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A Preclinical Course to Develop Clinical Reasoning Skills of First-year Medical Students

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Abstract

Background and Objectives: Clinical reasoning is developed sometime during medical school training. When and how this knowledge is attained is less clear. This study looks at clinical reasoning development after initiation of a rural experiential course for first-year medical students at the University of Minnesota Medical School, Duluth (regional) Campus.

Methods: The Rural Medical Scholars Program course (RMSP) was developed to create a longitudinal rural family medicine experience for first and second-year students at the University of Minnesota Medical School Duluth. Sixty-three first year medical students participated in this required course and their clinical reasoning levels were measured using the Diagnostic Thinking Inventory (DTI). The DTI was given to the medical students after one year of participation in the RMSP course. A previous cohort before the RMSP course was developed was used as a control. A literature search was used for comparison to other schools that measured the DTI in their students.

Results: Student diagnostic thinking performance as measured by the DTI after one year of the Rural Medical Scholars Program course significantly increased when compared to a previous cohort of first-year students who did not take the RMSP course. When compared to previously published DTI data, students after one year of RMSP had clinical reasoning levels of second through fourth-year students from other schools.

Conclusions: The addition of a rural experiential course with family medicine preceptors significantly increased clinical reasoning levels of first-year medical students.

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Conflicts of Interests: No conflicts to report

Keywords: Clinical reasoning; family medicine; experimental learning

Setup

“The wild raggedness of the room was the soul and symbol of Doc Vickerson; it was more exciting than the flat-faced stack of shoeboxes in the New York Bazaar: it was the lure to questioning and adventure for Martin Arrowsmith.”¹

Martin Arrowsmith is the medical student in Sinclair Lewis' 1905 Pulitzer Prize winning novel *Arrowsmith* and Doc Vickerson his Minnesota small-town mentor. Using Minnesota rural physicians as mentors in the 21st century is the basis of an experiential first-year course at the University of Minnesota Medical School, Duluth Campus.

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Clinical reasoning skills developed during medical school are represented as a competency in several domains by the AAMC.² Teaching of clinical reasoning is both informal and formal in the clinical years. Gay and colleagues³ described a formal curriculum for fourth-year medical students but there was no assessment of learning. Development of these skills has been measured by the Diagnostic Thinking Inventory in the clinical clerkship years by several authors.^{4,5,6,7,8} This study reports the positive effect of a rural experiential course on the clinical reasoning skill levels of first-year medical students as measured by the DTI.

Methods

Setting and Participants

The Rural Medical Scholars Program (RMSP) course was initiated in the 2010-2011 school year at the University of Minnesota Medical School Duluth. Our regional campus has a record of success in training rural family physicians over the past forty years.⁹ To maintain and build on this success, an experiential, longitudinal rural experience was created as a required course in the 2010-2011 school year. This course consists of students spending five one-week periods with a rural family physician. Course learning objectives are numerous and include: developing history and physical examination skills, understanding principles of longitudinal care in the community, using reflective practice and feedback, assessment of rural communities, exploring interprofessional relationships, demonstrating professionalism, and patient-centered care. Students are encouraged to see patients before preceptors to allow time for development of assessments and plans. Evaluation of each student includes submitted history and physicals, progress notes, completed interprofessional signature lists and reflection essays. These elements are assembled in a portfolio and reviewed a faculty advisor.

Clinical reasoning performance of the RMSP students was measured with the Diagnostic Thinking Inventory

(DTI).⁴ The DTI is composed of two parts, knowledge structure and flexibility of thinking. The DTI has been used to measure diagnostic reasoning in medical students and residents worldwide.^{5,6,7,8}

Sixty-three first-year medical students participated in the required RMSP course in the 2011-2012 school year. The DTI was completed by 58 of these students three months after the course. The results were compared to a control group of first-year students who took the DTI in 2010 before the RMSP course was developed. The control group had nine half-day visits with urban and rural preceptors compared to five weeks in the RMSP group. The DTI was given during the same month of the year to both the control and RMSP study group and was administered by the same administrative assistant. The control and RMSP groups of students had similar academic statistics entering medical school (Table 1).

