Training Orthopaedic Residents to Formulate Evidence-Based Questions

Jonathan D. Eldredge, PhD

Health Sciences Library and Informatics Center, School of Medicine, The University of New Mexico Health Sciences Center, Albuquerque, New Mexico

Department of Family & Community Medicine, The University of New Mexico Health Sciences Center, Albuquerque, New Mexico

Corresponding Author Jonathan D. Eldredge, PhD. Health Sciences Library and Informatics Center, MSC09 5100, 1 University of New Mexico, Albuquerque, NM 87131 (email: jeldredge@salud.unm.edu).

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ABSTRACT

Background: Formulating questions that are both focused and answerable is an essential clinical skill for evidence-based practice (EBP). Possessing this skill can successfully launch research projects. Yet studies have depicted mixed results pertaining to the teaching of question formulation. This report describes introducing orthopaedic residents to question formulation and showcases an accompanying evaluation rubric originally developed for training second-year medical students.

Methods: In this prospective cohort study, a total of 23 orthopaedic residents at The University of New Mexico Health Sciences Center participated in a 1-hour training. The study included application exercises using an evaluation rubric for learners to assess each other's formulated questions followed by faculty members' feedback. A Likert scale was used to evaluate participant responses.

Results: Anonymous student evaluations rated the training and application exercises highly (>4.0 of 5.0 on the Likert scale).

Conclusions: Future collaborations with other residency programs could foster increased success rates in teaching question formulation skills. With these skills, orthopaedic residents could better integrate EBP into their daily clinical service and likely develop better clinical research questions.

Keywords: Question Formulation, Evidence Based Practice, Medical Education, Logic, Concept Formation

INTRODUCTION

The skill to formulate effective questions offers various benefits for orthopaedic residents and practitioners. In evidence-based practice (EBP), being able to formulate a clear question serves as the first step towards making a sound clinical decision.[1,2] Additionally, this skill promotes lifelong learning and facilitates the research process.[3] Clinicians pose an average of one question for every two patients seen, and according to a systematic review,[4] this frequency increases in teaching hospitals. Clinicians raise questions pertaining to treatment and diagnosis about 52% and 25% of the time, respectively, according to a content analysis of clinical questions.[5]

Despite the importance of question formulation in EBP, few studies have reported exclusively on this first step. The second and third steps (ie, information seeking and critical appraisal, respectively) have attracted considerably more attention in EBP studies. For example, only 10 of 678 pages of the most famous EBP training manual teach question formulation skills.[6]

To help train and assess learners, the widely cited and validated[7-10] Fresno Test of Evidence Based Medicine[11] includes two segments on assessing skills in question formulation. However, the Fresno test places greater emphasis toward the second and third steps. Regarding question formulation, the test asks the learner to select either a scenario about breastfeeding or bedwetting; subsequently, it prompts the learner to construct a question according to the EBP Population, Intervention, Comparison, and Outcome (PICO) question structure. The Fresno test's scoring rubric does not extend into other dimensions that a well-formulated question might include. Another rubric for evaluating learned EBP skills is the Berlin Questionnaire, which resembles the PICO structure.[12] Additionally, Wyer et al[13] devised a rubric that adds the conceptual dimension of foreground versus background question typology, a concept originally developed by W. Scott Richardson.[14]

A Cochrane-sponsored systematic review studied interventions, most involving residents and physicians, to teach question formulation skills.[15] Specifically, the authors reported that these interventions produced mixed results and recommended a more robust intervention to teach EBP question formulation skills. This Cochrane systematic review on question formulation training motivated the author to develop a more robust intervention to teach EBP question formulation skills. The training was linked to a rubric that evaluated first- and second-year medical students' formulated questions. The training and use of the rubric began in 2012, through a series of trial and error approaches with students' providing course-based

