Programmatic Approach to Increasing Osteopathic Medical Student Participation in Research: The TCOM Experience

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Providing medical students with a meaningful research-based educational experience will help them become exemplary physicians and informed consumers of medical research outcomes in the practice of evidence-based medicine. By participating in research projects during medical school, students have the opportunity to study specific fields that interest them in greater depth and develop their written and oral presentation skills. Studies indicate that students who have participated in research and scholarly activities during medical school are at an advantage when matching to their preferred residency. In this article, the authors outline programs and projects that provide opportunities for osteopathic medical students at the University of North Texas Health Science Center Texas College of Osteopathic Medicine to research concepts and conduct hypothesis-driven, hands-on research projects.

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The American Association of Colleges of Osteopathic Medicine cites the importance of exposing osteopathic medical students to research in their mission statement, which highlights the need for promoting excellence in medical education, research, and service in colleges of osteopathic medicine.[1] In addition, the American Osteopathic Association's Council on Research stated in its 2013 to 2022 strategic research plan the need for research and research standards at every college of osteopathic medicine and osteopathic postdoctoral training institution.[2] The council listed 2016 as the deadline for defining and initiating this strategy.[2] Accordingly, 70% of all colleges of osteopathic medicine recognize in their mission statements the importance of research, scientists, or biosciences.[1]

Exposing medical students to research and scholarly activities plays an important role in many facets of a student's medical school experience.[3-6] Active engagement in research and understanding the research process increases intellectual curiosity by laying the foundation needed for interpreting the findings of research on new treatments, cures, and patient management. According to Donoff, "the body of knowledge that science provides shows students ways of understanding and making sense of the complexity of the experience of patient care."[7]

Medical students who are involved in research projects can gain exposure to specific areas of interest and cultivate their written and oral presentation skills.[4] Green et al[8] suggested that research experience and publications help to differentiate students with similar academic attributes during the residency selection process, particularly in competitive specialties. The 2014 National Residency Matching Program survey concluded that

43% of the 1793 surveyed residency program directors cited a demonstrated involvement and interest in research as important in the match process.[9]

Student Research Program

With the understanding that a meaningful research-based educational experience will help students become exemplary physicians and informed consumers of medical research outcomes in the practice of evidence-based medicine, the University of North Texas Health Science Center Texas College of Osteopathic Medicine (UNTHSC/TCOM) formed a student research department in 2012. The goals of this department were as follows: (1) develop and implement mandatory research didactic programs to be included in the second-year curriculum and (2) establish ample opportunities for students to conduct hands-on elective research projects with a research mentor.

Mandatory Research Didactic Programs

Providing osteopathic medical students with research-based competencies plays a critical role in understanding and applying evidence-based medical principles and practices. Basic biostatistic and epidemiologic terms as well as knowledge of different statistics used in evaluating research findings' relevance and validity are critical for integrating research findings into clinical practice. To help students understand findings on new treatments, cures, and patient management, 6 hours of biostatistics and epidemiology were added to the year-2 curriculum at UNTHSC/TCOM in the fundamentals of behavioral science course. The following 4 designated student assignments are required: (1) observational study design: epidemiologic, biases, and measurements of association; (2) experimental study design: epidemiologic, biases, and measurements of association; (3) assessment of a screening test; and (4) statistical concepts and research settings.

Completion of the designated student assignments portion of the mandatory research didactic program is followed by a 6-hour classroom experience. Students apply the knowledge gained from the designated student assignments to specific examples and questions in smaller breakout groups and in the larger class group, in which an audience response system is used to encourage and facilitate participation.

This change in curriculum had many positive outcomes. Results from pre- and posttests regarding the biostatistics and epidemiology topics covered in the designated student assignments and classroom experience showed an increase in the mean percentage of questions students answered correctly, with a pretest mean correct score of 50% and a posttest mean of 75%. Adding biostatistics and epidemiology to the year-2 curriculum resulted in a positive shift in the mean performance in biostatistics and epidemiology of students taking the United States Medical Licensing Examination Step 1 for the first time. Changes in Comprehensive Osteopathic Medical Licensing Examination-USA scores could not be evaluated because specific data on biostatistics and epidemiology topics are not available, to our knowledge.

Elective Hands-on Research Opportunities

A number of elective programs for conducting hands-on research under the direction of a research mentor have been developed and implemented. These elective research opportunities increase and diversify academic offerings.

Complementary and Alternative Medicine Short-Term Research Rotation

The National Institutes of Health (NIH) funded an 8-week research-intensive complementary and alternative medicine (CAM) short-term research rotation in the T35 category. This rotation occurred annually for 5 years and took place during the last 4-week rotation of year 3 and continued throughout the first 4-week rotation of year 4. Students were mentored by an interdisciplinary group of researchers and physicians on research methods, hands-on CAM methods, and scholarly presentations.

