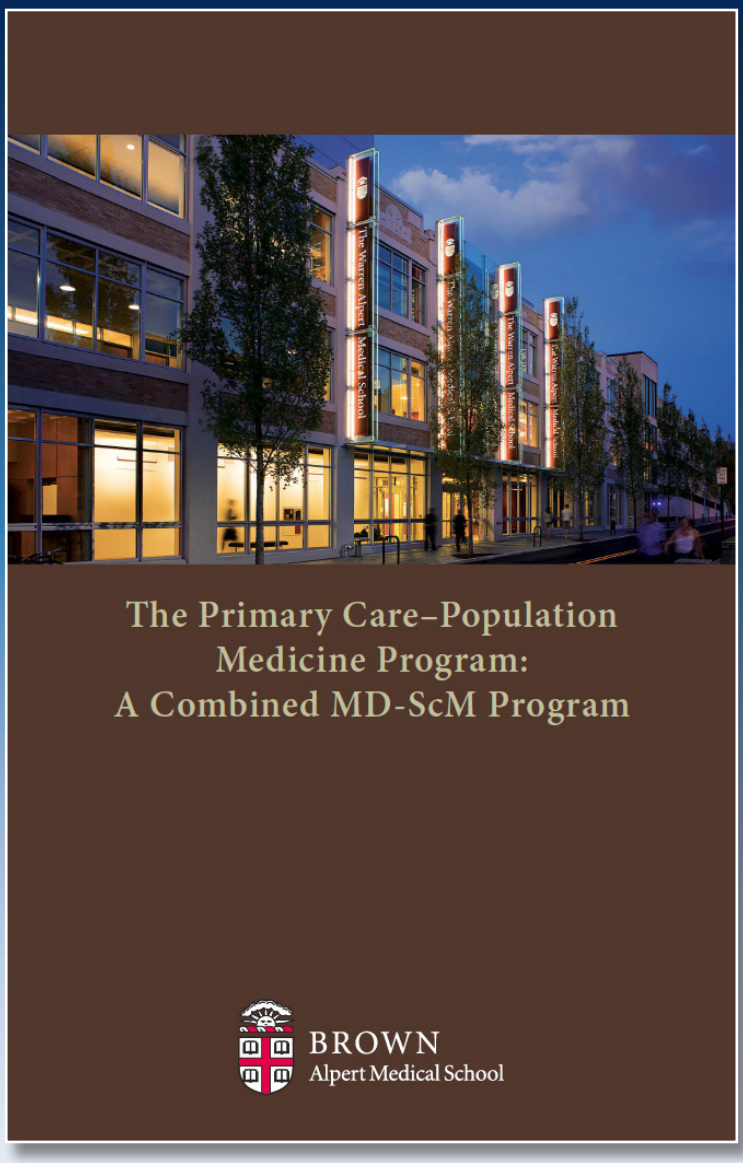
RHODE ISLAND MEDICAL JOURNAL



SPECIAL SECTION

PRIMARY CARE-POPULATION MEDICINE PROGRAM

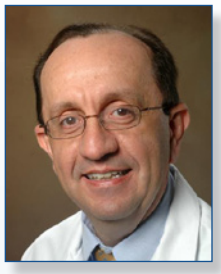
GUEST EDITORS PAUL GEORGE, MD, MHPE; JEFFREY BORKAN, MD, PhD

SEPTEMBER 2015 VOLUME 98 • NUMBER 9 ISSN 2327-2228

RHODE ISLAND
MEDICAL JOURNAL

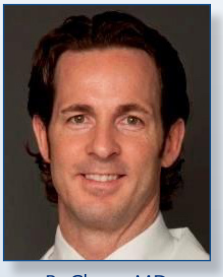

P. George, MD, MPHE


J. Borkan, MD, PhD


M. Mello, MD, MPH


G. Epstein-Lubow, MD


J. White, MD, MPH


B. Clyne, MD

Though currently a pilot program for a small group of selected students, the Longitudinal Integrated Clerkship (LIC) will become a standard element of the third year for all students enrolled in the Primary Care – Population Medicine (PC-PM) Program. Students in the pilot program this year, from left: Samantha Roche, Sarah Iosifescu, Jamila Wynter, David Corner, Divya Dethier, Abass Noor, Emily Davis and Zachary Tabb.


BROWN PC-PM PROGRAM

The Primary Care-Population Medicine Program at The Warren Alpert Medical School of Brown University

PAUL GEORGE, MD, MHPE; ALLAN R TUNKEL, MD, PhD; RICHARD DOLLASE, EdD; PHILIP GRUPPUSO, MD; LUBA DUMENCO, MD; BRENDA RAPOZA, MBA; JEFFREY BORKAN, MD, PhD

ABSTRACT

The United States healthcare system has been in a period of rapid evolution over the past decade, a trend that is anticipated to continue for the foreseeable future. Physicians are increasingly responsible for the quality of care they provide, and are being held accountable not just for the patient in front of them, but also for the outcomes of their patient panels, communities, and populations. In response to these changes, as well as the projected shortage of primary care physicians, the Warren Alpert Medical School of Brown University (AMS) developed the Primary Care-Population Medicine (PC-PM) program, which builds upon the traditional curriculum with major integrated curricular innovations. The first is a Master of Science Degree in Population Medicine that requires students to take nine additional courses over four years, complete a thesis project focused on an area of Population Medicine, and take part in significant leadership training. Another significant innovative element is the development of a Longitudinal Integrated Clerkship (LIC) during the 3rd year of medical school in which the students complete a longitudinal outpatient experience with the same preceptors and patients. During the LIC students will follow a panel of patients wherever care is provided, while focusing on population health and healthcare delivery issues, in addition to medical topics throughout their clinical and didactic experiences. Though several of the innovative elements are being piloted, the inaugural PC-PM class of up to 24 students will only begin in August 2015. While the outcomes from this program will not be known for many years, the potential impact of the program is significant for AMS, medical education, and the future of healthcare delivery.

KEYWORDS: Population health; Undergraduate Medical Education; Curriculum

INTRODUCTION

The healthcare system in the United States has been in a period of rapid evolution over the past decade, a trend that is anticipated to continue for the foreseeable future.[1] Major changes to US healthcare delivery and financing, such as the passage and implementation of the Affordable Care Act[2] and the recent repeal of the sustainable growth rate, are impacting physician roles and expectations. Physicians are increasingly asked to provide evidence of the quality of care they are providing, and are being held accountable not just for the patient in front of them, but also for the outcomes of their panels, communities, population of patients.[3] These new roles require skills not commonly taught in the traditional medical school curriculum. Medical schools must now make room for the "third science" of healthcare delivery, along with the basic and clinical sciences, and include topics such as quality improvement,[4] leadership,[5] and working in interprofessional teams.[6]

As the U.S. healthcare system continues to evolve, an anticipated shortage of physicians, both primary care and specialists, is expected to worsen over the next ten years. Current workforce projections predict a shortage of between 46,000 and 90,000 physicians by 2025,[7] with a potential deficit of 33,000 primary care physicians by 2035.[8] To alleviate the anticipated shortage of primary care physicians, authorities suggest increasing recruitment of medical students into primary care specialties using means as diverse as increasing the attractiveness of ambulatory rotations in medical schools, increasing team-based care,[9] and improving the parity between primary care and specialty incomes.[10]

In response to the changing healthcare system and a projected shortage of primary care physicians both locally and nationally, the Warren Alpert Medical School of Brown University (AMS) began planning for the development of a Primary Care-Population Medicine (PC-PM) program in 2011. The origins of the idea for such a program date back to the initiation of the medical school, which was originally conceived of as a "primary care medical school." Serious discussions to unite training in the three primary care specialties (Internal Medicine, Family Medicine, and Pediatrics) took place at Brown in the late 1980s and early 1990s, and Brown gained national prominence in this area.

Momentum for designing a unique primary care-population medicine program surfaced in 2011 and 2012 for several reasons:

- AMS moved into a new facility at 222 Richmond Street in the Providence Jewelry District, allowing for innovative medical education programs and an expansion of class size.
- The AMS faculty's depth of experience and comfort

with innovative approaches in the areas of primary care, population medicine, public health, and medical education enabled the design and implementation of the PC-PM program.

- Senior administrators from AMS including then Associate Dean for Medical Education, Dr. Philip Gruppuso, and then Dean of Medicine and Biologic Sciences, Dr. Edward Wing, proposed the program to Brown University leadership, including then President Ruth Simmons, along with leaders in Rhode Island (RI) health care and state government, receiving enthusiastic support for the concepts and were encouraged to develop the program.
- The American Medical Association (AMA) began a grant initiative in 2013, "Accelerating Change in Medical Education" (ACE), in which they sought bold proposals for schools to change how medical students are educated.[11] AMS and the PC-PM program, under the leadership of Dr. Paul George, Dr. Jeffrey Borkan and Dr. Gruppuso, received one of these $1 million dollar grants, boosting the visibility of the project and engaging national collaborators at the cutting-edge of medical education.
- The Rhode Island Foundation provided generous support, consistent with their aim to improve primary care in the State.
- Broad support for the initiative and its elements arose from students, faculty, and stakeholders across Rhode Island in government, medicine, healthcare, and elsewhere.

VISION OF THE PRIMARY CARE-POPULATION MEDICINE PROGRAM

The Planning Committee for PC-PM program, in 2012, consisting of senior administrative leaders at AMS and faculty physicians, set forth the following vision:

- The PC-PM program will be innovative and consistent with the reputation for excellence in medical education already held by Brown. It will enhance education in such areas as community engagement, non-traditional care settings and longitudinal educational experiences, areas that will attract outstanding students and facilitate their ability to achieve their career goals.
- Beyond training excellent primary care doctors, the program will train "clinicians plus" – leaders in education, research, and advocacy with a focus on generalist medicine and values consistent with service to the needs of patients.
- The program will be scholarly. It will provide opportunities for further academic and professional development in public health, medical education, health policy, health administration and business, as well as in clinical areas such as care of the underserved, quality improvement, and global health.
- Evidence-based approaches to pedagogy will be considered and used whenever possible – in development of curricular content, timing, sequence of experiences, extensive use of case study methods, and longitudinal clerkship experiences.
- Though established as a program with unique curricular and administrative aspects, the program will be integrated, wherever possible, with the existing medical education program in terms of administration, curriculum, space, and oversight by the Liaison Committee for Medical Education (LCME).

This vision was fashioned into a specific plan for a four-year program in which students receive both a Doctorate of Medicine and a Master of Science (ScM) degree in Population Medicine from AMS and Brown. In order to reduce the student loan burden, there will be no additional cost for the additional degree. As part of the ScM, there will be a research requirement in primary care, population medicine, or health policy, as well as interdisciplinary and leadership training. Methods for integrated, active learning will be central to its design and execution. The hope is that the graduates of this program will continue into residencies in primary care, ideally in Rhode Island; towards this end, there may be opportunities for PC-PM students to stay in Rhode Island to complete their residency training.

ADMISSIONS

The PC-PM program can accommodate up to 24 students per year. Students are admitted to the PC-PM program through the standard processes. Students complete an initial application through the American Medical College Application Service (AMCAS) and receive a secondary application from AMS; students have the option to indicate their interest in the PC-PM program on the secondary application. Once they indicate their interest, students complete two additional essays focused on the U.S. Healthcare System and Population Medicine. They are then screened by the AMS admission staff and offered an interview if they meet AMS' requirements. Students are interviewed by two members of the admissions committee, with one member typically faculty in the PC-PM program. They are then admitted to AMS by a vote of the Admissions Committee.

CURRICULAR ELEMENTS

There are two major curricular innovations within the PC-PM program. The first is the Master of Science Degree in Population Medicine, which requires students to take nine additional courses, over four years, complete a thesis with research focused on Population Medicine, and undertake an extensive leadership program.

These courses and programs include (see Mello et al in this issue for further details):

- Health Systems and Policy I: Taught in the 1st semester of 1st year, this course focuses primarily on health disparities and social determinants of health.
- Research Methods in Population Health: Taught in the 2nd semester of 1st year, this course focuses on research methods, including formulation of a population medicine research question, study design and manuscript preparation.
- Health Systems and Policy II: Taught in the summer between 1st and 2nd year, this hybrid course (partially in-class and partially web-based) will focus on the US Healthcare System.
- Quantitative Methods: Taught in the summer between 1st and 2nd year, this hybrid course (partially in-class and partially on-line) will focus on biostatistics and epidemiology.
- Research Independent Study: In this course, students will begin the research that will form the basis for their thesis project.
- Leadership: Taught primarily in 2nd year with elements integrated through the four years, this course will focus on the principles of leadership in healthcare settings.
- Clinical and Population Medicine I and II: Taught in the 3rd year, these courses will focus on the intersection between clinical and population medicine. These courses will have a focus specifically on quality improvement, the social and community context of healthcare and leadership.
- Capstone Seminar in Population Medicine: Taught in 4th year, this hybrid course (partially in-person and partially online) will revisit topics taught in the first three years while consolidating the skills students will need to be leaders in population health through residency and beyond.

