

Description and Early Outcomes of a Comprehensive Curriculum Redesign at the Northwestern University Feinberg School of Medicine

Heather L. Heiman, MD, Celia L. O'Brien, PhD, Raymond H. Curry, MD, Marianne M. Green, MD, James F. Baker, PhD, Robert F. Kushner, MD, John X. Thomas, PhD, Thomas C. Corbridge, MD, Julia F. Corcoran, MD, Joshua M. Hauser, MD, and Patricia M. Garcia, MD, MPH

Abstract

In 2012, the Northwestern University Feinberg School of Medicine launched a redesigned curriculum addressing the four primary recommendations in the 2010 Carnegie Foundation for the Advancement of Teaching report on reforming medical education. This new curriculum provides a more standardized evaluation of students' competency achievement through a robust portfolio review process coupled with standard evaluations of medical knowledge and clinical skills. It individualizes learning processes through curriculum flexibility, enabling students to take electives earlier and complete clerkships in their preferred order. The new curriculum

is integrated both horizontally and vertically, combining disciplines within organ-based modules and deliberately linking elements (science in medicine, clinical medicine, health and society, professional development) and threads (medical decision making, quality and safety, teamwork and leadership, lifestyle medicine, advocacy and equity) across the three phases that replaced the traditional four-year timeline. It encourages students to conduct research in an area of interest and commit to lifelong learning and self-improvement. The curriculum formalizes the process of professional identity formation and requires students to reflect on their

experiences with the informal and hidden curricula, which strongly shape their identities.

The authors describe the new curriculum structure, explain their approach to each Carnegie report recommendation, describe early outcomes and challenges, and propose areas for further work. Early data from the first cohort to progress through the curriculum show unchanged United States Medical Licensing Examination Step 1 and 2 scores, enhanced student research engagement and career exploration, and improved student confidence in the patient care and professional development domains.

Medical school curricula continue to evolve as schools try to anticipate tomorrow's medical and educational needs. The 2010 Carnegie Foundation for the Advancement of Teaching report, "Educating Physicians: A Call for Reform of Medical School and Residency," intensified and focused the ongoing process of curricular innovation by presenting to schools a set of common goals.¹ The report's authors offered four recommendations to guide reform efforts: (1) standardize learning outcomes, while individualizing learning processes; (2) promote multiple forms of curricular integration; (3)

prepare physicians who are committed to excellence by cultivating habits of inquiry, innovation, and improvement; and (4) address professional identity formation.

Many reports of curricular innovations describe the implementation of one or two of these recommendations.² However, the redesigned curriculum at the Northwestern University Feinberg School of Medicine (NUFSM) addresses all four recommendations. This curriculum was developed between 2009 and 2012 and first implemented in the fall of 2012 with the graduating class of 2016. Its development predated the publication of the Carnegie report, anticipating the four goals recommended by the report's authors. Still, the report served as a guide for the final implementation of the new curriculum and was a barometer for measuring the reform efforts. In this article, we describe the redesigned curriculum at NUFSM in the context of the Carnegie report recommendations, report preliminary outcomes data, and identify challenges to fully implementing the recommendations.

About the Former Curriculum

The curriculum in place at NUFSM before 2012 was introduced in 1993, when the school reduced the number of lecture hours, introduced problem-based learning (PBL), and instituted multidisciplinary science courses. At that point, the medical humanities, social sciences, and introductory doctoring content were combined into a unique course called Patient, Physician, and Society.³ Each class was divided into four learning communities (known as colleges) led by faculty mentors.

Although these changes were significant advances,⁴ important gaps remained. The first year focused on the normal structure and function of the human body; students had to wait until the second year to learn about disease. Integration of the basic sciences with clinical skills, humanities, and social sciences was minimal. Many courses outside the basic sciences lacked rigorous assessment. A framework of eight competencies existed, but students were not accountable for achieving specific benchmarks. Although many students chose to pursue research

Please see the end of this article for information about the authors.

Correspondence should be addressed to Heather L. Heiman, Northwestern University Feinberg School of Medicine, Clinical Education Center, 240 E. Huron St., Suite 1-442, Chicago, IL 60611; telephone: (312) 503-6451; e-mail: h-heiman@northwestern.edu; Twitter: @NUFeinbergMed.

