quality of the literature and how he interprets it.

Attendings stressed the significance of using current evidence to support clinical decision making. One learner noted that he has adopted this practice in his own teaching approach.

He’s teaching how to read the literature to make clinical decisions.... I teach that exactly how he taught me how to do it, to crunch the numbers yourself, to really boil it down to numbers to treat, to use evidence-based decisions.

Finally, attendings recognized gaps in medical literature and that not all clinical questions can be easily answered. They captured these moments as teaching opportunities by prompting learners to design research studies that might address these gaps.

But the one thing I think is unique...is the idea of creating your own [randomized controlled trial] or like how would you study this. And I think that’s really neat because I definitely don’t learn passively...and so it’s another way of manipulating the information in your head and thinking about it critically—which I really liked.

DISCUSSION

The duties of inpatient clinician-educators are numerous. They must gather critical elements of the patient’s history and examination, obtain diagnostic tests, harness prior knowledge and experience, accurately interpret data, develop and prioritize a list of potential diagnoses, decide on comprehensive, individualized management plans, and reflect on the decision-making process. Together, these tasks encompass clinical reasoning.^{19,20} Yet inpatient clinician-educators are also responsible for fostering principles of clinical reasoning within their teams, to develop the next generations of effective physicians.

The clinician-educator’s goal of cultivating clinical reasoning skills is beset by several challenges. The patient care environment is replete with learners of varying sophistication levels, patients with predetermined diagnoses, reliance on technology over interactions with patients, and a “hidden curriculum” that rewards rapid factual recall rather than critical reflection.²¹ Additionally, the clinician-educator is concurrently balancing educational objectives and evaluation of learners with optimal patient care.²²

The purposes of this study were to directly observe how clinician-educators overcome these challenges while teaching clinical reasoning during rounds and to evaluate how these methods resonated with learners. Through our qualitative analysis of the perspectives of attendings and current and former learners, we identified 4 themes that capture how attendings foster clinical reasoning: 1) emphasizing organization and prioritization, 2) accessing prior knowledge, 3) thinking aloud, and 4) analyzing the literature.

The clinician-educators we examined in this study approached the teaching of clinical reasoning with many strategies found in previous literature. They taught these concepts to all learning levels.^{6,7,18} They simplified, categorized, and organized patient information and prioritized key elements of the hospitalization.^{18,23} They focused on conceptualization rather than memorization.²⁴⁻²⁶ They recognized that expert clinicians must store and retrieve key information on many different diagnoses quickly through the use of illness scripts,^{4,18,27-29} a finding emphasized by the recent review by Brush et al.³⁰ Attendings encouraged learners to compare and contrast prior patient presentations with current patients to develop these scripts, not only to recognize similar conditions in the future but also to recognize subtle variations.^{6,18,24,25,29-33} Attendings asked questions that prompted learners to think aloud and provide justification for their plans^{9,21,30,34} and subsequently provided their own rationale and thought processes to model these for learners.^{9,18,21,33,35} They admitted the uncertainty and ambiguity that accompany clinical medicine.^{20,21} Finally, they fostered critical analysis and interpretation of literature rather than simple acceptance of findings.²¹

Our study adds to the existing literature in specific ways. We combined direct observation in an inpatient clinical environment and interviews with exemplary attendings and their learners to form a comprehensive picture of the teaching and learning of clinical reasoning. Observations of clinician-educators’ actions and behaviors within authentic clinical environments are needed to inform the practice of teaching clinical reasoning.^{4,6-8} To our knowledge, perspectives from learners are absent from the research on best practices for facilitating clinical reasoning, and our study emphasizes the voices of these key stakeholders. We also observed several techniques that have not been significantly described in previous studies. For instance, learners reflected that attendings’ documentation served as a useful model to better understand their clinical reasoning. They also valued active learning opportunities, such as developing hypothetical study designs.

Our findings should be interpreted in the context of some possible limitations. First, it was conducted with a limited number of attendings and their learners from larger, research-intensive hospitals in the United States. The participant attendings were purposefully selected, albeit through a non-exhaustive method, to provide a range in attending and facility characteristics, and enough interviews were conducted to reach data saturation.¹⁵ However, the

findings may not be generalizable to attendings in other settings. Second, this study focused on teaching during general medicine rounds and the results may not be generalizable to other subspecialties. Finally, as with all observational studies, there is potential for a Hawthorne effect. Our research team attempted to mitigate this by standing back and remaining silent to be as unobtrusive as possible.

Despite these limitations, our multisite qualitative study is important because it offers a framework of tangible behaviors and techniques for attending physicians to effectively facilitate clinical reasoning in the inpatient environment. We found empirical support for methods proposed by previous authors, and we add to the existing literature by including the perspectives of learners, key stakeholders in this educational endeavor. We believe that the techniques used by attendings in our study—emphasizing organization and prioritization, accessing prior knowledge, thinking aloud, and analyzing the literature—can be readily adopted by physicians to improve their own teaching skills.

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SUPPLEMENTARY DATA

Supplementary data accompanying this article can be found in the online version at <http://dx.doi.org/10.1016/j.amjmed.2017.03.050>.