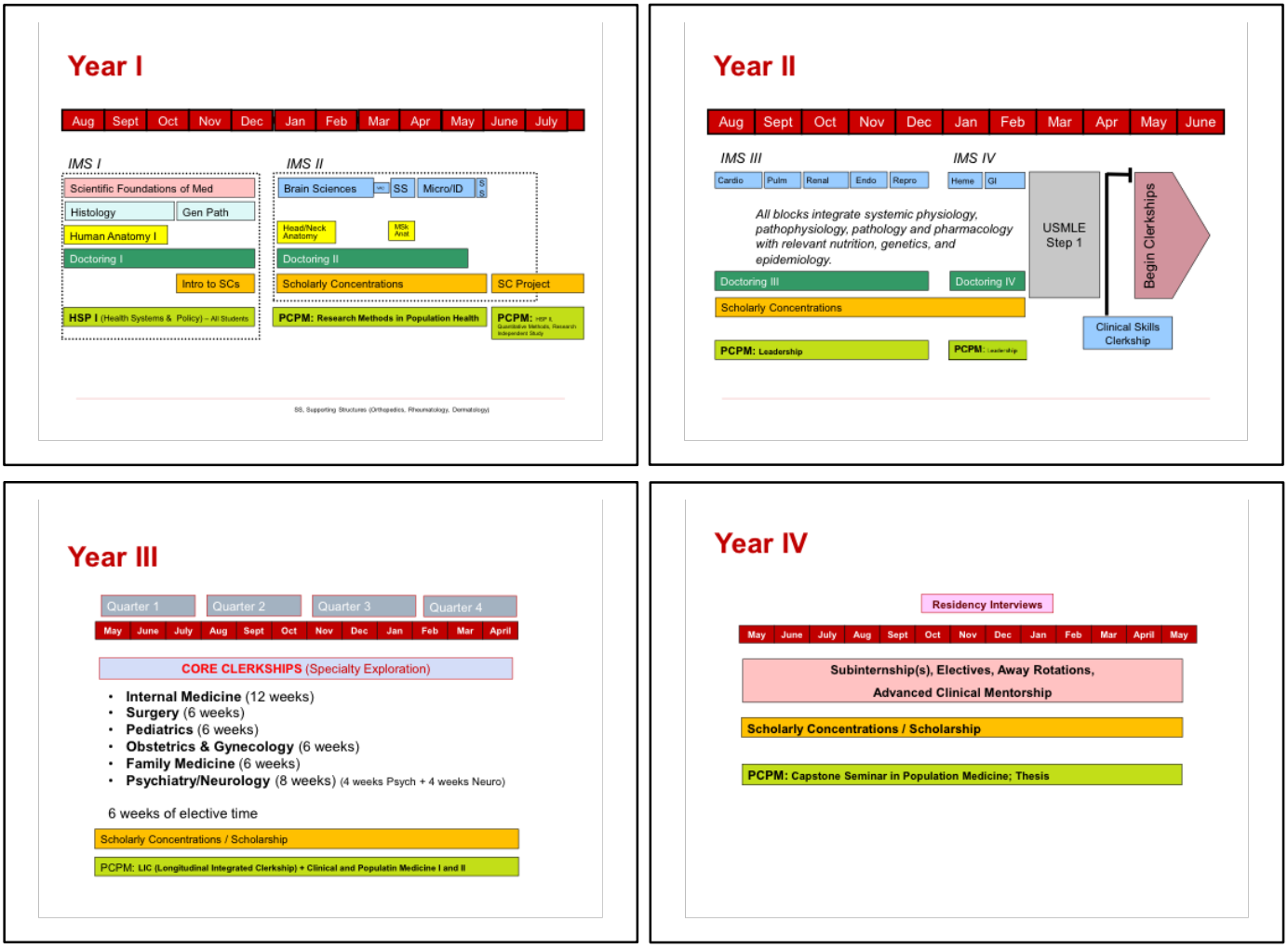
As part of the integrated ScM, students will undertake research in an area related to population medicine and complete a thesis on that research. The end product will be a manuscript suitable for submission to a peer-reviewed journal. While the Master's degree is integrated into the curriculum and designed for completion in four years, some students may consider an additional 5th year, at no tuition cost, to complete their research.

The second major element to the PC-PM program is a Longitudinal Integrated Clerkship (LIC) (see Epstein-Lubow et al in this issue for further details). Rather than moving from rotation to rotation every 6 or 12 weeks, the majority of a 3rd year student's time in the PC-PM program will be spent in the LIC. **Table 1** describes the differences between the traditional clerkship structure and the LIC at AMS. Over the course of 32 weeks, PC-PM students will spend one half-day per week with a mentor in family medicine, internal

Table 1. Comparison of Alpert Medical School Longitudinal Integrated Clerkship and Traditional Clerkship Structure

	Longitudinal Integrated Clerkship	Traditional Clerkship Structure
Specialties represented	Family Medicine, General Surgery, Internal Medicine, Obstetrics and Gynecology, Neurology, Pediatrics, Psychiatry	Family Medicine, General Surgery, Internal Medicine, Obstetrics and Gynecology, Neurology, Pediatrics, Psychiatry
Number of required inpatient weeks	12	23
Number of required outpatient weeks	32	21
Elective weeks	4	4
4th year requirements	ICU (4 weeks; preliminary); Sub-Internship (4 weeks)	Sub-Internship (4 weeks); Surgery selective (6 weeks)
Evaluation	Comprised of Shelf examination, OSCE and Direct Observation (in most cases, same as traditional clerkship structure)	Comprised of Shelf examination, OSCE and Direct Observation
Shelf exams administered…	Throughout the year after didactic content for a subject area delivered, with at least 1 month and typically six weeks separating exam administration	At the end of a block rotation
OSCEs administered	Intermittently throughout 3rd year	At the end of a block rotation
Clerkship directors	Same as traditional block clerkships	N/A
Didactics	Integrated, scheduled across entirety of LIC and includes Population Medicine content	Scheduled per block
Sites	For pilot, Rhode Island Hospital, Memorial Hospital and VA with inpatient rotations also at Women and Infants Hospital, Hasbro Children's Hospital, and Butler Hospital	Rhode Island Hospital, Memorial Hospital, VA, Miriam Hospital, Butler Hospital, Bradley Hospital, Women and Infants Hospital and Hasbro Children's Hospital

Figure 1. Schematic illustration of Primary Care-Population Medicine program Years 1–4 [click here to download enlarged figures]



medicine, obstetrics and gynecology, pediatrics, psychiatry/neurology, and surgery; emergency medicine experiences will also be included. Wherever possible, experiences will occur in the same hospital, hospital system, and geographic areas. PC-PM students will work with their preceptors to establish their own patient panel of approximately 30–50 patients and they will be expected to follow these patients to whatever healthcare setting they are sent. Using a protocol for prioritization, they may be present for their patients' deliveries and surgeries, visit them on the inpatient units and nursing homes, and even participate in home care. Finally, PC-PM students will participate in didactics on clinical and population medicine topics during the LIC. The LIC is currently being piloted for 8 AMS students, with support from both the American Medical Association and the Rhode Island Foundation, during the 2015–16 academic year. Feedback will be used to assess the experience. There are plans to expand the LIC pilot with 12 to 16 students during the 2016–2017 academic year.

Students in the PC-PM program will share many of the same experiences as those in the traditional medical program. For example they will have the same basic science courses and the same Doctoring (Introduction to Clinical Medicine course) experience as the students in the traditional program. However, to encourage the start of a primary care identity, during the Doctoring course, these students will be placed in advanced Patient-Centered Medical Homes for their Doctoring mentor sites. **Figure 1** depicts the curricular elements for all four years of the PC-PM program.

As part of the PC-PM program, elements of the curriculum have been or are being piloted. For example, the first course in the Master's degree sequence, entitled Health Systems and Policy I, was taught to all 1st year medical students during the 2014–2015 academic year.

EVALUATION PLAN

In order to evaluate the efficacy of the PC-PM program, program faculty and staff created a multi-faceted approach employing both qualitative and quantitative strategies. These methods include evaluating the entire AMS student body on items such as empathy, tolerance of ambiguity and

attitudes in working with underserved populations using previously validated surveys.[12,13,14] In addition, we will conduct both interviews and focus groups with AMS students in the PC-PM program and the standard program to ascertain commonalities and differences between these populations of students.

Finally, we will look at a number of measures of success for the PC-PM program and LIC. These include the following:

1. The number of students who successfully complete the PC-PM program and graduate with both an MD and Master of Science degree in Population Medicine.
2. The number of students who enter primary care residency programs.
3. The number of students who remain in Rhode Island for residency and attending positions.
4. The number of students who become physician leaders (such as Medical Directors, Academicians, and Public Health Directors and Assistant Directors).
5. The number of physician practices recruited to be part of the LIC and the impact of students on these practices.
6. The successful introduction by students of quality improvement projects.
7. The number and range of visits to healthcare settings that students attend with patients on their LIC patient panel.
8. The ability of students to work effectively in interprofessional health care teams. This will be measured through validated surveys, including the Readiness for Interprofessional Learning Scale1 and direct observations by faculty.
9. Clinical competency as measured through student scores on the discipline-specific Shelf Exams, the National Board of Medical Examiner's Licensing Examinations (i.e., USMLE Steps 1, 2, and 3), and Year 4 OSCEs (Objective Structured Clinical Examinations).
10. Student satisfaction with the PC-PM program.

DISCUSSION

The rapidly evolving US healthcare system and the projected shortage of primary care physicians are requiring the reassessment of how medical students are educated and trained. New knowledge, attitudes, and skills are needed for the increased demands of practice, and medical schools must adapt, adding the third science of healthcare delivery to the basic and clinical sciences. Other institutions, such as Duke with their Primary Care Leadership Track[15] and The University of Virginia with their Generalist Scholar Track,[16] have implemented potential solutions. However, the PC-PM program at AMS is unique among programs with its longitudinal emphasis on seamlessly integrated population medicine throughout the four years of medical school and the awarding of a Master of Science degree in Population Medicine at its conclusion. In addition, by developing a sizable number of assured primary care residency positions in the state, this program will provide the next generation of primary care "clinicians-plus" who will be the future practitioners, leaders, educators, researchers and advocates for primary care and population medicine.

There are potential barriers for the PC-PM program. As with any expansion of medical school class size, there must be increased capacity for clinical training. This is especially true with LICs, which are resource consuming. AMS is working on engaging partners, new and old, to ensure the same high level of training for its students. In addition, recruiting talented and dedicated students into primary care specialties remains a challenge, as student loan debt increases and primary care physician salaries lag. Finding partners (such as foundations, hospital systems or others) to offset the cost of medical education is a priority.

Barriers notwithstanding, the Primary Care-Population Medicine program is an innovative and exciting program that provides students with the knowledge, skills and attitudes they need to function as physician leaders in an ever-changing healthcare system. We anticipate the PC-PM program will lead to improvements in the outcomes, quality and organization of healthcare in the state, while at the same time fostering research in primary care, population medicine and health policy. While the evaluation of the program outcomes will not be known until students graduate and move on to residencies and practice, there is great potential of the program to affect medical education at AMS, in Rhode Island and nationally.

References

1. https://www.aamc.org/download/370550/data/advancing.pdf. Accessed June 1, 2015.
2. McDonough JE, Adashi EY. Realizing the promise of the Affordable Care Act – January 1, 2014. *JAMA*. 2014;311:569-70.
3. Doherty RB. Goodbye, sustainable growth gate – hello, merit-based incentive pay system. *Ann Intern Med*. 2015; doi: 10.7326/M15-0992. [Epub ahead of print].
4. Boonyasai RT, Windish DT, Chakraborti C, Feldman LS, Rubin HR, Bass EB. Effectiveness of teaching quality improvement to clinicians. *JAMA*. 2007;298:1023-1037.
5. Webb AM, Tsipis NE, McClellan TR, McNeil MJ, Xu M, Doty JP, Taylor DC. A first step toward understanding best practices in leadership training in undergraduate medical education: a systematic review. *Acad Med*. 2014;89:1563-70.
6. MacDonnell CP, Rege SV, Misto K, Dollase R, George P. An introductory interprofessional exercise for healthcare students. *Am J Pharm Educ*. 2012;76:154.
7. https://www.aamc.org/download/426242/data/ihsreportdownload.pdf. Accessed May 28, 2015.
8. Petterson SM, Liaw Wr, Tran C, Bazemore AW. Estimate the residency expansion required to avoid projected primary care physician shortages by 2035. *Ann Fam Med*. 2015;13:107-14.
9. Fodeman J, Factor P. Solutions to the primary care physician shortage. Am J Med. 2015; pii: S0002-9343(15)00266-1. doi: 10.1016/j.amjmed.2015.02.023. [Epub ahead of print].

