Developing Tomorrow’s Leaders: A Medical Student Distinction Track in Health System Transformation and Leadership

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Abstract

Problem
Calls for medical education reform focus on preparing physicians to meet the challenges of today’s complex health care system. Despite implementing curricula focused on health systems science (HSS), including quality improvement (QI), patient safety, team-based care, and population health, a significant gap remains in training students to meet the system’s evolving needs.

Approach
Brody School of Medicine redesigned its curriculum to prepare leaders to effect health system change. This included development of a distinction track in health system transformation and leadership, known as the Leaders in INnovative Care (LINC) Scholars Program. Selected LINC scholars spend eight weeks in a summer immersion experience designed to provide foundational knowledge and practical application.

Outcomes
Two cohorts (15 LINC scholars) completed the summer immersion in 2015 and 2016. Participants demonstrated significant improvement in knowledge and confidence and continue to be engaged in ongoing QI projects throughout the health system. All scholars have presented their work at local, regional, or national meetings. Students rated patient navigation experiences, health system leader interviews, QI project application, and interprofessional experiences as most valuable and recommended adoption in the curriculum for all students.

Next Steps
A distinction track with an immersion component can be an effective method to pilot innovative HSS components for the entire curriculum while preparing a cadre of learners with advanced expertise. To longitudinally measure HSS knowledge change, behavioral impact, and organization-level outcomes, next steps must focus on development of workplace-based assessments, establishment of learner portfolios, and longitudinal tracking of student outcomes, including career trajectory.

Problem
Transforming the health care delivery system to improve patient safety and quality, while emphasizing collaborative partnerships among health professionals and the patients, families, and communities they serve, remains one of the greatest challenges in medicine. Medical errors are reported to be the third leading cause of death and are largely due to disjointed care delivered in highly complex health care delivery systems.1 Determining how to prepare the next generation of physicians to meet the Institute of Medicine goals and embrace the Quadruple Aim is a critical strategic priority.2–5 Although there have been calls to create a more reliable health care system and advance the science of safety and quality improvement (QI) nationally, few medical schools incorporate training that prepares graduates to meaningfully contribute to these goals.6–8 Stakeholder receptivity, competing curricular demands, focus on standardized examination performance, lack of faculty expertise, and nascent health systems science (HSS) curricula and assessments have been proposed as potential obstacles.7 Reports have identified deficiencies among newly trained physicians in health care delivery, financing, communication skills, team-based care, population health, and the attainment of patient safety and quality, indicating a pressing need for HSS in medical education.6–8 An inclusive HSS framework was developed that aligns these broader curricular gaps with the Accreditation Council for Graduate Medical Education’s systems-based practice core competency domain and the Association of American Medical Colleges’ Core Entrustable Professional Activities for Entering Residency.9 Preparing students for practice by advancing collaborative care and modeling attributes of a learning health system requires that health professional schools redesign their curricula to incorporate HSS as the third pillar of essential education alongside basic and clinical sciences.5,9,10

With five-year funding from the American Medical Association’s (AMAs) Accelerating Change in Medical Education program, Brody School of Medicine at East Carolina University (BSOM) implemented a three-pronged strategy to implement an HSS curriculum for medical students in its Redesigning Education to Accelerate Change in Healthcare initiative (www.ecu.edu/reach). The strategy included a longitudinal curriculum in HSS for all students, a yearlong faculty professional development component, and the creation of a distinction track in health...
system transformation and leadership—called the Leaders in INnovative Care (LINC) Scholars Program—for selected medical students.

In this report, we describe the design and preliminary outcomes of the summer immersion experience that launches the LINC Scholars Program. The goal of this experience is to frontload knowledge and skills needed for competency in HSS through advanced course work, experiential activities, and practical application within the delivery system.

Approach
Overview
The LINC program begins with an eight-week summer immersion between the first and second years of medical school, followed by additional longitudinal training woven throughout the remainder of medical school as paracurricular experiences for participating students. The summer immersion provides these scholars with advanced knowledge and skills required for the subsequent co-curricular experiential components that require increasing independence. Because BSOM is an institution dedicated to providing health care for rural and underserved communities, topics on health care disparities, access to care, and value have been heavily integrated throughout the new HSS curriculum required for all students. The training provided in the summer immersion was intended to add to or more deeply cover this content.