SEMI-STRUCTURED INTERVIEW GUIDE

Instructions to Begin the Interview

- Introduce the team (whoever is present).
- Review with the participant
 - The purpose of the study is to better understand what great inpatient medical attendings do.
 - That participation is completely voluntary, confidential, and can be stopped at any time.
 - That the interview will be recorded so that we are sure to capture their words accurately but that all recordings and transcripts will remain confidential to the best of our ability. The only people who will have access to any identifiable data will be those on the project who have a need to access it.
 - We plan to use the information from these interviews to help other attendings, residents, and medical students become better teachers.

For Attendings:

Background.

1. What was your experience like being a medical student and/or resident?
 - a. What was your education like?
 - b. Did you have a particularly good teacher (whether in the field of medicine or another discipline)?
 - i. What approach to teaching did s/he take?
 - ii. What qualities did s/he demonstrate?
 - iii. What qualities do you try and emulate?
 - c. Did you have a particularly poor teacher (whether in medicine or another discipline)?
 - i. What approach to teaching did s/he take?
 - ii. How did having a poor teacher affect your approach?
2. How often do you attend on the inpatient wards in one year?
 - a. What other responsibilities do you have?

Teaching Philosophy.

3. What is your teaching philosophy?
 - a. Where does this philosophy come from?
4. Did you ever have a patient or student that changed how you teach?
5. What qualities do you think are most important to be a great teacher?

Teaching Approach.

6. Is there anything that you learned when you were a trainee that you use in your teaching?
 - a. Anything you learned that you don't do?
7. What teaching aids, if any, have you found to be most effective in terms of students understanding a concept?
8. How does team composition affect how you teach?

9. What is the most important thing you hope your students get out of their time with you?
10. When you are on the unit teaching, what are you most focused on?
11. How has your teaching approach changed over the years?

Teaching Advice.

12. Did you receive any formal education on teaching?
13. Has anyone ever sought your advice on teaching?
 - a. If yes, what did you tell him/her?
14. What is the one thing you would tell someone is the most important quality to have to be a great teacher?
15. If you wrote a book on your teaching experiences, what would the title be?

For Current Medical Students/Residents:

Background.

1. To begin with can you introduce yourselves and tell us what year you are?

As you know, we are trying to better understand the various teaching approaches that are being used on the inpatient units and therefore, are particularly interested in hearing about your experiences as a learner with (Dr. XX) as your attending physician.

Learning Experience.

2. Can you tell us how attending rounds with (Dr. XX) usually go?
 - a. What aspects of patient care does s/he focus on?
 - b. How does (Dr. XX) ask for opinions, input, suggestions from you and other learners?
3. How would you describe (Dr. XX)'s teaching approach?
 - a. Does s/he do anything different from other attendings you have had?
4. What are the expectations (Dr. XX) has for your learning?
 - a. How are you made aware of these?
5. If someone is wrong about a diagnosis or patient's plan of treatment, how does (Dr. XX) respond?

Thoughts About Teaching.

6. As a teacher, what qualities does (Dr. XX) have?
7. What do you think is the most important quality that makes a great teacher?
8. How does (Dr. XX) compare to other inpatient attendings you have had?
 - a. Is there anything that (Dr. XX) does in terms of teaching that none of your other teachers have done?

Summary Questions.

9. What was the most important thing you have learned from (Dr. XX) about patient care?

- a. About being a doctor?
 - b. About being a teacher?
10. If you are to someday teach, is there anything that (Dr. XX) does that you will do with your students?
 11. What 3 words would you use to describe (Dr. XX) as a teacher?

For Past Medical Students/Residents:

Background.

1. To begin with we would just like to get to know your background a little better. Can you tell us your name, specialty, and how long ago was Dr. XX your attending/mentor?

As you know, we are trying to better understand the various teaching approaches that are being used on the inpatient units and therefore, are particularly interested in hearing about your experiences as a learner especially with (Dr. XX) as your attending physician.

Learning Experience.

2. Can you tell us how teaching rounds with (Dr. XX) went?
 - a. What aspects of patient care did s/he focus on?
 - b. How did (Dr. XX) ask for opinions, input, suggestions from you and other learners?
3. How would you describe (Dr. XX)'s teaching approach?

- a. Did s/he do anything differently from other attendings you have had?
4. What are the expectations (Dr. XX) has for your learning?
 - a. How are you made aware of these?
 5. If someone is wrong about a diagnosis or patient's plan of treatment, how does (Dr. XX) respond?

Thoughts About Teaching.

6. As a teacher, what qualities did (Dr. XX) have?
7. What do you think is the most important quality that makes a good teacher?
8. How does (Dr. XX) compare to other inpatient attendings you had?
 - a. Is there anything that (Dr. XX) did in terms of teaching that none of your other teachers have done?

Summary Questions.

9. What was the most important thing you learned from (Dr. XX) about patient care?
 - a. About being a doctor?
 - b. About being a teacher?
10. If you are teaching now/or were to someday teach, is there anything that (Dr. XX) does that you do/will do with your students?
11. What 3 words would you use to describe (Dr. XX) as a teacher?