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or scholarship, these efforts were predominantly extracurricular.

Structure of the Current Curriculum

The current curriculum (CC) was implemented in 2012 and replaced the traditional four-year structure with three competency-based phases (see Figure 1). Phase 1 covers the first 20 months of medical school. Fourteen modules of varied length are presented by organ system, with normal and pathological processes addressed simultaneously. Integrated within each module are four elements—science in medicine, clinical medicine, health and society, and professional development. The science in medicine element is the most prominent. Phase 2 emphasizes intense

clinical experiences through department-based core clerkships. Phase 3 focuses on advanced clinical rotations and professional development. Five curricular threads are woven through all three phases; they define areas of special emphasis, such as medical decision making and diagnostic testing, health care quality and patient safety, teamwork and leadership, lifestyle medicine, and health advocacy and equity. The learning communities from the former curriculum (FC) remain.

Evaluation methods still include traditional measures of knowledge and clinical performance but now also include a new dimension, longitudinal student portfolios, which are grounded in an ideology of “evaluation for learning” in addition to evaluation of learning.⁵

Integration of the Carnegie Report Recommendations

Recommendation 1: Standardize learning outcomes and individualize learning processes

A primary framework for the evaluation of student outcomes in the CC is the longitudinal student portfolio.⁶ At NUFSM, these portfolios are electronic repositories of all quantitative and qualitative evaluation data, accessible only to the students and their faculty mentors. Within the portfolio, each student must demonstrate phase-appropriate achievement of five performance-based competencies—patient care; communication skills; professionalism; system awareness and team-based care; and continuous learning and quality