10. Family Medicine for America's Health Writing Group. Health is primary: Family Medicine for America's Health. *Ann Fam Med*. 2014;12: S1-S12.
11. http://www.ama-assn.org/sub/accelerating-change/index.shtml. Accessed Mary 28, 2015.
12. Geller G. Tolerance for ambiguity: an ethics-based criterion for medical student selection. *Acad Med.* 2013;88:581-4.
13. Hojat M, Gonnella JS, Nasca TJ, Mangione S, Veloksi JJ, Magee M. The Jefferson Scale of Physician Empathy: further psychometric data and differences by gender and specialty at item level. *Acad Med.* 2002;77: S58-60.
14. Stephens MB, Landers G, Davis SW, Durning SJ, Crandall SJ. Medical Student Attitudes Toward the Medically Underserved: The USU perspective. *Mil Med*. 2015;80:61-3.
15. http://medschool.duke.edu/education/degree-programs/pclt. Accessed Mary 28, 2015.
16. http://www.medicine.virginia.edu/education/more/generalist-scholars-program/home. Accessed May 28, 2015.

Authors

Paul George, MD, MHPE, Director of the Primary Care-Population Medicine Program and Associate Professor of Family Medicine, Department of Family Medicine, and Office of Medical Education, The Warren Alpert Medical School of Brown University, Providence, RI.

Allan R. Tunkel, MD, PhD, Associate Dean for Medical Education and Professor of Medicine and Medical Science, Office of Medical Education and Department of Medicine, The Warren Alpert Medical School of Brown University, Providence, RI.

Richard Dollase, EdD, Director of the Office of Medical Education, The Warren Alpert Medical School of Brown University, Providence, RI.

Philip Gruppuso, MD, Professor of Pediatrics, Department of Pediatrics and Office of Medical Education, The Warren Alpert Medical School of Brown University, Providence, RI.

Luba Dumenco, MD, Lecturer in Pathology and Laboratory Medicine and Director of Preclinical Curriculum, Office of Medical Education, and Department of Pathology and Laboratory Medicine, The Warren Alpert Medical School of Brown University, Providence, RI.

Brenda Rapoza, MBA, Coordinator of the Primary Care-Population Medicine Program Office of Medical Education, The Warren Alpert Medical School of Brown University, Providence, RI.

Jeffrey Borkan, MD, PhD, Assistant Dean for the Primary Care and Population Medicine Program, Professor and Chair of Family Medicine, Department of Family Medicine, and Office of Medical Education, The Warren Alpert Medical School of Brown University, Providence, RI.

Disclosures

Drs. George, Tunkel, Dollase, Dumenco and Borkan and Ms. Rapoza all receive grant funding through the American Medical Association's Accelerating Change in Medical Education Grant Initiative; Dr. George and Ms. Rapoza receive grant funding through the Health Resource Service Administration; Dr. George and Dr. Gruppuso receive grant funding from the National Institutes of Health; Dr. George receives grant funding from the Rhode Island Foundation.

The Primary Care-Population Medicine program is supported, in part, by a grant from the American Medical Association's "Accelerating Change in Medical Education" program.

The Longitudinal Integrated Clerkship pilot is supported, in part, by a grant from the Rhode Island Foundation.

Correspondence

Paul George, MD, MHPE
Office of Medical Education
Alpert Medical School of Brown University
Box G-M 109
70 Ship Street
Providence, RI 02903
Paul_George@brown.edu

Advancing the Integration of Population Medicine into Medical Curricula at The Warren Alpert Medical School of Brown University: A New Master's Degree Program

MICHAEL J. MELLO, MD, MPH, FACEP; EDWARD FELLER, MD, FACP, FACG; PAUL GEORGE, MD, MHPE; JEFFREY BORKAN, MD, PhD

ABSTRACT

Additional knowledge, attitudes and skills are required for the next generation of medical students as they expand the traditional focus on individual patients to include population-based health and scholarly investigation. The Warren Alpert Medical School of Brown University (AMS) is initiating a master's degree program as a key component of the new Primary Care-Population Medicine program at AMS leading to both a Doctorate in Medicine (MD) and Master of Science in Population Medicine (ScM) degrees in four years. The ScM is composed of a series of nine courses, integrated into the four-year MD curriculum, as well as a thesis. Additional attention will be given to leadership and quality improvement training. The goal is to produce graduates competent in the care of individual patients, panels, communities, and populations.

KEYWORDS: Population health; Undergraduate Medical Education; Curriculum

INTRODUCTION

Expanding the traditional focus on individual patients to include population-based health and scholarly investigation are core principles of current undergraduate medical education. The American Association of Medical Colleges (AAMC) via its Medical School Objective Project (MSOP) Report II, notes the importance of "a population health perspective which encompasses the ability to assess the health needs of a specific population, implement and evaluate interventions to improve the health of that population."[1] The Warren Alpert Medical School of Brown University (AMS) leadership, encouraged by stakeholders across Rhode Island in healthcare, government, and academia, recognized and responded to the need for increasing its educational efforts regarding population medicine by increased attention to this topic in the curricula for all students. In addition, motivated by the need to produce physicians who care for patient panels, communities and populations, as well as individual patients, AMS created the Primary Care-Population Medicine (PC-PM) program. The impetus for this program was supported by the Institute of Medicine 2012 report that strongly encouraged consolidation of primary care and public health, "in ways that will yield substantial, lasting improvements in the health of individuals, communities, and populations."[2] Early in the development of the new PC-PM program, program faculty felt it vital for students in this program to have mastery of population medicine, defined by Kindig as "the health outcomes of a group of individuals, including the distribution of such outcomes within the group."[3] This skill set must be robust in developing future clinicians, educators, investigators and leaders who can contribute to scholarly investigation in the field.

This report describes the rationale and structure of a novel master's degree program that is a key component of AMS' PC-PM program leading to both a Doctorate in Medicine (MD) and Master of Science in Population Medicine (ScM) degrees in four years. The Master's program in Population Medicine may be the first of its kind in the US. Embedded in Brown's ScM program is a thesis model that conforms to the AAMC's Population Health Perspective Panel guidelines which state that medical students must be able to define and describe a population or community and must understand the methodology needed to gather this health information.[1]

As described in detail elsewhere in this edition of the *Rhode Island Medical Journal*, faculty leadership and PC-PM Working Groups began designing the Master's degree in 2012. Originally, there were discussions about having students pursue master's degrees in public health, medical education or even public policy. Brown University has outstanding resources and educational experiences in these areas, including existing master's programs in Public Health and Public Affairs. However, after long productive deliberations about the pros and cons, the PC-PM leadership and Working Groups chose a less traditional, and perhaps more arduous path by designing a completely new degree. This innovation was selected for content, pedagogic and pragmatic reasons. The most significant content factor was a clear sense that students would require a different subset of knowledge, attitudes, and skills than those provided by existing master's programs if they were to be successful in providing care to individuals, patient panels, communities, and populations in a complex, rapidly evolving US healthcare delivery system. Although a new master's degree program required much more up-front curriculum design, resource acquisition, and regulatory steps, once assembled, it would be more rapidly adaptable as healthcare evolves and can be constructed to focus on producing physician-leaders, well versed in population medicine and engaged in relevant scholarship. At the

same time other pragmatic decisions involving the degree were made. For example, medical student debt is related to career choice;[4] since this program is designed to encourage careers in primary care, increasing the tuition burden with a master's degree was thought to be counter-productive. In order to control tuition costs for students enrolled in the PC-PM program, AMS senior level administrators and program faculty made the decision to design the degree without the requirement of additional tuition cost to students. Additionally, scheduling and calendar conflicts between medical school courses and university courses are common issues faced around the country, including at Brown. Constructing a new master's program from scratch allowed intentional design and flexibility in scheduling to fit both the developmental stage of the learner and to integrate relatively easily with students' other scheduled curricular requirements. The goal was to provide the right experiences at the appropriate times for PC-PM students in a synergistic, complementary fashion.

In 2014, after several stages of a rigorous review process, the Brown University Corporation approved a medical school initiative to offer the ScM degree in Population Medicine in conjunction with the MD degree. The program will receive its initial cohort of up to 24 first-year medical students in Fall 2015. This initiative consists of a didactic nine-course sequence delivered over four years that is focused on health disparities and social determinants of health, biostatistics, epidemiology, intersection between clinical and population medicine, leadership, health care systems and has a research requirement that culminates in a master's thesis (see **Table 1**). Parts of the curriculum will be delivered to all AMS students, but some are unique to this program. All ScM students will take the same coursework; however their scholarly investigations leading to a thesis will be individually based.

CURRICULAR ELEMENTS

The master's curriculum requires students to develop research skills and scientific writing proficiency and demonstrate these in a thesis.[5] The ScM thesis could be 1) Descriptive Research - examining population patterns of a health-related outcome; 2) Investigative Research - quantifying the relation between an intervention or exposure and a health-related outcome; 3) Health Policy Research – developing and evaluating policy uptake and impact; 4) Program Evaluation – assessing the efficacy of a population-based intervention intended to prevent or control a poor health outcome; or 5) Quality Improvement or Patient Safety Research – examining a medical practice or institution's compliance with establish guidelines or quality indicators.

Barriers have been identified that impede student research during medical school.[6,7] (See **Table 2.**) Successful strategies of medical school investigative initiatives for students are diverse. Formal curricular structures to optimize scholarly efforts commonly involve long-term basic science or clinical investigative efforts. Models may include a specific student research scholar track or longitudinal elective,[8] formal population-based research time,[6] curricular or non-curricular research electives,[10, 11] leaves of absence, and departmental or medical school-level research infrastructure including research workshops.[11] These structural components may be aided by having a student research coordinator or dean leading the program.[12]

During the first academic medical school year (see **Table 1**), ScM candidates will participate in a newly established medical school course, Research Methods in Population Medicine, led by two experienced faculty (MM and EF). This course will prepare students to develop and demonstrate the necessary research skills to formulate a population medicine research question and then design and conduct an investigational study culminating in a manuscript to satisfy thesis requirements. Its educational objectives include having (1) students interpret relevant population health literature and analyze its applicability to community-based practice; (2) compose a research question and formulate a study design to examine it; (3) use biostatistics and epidemiologic methodology in their research design; (4) demonstrate commitment to responsible conduct of research and employ these values in working with an IRB and human subjects; (5) interpret data in the context of the proposed research question, and (6) disseminate their research findings including creating a poster presentations and composing a manuscript of publishable quality.

The course will use multiple educational components including online modules to prepare students for in-person and online discussions. Students will learn different study designs to utilize in answering their specific research question. They will develop basic quantitative and qualitative data- analysis skills and have access to faculty with expertise in these areas. There will be content to educate students about conflict of interest, responsible conduct of research, research misconduct and research finances that interface with research ethics. Additionally, multiple interactive journal clubs will be held regularly to have students develop and obtain mastery in critically reading and assimilating the medical literature in this field.

A representative example of the curriculum content is its focus on quality improvement in health care and use of patient and community safety data. An online class discussion will formulate a research study to answer a specific quality improvement issue, such as "Reducing the number of avoidable hospital re-admissions." Preparatory assigned readings for this module explore issues in measuring quality in health care. In-class discussion will access implementation barriers and opportunities for improvement. A journal club will examine a published hypothesis-based quality improvement intervention and its research methodology.