Rubric for Evaluating Formulated EBP Questions

Element	Points
Identifies and focuses upon the main problem or disease	1
Reduces "noise" in formulated question by reducing unneeded elements	1
Amplifies the signal in the question, *as applicable*, with:	
• Semantic qualifiers (Examples: acute/chronic, insidious/abrupt, proximal/distal, sharp/dull)	1
• Scale (Examples: neoplastic staging and child development Tanner stages)	1
• Temporality (Examples: duration of illness; length of treatment; seasonality, etc.)	1
Describes the population aspects (age, geography, ethnicity, income)	1
Question Composition:	
Composes question clearly so a targeted answer can be pursued	1
Question accurately reflects contextual details of the patient case	1
The final formulated question "stands by itself"	1
Possible Categorizations *(if justifiably not applicable, give 1 point each):*	November 2016
Distinguishes between diagnosis, treatment, and prognosis types	1
TOTAL POINTS (out of 10 possible points)	10

Figure 1. *Evaluation rubric used to assess the evidence-based practice question formulation of 23 orthopaedic residents (17 responses).*

feedback (immediate and formal) for an EBP course. The rubric was designed to ensure interrater reliability scores that assured students that their grades were fair.

Over several years, the author used the same rubric and similar training to instruct physician-assistant students and public-health students. The author discovered that little adaptation was needed to the student-training programs despite the different professions. In regards to the most recent training for second-year medical students, anonymous end-of-semester student evaluations indicated a high rating with an average of 3.5 on a 5.0 Likert scale. This education article provides a brief report on using question formulation training with an evaluation rubric for orthopaedic residents at The University of New Mexico Health Sciences Center.

METHODS

After receiving approval from our Human Research Review Committee (HRRC #18-792), the author conducted a prospective cohort study with 23 orthopaedic residents. On October 11, 2017, the exposure involved a 1-hour training session that included exercises on the use of the evaluation rubric (Figure 1). This session was the first of 3 monthly sessions regarding EBP. It was titled "Formulating High Yield Research Questions" and included modeled examples with residents applying what they learned. During the 1-hour session, residents worked together in groups of two or three to formulate and evaluate each other's questions using the rubric criteria. Afterward, the groups reported their final questions and received comments by either the instructor or the faculty-research advisor.

The 23 residents who participated in the training were asked to turn in evaluation forms, of which 17 residents completed (74% response rate). Table 1 summarizes the core four questions related to their training. Likert scale ratings of 1.0 (disagree) to 5.0 (agree) were used to assess residents' responses.

RESULTS

In Table 1, the first three evaluation questions pertained specifically to EBP training. With a mean score of 4.53 of 5.0 on the Likert scale, the residents reported that they gained an appreciation for the importance of question formulation (question 1). Residents assigned the highest mean score of 4.76 for learning at least two techniques to formulate effective questions (question 2). Finally, residents believed that the training had improved their question formulation skills with a mean score of 4.53 (question 3). The faculty members at the session were encouraged that the residents also could apply the skills learned toward future research projects (question 4), despite the training being directed within an EBP framework.

DISCUSSION

This 1-hour training session in question formulation using a rubric showed promising results with orthopaedic residents. Previously, this question formulation training and rubric evaluation had been developed and refined for second-year medical students. The rubric was designed to include interrater reliability in the grading of more than 100 questions formulated by medical students per year.[16-18]

The principal limitation of this study was the small number of residents (n = 23). However, this question

Table 1. Residents' evaluations of the core four questions related to their question formulation session[a,b]

No.	Evaluation question	Mean score
1	I now appreciate the importance of formulating effective research questions	4.53
2	I now know at least two (2) techniques for formulating research questions	4.76
3	This session has improved my skills in formulating effective research questions	4.53
4	I can apply what I've learned today to future research projects	4.59

[a]Evaluations were based on a minimum "disagree" score of 1.0 to a maximum "agree" score of 5.0 on a five-point ordinal Likert scale.
[b]The 1-hour training session was held on October 11, 2017.

formulation training and rubric evaluation was endorsed by orthopaedic residents according to their high, anonymous evaluation scores. By publishing the successful findings of this report, the author hopes to prompt colleagues in other residency programs to replicate this study. The author looks forward to collaborating with colleagues and adapting the teaching materials and copyrighted rubric to other teaching contexts. Results of the current study and any future work might help the medical profession improve teaching question formulation skills to residency programs, which might subsequently help overcome the mixed results reported in the Cochrane systematic review.[15] Therefore, including this brief training in the curriculum or orthopaedic residency programs will likely improve valuable question formulation skills.

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