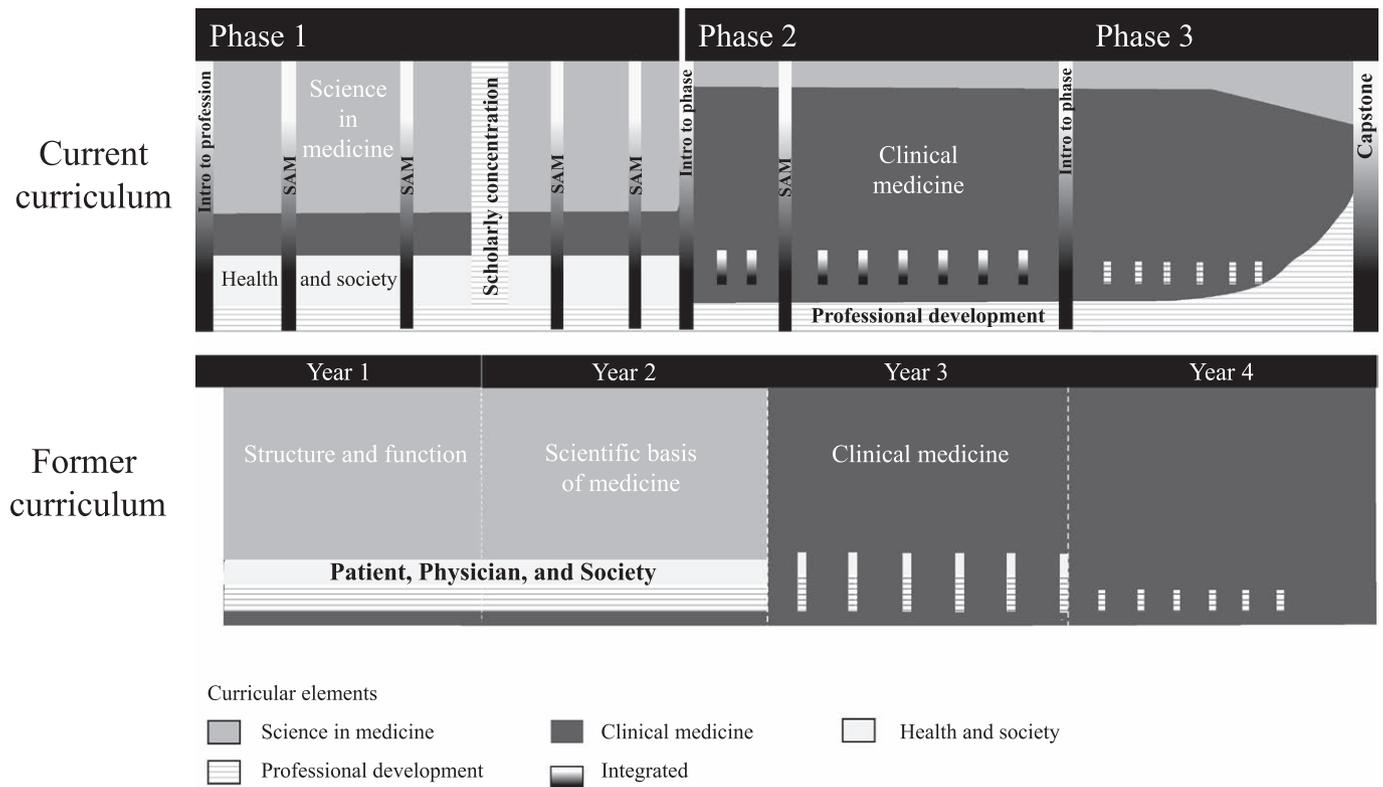


Figure 1 Comparison of the structure of the former curriculum (FC) (bottom) and the current curriculum (CC) (top) at the Northwestern University Feinberg School of Medicine. The four years of training in the FC unfold over three phases in the CC. The colors/patterns represent the curricular content areas as they are now defined. The CC starts one month earlier than the FC. Each phase begins with a weeklong introduction, exploring the integrated content of each curricular element. Science in medicine is presented in organ-based modules in the CC, rather than as a year of structure and function followed by a year of pathophysiology in the FC. The basic sciences are revisited in phases 2 and 3, with an increasing focus on career-relevant content. Clinical medicine starts at matriculation and forms a larger part of early training in the CC. Professional development is present throughout each phase and is highlighted in the summer of phase 1 and towards the end of phase 3 as students focus on their area of scholarly concentration. Health and society is integrated with the science in medicine and clinical medicine content throughout phases 1 and 2. In the CC, synthesis and application modules (SAMs) and Introductions to the Phase are intersessions, which provide spaced repetition of content and integration across organ systems, elements, and the preceding modules in phase 1, and they allow focused career exploration and integration across elements in phases 2 and 3. The short vertical bars in phase 2 represent interdisciplinary curricular sessions, while in phase 3 they represent professional development sessions. These sessions are a feature of both the FC and CC during clinical clerkships, but in phase 2 in the CC they deliberately revisit science in medicine content integrated with professional development and health and society content. The CC concludes with a capstone course, a career-specific, two-week series of integrated content across all elements intended to ensure students’ proficiency before graduation. See Supplemental Digital Appendix 1 at <http://links.lww.com/ACADMED/A486> for details related to the schedule in each phase.

improvement. At the end of phases 1 and 2, two faculty reviewers assess each student's portfolio, along with a student-generated self-reflection, to determine the student's readiness for the next phase of training. Three competencies are excluded from the formal portfolio evaluation, although they are still taught and assessed. The personal awareness and self-care competency is not judged summatively because of its personal nature. As community engagement and service activities vary widely among students, this competency defies standardized evaluation. Finally, the medical knowledge competency is chiefly evaluated via written examinations.

In addition to this summative review, the portfolios serve a crucial formative purpose—to individualize learning. Students meet with their learning community mentors twice yearly to review their assessment data, reflect on their strengths and weaknesses, and develop a learning plan. Learning plans and formative reflections are shared only with the students' mentors.

For each of the five competencies listed above, students receive one of the following assessment decisions based on their portfolio—progressing toward competence, progressing toward competence with concern, or progressing toward competence pending remediation (now called progressing toward competence pending additional development). Students progressing with concern must meet again with their mentors to create an improvement plan. Students requiring remediation must work through an individualized educational support program before advancing to the next phase. This program may involve directly observed patient encounters and presentations, standardized patient interactions, clinical reasoning exercises, and even personal coaching for those students who struggle with teamwork.