Participant selection
Recruiting the first two cohorts of LINC scholars began with midyear informational sessions for all first-year students, emphasizing why HSS training is needed and could impact their development as physicians and future leaders. Applications from interested students in good academic standing detailed their leadership activities, career goals, and prior experience in HSS. An advisory committee reviewed applications and interviewed a select subset of students. A pilot cohort of 5 scholars (Cohort 1) and a second cohort of 10 scholars (Cohort 2) were notified of acceptance in March 2014 and 2015, respectively. The average age of participating students was 24.5 years. Four students were underrepresented minorities, and 6 were female. Two students had prior military experience, and 2 had advanced degrees.

Program content
Designed using a learning community model, the pedagogical framework included targeted reading assignments, small-group facilitated discussions, written assignments, student presentations, specific skill development (e.g., use of data to drive improvement; leading improvement teams), role modeling, experiential activities (e.g., participation in health system quality committees), and mentored completion of a clinical improvement project. Students were required to complete the Institute of Healthcare Improvement (IHI) Open School Basic Certificate in Quality and Safety to provide a cognitive foundation for learning and to support “flipping the classroom” to focus face-to-face sessions on facilitated discussion and applied exercises. Students spent 30 to 40 hours a week in structured and experiential activities. Appendix 1 describes curricular topics, applied learning activities, assessment methods, and QI projects that were additive to the longitudinal HSS curriculum or taught at an advanced level during the immersion. As part of the program, LINC scholars formally presented their patient navigation experience assessments and QI projects to audiences that included faculty, hospital and ambulatory medical directors, QI officers, and patient advocates from our partnering health system.

Evaluation measures
LINC scholars completed three specific evaluation instruments designed by program leaders and faculty: (1) a pre and post 20-item knowledge test of session content; (2) a self-assessment of pre- and postprogram knowledge, skills, and confidence regarding HSS components using a six-point Likert scale (0 = “none,” 5 = “highly skilled/confident”); and (3) a postprogram 39-item subjective assessment of the program structure, content, and delivery. In addition, Cohort 1 scholars and faculty completed a qualitative review of the experience to inform changes for future cohorts. Student participation in QI projects, TeamSTEPPS (Team Strategies and Tools to Enhance Performance and Patient Safety) master training, and presentations were tracked and presented as outcomes.

Resources needed
Delivery of these diverse experiences required recruitment of a dedicated track leader, curriculum design team, and knowledgeable faculty and mentors. Additionally, support from the affiliated teaching hospital and medical school practice plan were essential as clinical sites for experiential learning and QI projects. The county health director was instrumental in designing activities related to population health, care access, and public health.

The financial investment for two cohorts was $151,987 over two years with $78,863 allocated to funding faculty efforts, $16,115 covering materials, and $42,000 supporting student summer stipends. Student stipends ($2,800 per student) were provided to offset summer living costs and as a recruitment tool. After the first summer, the inaugural scholars became natural ambassadors for LINC with significant increases in students applying for subsequent cohorts.

Design team faculty included one distinction track leader, one program manager, two AMA grant coprincipal investigators, four subject matter experts, and one evaluator, who worked together to develop the curriculum goals, objectives, methods, and evaluation over a nine-month lead-in period. Faculty mentors for each scholar were identified on the basis of QI experience and current QI activities. Over 50 faculty and other interprofessional health system leaders contributed to content delivery and skill acquisition through lecture bursts, discussions, clinical site coaching, and interview/panel participation. The leadership site visits were very beneficial and included key senior administrators, including the chief executive officer (CEO) of the health system and the BSOM dean. Computer labs were successfully used to teach QI improvement tools. Nursing, allied health, dental, and public health faculty joined their medical faculty peers to employ an interprofessional team teaching approach.

Outcomes
Educational and self-assessment outcomes
All 15 scholars completed the summer immersion program, the IHI Open School Basic Certificate, and TeamSTEPPS training. Ninety
percent (9/10) of Cohort 2 students also completed master training in TeamSTEPPS.

Students’ pre and post mean knowledge scores increased 17 points from baseline (Table 1). Student self-assessment of knowledge and skills in patient safety, QI, team-based care, population health, and leadership competencies demonstrated significant improvements post program.