In a large survey of faculty clinical investigators, 98% of respondents identified lack of a mentor as a prime limitation

Table 1. Master of Science (ScM) in Population Medicine Timeline

THESIS TIMELINE	DEGREE COURSEWORK
Medical School Year One	
Overview Meeting with PC-PM students • Thesis topics/list of mentors • Timeline and policies • Resources available	Health Systems and Policy I (MED 2010) • Elizabeth Tobin Tyler, JD Assistant Professor of Family Medicine • Gowri Anandarjah, MD Professor of Family Medicine Research Methods in Population Medicine (MED 2030) • Michael Mello, MD, MPH Professor of Emergency Medicine • Edward Feller, MD Clinical Professor of Medicine
Individual Student Meetings • Approach to clinical investigation • Discuss research interests • Discuss potential mentors	
Development of Thesis Proposal • Selection of thesis mentor (and reader) • Meeting with thesis mentor • Completion of thesis proposal form and submission for approval	
Thesis Proposal Submission • Thesis proposal due to ScM director • Summer 1 proposed milestones due	
Human Subject Protection Training	
Summer Between Medical School Year One and Two	
Summer Research Assistantship with thesis mentor for project-related work	Health Systems and Policy II (MED 2040) • Elizabeth Tobin Tyler, JD Assistant Professor of Family Medicine Quantitative Methods (MED 2045) • David Anthony, MD, MSc Associate Professor of Family Medicine Independent Study – Thesis Research (MED 2980) • Varied Faculty
Medical School Year Two	
Continued work on research project with mentor • Use scholarly concentration time and independent learning time • Check-in meetings with Drs. Mello and Feller on progress of project Present summer research at AMS Symposium	Leadership (MED 2046) • Brian Clyne, MD Associate Professor of Emergency Medicine
Medical School Year Three	
Continued work on research and/or writing thesis manuscript including use of LIC free ½ days	Clinical and Population Medicine I (MED 2050) Clinical and Population Medicine II (MED 2060) • Jordan White, MD, MPH Assistant Professor of Family Medicine • Alison Riese, MD, MPH Assistant Professor of Pediatrics
Individual Student Meetings • Discussion of fifth-year pathway for ScM • Plan research time into 4th year schedule • Discussion on writing manuscripts, targeting journal for publication	
Medical School Year Four	
Thesis manuscript development continues • Submit thesis to thesis mentor (and reader if appropriate) for review and comment • Submit manuscript to peer reviewed journal • Present research findings at conference Submit thesis to Brown University Graduate School	Capstone Seminar in Population Medicine (MED 2070) • Jeffrey Borkan, MD, PhD Professor of Family Medicine

Table 2. Barriers to medical student research[13] and ScM strategies for success

Barrier	Strategy for Success
Limited training in research methods	Research methodology curriculum; journal club
No protected time for research	Dedicated curricular time for independent ScM project study, summer research assistantship stipend
Lack of a supportive research environment	Medical school librarian; statistical support; two senior faculty advisors
Poor scholarly writing skills	AMS Writing Center component of Brown University Writing Center, scientific writing sessions embedded in curriculum

to trainee.[7] A unique component of the AMS ScM program confronts this vital element with multiple levels of mentorship. The master's thesis project has two dedicated senior faculty (MM, EF) leading the program, advising students in choosing a mentor, implementing a population-based research project and collaborating longitudinally with the students throughout their progress through the degree program. An innovative feature of the program is assembling a cohort of productive faculty members as potential master's thesis mentors. The thesis mentor-ScM mentee collaboration will be a multiyear relationship that will allow for a substantive project of publishable quality. Each thesis mentor will receive an annual stipend. Additionally, students have the option of having an additional mentor as a thesis reader. Thesis readers do not have the continuous relationship but rather a focused expertise or data set that they will share with the student and agree to later review the student's final thesis manuscript.

THESIS PROJECTS

All course content and each student's research project is designed to be completed over four years of study integrated with the entire medical school curriculum. ScM program time is built into the schedules during each academic year. Students will be supported by a medical school stipend to work with their mentor on the research project during the summer between the first and second academic years. This dedicated block of time allows for a project's foundation to be established and built upon during the remaining academic years. A few students may choose additional time to complete the degree requirements; thus, students have the option to utilize a fellowship year between years three and four to advance their research project.

Student thesis projects will be varied and may use both qualitative and quantitative research methodology. They could include policy evaluation at either a state or institutional level. An example would be examining the state 's prescription monitoring program's uptake by health providers and its impact on prescribing patterns. It could address implementation of an interpersonal violence screening program within a primary care practice and linking victims to community resources. Another example would be a quality improvement project within a clinical practice that measure adherence to established disease specific quality indicators, such as a diabetes monitoring initiative or methodologies for further engaging patients using advanced electronic health record patient portals.

There is structured course content on scientific writing, constructing a manuscript, selecting an appropriate journal for submission and the peer review process. Additionally students will develop and demonstrate the skill in creating a scientific poster presentation. Students will have also access to other university resources, including a component of Brown's Writing Center based at AMS, to assist them in manuscript development.

DISCUSSION

We anticipate that this initiative will advance an AMS culture of student scholarship and create an incubator for improved and increased student research productivity. Elements of the program that can contribute to a sustained student investigational infrastructure include (1) a Research Methods course in the curriculum; (2) establishment of a roadmap for all students to approach their entry into research endeavors; and 3) integration of existing institutional resources (dedicated medical librarian, statistical support, AMS-specific Writing Center and Writing Fellows Program) to support medical student research.

Concerns about this program range from apprehensions about the level of rigor to whether the required course work and thesis can be completed in four or even five years. Other concerns include the long-term commitment of scholarly mentor and sites and whether thesis projects will be considered "added value" to the institutions supporting this initiative. Most notably, since students will have freedom of choice regarding careers, there are concerns that students will not enter primary care or generalist fields and that the additional knowledge, attitudes, and skills acquired during the PC-PM program will not be put to use. However, having expertise in population medicine in other fields outside of generalist medicine also confers important benefits.

Evaluation of the program will include collecting prospective data on the effectiveness of the ScM program, measuring short- and long-term results of quality and quantity of scholarly publications and presentations as well as effects on graduates' career choices and productivity. We will continuously

monitor the ScM curriculum by pre- and post-curriculum assessment measures and by student course evaluations.[14] In addition, the PC-PM program will follow graduates as they progress to residency and beyond, measuring markers related to program success. We anticipate that such a major initiative will continually evolve. Ongoing evaluation of data will drive assessment documenting achievements as well as identifying limitations and gaps.

This unique curriculum fulfills a vital gap in medical education – a structured, didactic program to develop physician leaders who have a population-based emphasis in their clinical, investigational, teaching and administrative careers. Program graduates will be sophisticated proponents and practitioners of population medicine as well as future productive clinical investigators. This master's program in Population Medicine, perhaps the first in the US, may provide a valuable example to other medical schools and be translatable to other health professional colleges and universities.

References

1. Contemporary issues in medicine—medical informatics and population health; report II of the Medical School Objectives Project. *Acad Med*. 1999;74:130-41.
2. Institute of Medicine Primary Care and Public Health: Exploring Integration to Improve Population Health. Washington DC: The National Academies Press; 2012.
3. Kindig, DA, Stoddart G. What is population health? *American Journal of Public Health*. 2003;93:366-369.
4. Phillips JP,Petterson SM, Bazemore AW, Phillips RL. A Retrospective Analysis of the Relationship Between Medical Student Debt and Primary Care Practice in the United States. *Ann Fam Med*. November/December 2014;12(6):542-549.
5. Learning objectives for medical student education-guidelines for medical schools: report I of the Medical School Objectives Project. *Acad Med*. 1999;74:13-18.
6. Hirsh DA, Ogur B, Thibault GE, et al. "Continuity" as an Organizing Principle for Clinical Education Reform. *N Engl J Med*. 2007;356; 858-866.
7. Jackson V, Palepu A, Szalacha L, et al. "Having the right chemistry": A qualitative study of mentoring in academic medicine *Acad. Med*. 2003;78:328–334.
8. Smith FG, Harasym PH, Mandin H, et al Development and evaluation of a research project program for medical students at the University of Calgary faculty of medicine. *Acad Med*. 2001;76:189-194.
9. McIntosh S, Block RC, Kapsak G. Training medical students in community health: A novel required fourth-year clerkship at the University of Rochester. *Acad Med*. 2008; 83:357–364.
10. Jacobs CD, Cross PC. The value of medical student research: the experience at Stanford University School of Medicine. *Med Educ.* 1995;29: 342-6.
11. O'Brien Gonzales A, Westfall J, et al. Promoting medical student involvement in primary care research. *Fam Med*. 1998;30:113-6.
12. Zier K, Stagnaro-Green A. A multifaceted program to encourage medical students' research. *Acad Med.* 2001;76:743-7.
13. Herbert RS, Levine RB, Smith CG, Wright SM. A systematic review of resident research criteria. *Acad Med*. 2003;78:61-68.
14. Green ML. Identifying, appraising and implementing medical education curricula - A guide for medical educators. *Ann Int Med*. 2001;135: 889–896.

Authors

Michael J. Mello, MD, MPH, FACEP, Professor of Emergency Medicine, Department of Emergency Medicine, The Warren Alpert Medical School of Brown University, and Department of Health Services, Policy and Practice, Brown University School of Public Health, Providence, RI.

Edward Feller, MD, FACP, FACG, Clinical Professor of Medicine, Department of Medicine, The Warren Alpert Medical School of Brown University, and Department of Health Services, Policy and Practice, Brown University School of Public Health, Providence, RI.

Paul George, MD, MHPE, Associate Professor of Family Medicine, Department of Family Medicine and Office of Medical Education, The Warren Alpert Medical School of Brown University, Providence, RI.

Jeffrey Borkan, MD, PhD, Professor and Chair of Family Medicine, Department of Family Medicine, and Office of Medical Education, The Warren Alpert Medical School of Brown University, Providence, RI.

Disclosures

Drs. George and Borkan receive grant funding from the American Medical Association's "Accelerating Change in Medical Education" Grant Initiative; Dr. George receives grant funding from the Rhode Island Foundation.

The Primary Care-Population Medicine program is supported, in part, by a grant from the American Medical Association's "Accelerating Change in Medical Education" program.

The Longitudinal Integrated Clerkship pilot is supported, in part, by a grant from the Rhode Island Foundation.

Correspondence

Michael Mello, MD, MPH
Injury Prevention Center
Rhode Island Hospital/Hasbro Children's Hospital
55 Claverick Street, 2nd Floor
Providence, RI 02903
mjmello@lifespan.org

Development of a Longitudinal Integrated Clerkship at The Warren Alpert Medical School of Brown University

GARY EPSTEIN-LUBOW, MD; SYBIL CINEAS, MD; JAMES YESS, MD; DAVID ANTHONY, MD, MSc; MARK FAGAN, MD; PAUL GEORGE, MD, MHPE

ABSTRACT

The Warren Alpert Medical School of Brown University is introducing a longitudinal integrated clerkship for third year students in the Primary Care-Population Medicine Program as an alternative to more traditional clerkship models. In developing the longitudinal integrated clerkship, program faculty incorporated a historical perspective of medical education, modern knowledge about students' development of clinical skills, and educational science as it relates to faculty development and learner evaluation. The longitudinal integrated clerkship is being tailored to the fit the Brown University system; as such, it will be unique in its attention to population medicine, including its exposure of students to several distinct health care systems within a single geographic region, and integration of clinical training with completion of a Master's in Population Medicine.

KEYWORDS: Undergraduate Medical Education; Longitudinal Integrated Clerkship

INTRODUCTION

The Warren Alpert Medical School of Brown University is introducing a longitudinal integrated clerkship (LIC) in the 2015-2016 academic year. An LIC is a method of clinical medical education in which traditional specialty-specific block rotations lasting several weeks and occurring sequentially are replaced by longitudinal experiences for all core specialties occurring concurrently over many months and largely in the outpatient setting. Though currently a pilot program for a small group of selected students, the LIC will become a standard element of the third year for all students enrolled in the Primary Care – Population Medicine (PC-PM) Program, a four-year dual-degree program in which students earn both an MD degree and a Master's in Population Medicine (see the lead article in this issue, George, et. al., for further details).

A HISTORY OF LONGITUDINAL INTEGRATED CLERKSHIPS

The LIC model for core clinical education in medical schools was first introduced in the 1970s. The LIC model is similar to the historical medical apprenticeship, such as those that occurred in the United States in the 1700–1900s in which the doctor in training gained medical knowledge by participating in clinical care delivery alongside one or more experienced physicians and other clinicians. Innovators in medical education re-popularized this form of clinical training beginning in the late 1990s when LICs were implemented by medical schools in Australia, Canada, South Africa, and the United States in both rural and urban areas and more recently at academic centers.[1,2] LICs are based on the organizing principle of continuity of the learning environment which fosters patient-centeredness and learner-centeredness.[3] The International Consortium of Longitudinal Integrated Clerkships defines the LIC as an educational experience in which medical students participate in the comprehensive care of patients over time, participate in the continuing learning relationships with these patients' clinicians, and meet the majority of the year's core clinical competencies across multiple disciplines simultaneously.[4] This model provides students with an understanding of the continuum of health and disease, and transitions in care, by participating in the care of patients wherever it is delivered – from the outpatient setting to the hospital, rehabilitation, and care in the home. Studies show that students trained in LICs achieve academic results equivalent or better as compared to students in traditional models, while maintaining empathy and patient-centered values at a rate surpassing their colleagues.[5,6,7]

THE WARREN ALPERT MEDICAL SCHOOL'S LONGITUDINAL INTEGRATED CLERKSHIP

The goals of the AMS LIC are to: 1) gain longitudinal experience in each of the six core clerkships (including internal medicine, surgery, family medicine, pediatrics, obstetrics and gynecology, and integrated neurology and psychiatry); 2) promote continuity with patients and their care environments; 3) integrate population health with clinical medicine; 4) longitudinally follow and participate in treatments of patients over time and across specialties; and, 5) complete a quality improvement and/or patient safety project focused on population medicine.