Beyond the individualization of learning plans and education support within the portfolio process, students build on their unique interests via an area of scholarly concentration (AOSC). All students who are not in a concurrent master's or doctoral degree program select an AOSC and complete an independent, mentored scholarly project, which spans the duration of medical school.

Flexibility in the curriculum timeline has increased in the CC, allowing greater individualization and earlier career exploration (see Supplemental Digital Appendix 1 at <http://links.lww.com/ACADMED/A486>). Students matriculate earlier, the preclerkship phase is shorter, and the core medicine and surgery clerkships are truncated, enabling students to start their core and advanced clerkships earlier. These changes encourage students to tailor their schedules and intersperse early electives, research, and vacation time in phases 2 and 3 to meet their specific learning and career exploration goals.

Recommendation 2: Promote multiple forms of curricular integration

Multifaceted integration is an organizing principle of the CC, with the goal of achieving four-year interdisciplinary integration both horizontally and vertically.⁷ Science in medicine content is horizontally integrated⁸ with content from the other curricular elements within each phase 1 module. For example, in the cardiovascular and pulmonary modules, students study the impact of smoking on lung tissue in the science in medicine element, explore policy issues related to tobacco control in the health and society element, and practice motivational interviewing to address behavior change in the clinical medicine element. See Supplemental Digital Appendix 1 at <http://links.lww.com/ACADMED/A486> for a sample weekly schedule.

Although PBL was used in the FC, it now is included in every phase 1 module. PBL cases still prompt basic science learning in the clinical medicine element and are now used to effectively integrate content from the other curricular elements by introducing prompts related to clinical reasoning, ethics, quality and safety principles, and social determinants of health. Clinical skills are an integral part of each phase 1 organ-based module. For example, taking a history of present illness is introduced to students in a clinical correlation exercise—an interactive lecture and interview of a real patient with a disease process related to the basic science content of the module. Students practice this clinical skill in the standardized patient center several days later, and the following week they apply it in a real clinical environment.

Vertical integration is achieved by deliberately scaffolding and developing students' knowledge and skills across the three phases. For example, the

pain curriculum begins in phase 1 with an introduction to basic pain pathways, neurotransmitters, and analgesic pharmacology. In phase 2, an interdisciplinary team-based learning session for all clerkship students reintroduces the basic science principles and challenges students to apply their learning to treat patients' pain. In the phase 3 capstone course (described below), students address safe prescription policies and practices.

Similarly, clinical skills are developed and integrated across the three phases. Motivational interviewing, for example, is a skill students learn in the first few months of medical school and must demonstrate in a phase 1 objective structured clinical exam (OSCE), then again in their phase 2 primary care clerkship. Likewise, we revisit the challenging skill of delivering difficult diagnoses across the phases using a common framework. Students practice disclosing bad news to a standardized patient twice during phase 1. In phase 2, they must then reveal a potential cancer diagnosis during a core clerkship OSCE, and in phase 3, they must demonstrate competence in this skill again during the capstone course.

In addition, approximately 40% of our students participate in an education-centered medical home (ECMH), a four-year longitudinal primary care experience in which students from all phases collaborate to care for a panel of patients with chronic illness.⁹ This longitudinal clinical experience not only vertically integrates clinical skills development throughout all three phases but also enables students to progressively learn and be assessed according to a spiraled quality and patient safety curriculum. All students not in an ECMH complete a longitudinal clinical preceptorship, generally in primary care, in phase 1 followed by a four-week primary care clerkship in phase 2.

Vertical integration is also accomplished through weeklong synthesis and application modules (SAMs), which are interspersed throughout the three phases. SAMs integrate material from the preceding modules, facilitating students' progressive mastery of the content through spaced repetition and active learning, including simulation and case-based learning activities. The goal of the SAMs is to promote students' retention and integration of prior knowledge

by deliberately revisiting content that is presented in progressively complex problems across phase 1.¹⁰ In phases 2 and 3, SAMs and monthly half-day interdisciplinary sessions bring together students from different clerkships to allow for focused career exploration, a return to the basic sciences, and small-group discussions of the health and society content that has come up on the clerkships, such as health disparities and quality and safety issues. The SAMs at the start of phases 2 and 3 are known as introductions to the phase, during which students learn the competencies and new skills related to each element that are required for their success in that phase.