LINC scholars participated in all required activities and have been engaged in 15 different QI initiatives across the medical school and health system (Table 1). Scholars are provided financial support to present their projects at appropriate professional conferences. LINC training has served as a catalyst for advanced expertise and leadership, leading to 16 student presentations at 7 regional and national conferences. Twelve students have presented at the school’s annual Quality Improvement Symposium and 4 at the annual Brody Medical Education Day.

Program evaluation

Student reaction to the summer immersion experience has been favorable with 93% (14/15) of students rating the experience as “highly valuable” or “valuable” and 87% to 100% (13–15/15) rating each of the intended objectives as successfully met (Table 2). Of the experiential activities, the five rated most highly were immersion in a QI project; a patient shadowing clinical workflow analysis and presentation to faculty and patient advisors; experience at the county health department; an observation of “QI and innovation in action” in the neonatal intensive care unit; and an interactive session with the health system CEO. Other interactive activities with executives, educators, and interprofessional students were also consistently rated as valuable.

Completion of IHI modules, sessions on HSS history and population health, clinical team observations, and a population health windshield tour were not rated as highly.

Cohort 1 students completed a qualitative postprogram review to identify the most valuable educational experiences and make recommendations for inclusion in the longitudinal HSS curriculum. These recommendations included incorporation of patient navigation, system leader interviews, quality tools and project application, clinical team observations, and interprofessional exercises with dental, nursing, and allied health students into the longitudinal HSS curriculum. To date, this has been accomplished with a modified activity in patient navigation, interprofessional shadowing, team training, and QI tool applications. Scalability of individualized, highly experiential sessions with appropriate debriefing is a major challenge. Based on participant and faculty input, we added additional health policy, finance, and communication topics that included site visits to the state medical society and state legislature, interviews with health system leaders, and media interview training for Cohort 2. All were very well received by participants.

Next Steps

These early outcomes suggest that a summer immersion program in HSS is effective to increase knowledge, skills, and confidence in related topics and to lay the groundwork for more intensive, longitudinal experiences for students interested in developing greater expertise. There has been no attrition from the distinction track since the program began, and the inaugural cohort of students graduated in May 2018 after meeting all program requirements. We continue to develop the training experiences for the LINC curriculum for students in their second through fourth years.

The LINC Scholars Program can serve as a road map for others planning to implement curricular changes focused on HSS topics. These results suggest that early preclinical students can develop knowledge and skills in advanced HSS content to accelerate their preparation and contribution to health systems improvement.

We faced several challenges and learned key lessons throughout launch of this program. Identifying mentors with availability and expertise remains the greatest challenge in delivering and sustaining the curriculum. We addressed this need through establishment of the Teachers of Quality Academy, which has been previously described.10 Additionally, ensuring adequate support and funding for co-curricular programs is always challenging. Continuously delivering three years of training that includes an intensive summer immersion program was difficult for a single director to manage in the context of other faculty work; we have now expanded this into a role shared by codirectors.

One of the greatest challenges has been evaluation of HSS content because of the lack of readily available and validated

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Table 1

Combined Scores of Cohort 1 (2015) and Cohort 2 (2016) Reflecting Changes in Measures Related to Health Systems Science Components of the LINC Scholar Program, Assessed Pre and Post Summer Immersion Experience

| Assessment                              | Pre. mean (SD) | Post. mean (SD) | P value |
|-----------------------------------------|----------------|-----------------|---------|
| Knowledge test, mean (SD) score         | 61 (10.98)     | 78 (6.06)       | < .001  |
| Self-assessment*                        |                |                 |         |
| Knowledge                               | 7.3 (1.09)     | 8.4 (0.71)      | < .001  |
| Quality improvement principles and processes | 2.1 (1.09)     | 3.9 (0.82)      | < .001  |
| Patient safety principles and processes | 1.9 (1.15)     | 3.9 (0.75)      | < .001  |
| Team-based care principles              | 2.1 (1.15)     | 4.2 (0.54)      | < .001  |
| Team-based care principles              | 1.5 (1.26)     | 3.7 (0.85)      | < .001  |
| Population health principles            | 1.9 (1.44)     | 3.8 (0.75)      | < .001  |
| Effective leadership strategies         | 3.3 (1.10)     | 4.4 (0.71)      | .004    |
| Skills                                  |                |                 |         |
| Quality improvement                     | 1.5 (1.09)     | 3.9 (0.62)      | < .001  |
| Patient safety                          | 1.9 (1.15)     | 3.9 (0.50)      | < .001  |
| Team-based care principles              | 2.1 (1.15)     | 4.2 (0.54)      | < .001  |
| Population health principles            | 1.5 (1.26)     | 3.7 (0.85)      | < .001  |
| Effective leadership of a defined team  | 2.5 (1.02)     | 4.1 (0.50)      | < .001  |