Students who participated in the rotation received a standard NIH predoctoral fellowship, tuition reimbursement, and a research expense–related stipend.

These students were exposed to 64 hours of research didactic activities (*Figure 1*). In addition, all students worked full time for 8 weeks on a hypothesis-driven CAM research project under a faculty mentor and completed a scholarly activity (eg, poster presentation or journal publication).

During a 5-year period, 36 students completed the CAM research rotation. In focus groups conducted after completion, the students indicated that the overview of CAM research covered in the rotation was excellent. In particular, they mentioned that the challenges associated with conducting a CAM research project (eg, choosing the correct control) were beneficial. In addition, all students said they benefited greatly from the biostatistics and epidemiology portions of the rotation. Students also expressed great interest in the institutional review board meeting, tours of the animal facility, and sections reviewing the challenges associated with CAM research (eg, publication issues and experimental design issues).

Topics of students' research projects include the lymphatic system, prosthetic feet, and osteopathic manipulative treatment for pregnant women. A 5-year postanalysis of the rotation participants revealed that 25 publications were published in peer-reviewed journals. Two students used data from their rotation studies to successfully write grant proposals and receive funding—one from the American Osteopathic Association and the other from a pharmaceutical company. One student was accepted into the NIH Fogarty International Clinical Research Scholars and Fellows Program and spent a year conducting a research project under the NIH umbrella. Another student reported that at his interview for a prestigious residency program, the interviewer told him they had never invited an osteopathic medical student for an interview but had selected him in part because of his participation in the CAM research rotation program.

History of CAM
Types of CAM: ayurveda; biological-based therapies; energy therapies; homeopathy; manipulative, body-based therapies; mind-body; naturopathy; traditional Chinese
Introduction to epidemiology
Responsible conduct of research
Basics of human protective programs and IRB processes
Form a hypothesis
Search the CAM literature
Descriptive statistics
Challenges of CAM research
Inferential statistics
Tour of the animal facility
Use surveys as a research tool
How to make a poster
CAM and publication issues
Attend an IRB meeting
CAM and ethics
Personal opinions and CAM

Figure 1.
Topics and activities covered in a 8-week research-intensive complementary and alternative medicine short-term research rotation funded by the National Institutes of Health (64 hours). *Abbreviations:* CAM, complementary and alternative medicine; IRB, institutional review board.

Honors Research Practicum

The overarching goal of the Honors Research Practicum is to provide lifelong competency in research methods to students. The practicum is open to second-year osteopathic medical students in the top 10% of their class. Students are required to complete 20 hours of research didactic activities presented in 5 four-hour sessions over 7 months. In addition, students must work on a hypothesis-driven research project under a research mentor and present their results to their peers at the end of the practicum and to the general university population in a poster format at the university's annual Research Appreciation Day.

At the beginning of the practicum, students declare their research interests and are paired with faculty research mentors in their areas of interest. Faculty mentors and students meet to determine compatibility and common goals. If both parties agree to work together, they sign a research contract outlining goals and expectations from both sides to clarify what the project entails.

The laboratory in which students conduct their research receives a small stipend to defray the associated costs.

Students are provided with a syllabus outlining lecture topics and required reading. *Figure 2* outlines the activities presented at each of the 5 four-hour didactic sessions. In addition to the lecture portion of the didactic session, time is provided for students to briefly present the progress they have made on their research projects and the stumbling blocks they encountered. These discussions have proven to be an extremely beneficial learning tool, with students helping each other overcome some of the challenges associated with successfully conducting a research project.

In any given year, between 70% and 95% of students in the top 10% of the class accept the invitation to participate in the Honors Research Practicum, resulting in a class size of 14 to 22 students. To date, 1 student has dropped out of the practicum. Generally, 60% to 70% of students participating in the practicum continue and expand their research projects during medical school years 3 and 4 under the direction of their faculty research mentor.

Scholarly activity outcomes and achievements associated with student research projects is evident in the 13 students who participated in the 2013 to 2014 Honors Research Practicum. In total, 8 research presentations were made at UNTHSC's annual Research Appreciation Day, 2 presentations at international conferences, 5 at national conferences, and 1 at a local conference. Two students have had results from their projects published, and 6 additional publications are currently under review or in development. One student won first place in best clinical abstract for a platform presentation at the American Orthotic & Prosthetic Association National Assembly.

Year-4 Research Elective

This 1-month research elective provides a vehicle for fourth-year osteopathic medical students to participate in a hypothesis-driven research project under a research mentor. The student and mentor are required to complete a form before participation in the elective. The form includes a brief description of the study, what is to be accomplished, a signed statement by the research mentor that the project will be 40 hours per week or more, and, if appropriate, institutional review board approval numbers (for human subject research or institutional animal care) and committee approval numbers (for animal research projects). All projects and forms must be approved by the assistant dean of research and the clinical education department. At the end of the elective, the research mentor is required to complete an evaluation of the student's progress. Approximately 10% of fourth-year osteopathic medical students successfully complete this 1-month research elective.