Mirroring this approach to learning is the integrated assessment structure in phase 1. Each module examination incorporates all the curricular elements. After each block, consisting of two or three modules, a pass or fail grade is awarded to each student based on a composite score, which incorporates the student's scores on the written module examinations, small-group assessments, OSCEs, group work products, and oral examinations. This block evaluation system parallels and complements the longitudinal student portfolio system.

Recommendation 3: Prepare physicians who are committed to excellence by cultivating habits of inquiry, innovation, and improvement

The CC aims to promote inquiry and curiosity to develop students' adaptive expertise and their ability to investigate domains of uncertainty.¹¹ Our AOSC component requires that students pursue a scholarly project in which they attempt to answer an unsolved question. AOSC didactics and poster sessions educate students in the conduct and ethics of research, while 1:1 mentorship allows nearly every student to complete a scholarly project in fields ranging from the basic sciences to translational medicine to health services research and global health.

The student portfolio system further promotes adaptive expertise by emphasizing the competencies beyond pure medical knowledge. For example, the continuous learning and quality improvement competency requires that students use peer and faculty feedback and self-assessment to identify gaps in their skills and knowledge and develop learning plans to address these gaps. Learning plans are developed

semiannually and iteratively; they act as a preview of physicians' lifelong process of self-evaluation and improvement.

The system awareness and team-based care competency encourages students to collaborate with their peers to solve new problems. PBL cases are the primary way for students to develop this competency in phase 1; in phase 2, it is the patient care team. Efforts by curricular leaders to develop faculty members' and students' qualitative feedback skills have increased the quality of assessments, fostering a learning climate dedicated to the goal of improvement.

Two of the five curricular threads also foster innovation and improvement. The health care quality and patient safety thread is woven through all three phases via didactic and small-group activities for all students. In the ECMH, students take responsibility for monitoring the quality of the care provided for their panel of patients, and they conduct a yearly quality improvement team project.⁹ The lifestyle medicine thread introduces students to the sciences of nutrition, physical activity, and behavior change management.^{12,13} As part of this thread, students complete a personal behavior change plan, learning about the process and principles of behavior change while striving to improve their own health.¹⁴

Recommendation 4: Address professional identity formation

The formal CC prioritizes students' professional identity formation with a weeklong course at matriculation called Introduction to the Profession. Each day, students examine one of their nascent roles: healer; team member; scholar, learner, and teacher; and member of a profession. These roles directly relate to the competencies and are revisited throughout the three phases.

Career development becomes a major focus in phases 2 and 3. As we discussed earlier, the flexibility of phase 2 allows students to explore the different specialties earlier through electives. In phase 3, the last SAM divides students into career-focused tracks. The subsequent two-week capstone course held prior to graduation is also divided into tracks that match students' career intentions. Through deliberate practice and mastery learning, the capstone course requires students to demonstrate competence in tasks ranging from writing orders to discussing

difficult topics.¹⁵ Like the Introduction to the Profession week, the capstone course serves as a bookend to frame the trajectory of students' professional identity formation throughout medical school. It is also a launching pad to residency.

Professional identity formation is also a function of the informal and hidden curricula that exist at every medical school.¹⁶ To address the interactions that occur between students and their peers and teachers outside the classroom and the values conveyed by institutional rules and structures, we established multiple venues for students to reflect on what they experience from their clinical placements, research work, the medical school, and the medical center. A Personal Transition to the Profession course now spans the four years of medical school and is conducted mainly through small-group discussion and blogging exercises. Learning community mentors and small-group facilitators explore the challenges inherent in the development of a professional identity; topics allow students to reflect on the learning environment and on role models, both positive and negative. Sample topics in phase 1 include self-doubt and imposter syndrome and defining success. Topics in phase 2 include boundary issues and medical hierarchy. In phase 3, social media and relationships with the pharmaceutical industry are discussed, among other topics. Ethics-in-action small-group sessions also are held over the course of phase 1 and in every required clerkship in phase 2. During these sessions, students must present a real ethical challenge from a clinical setting and discuss and analyze the patients' and providers' responses.