Table 1

Matriculating Year	GPA	BCPM of GPA	MCAT total
2009	3.62	3.52	28.7
2011	3.63	3.54	29.2

Ethical Approval

The University of Minnesota Institutional Review Board approved this study.

Results

Fifty-four (of 63) students completed the Diagnostic Thinking Inventory three months after completing the RMSP course in the spring of 2013. The RMSP students scored at a mean level of 168.9. When compared to 55 (of 63) non-RMSP students in 2010, the study group had a statistically increased total DTI score and in the components of structure and flexibility. (Table 2).

When compared to previously published studies, our study group's total DTI was comparable to more advanced students from other schools (Table 3).

Table 2

Year	DTI Structure	DTI Flexibility	Mean DTI Total	Standard Deviation Total
2013 n=54	81.0*	87.9*	168.9*	8.49
2010 n=55	74.2	82.4	156.6	9.36

* $p < 0.05$, *Student's t-test*

Table 3

School	Medical Student Year	DTI - Total
U. of Leuven, Belgium⁵	Fourth-year	168
U. of Brasilia, Brazil⁶	Third-year	169
Mayne Medical School, Australia⁷	Second-year	158
Johns Hopkins⁸	Second-year	165
Minnesota Duluth With RMSP Without RMSP	After First-year 2013	169
	2010	157

Discussion

First-year medical students were shown to statistically increase their diagnostic reasoning skills after completing a required longitudinal experiential rural course. The mechanism for this improvement on first glance would seem to be related to time-on-task and the nature of the RMSP experience.

Time-on-task would be an obvious explanation for improved performance but educational literature is mixed on this theory. Karwett reviewed 50 years of K-12 studies and found inconsistent and modest effects of increasing time in the curriculum.¹⁰ He found studies that had increased engaged time showed

increased learning but studies with increased non-engaged time actually decreased learning. Similarly, Beattie and colleagues found learning is related to the difficulty of the task and the engagement of the learner.¹¹ Their work looked at the role of self-efficacy and learning. If a task was static and unchallenging then a student's self-efficacy was not developed. A student would feel bored and determine "anyone can learn this." Repeated interesting and challenging tasks energize and increase self-efficacy which then energizes the student's learning.

We feel the nature of the RMSP student experience contributes to increased diagnostic reasoning skills. The benefit of experiential learning has its origins in

the works of David Kolb.¹² His theory of experiential learning explains how adult learners use educational experiences to develop and retain knowledge. In essence, his model starts with concrete experiences; progresses to observations and reflections of those experiences by students and faculty, then students develop new models of reasoning. The final stage is testing the new models with another concrete experience. By repeating this reflective process thorough numerous experiences, a student will attain not only experience but also knowledge. The RMSP course has all of these elements. A student will see a patient in the rural office or hospital (concrete experience). He/she will then reflect on that experience both verbally with their preceptor and in written form with their preceptor and other course faculty. Based on oral and written feedback the student will create a slightly or significantly changed model of reasoning and test their reasoning when they see their next patient. Bowen describes this process of promoting diagnostic reasoning in medical students and residents.¹³ She feels key elements of the process are students diagnosing patients under the guidance of teachers who bring knowledge, context, and experience. Again, the RMSP course has all these elements; students, patients and knowledgeable family physicians.

Strengths and Limitations

The strength of the study is in a clearly defined and validated instrument, the Diagnostic Thinking Inventory. Although the control group was medical students from three years prior, the regional campus medical students are very similar from year to year when measured in both academic and demographic terms. A limitation of the study revolves around time-on-task in that the RMSP group had more patient contact hours. Our discussion of time-on-task in the previous section addresses the potential mitigation of these increased contact hours.

Conclusions

First-year medical students at the University of Minnesota Medical School, Duluth regional campus developed significantly increased diagnostic thinking skills after participating in a longitudinal required

rural experience. This finding is supported by educational literature related to strategies in promoting experiential learning.

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