Pediatric Research Program

A summer research elective in pediatrics is available to rising second-year osteopathic medical students. This 4-week research program is conducted in conjunction with a local children's medical center and takes place during the summer between years 1 and 2. Approximately 10% of second-year students are selected to participate in this program.

The program provides an introductory hypothesis-based research experience on a wide range of pediatric-related topics, including anesthesiology, cardiology, endocrinology, hematology-oncology, neonatology, neuroscience, and quality and safety. Students are assigned to a research mentor and meet with the group on a regular basis. Students participating in this program may qualify for a small stipend.

This program serves as a foundation for students to continue productive research in the ensuing years of medical school and to enhance students' capacity to appreciate and critically analyze research literature. Students in this program have presented their findings at scientific meetings and have received awards for their research.

Individual Research Projects

For students who are interested in conducting a research project but are not interested in or do not qualify for any

of the formal elective research programs currently offered, other options exist. Students can take initiative to find their own project and mentor, or they can work with administration to help them locate an appropriate research project.

Additional Research Opportunities

Research in Rural Health

Approximately 8% of the student body is enrolled in UNTHSC/TCOM's Rural Osteopathic Medical Education program. Students in this program are required to complete a community-based research project. The purpose of the community project is to provide students experience in community responsiveness and leadership through the identification and development of a plan or course of action to address a relevant health concern in the community. This project is initiated during year 2 and due for completion and academic credit in year 4.

Dual-Degree Programs

For osteopathic medical students interested in a more rigorous research experience, UNTHSC offers several dual-degree programs, including DO/MS, DO/PhD, and DO/MPH. The DO/MS and DO/PhD programs require completion of an extensive research thesis project to be approved by a thesis committee. The DO/MPH program does not require a research thesis. During the 2013 to 2014 academic year, 14 UNTHSC students were enrolled in or graduated from the DO/MS or the DO/PhD dual-degree programs.

Session 1: Introduction to the Research Process
Description of course objectives
Review of course calendar
How to fit research into a busy medical practice
Orientation to the basic science laboratory
Orientation to the clinical environment
Session 2: Building the Background for Your Research
Animal use and care
Protection of human participants
Background information and literature to support research project (working session)
Student roundtable: update on research project status (5 min per student)
Session 3: Fine-Tuning Your Research Project
Research checklist
Interpretation of the clinical research report
Student roundtable: update on research project status (10 min per student)
Session 4: Scholarly Presentation of Your Research Results
Writing abstracts for a research project
Construction of exhibits or posters
Presentation skills for oral presentations
Student roundtable: update on research project status (5 min per student)
Session 5: Final Presentations
Brief, formal presentation of research (5-7 min, plus 5 min for questions)
Submission of the final written abstract
Critique of presentation by course directors

Figure 2.
Topics covered in the Honors Research Practicum in which students worked on a hypothesis-driven research project and presented their results to their peers and to the general university population. Each session is 4 hours for a total of 20 hours.

Research Appreciation Day

Every year on Research Appreciation Day, all UNTHSC students, faculty, and staff share their research efforts with the campus community and the public. The program encourages the development of joint research projects and increases the community's awareness of the quality and range of research conducted at UNTHSC. Generally, 90 osteopathic medical students present each year. During Research Appreciation Day, faculty judge the quality and impact of medical students' research and presentations, and the winners are recognized at an award ceremony.

Benefits of Student Research

Research plays an important role in medical education as students are learning to become model physicians and informed consumers of medical research outcomes in their future practice of evidence-based medicine.[3-5] Competency VI from the American Association of Colleges of Osteopathic Medicine's core competencies details the importance of practice-based learning and improvement and the need for integrating research evidence and critical evaluation of medical information into clinical practice as it pertains to patient care.[10]

A secondary potential benefit of engaging medical students in research activities relates to the residency selection process. With the expansion of both osteopathic and allopathic medical schools, more students are competing to match in their selected residency. Participation in research activities is an additional domain for program directors to evaluate residency applicants beyond Comprehensive Osteopathic Medical Licensing Examination-USA scores or letters of recommendation. Although we have not yet collected data that delineate a specific role for student research and publications in the residency selection criteria of the institution, a study of 2568 program directors found that research experience and publication are important criteria for acceptance to more competitive programs.[8]

Conclusion

The numerous research programs and opportunities UNTHSC/TCOM offers has provided students with the opportunity to explore their areas of medical interest in greater detail. Many students have published their research in peer-reviewed journals and have presented their findings at local, state, national, and international conferences. Implementing research programs, adding research-focused content to the curriculum, and providing elective hands-on research experiences under the direction of a mentor can be successfully leveraged to expand the medical student research experience. In doing so, we are providing students with opportunities to increase intellectual curiosity, improve their written and oral presentation skills, and build an academic track record.

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