Students in the LIC will seek to longitudinally follow at least 3–5 patients per specialty area (up to a maximum of 30 patients) for up to one year, including pregnant women, newborns, pre- and post-surgical patients, geriatric patients, and

persons near the end of life. It will require effort from both students and faculty to collaboratively develop a diverse panel of patients that includes common chronic conditions plus a variety of important case material that students will apply to their study of clinical medicine. For most of the year, the student's schedules include one-half day per week in each of the six core clerkships; the remaining half days are devoted to seminars, other study, and participating in medical visits of the patients in the student's panel. Didactics will include both morning reports twice weekly and a half-day of clinically relevant seminar experiences; this educational curriculum includes coursework in population health and health care systems as described by White et al in this issue of the *Rhode Island Medical Journal*. PC-PM students will apply this coursework towards completion of the Master's in Population Medicine. Throughout the year, the students are expected to serve as advocates and navigators for their longitudinal patients, attending visits with physicians, other clinicians, clinical tests and procedures or surgeries.

The primary curriculum focus for medical students in the LIC emanates from its emphasis on comprehensive, integrated patient care over time, largely in the outpatient setting. Continuity of both mentors and patients is prioritized. This longitudinal education in the outpatient setting is described by in depth elsewhere (see White at al in this issue for further details). To supplement the outpatient experiences, students participate in shortened, highly-structured versions of traditional inpatient rotations; these 1–3 week "immersion" experiences occur in core areas including internal medicine, surgery, pediatrics, psychiatry, neurology and obstetrics. Students also complete recurrent "pulse" experiences such as in the emergency departments. In addition, there are many "one-time" experiences expected of students, such as home hospice care and the newborn nursery. There are skills workshops in physical examination, radiology, electrocardiogram interpretation, and others as would occur in standard third-year curriculums. Finally, attention is given to students' professional development as they establish doctor-patient relationships as the clinical provider.[8]

SELECTING MEDICAL STUDENTS FOR THE LIC DEVELOPMENTAL PILOTS

The initial AMS LIC pilot, which began in May 2015, involves eight students. Students at AMS were queried about their interest in the LIC during the summer of 2014. More than 20 second-year students demonstrated interest in the program and subsequently applied to be part of the initial cohort. From there, through an application process that encompassed academic markers such as grades, mentor evaluations and interviews with PC-PM faculty, eight students were selected. Special attention was paid to the specific characteristics of students, examining the potential for them to thrive in the LIC. The student characteristics that PC-PM faculty sought included: self-directedness, comfort with uncertainty, the ability to be a caregiver and the ability to function as part of a team. Faculty also focused on students who would advocate for patients. These characteristics were vetted in previous studies as important for success in LICs.[9]

Once the students were selected, we sought to match them with their ideal site. Program faculty met with the students and described the three possible practice settings which would serve as the students home base for the entirety of the LIC: Memorial Hospital of Rhode Island, the Veterans Administration Medical Center and Rhode Island Hospital. Students ranked their preferences and seven of the eight were placed at their top choice site.

RECRUITING FACULTY MEMBERS TO TEACH AND SUPERVISE LIC STUDENTS

The process of recruiting faculty members to teach and supervise LIC students has been an ongoing intensive process that began even before sites were chosen. Whenever possible, the medical school and LIC leadership attempted to recruit faculty who were not already involved in the traditional AMS clerkships, so as not to draw away resources from current clerkship rotations. Preference was given to clinical practice opportunities at those sites where students could participate fully in patient-centered experiences. Optimally in LICs, clerkship sites engage and integrate the student into the structure of the practice in which the student has the opportunity to learn from medical assistants, nurse case managers, pharmacists, social workers, other clinicians and technicians, and the patients and families. It is expected that preceptors will foster mentoring relationships with students, and work in an environment that facilitates integrated, longitudinal learning experiences.

When recruiting faculty for the LIC, a number of obstacles were anticipated. Any medical school clerkship expansion requires increased faculty participation and an LIC expansion demands both more faculty and a different approach to medical student clinical training. Willingness to learn new educational approaches must come from both veteran faculty who are familiar with the traditional "6-week" block rotations, plus new community physicians who have not yet chosen to affiliate with an academic center and who may have little teaching experience. Thus, the recruitment of faculty to this new process must be successful in convincing seasoned preceptors to change aspects of their teaching style, and the faculty recruitment must also provide incentive for new community physicians to join. Both groups will also require significant faculty development.

AMS addressed these potential barriers in several ways. There was a process of directly reaching out to group practices by holding informational seminars on-site plus invited "retreats" at the medical school including national experts in the LIC model. Program leaders engaged early in the planning process to personally and directly speak with clinical

sites and practitioners throughout Rhode Island. Incentives included a Brown University clinical appointment plus access to general faculty development programs, live lectures/conferences, and skills-based workshops. In addition, there will be regularly scheduled faculty development, targeted to LIC faculty, with a focus on topics such as integrating learners into clinical settings and providing feedback.

Recruitment into any new program takes time, patience, due diligence and hard work, and this LIC is no exception. We expect that once new faculty preceptors see firsthand the rewards of meaningful year-long teaching relationships, and witness the students becoming active contributors to their health teams, expansion to additional clinical sites will naturally occur. In fact, for selected specialties in 2015, there was over-enrollment from interested faculty, who will now wait to accept students for the 2016 class. Ultimately, we believe that as preceptors experience their longitudinal student(s) facilitating patient-centered care and building meaningful multifaceted relationships, even seasoned skeptical clinical educators will find new vigor for their teaching.[10]

THE VISION FOR FACULTY TEACHING AND SUPERVISION IN THE LIC

As described above, the principle feature of the LIC is that students have longitudinal experiences with faculty preceptors in each of the core clerkship disciplines (**Figure 1**). Whenever possible, these specialists all work within one healthcare network, allowing for maximal coordination between disciplines and for students to follow patients between healthcare settings (e.g., a student may see a patient referred to a surgeon from a family physician's office and then see the same patient at the surgeon's office and in the operating room). From a preceptor's perspective, this allows for the development of a robust and increasingly trusting relationship with the student, as the two work together weekly for nine months. Experience from other schools indicates that LIC preceptors feel able to develop authentic and meaningful relationships with their students, which allows for robust mentoring and coaching and an expansion of the roles preceptors feel comfortable assigning to their students.[11,12] Students in LICs report that the feedback they receive from their preceptors is authentic and enhanced by the continuity relationship.[13] At AMS, LIC preceptors receive initial orientation through a kick-off event and meet in groups periodically to review the progress of their students. This process affords preceptors the opportunity to iteratively assess the abilities of their students and foster students' development into competent professionals.[14]

ASSESSMENT AND EVALUATION OF STUDENTS IN THE LIC

The Longitudinal Integrated Clerkship offers the opportunity to repeatedly assess students' skills, provide feedback and monitor progress. In addition, it creates the possibility of implementing new methods of student assessment. Like AMS students in traditional clerkships, LIC students will take the National Board of Medical Examiners subject examinations ("shelf exams"). These exams will be spread out over the course of the LIC starting after the first 3 months, beginning with the broadest specialties of family medicine and internal medicine and progressing to the more focused specialties of surgery, pediatrics, obstetrics and gynecology, psychiatry and neurology. The LIC students will also take four integrated Objective Structured Clinical Examinations (OSCEs), specifically designed for the LIC, over the course of the year, and each OSCE will have stations containing content from multiple specialties. To make the OSCE program successful in the LIC model, clerkship directors identified OSCE cases best suited for delivery to students early in the year as well as complex cases requiring an integration of skills at the year's end.

At each clinical site, students will complete a monthly clinical encounter (mini Clinical Evaluation eXercise or "mini-CEX") observed by their preceptors, and these will be used to provide formative feedback. Each clinical preceptor will also complete a quarterly clinical evaluation for the student, using a new clinical evaluation form developed on the Association of American Medical College's Entrustable Professional Activities (EPAs) for entering residency.[15] Some domains of this tool are familiar: "Evaluate patients with new or undiagnosed symptoms," and some reflect new areas felt to be important: "Give or receive a patient handover to transition care responsibility to another health provider or team." Evaluations from patients and clinical site staff will be used to provide "360 degree" evaluation[16] of the students from multiple perspectives, which has high reliability and

Figure 1. Sample weekly schedule for LIC student

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
MORNING (8am–Noon)	Internal Medicine	*White Space (Patient panel visits, specialty experiences)*	Neurology & Psychiatry	Pediatrics	Family Medicine
AFTERNOON (1–5pm)	*White Space (Patient panel visits, specialty experiences)*	OB/GYN	*White Space (Patient panel visits, specialty experiences)*	Surgery	Core Education Sessions @ Alpert Medical School

validity in assessing physician competency. Each student will receive a LIC grade for each specialty, weighted approximately (with differences across specialties) 25% for the shelf exam, 25% for the OSCE, and 50% for clinical evaluations.

ASSESSMENT AND EVALUATION OF THE LIC CURRICULUM AND FACULTY

For the 2015–2016 academic year, the LIC is a pilot; however, for the 8 selected students participating in this LIC, it is the required core clinical education for medical training. From these students reports, and the program's assessments of itself and the students' performance, the 2016–2017 LIC schedule and core experiences will be adjusted to better aid student learning and overall functioning of the LIC program within the affiliated healthcare systems. Over time, the LIC will be tailored to best support the Primary Care – Population Medicine students integrated degree program. In addition, the Alpert Medical School may consider offering the LIC as an optional alternative for third-year students in the traditional MD training program.

INNOVATIONS OF THE WARREN ALPERT MEDICAL SCHOOL'S LIC

Several innovations will enhance AMS students' experiences, making the LIC at Brown University unlike other programs. First, the AMS LIC is part of the four-year dual degree Primary Care – Population Medicine program. Students completing this program will 'experience' population medicine by functioning as clinical service providers while concurrently completing coursework in clinical medicine alongside didactic classes and preparation of a thesis in population medicine. Whereas most LIC students learn only about the care of individual patients, students in the AMS LIC will be exposed to the intricacies of panel and population management. Second, students will have opportunity to compare and contrast healthcare system successes. All LIC students will participate together in weekly experiences, however, each individual student will complete all clinical experiences within only one of three clinical systems (two private, non-profit and one Veterans' Affairs). This intermingling of experiences will allow AMS students and educators to comparatively view separated healthcare system responses to similar population health problems. Finally, new medical school courses specific to the PC-PM program will empower students with a) the language of population medicine science and b) practical skills in quality improvement and patient safety.

CONCLUSIONS

The LIC at AMS, and the PC-PM program are innovative models designed to train physician leaders in the core skills of medicine plus necessary contemporary skills in clinical service delivery and practice change. By exposing students to the longitudinal complexities of health care system functioning, and training them how to overcome barriers to high-quality care during the important developmental time of the third year, AMS and other LICs expect to produce physicians equipped with tools to treat individuals and populations at the highest level, improving healthcare delivery in the United States. Assessments of the students, the faculty, and the LIC program will provide valuable insights and help advance and refine this innovative medical education model.