Abbreviations: LINC indicates Leaders in INnovative Care; SD, standard deviation. *Rated on six-point scale (0 = none; 5 = very knowledgeable or highly skilled/confident).
learner and program-level assessment tools. Multiple-choice questions on these content areas are difficult to write, and authentic workplace assessment is challenging because of the lack of agreement on essential skills and behaviors. Identification of valid and reliable quantitative and qualitative tools to assess learner change and program effectiveness in HSS competencies is a tremendous need for the continuum of medical education.

Optimizing health outcomes and preparation of learners for a 21st-century health care system requires that medical school curricula incorporate HSS as the third pillar along with traditional basic and clinical science components. Prioritization of this content can be further supported by testing these concepts in high-stakes exams across the learning continuum. Our key message is that a distinction track incorporating HSS competencies is an effective way to pilot curricular components for the entire curriculum while preparing a smaller cadre of learners with advanced expertise to become health system leaders. Our design immersed learners in HSS and led to increased collaboration across the health care system, development of faculty as HSS mentors, identification of new stakeholders, and innovative training opportunities.

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Appendix 1
Learning Activities and Method of Assessment/Evaluation, Leaders in INnovative Care (LINC) Scholars Program, Brody School of Medicine

| LINC Scholars Program learning activities | Activity | Description | Assignment/evaluation |
|------------------------------------------|----------|-------------|-----------------------|
| Leadership                               | Leadership retreat* | Two-day workshop to learn principles of leadership and develop essential skills to lead self, lead others, and lead for change. | Reflection, small- and large-group debrief. |
| Media training*                          | In conjunction with ECU news services and school of communication, students learned the interpersonal communication skills for presentations, patient communication, and media interviews. | Participants researched a current topic/presentation related to health care and participated in a recorded mock interview. Small-group debrief and feedback of interview. Developed sample press release and social media postings. |
| Interview with health system CEO         | Facilitated interview with health system CEO related to operational, strategic, clinical roles and to explore personal leadership style and philosophy in leading a large health system. | Small-group debriefing. |
| QI                                       | QI project analysis | Reviewed a QI project conducted by their mentor and provided analysis of QI process application, impact, outcomes, strengths, and opportunities for improvement. | QI project analysis presentation to large interdisciplinary group including faculty, medical directors, patient experience officials, and mentors. |
| Lean Six Sigma exercise                  | Scholars participated in group activity to illustrate principles of Lean and how they are used to drive quality. | Participants would individually attempt to sequence numbers on a jumbled page. On subsequent rounds, the numbers were sorted according to Lean principles to illustrate how to more easily sequence them. |
| Data analysis activities                 | Scholars manipulated datasets to create run charts, distribution plots, and other QI data analysis tools. | Faculty-led, large-group computer lab session. |
| Paper airplane activity                  | Teams of students created and managed a system for making paper airplanes efficiently. This activity was designed to introduce and practice skills in designing systems, PDSA cycles, communication, and teamwork. | Teams competed in three rounds of designing an efficient paper airplane factory. The group debriefed after every round. |
| Draw the pig activity                    | The primary objective of this activity was to describe strategies for reducing process variation in health care, identify advantages and disadvantages of standardization, and examine the relationship between quality and leadership. | Participants were tasked with drawing a pig. The first round had only 3 basic instructions. The second round, participants were given a detailed list with 13 tasks and 6 subtasks. Final round included an image with the steps to draw the pig. A large-group debrief occurred after each round. |
| Hospital patient safety QI               | Participated in hospital QI meeting to observe real-life application of QI tools, including PDSA, data analysis, change management, and leadership. | Large-group debriefing. |
| Patient safety                           | Scholars shadowed a patient and their family through a care experience from “parking lot to parking lot,” documenting every detail in the care process as it is experienced by the patient. | Patient shadowing flow map, patient navigation presentation, and recommendations. |
| Root cause analysis                      | Scholars simulated RCA on a historical, real case. They simulated interviews, developed findings, and compared to real case outcome. | Large-group debrief. |