Two competencies that address the potential consequences of the informal and hidden curricula were added to the competencies we discussed above (i.e., patient care, communication skills, professionalism, system awareness and team-based care, continuous learning and quality improvement, and medical knowledge). Given the prevalence and consequences of stress in medical school,¹⁷ the personal awareness and self-care competency focuses on wellness and resilience. The community engagement and service competency urges students to step beyond their institution to engage in service to the larger local and global population.

Early Outcomes of the CC

We divided the outcomes of the CC into three categories: (1) academic, (2) career exploration, and (3) student confidence. When possible, we compared student learning in the FC and CC. For these comparisons, we looked at the last cohort in the FC (matriculating class of 2011) and the first cohort in the CC (matriculating class of 2012). For the United States Medical Licensing Exam (USMLE) Step 1 scores, however, we compared the last two cohorts in the FC (matriculating classes of 2010 and 2011) and the first two cohorts in the CC (matriculating classes of 2012 and 2013). For USMLE Step 2 scores, we compared the last cohort in the FC and the first cohort in the CC only. For initiatives that were completely new (e.g., the student portfolio), the outcomes data we present are descriptive and without comparison. See Table 1 for all outcomes and comparisons. The Northwestern University institutional review board approved our reporting of aggregated outcomes data.

Academic outcomes

A comparison of students' USMLE Step 1 and Step 2 scores showed essentially no difference between FC and CC students. Notably, only 10% (13/133) of FC students completed a research thesis, compared with 97% (112/115) of CC students, which reflects the CC's focus on inquiry and scholarship. The percentage of students who coauthored an extramural publication, presentation, abstract, or book chapter also rose from 67% (88/131) in the FC cohort to 75% (85/114) in the CC cohort. First authorship of these academic works increased from 46% (60/131) to 50% (57/114). However, these two increases in authorship were not significant.

According to the student portfolio reviews at the conclusion of phase 1, 81% (123/152) of CC students were judged to be progressing toward competence in all categories, while 16% (25/152) were judged to be progressing with concern in at least one competency. Three percent (4/152) needed faculty-supervised remediation in at least one competency before advancing to phase 2. Competencies requiring remediation at the conclusion of phase 1 included patient care, communication skills, and professionalism.

Phase 2 student portfolio reviews were completed for 132 students in the first CC cohort, as some students interrupted

their medical training to conduct research, complete additional degrees, or for leaves of absence. Eighty-nine percent (118/132) were judged to be progressing without concern, 7% (9/132) were progressing with concern in at least one competency, and 4% (5/132) needed supervised remediation in the following competencies: patient care, communication skills, and continuous learning and quality improvement, before advancing to phase 3.

Career exploration outcomes

Students used the curricular flexibility in phases 1 and 2 to explore medical fields not traditionally taught in the core clerkships. The FC did not allow students to take early electives or advanced clerkships. By contrast, 90% (103/115) of CC students completed a third-year elective. In addition, 27% (31/115) completed a four-year primary care experience (i.e., ECMH). This percentage has increased annually as capacity has expanded.

Student confidence outcomes

The last cohort in the FC (matriculating class of 2011) and the first cohort in the CC (matriculating cohort of 2012) responded to two surveys about their preparedness and confidence at the start of their clerkships (see Supplemental Digital Appendix 2 at <http://links.lww.com/ACADMED/A486> for the survey details). CC students reported that they were significantly better prepared preclerkship than their FC counterparts in clinical skills including history taking, physical examination, and differential diagnosis. CC students also expressed greater confidence than FC students in their professional development, including in the ethical care of patients, team orientation, and scholarship.

Implications of the CC

The redesigned curriculum at NUFSM incorporates the four major recommendations presented in the Carnegie report calling for the reform of medical education. O'Brien and Irby's² review of publications that address these recommendations for curricular innovation found that only a quarter try to address more than one recommendation.

The student portfolio assessment system is likely the most transformative and successfully implemented part of the

CC, as it addresses the standardization of learning outcomes. Student outcomes data demonstrate that CC students felt more clinically prepared than their predecessors at the start of their clerkships. They also viewed themselves as more skilled in the domains that reflect our holistic competency framework, such as ethics, teamwork, and learning plan development.