References

1. Poncelet A, Bokser S, Calton B, Hauer KE, Kirsch H, Jones T, Lai CJ, Mazotti L, Shore W, Teherani A, Tong L, Wamsley M, Robertson P. Development of a longitudinal integrated clerkship at an academic medical center. Medical education online. 2011;16. Epub 2011/04/09. doi: 10.3402/meo.v16i0.5939. PubMed PMID: 21475642; PubMed Central PMCID: PMC3071870.
2. Norris TE, Schaad DC, DeWitt D, Ogur B, Hunt DD. Consortium of Longitudinal Integrated C. Longitudinal integrated clerkships for medical students: an innovation adopted by medical schools in Australia, Canada, South Africa, and the United States. *Academic medicine : journal of the Association of American Medical Colleges*. 2009;84(7):902-7. Epub 2009/06/25. doi: 10.1097/ACM.0b013e3181a85776. PubMed PMID: 19550184.
3. Hirsh DA, Ogur B, Thibault GE, Cox M. "Continuity" as an organizing principle for clinical education reform. *The New England journal of medicine*. 2007;356(8):858-66. Epub 2007/02/23. doi: 10.1056/NEJMsb061660. PubMed PMID: 17314348.
4. International_Consortium_of_Longitudinal_Integrated_Clerkships. Consensus Longitudinal Integrated Clerkship Definition, CLIC Meeting: 10-14 November 2007; Cambridge, MA. 2007.
5. Gaufberg E, Hirsh D, Krupat E, Ogur B, Pelletier S, Reiff D, Bor D. Into the future: patient-centredness endures in longitudinal integrated clerkship graduates. *Medical education.* 2014;48(6):572-82. Epub 2014/04/10. doi: 10.1111/medu.12413. PubMed PMID: 24713035.
6. Ogur B, Hirsh D, Krupat E, Bor D. The Harvard Medical School-Cambridge integrated clerkship: an innovative model of clinical education. *Academic medicine : journal of the Association of American Medical Colleges*. 2007;82(4):397-404. Epub 2007/04/07. doi: 10.1097/ACM.0b013e31803338f0. PubMed PMID: 17414198.
7. Walters L, Greenhill J, Richards J, Ward H, Campbell N, Ash J, Schuwirth LW. Outcomes of longitudinal integrated clinical placements for students, clinicians and society. *Medical education.* 2012;46(11):1028-41. Epub 2012/10/20. doi: 10.1111/j.1365-2923.2012.04331.x. PubMed PMID: 23078680.
8. Wald HS, Anthony D, Hutchinson TA, Liben S, Smilovitch M, Donato AA. Professional identity formation in medical education for humanistic, resilient physicians: pedagogic strategies for bridging theory to practice. *Academic medicine : journal of the Association of American Medical Colleges*. 2015;90(6):753-60. Epub 2015/04/23. doi: 10.1097/ACM.0000000000000725. PubMed PMID: 25901874.
9. O'Brien B C, Hirsh D, Krupat E, Batt J, Hansen LA, Poncelet AN, Ogur B, Hauer KE. Learners, performers, caregivers, and team players: Descriptions of the ideal medical student in longitudinal integrated and block clerkships. *Medical teacher.* 2015:1-9. Epub 2015/04/22. doi: 10.3109/0142159X.2015.1033390. PubMed PMID: 25894329.
10. Poncelet AN, Mazotti LA, Blumberg B, Wamsley MA, Grennan T, Shore WB. Creating a longitudinal integrated clerkship with mutual benefits for an academic medical center and a community health system. *The Permanente journal*. 2014;18(2):50-6. Epub 2014/05/29. doi: 10.7812/TPP/13-137. PubMed PMID: 24867551; PubMed Central PMCID: PMC4022558.

11. Hauer KE, Hirsh D, Ma I, Hansen L, Ogur B, Poncelet AN, Alexander EK, O'Brien BC. The role of role: learning in longitudinal integrated and traditional block clerkships. *Medical education*. 2012;46(7):698-710. Epub 2012/06/14. doi: 10.1111/j.1365-2923.2012.04285.x. PubMed PMID: 22691149.
12. Walters L, Prideaux D, Worley P, Greenhill J. Demonstrating the value of longitudinal integrated placements to general practice preceptors. *Medical education*. 2011;45(5):455-63. Epub 2011/04/14. doi: 10.1111/j.1365-2923.2010.03901.x. PubMed PMID: 21486321.
13. Bates J, Konkin J, Suddards C, Dobson S, Pratt D. Student perceptions of assessment and feedback in longitudinal integrated clerkships. *Medical education*. 2013;47(4):362-74. Epub 2013/03/16. doi: 10.1111/medu.12087. PubMed PMID: 23488756.
14. Hirsh DA, Holmboe ES, ten Cate O. Time to trust: longitudinal integrated clerkships and entrustable professional activities. *Academic medicine : journal of the Association of American Medical Colleges*. 2014;89(2):201-4. Epub 2013/12/24. doi: 10.1097/ACM.0000000000000111. PubMed PMID: 24362396.
15. Ten Cate O. Nuts and bolts of entrustable professional activities. *Journal of graduate medical education*. 2013;5(1):157-8. Epub 2014/01/10. doi: 10.4300/JGME-D-12-00380.1. PubMed PMID: 24404246; PubMed Central PMCID: PMC3613304.
16. Donnon T, Al Ansari A, Al Alawi S, Violato C. The reliability, validity, and feasibility of multisource feedback physician assessment: a systematic review. *Academic medicine : journal of the Association of American Medical Colleges*. 2014;89(3):511-6. Epub 2014/01/23. doi: 10.1097/ACM.0000000000000147. PubMed PMID: 24448051.

Authors

Gary Epstein-Lubow, MD, Assistant Professor of Psychiatry and Human Behavior and Health Services, Policy and Practice, Department of Psychiatry and Human Behavior, The Warren Alpert Medical School of Brown University; Department of Health Services, Policy and Practice, The Brown University School of Public Health.

Sybil Cineas, MD, Associate Professor of Medicine and Pediatrics (Clinical), Department of Medicine and Department of Pediatrics, The Warren Alpert Medical School of Brown University.

James Yess, MD, Clinical Assistant Professor of Medicine, Department of Medicine, The Warren Alpert Medical School of Brown University.

David Anthony, MD, MSc, Associate Professor of Family Medicine, Department of Family Medicine, The Warren Alpert Medical School of Brown University.

Mark Fagan, MD, Professor of Medicine, Department of Medicine, The Warren Alpert Medical School of Brown University.

Paul George, MD, MHPE, Associate Professor of Family Medicine, Department of Family Medicine, The Warren Alpert Medical School of Brown University, Office of Medical Education, The Warren Alpert Medical School of Brown University.

Disclosures

Drs. Epstein-Lubow, Anthony and George receive funding from the American Medical Association Accelerating Change in Medical Education Grant Initiative in support of this work; Drs. Anthony, Fagan and George received funding from the Rhode Island Foundation in support of this work.

The Primary Care-Population Medicine program is supported, in part, by a grant from the American Medical Association's "Accelerating Change in Medical Education" program.

The Longitudinal Integrated Clerkship pilot is supported, in part, by a grant from the Rhode Island Foundation.

Correspondence

Gary Epstein-Lubow, MD
Psychosocial Research Program
Butler Hospital
345 Blackstone Boulevard
Providence, RI 02906
Gary_Epstein-Lubow@Brown.edu

Integrating Population and Clinical Medicine: A New Third-Year Curriculum to Prepare Medical Students for the Care of Individuals, Panels, and Populations

JORDAN WHITE, MD, MPH; ALISON RIESE, MD, MPH; BRIAN CLYNE, MD; MARCIA W. VANVLEET, MD, MPH; PAUL GEORGE, MD, MHPE

ABSTRACT

Population and Clinical Medicine (PCM) I & II constitute two of the nine courses established for the Warren Alpert Medical School of Brown University's (AMS) innovative dual-degree Primary Care-Population Medicine (PC-PM) program. The courses will run consecutively during students' third year in the program, in conjunction with the Longitudinal Integrated Clerkship (LIC). Throughout the courses, students will examine the intersection between population and clinical medicine with a focus on vulnerable populations, the social and community context of care, quality improvement, and leadership. In addition to attending class sessions in which students will engage with leaders in relevant fields, students will also draw from patient and population-level experiences in the LIC to plan and implement two projects: a community-based intervention to address a particular health issue, and a quality improvement project to change a small aspect of care delivery at a clinical site. Finally, leadership skills development sessions will be incorporated, and leadership practice will occur during implementation of student projects.

KEYWORDS: Undergraduate medical education; population medicine

INTRODUCTION

Traditionally, medical education focused on the training of physicians to take care of individual patients. The Flexner Report of 1910 established the biomedical model with basic and clinical science components as the basis for medical education in the United States: a focus on research to improve medical knowledge, combined with hands-on clinical training to gain experience in patient care, has served as the foundation for training physicians for nearly a century.[1] William Osler, too, noted that "the primary work of a professor of medicine in a medical school is in the wards, teaching his pupils how to deal with patients and their diseases." The term "clinical medicine" stems directly from these ideas, and is commonly used to refer to the "study and practice of medicine in relation to the care of patients."[2] This topic receives significant attention in medical education: interviewing and physical examination skills, building rapport with patients, developing differential diagnoses, and other important clinical skills are covered extensively not only in the final two years of medical school during clinical clerkships, but also in the first two years during courses that prepare students to interact with actual patients. However, in a rapidly evolving healthcare system, physicians must be prepared to take care of populations in addition to the individual in front of them. This may include extended families, patient panels, neighborhoods, communities, or larger populations of people.

Various terms are used to describe measures that define the care of populations rather than individuals. Population medicine, a term developed by the Institute for Healthcare Improvement (IHI), refers to healthcare services designed to care for populations of people. Specifically, population medicine aims to improve the patient experience of care (both quality and satisfaction), improve the health of populations, and reduce healthcare associated costs. These three goals together define the Triple Aim, an IHI initiative to optimize health system performance.[3] Population medicine differs from public health and population health in its focus on system design to improve outcomes (see **Table 1**).

The Primary Care-Population Medicine (PC-PM) program at the Warren Alpert Medical School of Brown University (AMS) was developed, in part, to address a deficit in training of physicians skilled in caring for populations. Care that attends to the needs of the community or population – in addition to those of the individual patient – is needed in order to improve the health of Americans, who are participants in a costly system that lags in terms of outcomes and experiences, compared to many other developed countries.[6]

Table 1. Definitions of Public Health, Population Health, and Population Medicine

Public Health	All organized measures (whether public or private) that prevent disease, promote health, and prolong life among the population as a whole[4]
Population Health	The health outcomes of a group of individuals, including the distribution of such outcomes within the group[5]
Population Medicine	The design, delivery, coordination, and payment of high-quality healthcare services to manage the Triple Aim for a population using the best resources we have available within the healthcare system[5]

However, training that includes the necessary knowledge, attitudes, and skills is sorely lacking. Physician leaders who are "trained to understand and improve the community health context of their patients"[7] should be able to more effectively address the needs of their individual patients during the traditional office visit, but also step outside of this model to understand and address the higher-level issues that result in poor health outcomes for certain groups of people. Physicians who develop programs that consider patterns of disease in their communities (for example, combating obesity by addressing the fact that some neighborhoods may lack safe walking space or be food deserts) will better impact the issues that affect the health of their individual patients. Intervening at both the individual and community levels may be part of the answer to many of the health disparities that plague our country, based as they are in systemic issues rather than individual ones. By practicing clinical and population medicine as two parallel processes that use different models to address health issues (see **Table 2**), physicians may most effectively meet the needs of their patients. This article describes the population and clinical medicine courses that make up two of the nine Master of Science in Population Medicine courses in the PC-PM program, and specifically address the integration of these two levels of care.

Table 2. Key Characteristics of Clinical and Population Medicine

Clinical Medicine	Population Medicine
One physician/team; one patient	One physician/team; one or more populations
History and physical	Patterns of diseases
Treatment plan individualized by patient	Programs "treat" groups
Monitor using symptoms, labs, etc	Monitor using population level data

WHY SHOULD POPULATION MEDICINE CONTENT BE TAUGHT IN MEDICAL SCHOOL?

As noted previously, traditional medical school training prepares students well for the practice of medicine. However, the principles of population health and systems improvement are less consistently integrated. The AAMC's Medical School Objectives Project (MSOP) issued a report in 1998 which recognized population health to be one of two key areas where a growing need for physician education existed. The report noted that "in the future, physicians will be expected to be more committed to using systematic approaches for promoting and maintaining the health of both individuals and the populations of which those individuals are members" and called for the "population health perspective" to be included in medical training.[8] For the physician workforce to be prepared to do so, these principles must be introduced *during medical training* and *in conjunction with clinical care.* Specific public health competencies for training physicians have now been established, and should be incorporated into medical student education and evaluation.[9,10] As noted in the MSOP report, students must also be prepared to be leaders beyond the walls of their individual practices, at the community, national, and global levels. While a number of training institutions have begun to incorporate innovative experiences into medical school,[11] there continue to be strong calls for more widespread adoption of these ideas.[12,13]

POPULATION AND CLINICAL MEDICINE COURSE OVERVIEW

As such, two of the nine courses in the master's degree program contained in the PC-PM program at AMS (Population and Clinical Medicine (PCM) I and II) will focus on the integration of population and clinical medicine, with the goal of preparing future physicians to excel in both areas. Given the importance of population-level interventions for impacting the health of vulnerable and underserved patients, the course will pay specific attention to these populations (see **Table 3**), as well as to creative measures by which our system may better care for those groups (see **Table 4**). Small group sessions on these population- and system-based topics will all be facilitated by experts in the relevant field and augmented by relevant required readings.[14] We will address particular conditions that can lead to populations receiving inadequate care; the skills and approaches that can improve care for these groups, and the practical skills required for physicians to manage both individual and population level issues. Additionally, the course contains five case-based sessions, also used for students in the Family Medicine clerkship of the traditional program, which follow a family's interaction with the medical system for various health-related problems.[15] As with the course as a whole, these cases combine principles of caring for vulnerable individuals with specific medical problems such as diabetes, with population-level interventions such as the patient-centered medical home that address the same issue at a higher level.