*Appendix continues*
### LINC Scholars Program learning activities

| Topic                          | Activity                                      | Description                                                                                   | Assignment/evaluation                      |
|-------------------------------|-----------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------|
| Interprofessional education   | Interprofessional team clinical observation   | Observed health care teams in a clinical setting.                                             | Team observation report.                    |
|                               | panel discussion                              | Panelists provided an overview of their training and clinical practice, and described how their practice intersects with other health care professionals. | Large-group debrief.                        |
|                               | Interprofessional speed dating activity       | Students from other health professions schools participated in a speed dating activity to learn about the other participants' journey to choosing their profession, clinical practice, and educational requirements. | Large-group debrief and discussion.         |
|                               | Allied health sciences lab tours              | Students visited allied health sciences labs to learn about their role in health care delivery. | Large-group debrief.                        |
| Population health             | Community windshield tour                    | Students identified a small town and conducted a "windshield" tour of the town to capture examples of positive and negative determinants of health and access to food and health services. | Presentation of windshield tour experience and reflection assignment. |
| Health department experience  | Schol~ars spent a day learning about the various divisions, clinics, services, and programs offered at the public health department. | Large-group discussion.                                                                     |
| Poverty and privilege monopoly| Teams of five players were assigned to a different socioeconomic class by drawing an envelope. The envelope contained a description of the family, the money the family had, the family's income, and property they owned. There were certain restrictions and stipulations for the players based on which family they were assigned. Game is played to demonstrate the impact of socioeconomic class on opportunities and outcomes of the players. | Large-group discussion and debrief.          |
| Systems of care               | Health system leader interview                | Pairs of scholars interviewed health system leaders at various levels (i.e., department chairs, medical directors, nurse managers, senior leadership). | Health system reflection matrix, large-group discussion. |
|                               | Health system exploration                    | Scholars each researched a different health system across the state on their mission, financing, size, and scope. | Presentation of each system and large-group discussion. |
| Health care policy            | Trip to visit North Carolina legislature      | Scholars researched relevant health policy topics and shared with the cohort. During the daylong visit, they were briefed by the North Carolina medical society staff on topical legislative issues. They met with individual legislators to discuss policies and gain insight into their leadership philosophy. | Large-group discussion.                    |
| Finance                       | Discussion with health system CFO            | Scholars interviewed CFO to gain insight into financing, implications of insurance, and government payers. | Large-group discussion.                    |
|                               | Costs of running a practice                  | Scholars participated in a moderated exercise discussing the complexities and associated revenue and expenses with running a medical practice. | Large-group discussion.                    |

### LINC Scholars Program quality improvement projects

| 2015 cohort                     | 2016 cohort                                          |
|---------------------------------|------------------------------------------------------|
| • Decreasing episodes of hypocarbia in extremely low-birth-weight infants | • Quality of life in home dialysis patients |
| • Implementation of a multidisciplinary sepsis pathway                  | • Modified early warning system to detect sepsis |
| • The effects of the I-PASS handover mnemonic in medical education       | • Checklist-driven standardization to drive better EMS-related CPR outcomes |
| • Accelerating the PDSA cycle, using computer simulation for operational improvement in the emergency department | • Emergency department arrival to occupy inpatient bed—time reduction project |
| • Improving management of patients with diabetes                          | • Improve mammography screening in ambulatory continuity clinic |

**Abbreviations:** ECU indicates Eastern Carolina University; CEO, chief executive officer; QI, quality improvement; PDSA, plan do study act; RCA, root cause analysis; CFO, chief financial officer; I-PASS, illness severity, patient summary, action list, situation awareness and contingency planning, synthesis by receiver; EMS, emergency medical services; CPR, cardiopulmonary resuscitation; OR, operating room.

*2016 cohort only.

*2015 cohort only.