To individualize learning, phase 1 students now are able to select and pursue a mentored area of scholarship, and phase 2 students have flexibility and control over the order of their clerkships and can explore electives earlier in medical school. Almost all CC students participated in elective and research opportunities during the core clerkship year rather than moving through the required clerkships in rapid succession.

We significantly enhanced curricular integration, the second recommendation in the Carnegie report, by enacting structural reforms along with pedagogical approaches to facilitate vertical and horizontal integration of both science and nonscience content throughout each phase of the curriculum. Despite an increase in curricular time spent on performance-based competencies outside the basic sciences, students' USMLE Step 1 scores did not change, which was a reassurance that their medical knowledge did not suffer. Perhaps the most innovative aspect of this curricular integration was the development of the ECMH, which enabled the meaningful integration of additional topics, like quality improvement, patient safety, social determinants, health equity, and behavior change, into the curriculum. As O'Brien and Irby² noted, this "integration of perspectives" provides "more continuity and less fragmentation so that learners can form the kinds of relationships with patients, supervisors and staff that offer insight into the experiences and perspectives of others."

To align with recommendation 3, we implemented a scholarship requirement (AOSC) and the student portfolio. Students' scholarly output has been increasing, attesting to the impact of the CC on inquiry-driven learning. By requiring reflections and learning plans as part of the portfolio process, we are cultivating lifelong learning habits in our students. Consistent with recommendation

Table 1

Comparison of the Outcomes of Northwestern University Feinberg School of Medicine's Former Curriculum (FC) and Current Curriculum (CC)

Outcomes	Former curriculum (FC)	Current curriculum (CC)	P value
Academic outcomes			
Mean (SD) USMLE Step 1 score ^a	240 (16)	240 (17)	NS
Mean (SD) USMLE Step 2 Clinical Knowledge score ^b	249 (14)	252 (12)	NS
No. (%) of students authoring a research thesis ^b	13/133 (10)	112/115 (97)	< .001
No. (%) of students coauthoring an extramural peer-reviewed publication, presentation, abstract, or book chapter ^c	88/131 (67)	85/114 (75)	NS
No. (%) of students first-authoring an extramural peer-reviewed publication, presentation, abstract, or book chapter ^c	60/131 (46)	57/114 (50)	NS
No. (%) of students receiving phase 1 portfolio competency assessment ^d			
Progressing toward competence	—	123/152 (81)	—
Progressing toward competence with concern	—	25/152 (16)	—
Progressing toward competence pending remediation	—	4/152 (3)	—
No. (%) of students receiving phase 2 portfolio competency assessment ^d			
Progressing toward competence	—	118/132 (89)	—
Progressing toward competence with concern	—	9/132 (7)	—
Progressing toward competence pending remediation	—	5/132 (4)	—
Career exploration outcomes^e			
No. (%) of students pursuing a third-year elective	—	103/115 (90)	—
No. (%) of students completing a four-year primary care experience	—	31/115 (27)	—
Student confidence outcomes			
Mean rating of confidence in clinical skills preparation at the start of clerkships (1 = not at all prepared, 5 = extremely well prepared) ^f			
Take a history	3.60	4.00	< .01
Discuss sensitive topics with patients	2.96	3.26	< .01
Perform an overall physical exam	3.10	3.39	< .01
Formulate a differential diagnosis	2.83	3.18	< .01
Give oral presentations	2.81	3.14	< .01
Write a history and physical	3.24	3.47	< .05
Overall clinical skills preparation	2.91	3.39	< .001
Mean rating of confidence in competencies related to professional development at the start of clerkships (1 = not confident, 5 = very confident) ^g			
Ethics relating to individual patients	3.88	4.15	< .05
Ethics relating to health systems	3.87	4.25	< .01
Maintaining own physical and mental health	3.86	4.21	< .05
Team orientation	3.78	4.10	< .01
Leadership	4.19	4.46	< .05
Scholarship	3.33	3.77	< .01
Creating a plan for improvement	3.83	4.15	< .01
Situational awareness	3.72	3.98	< .05

Abbreviations: USMLE indicates United States Medical Licensing Exam; NS, not significant.