Table 3. Population Based Topics in the Population and Clinical Medicine Course

Incarceration	Adolescent and Elderly Patients
Homelessness	Lesbian, Gay, Bisexual, Transgender Patients
Race	Patients with chronic pain
Immigrant Health Issues	Patients with substance abuse

Table 4. Systems Based Topics in the Population and Clinical Medicine Course

Group Visits	Behavior Change
Advocacy	Leadership
Quality Improvement	Patient-Centered Medical Home

Importantly, the PCM courses will run during the third year of medical training in conjunction with the Longitudinal Integrated Clerkship (LIC), described elsewhere in this issue of the *Rhode Island Medical Journal*. During the LIC, students will be developing longitudinal relationships not only with their patients and preceptors, but also with their communities. More so than during the two- to six-week time periods that third-year clerkship students typically spend at one site, PC-PM students will gain perspective on the health of the communities that their practices serve, and will be able to identify deficiencies in the system where improvements can be made to better the health of their patients. Students will draw from their experiences in the LIC to propose and implement quality improvement and community-based projects for the PCM courses; equally, they will gain perspective on individual, panel, and population level care during the courses, and use this insight to enhance their clinical experiences.

LONGITUDINAL COMPONENTS

In addition to the sessions focusing on specific populations or systems approaches to care, the course will contain three components that are integrated longitudinally throughout the year.

The Social and Community Context of Care (SACC): Education that improves future physicians' abilities to care for patients with backgrounds different from their own may reduce the health disparities seen in the United States: for example, physicians who better understand the sociocultural factors that impact their patients' health should be better able to provide appropriate, culturally competent, patient-centered care.[16] In the standard Family Medicine clerkship, all students are required to consider the social and community context of a particular health issue affecting the population served by their clinical site, and propose a theoretical intervention to address that issue. As described previously,[17] students first explore the communities surrounding their individual preceptor sites to investigate key resources such as service organizations. Students also use internet resources to understand the demographics and health statistics relevant to that community and to further understand the chosen health issue. They conduct a literature review to inform their intervention design, and compile information about the status, content and quality of existing community resources related to their target health problem. Students next conduct key informant interviews with patients/caregivers affected by the health problem and with non-physician community-based individuals who can provide them with information about the problem from differing perspectives. Finally, students propose a feasible, community-based intervention that is relevant to the needs and resources of their community, is informed by their key-informant interviews, and is targeted to the particular social and community context. During PCM I, students will be responsible for going through these same steps and proposing an intervention to address their chosen health issue; during PCM II, they will actually implement their intervention and report on that experience at the end of the course.

Quality Improvement: Quality improvement (QI), which consists of "systematic and continuous actions that lead to measurable improvement in healthcare services and the health status of targeted patient groups,"[18] is of critical importance for the future of our entire healthcare system, as well as for individual practices and smaller systems. To improve the care of both individual patients as well as populations, physicians, practices, and systems must be able to effectively monitor their own performance and quickly make changes to ensure that the best possible care is being provided. Interspersed throughout the two semesters of PCM, students will participate in active sessions designed to enhance their understanding of quality improvement, specifically how QI methodology can be used to affect the care of vulnerable populations. During these sessions, students will practice quality improvement through hands-on experience, become immersed in the use of data at the practitioner and practice level to inform practice processes and outcomes, and consider the model of the patient-centered medical home to impact the quality of care nationwide. As with the format of the SACC projects described above, during the first semester, students will observe their practice sites and identify an area in the clinical care of their patients in which an improvement could be made. They will then define an aim statement with measurable outcomes, collect baseline data, and identify key drivers to this process including critical team members. This information along with a proposal for a small test of change or plan-do-study-act (PDSA) cycle will be presented at the end of PCM I. During the second semester, students will act on that proposal and implement their proposed PDSA cycle to affect the quality of care for that particular issue at their site, reporting on the results at the end of the course.

Leadership: To fulfill its vision of preparing students to make societal impact through "leadership roles in healthcare on the local, state, or national level in areas ranging from primary care clinical service to research, education, and health policy,"[7] the PC-PM program places an emphasis on longitudinal leadership development. *Leadership in Healthcare*, the first formal leadership curriculum at AMS, is designed to equip students with the skills to be effective in future leadership roles. As described in the accompanying article, students will gain foundational exposure to core leadership topics during their preclinical years. The initial course includes didactics, mentorship, and an experiential "Leadership Action Project." Subsequently, the PCM course will integrate leadership concepts with a more clinical focus, allowing students to explore change leadership as it applies to their SACC and QI projects. Written assignments will require application of Kotter's framework[19] for leading change, as well as reflections on what it means to be an effective clinical leader. This model for longitudinal student

leadership training established for the PC-PM program may serve as a model for future leadership curricula and will give our students the skills they need to become the physician leaders of the future.

EVALUATION AND ASSESSMENT

Student evaluations for the course will be based upon the two projects and one writing assignment described above (SACC and QI projects; leadership paper) as well as participation in small group sessions. Assessment of the course will be ongoing via student feedback to the course directors (verbal and written) as well as, in the future, via more robust evaluation of educational and clinical outcomes.

CONCLUSIONS

It is imperative that students are trained to become facile in managing the health of patient panels, communities, and populations as well as excellent clinical physicians for individual patients. The PCM courses, as an integral piece of the overall PC-PM program, will help students learn to take care of their patients as well as the communities from which they come. As future leaders in our healthcare system, this training in integrated clinical and population medicine will serve them well as they seek to redefine the ways in which we care for all patients, especially those from vulnerable and underserved populations.

References

1. Duffy TP. The Flexner Report - 100 Years Later. *The Yale Journal of Biology and Medicine*. 2011;84(3):269-276.
2. Stedman TL. Stedman's Medical Dictionary for the Health Professions and Nursing. Accessed online June 5, 2015 at http://www.medilexicon.com/medicaldictionary.php?t=53425.
3. IHI Triple Aim Initiative: Better Care for Individuals, Better Health for Populations, and Lower Per Capita Cost. Institute for Healthcare Improvement website. Accessed online June 16, 2015 at http://www.ihi.org/Engage/Initiatives/TripleAim/pages/default.aspx.
4. World Health Organization Glossary of Globalization, Trade, and Health Terms. Accessed online June 5. 2015 at http://www.who.int/trade/glossary/story076/en/.
5. Lewis N. Populations, population health, and the evolution of population management: making sense of the terminology in US health care today. Institute for Healthcare Improvement Leadership Blog. Accessed online June 5, 2015 at http://www.ihi.org/communities/blogs/_layouts/ihi/community/blog/itemview.aspx?List=81ca4a47-4ccd-4e9e-89d9-14d88ec59e8d&ID=50.
6. OECD Health Statistics 2014: How does the United States Compare? Organisation for Economic Co-operation and Development. Accessed online June 16, 2015 at http://www.oecd.org/unitedstates/Briefing-Note-UNITED-STATES-2014.pdf.
7. Primary Care-Population Medicine Overview. Accessed online June 5, 2015 at http://www.brown.edu/academics/medical/education/other-programs/primary-care-population-medicine/.
8. Friedman C, Corn M, Frisse M, et al. Contemporary issues in medicine - Medical informatics and population health: Report II of the Medical School Objectives Project. *Acad. Med.* 1999;74(2):130-141.
9. Kaprielian VS, Silberberg M, McDonald MA, et al. Teaching population health: a competency map approach to education. *Acad. Med.* 2013;88(5):626.
10. Regional Medicine-Public Health Education Centers. Population health competencies for medical students. American Association of Medical Colleges. Accessed online June 5, 2015 at https://www.aamc.org/download/153064/data/rmphec_flyer.pdf.
11. Sheline B, Tran AN, Jackson J, Peyser B, Rogers S, Engle D. The Primary Care Leadership Track at the Duke University School of Medicine: Creating Change Agents to Improve Population Health. *Acad. Med.* 2014;89(10):1370-1374.
12. Berwick DM, Finkelstein JA. Preparing medical students for the continual improvement of health and health care: Abraham Flexner and the new "public interest". *Acad. Med.* 2010;85(9):S56-S65.
13. Irby DM, Cooke M, O'Brien BC. Calls for reform of medical education by the Carnegie Foundation for the Advancement of Teaching: 1910 and 2010. *Acad. Med.* 2010;85(2):220-227.
14. King, TE, Wheeler, MB. *Medical management of vulnerable and underserved patients: Principles, practice, and populations*. New York: McGraw-Hill Medical Pub. 2007.
15. Anthony D, George PF, Zeller K, Taylor JS. Virtual Silva Family Curriculum. Family Medicine Digital Resources Library; 2011. Available at: http://www.fmdrl.org/index.cfm?event=c.beginBrowseD&1=1#3361.
16. Betancourt J. Eliminating racial and ethnic disparities in health care: What is the role of academic medicine? *Acad Med*. 2006;81:788-792.
17. White J, Heney J, Esquibel A, Dimock C, Goldman R, Anthony D. Teaching and addressing health disparities through the family medicine social and community context of care project. *RIMJ*. 2014;97(9);26-30.
18. Health Resources and Services Administration. Quality improvement. Accessed online June 5, 2015 at http://www.hrsa.gov/quality/toolbox/methodology/qualityimprovement/.
19. Kotter JP. Leading change: why transformation efforts fail. *Harv Bus Rev*. 1995; 73(20: 59-67.

Authors

Jordan White, MD, MPH, Assistant Professor of Family Medicine, Department of Family Medicine, The Warren Alpert Medical School of Brown University, Providence, RI.

Alison Riese, MD, MPH, Assistant Professor of Pediatrics, Department of Pediatrics, The Warren Alpert Medical School of Brown University, Providence, RI.

Brian Clyne, MD, Associate Professor of Emergency Medicine, Department of Emergency Medicine, The Warren Alpert Medical School of Brown University, Providence, RI.

Marcia W. VanVleet, MD, MPH, Associate Professor of Pediatrics (Clinical), Department of Pediatrics, The Warren Alpert Medical School of Brown University, Providence, RI.

Paul George, MD, MHPE, Associate Professor of Family Medicine, Department of Family Medicine and Office of Medical Education, The Warren Alpert Medical School of Brown University, Providence, RI.

Disclosures

Dr. George receives grant funding from the American Medical Association Accelerating Change in Medical Education Grant Initiative for the support of this work.

The Primary Care-Population Medicine program is supported, in part, by a grant from the American Medical Association's "Accelerating Change in Medical Education" program.

The Longitudinal Integrated Clerkship pilot is supported, in part, by a grant from the Rhode Island Foundation.

Leadership in Undergraduate Medical Education: Training Future Physician Leaders

BRIAN CLYNE, MD; BRENDA RAPOZA, MBA; PAUL GEORGE, MD, MPHE

ABSTRACT

To confront the challenges facing modern health care, experts and organizations are calling for an increase in physician leadership capabilities. In response to this need, physician leadership programs are proliferating, targeting all levels of experience at all levels of training. Many academic medical centers, major universities, and specialty societies now sponsor physician leadership training programs. To meet this need, The Warren Alpert Medical School of Brown University, as part of its Primary Care-Population Medicine (PC-PM) Program, designed a four-year integrated curriculum, *Leadership in Health Care,* to engage with leadership topics starting early in the preclinical stages of training. This paper describes the design and implementation of this leadership curriculum for PC-PM students.

KEYWORDS: Physician Leadership Programs; Training Future Physicians

THE PHYSICIAN LEADERSHIP IMPERATIVE

To confront the challenges facing modern health care, experts and organizations are calling for an increase in physician leadership capabilities.[1,2,3] The Institute of Medicine describes a need to "develop leaders at all levels who can manage the organizational and systems changes necessary to improve health..."[4] The Association of American Medical Colleges (AAMC) calls for "new roles for physician leaders" and a "focus on organizational leadership in a new era of health care."[5] In graduate medical education, the requirement to develop physician leaders is explicit. The Accreditation Council for Graduate Medical Education's (ACGME) requires residents to demonstrate the ability to "work effectively as a member or leader of a health care team or other professional group."[6] Finally, the Royal College of Physicians and Surgeons of Canada's CanMEDS physician competency framework includes "Manager" as one of the essential roles of physicians.[7]

In response to this need, physician leadership programs are proliferating, targeting all levels of experience at all levels of training. Many academic medical centers, major universities, and specialty societies now sponsor physician leadership training programs.[8,9] In the United Kingdom, the National Health Service (NHS) established a Healthcare Leadership Model and development program for all health care providers.[10] At the same time, leadership has become an essential competency for medical students. Among the expected behaviors of medical school graduates, as described by the AAMC, is the ability to "provide leadership skills that enhance team functioning, the learning environment, and/or the health care delivery system."[11]

Despite this changing paradigm and evidence that leadership training should begin in undergraduate medical education (UME) and continue throughout training,[12,13,14] many schools lack formal leadership curricula. This may reflect time constraints in the existing curriculum, limited resources, beliefs that leadership cannot be taught, a lack of consensus about the content in leadership courses, or a host of other factors. Recent developments indicate progress toward addressing the need for student leadership training imperative. For example, the American Medical Association's Accelerating Change in Medical Education consortium (AMA-ACE) includes schools with proposals focused on student leadership development such as the Brody School of Medicine at East Carolina University.[15] In addition, a new special interest group, the Leadership and Innovation in Medical Education (LIME) was formed through the Association of American Medical Colleges (AAMC) with the vision of creating longitudinal, integrated leadership development programs for students. These initiatives will undoubtedly yield more formal, evidence-based training to prepare students as health care leaders.