^aFC students matriculated in 2010 or 2011 (n = 325), and CC students matriculated in 2012 or 2013 (n = 292).

Students were included if they took their Step 1 exam on time (within two years of matriculation).

^bFC students matriculated in 2011, and CC students matriculated in 2012. Students were included if they graduated in four years.

^cFC students matriculated in 2011, and CC students matriculated in 2012. Students were included if they graduated in four years. Research products were assessed based on curriculum vitae (CV) submitted before residency applications. Three CVs were unavailable for analysis, two for FC students, and one for a CC student.

^dCC students matriculated in 2012.

^eCC students matriculated in 2012.

^fFC students (n = 116) were surveyed in 2013 at the beginning of their third year, and CC students (n = 122)

were surveyed in 2014 at the beginning of phase 2. Students delaying the start of their clerkships were not

included in the sample. For more information, see Supplemental Digital Appendix 2 at <http://links.lww.com/ACADMED/A486>.

^gFC students (n = 113) were surveyed in 2013 at the beginning of their third year, and CC students (n = 61)

were surveyed in 2014 at the beginning of phase 2. Only students who completed their preclerkship requirements

in two years and proceeded directly to clerkships were included in the sample. For more information, see

Supplemental Digital Appendix 2 at <http://links.lww.com/ACADMED/A486>.

4, we implemented the four-year Personal Transition to the Profession course, which is the touchstone for students' exploration of professional identity and the impact of the informal and hidden curricula.

Challenges remain as we continue to seek outcomes data and curricular innovation. We have not yet individualized learning in phase 1 such that a student with preexisting knowledge and skills might elect for an accelerated timeline for studying the basic course work. In fact, the extensive integration of the preclinical curriculum makes it difficult to isolate material for this type of accelerated study. In addition, we are working to integrate the new elements and thread structure into the clerkship years in a more seamless way. Next, we plan to initiate discussions about the CC with faculty and institutional leaders in an effort to better integrate the formal, informal, and hidden curricula. Finally, we are examining the unintended consequences of these changes, such as potentially increasing students' workload given the earlier introduction of non-basic-science elements in phase 1.

Just as we instill in our students the importance of innovation and improvement, we have established multifaceted review processes for our curriculum. Student representatives analyze their peers' feedback and meet regularly with key faculty to discuss strengths and weaknesses for each of the elements in phase 1. The curriculum committee combines this student feedback with reports from faculty and objective data to formally evaluate each block and element periodically. In the 2016–2017 academic year, we invited external evaluators to review our curriculum and recommend modifications. Anticipated changes that came out of these external evaluations include a renewed push for active learning to replace many phase 1 lectures and for additional science in medicine and health and society content in phase 2.

We continue to research the effects of the ECMH, the capstone course, and the student portfolio process. Ongoing residency program director surveys will indicate how CC students are performing as new physicians. Educational changes such as the ones we implemented require a cultural shift which could take years to occur. Knowing that change is a constant, we continue to innovate and study the impact of our innovations.

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H.L. Heiman is associate professor, Departments of Medicine and Medical Education, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

C.L. O'Brien is instructor, Department of Medical Education, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

R.H. Curry is professor, Departments of Medicine and Medical Education, and senior associate dean for educational affairs, University of Illinois College of Medicine, Chicago, Illinois.

M.M. Green is associate professor, Departments of Medicine and Medical Education, and senior associate dean for medical education, Augusta Webster Office of Medical Education, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

J.F. Baker is professor, Department of Physiology, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

R.F. Kushner is professor, Department of Medicine, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

J.X. Thomas is professor, Departments of Physiology and Medical Education, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

T.C. Corbridge is professor, Department of Medicine, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

J.F. Corcoran is adjunct associate professor, Departments of Surgery and Medical Education, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

J.M. Hauser is assistant professor, Department of Medicine, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

P.M. Garcia is professor, Departments of Obstetrics and Gynecology and Medical Education, Northwestern University Feinberg School of Medicine, Chicago, Illinois.

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