The Alpert Medical School of Brown University (AMS) was chosen as one of the AMA-ACE schools for its new Primary Care – Population Medicine (PC-PM) program (see George et al in this issue for further details). We describe the ambitious leadership education effort that is one of the central elements of this new effort.

LEADERSHIP EDUCATION AT THE WARREN ALPERT MEDICAL SCHOOL OF BROWN UNIVERSITY

This fall, the first cohort of up to 24 students will enroll in the Primary Care-Population Medicine (PC-PM) program. This unique program allows medical students to earn a Master of Science in Population Medicine (ScM) in addition to their Doctorate of Medicine (MD), through a course of study

that includes research methods, population science, and leadership.

A special four-year integrated course, *Leadership in Health Care,* was designed for PC-PM students to engage with leadership topics starting early in the preclinical stages of training. The course required careful planning and preparation, owing to the challenges of tackling a complex and multifaceted topic that would need to be both relevant and engaging to UME students. The most immediate philosophical question to consider was whether leadership can be taught at all. Is leadership innate, trait-based, or acquired only through experience? If an educational construct does apply, what leadership models should inform the curriculum? What are the program's goals, and what are the most effective learning experiences to achieve them? What specific knowledge, skills, and attributes should be emphasized? What outcomes should be measured to indicate program effectiveness? Answering these questions has been a process, resulting in a longitudinal, integrated curriculum on leadership.

INFLUENTIAL THEORIES AND GUIDING PRINCIPLES

We designed the *Leadership in Health Care* course based on multiple needs assessments, interviews with physician leaders, and consideration of a wide range of leadership theories that are relevant to health care and appropriate to student curriculum. This course is influenced by three major leadership theories: transformational, situational, and servant leadership. Each has features that align with expressed beliefs about physician leadership. The theory of transformational leadership contends that leaders stimulate others to transcend their own self-interest to reach higher-order goals or visions.[16] This approach emphasizes motivating others by raising awareness of idealized goals, and is achieved through role modeling. Servant leadership theory posits that a leader's influence derives from serving the needs of others. Characteristic behaviors of servant leaders include listening, empathizing, accepting stewardship, and actively developing other's potential.[17] In situational leadership theory, effective leadership depends on selecting the right leadership style contingent on the followers or group context. Situational leaders shift flexibly among four behaviors: directing, coaching, supporting and delegating in response to follower readiness.[18] As with all forms of leadership, effective physician leadership likely requires the right combination of personality traits, modifiable behaviors, and context.

While it may seem peripheral to curriculum development, exploring leadership theories and how they relate to the professional role of the physician was an essential step early in the process. Clarifying personal beliefs and assumptions about physician leadership helped articulate the program's guiding principles as well as subsequent goals, objectives, and competencies for the *Leadership in Health Care* course (**Tables 1 and 2**).

DETERMINING COMPETENCIES

While there is growing emphasis on leadership education, there is no consensus on what defines effective physician leadership, nor is there much in the literature about best practices to guide curriculum planning. As a result, medical school leadership curricula vary widely in the competencies they emphasize and their methods of delivery.[19] For example,

Table 1. Guiding Principles for Leadership in Health Care

Leadership is both an essential aspect of the physician identity and a professional responsibility
Leadership is a developmental process, best learned through practical application and experience
Leadership in health care should emphasize teamwork and a service orientation
Leadership training should be competency-based and informed by evidence

Table 2. Leadership in Health Care Course Objectives

At the completion of the course, participants will:
Identify as a physician leader, with the self-awareness to articulate what makes them a leader, in what context, and to what end.
Identify their personal leadership style, strengths, and weaknesses
Explain the definitions and prevailing theories of leadership
Demonstrate core physician leadership attributes including personal integrity, emotional intelligence, patient-centeredness, and selflessness
Apply leadership knowledge to improve team dynamics and effectiveness
Demonstrate effective verbal and nonverbal communication skills to persuade, motivate, influence, and inform followers
Demonstrate critical thinking skills and an understanding of quality improvement principles
Demonstrate the ability to apply leadership skills to a change initiative (the Leadership Action Project)

some curricula stress quality improvement, while others emphasize clinical or academic leadership development.

Most contemporary leadership models are organized by broad domains divided into competencies that describe the specific knowledge, skills, or attitudes desired of learners. One example is the National Center for Healthcare Leadership's (NCHL) Health Leadership Competency Model. Its three domains – transformation, execution, and people – are further defined by twenty-six leadership competencies such as analytical thinking, project management, and interpersonal understanding.[20] The United Kingdom's Healthcare Leadership Model includes nine dimensions (or domains), with detailed descriptions of leadership competencies within each dimension.[21] The Medical Leadership Competency Framework (MLCF), also developed by the NHS, describes five domains: setting direction, demonstrating personal qualities, working with others, managing services, and improving services. Within each MLCF domain are four competencies for leadership directed toward undergraduate medical students.[22] In defining the requisite skills and competencies for *Leadership In Health Care*, we drew on components of these established models. We also mapped leadership to AMS' Nine Abilities – the core competencies that define Alpert Medical School's overall curriculum.

Leadership in Health Care is also based on evidence from the few studies that have examined physician-specific leadership competencies. One study examined physician beliefs regarding nine leadership competencies and determined that interpersonal and communication skills, professional ethics and responsibility, and continuous learning and improvement were the most important.[23] Taylor asked aspiring and established physician leaders about the knowledge, skills and attitudes they believed were fundamental to being a successful physician leader. Participants consistently described the importance of emotional intelligence and vision.[24] Another study examined faculty, medical student, and administrator attitudes regarding the competencies necessary for a UME leadership curriculum and found that communication, ethics, and conflict resolution were the most highly rated.[25] The *Leadership in Health Care* course aligned with known leadership models and evidence, but also considered the specific needs of our students. In a 2014 needs assessment survey, AMS students rated emotional intelligence, communication, and teamwork as the most important competencies to include in the leadership curriculum.

CORE TOPICS AND TEACHING METHODS

Each *Leadership in Health Care* session will focus on one core topic using techniques that address the

Table 3. *Leadership in Health Care* core sessions

Understanding leadership theory and competencies
Becoming a change agent
Leading with personal integrity
Communicating effectively
Speaking persuasively
Managing conflict and negotiating
Exerting influence within health care organizations
Creating and sharing a vision
Developing others
Networking and advocacy
Managing crises: high stakes clinical teamwork
Risk-taking and creativity
Enhancing your EQ: emotionally intelligent leadership
Developing life-long leadership habits

Table 4. An example core session

Session 3
Leading with Personal Integrity

Topics
- Defining and cultivating integrity
- Servant leadership
- Ethical decision-making
- Personal accountability

Goals and Objectives
- Understand how deeply help personal values inform leadership behaviors
- Describe the characteristics of authentic leadership
- Reflect on the relationship between ethics, service and leadership effectiveness
- Explain the components of trust; how it is developed and manifested
- Describe methods for identifying personal core values

Reading/Preparation
- Excerpts from: *"Five Days at Memorial: Life and Death in a Storm-Ravaged Hospital." By: Sheri Fink*
- Collins J. Level 5 Leadership. Harvard Business Review. January 2001
- Leadership integrity case vignettes 1&2; prepared written responses to vignettes DUE this session

Additional Optional Resources
- George B, Sims P, McLean AN and Mayer D. Discovering Your Authentic Leadership. Harvard Business Review. February 2007
- Souba WW. The Being of Leadership. Philosophy, Ethics, and Humanities in Medicine. 2011; 6:5

Class Activities
- Personal core values exercise
- Guided discussion of "Five Days" case summary
- Screening and discussion of: Escape Fire: *The Fight to Rescue American Health Care*; Chapters 6&7
- Integrity case discussion facilitated by expert panel

needs of adult learners (**Table 3**). Sessions are designed to be goal-oriented, related to prior experiences, practical, and interactive. Teaching methods are intended to encourage action, teamwork, and higher-order thinking skills using a variety of techniques. Examples include: cooperative learning activities, demonstrations, debates, expert panels, simulations, public speaking, negotiation exercises, design challenges, case analysis, and reflective writing. **Table 4** describes an example session. The course will run over a period of eight months in the 2nd year of medical school, with curriculum also embedded in the 3rd and 4th years.

EXPERIENTIAL LEARNING

Many leadership programs are centered on the transfer of conceptual knowledge; they teach theory and principles in a traditional lecture format. Like the acquisition of clinical skills that occurs during residency, however, developing as a leader is a process that requires learning new behaviors and skills through experience. It requires experimentation, application, and deliberate practice.

A critical component of *Leadership in Health Care* is the leadership action project (LAP), an experiential learning activity that allows students to apply lessons learned in class to their leadership development. The LAP is a longitudinal, team activity completed over the course of the semester. Teams will focus on an issue or concern related to medicine, and take the required steps to lead change. Projects may arise from clinical, educational, or research experiences. Mentored learning teams will meet regularly to develop the project and prepare briefs at critical junctures – framing the problem, generating and deciding on solutions, communicating with stakeholders, selecting implementation strategies, and preparing a timeline. At the completion of the process, teams will prepare a report and present to a panel of experts and health care leaders as a final project.

FUTURE DIRECTIONS

It is exciting to report on progress towards a formal leadership curriculum at AMS that addresses a well-recognized educational gap. Although it is still in its infancy, *Leadership in Health Care* has been designed with the complementary experiences that predict a successful leadership program: classroom didactics, faculty mentorship, and experiential learning. As the program matures, we hope to measure its outcomes in terms of individual leadership ability, organizational benefit, and societal impact. Developing appropriate measurement tools for these outcomes is the next challenge.

CONCLUSION

If the four years of medical school are the ideal time to introduce integrated physician leadership competencies, then AMS' new Primary Care-Population Medicine program may be the ideal setting. With its mission to *"educate a new type of physician through a course of study that emphasizes teamwork and leadership,"* the program has already attracted students with impressive leadership capacity. *Leadership in Health Care* promises to strengthen their leadership foundations and prepare them to confront the many challenges ahead. If successful, this leadership course may provide a generalizable model for leadership training at AMS (for all students) and US medical schools in the future.

References

1. Feeley D. Leading improvement in population health: focusing on population health requires a new leadership approach. *Healthcare Executive*. 2014. May/June. Available at www.ache.org. Accessed May 24, 2015.
2. Swensen S, Pugh M, McMullan C, Kabcenell A. Institute for Healthcare Improvement. High-impact leadership: improve care, improve the health of populations, and reduce costs. Cambridge, MA. 2013. Available at www.ihi.org. Accessed May 24, 2015.
3. Gabow P, Halvorson G, Kaplan G. Marshaling Leadership for High-Value Health Care: An Institute of Medicine Discussion Paper. *JAMA*. 2012;308(3):239-240.
4. Institute of Medicine. *Academic health centers: Leading change in the 21st century* Washington, DC: National Academy Press. 2004.
5. Enders T and Conroy J. *Advancing the academic health system for the future: A report of the AAMC health advisory panel.* 2014. The Association of American Medical Colleges. Washington, DC.
6. The Accreditation Council for Graduate Medical Education. ACGME Common Program Requirements. 2013 p. 9. Requirement IV.A.5.d).(3). Available at www.acgme.org. Accessed May 24, 2015.
7. Frank JR, Snell L, Sherbino J, editors. *The Draft CanMEDS 2015 Physician Competency Framework – Series IV.* Ottawa: The Royal College of Physicians and Surgeons of Canada; 2015 March.
8. Day CS, Tabrizi S, Kramer J, Yule AC, Ahn BS. (2010). Effectiveness of the AAOS leadership fellows program for orthopaedic surgeons. *J Bone Joint Surg Am.* 2010;92(16):2700–8.
9. Straus SE, Soobiah C, Levinson W. The impact of leadership training programs on physicians in academic medical centers: a systematic review. *Acad Med.* 2013;88(5): 710–23.
10. Storey J, Holti R. *Towards a New Model of Leadership for the NHS.* National Health System (NHS) Leadership Academy. 2013. oro.open.ac.uk. Accessed May 24, 2015.
11. Core entrustable professional activities for entering residency: curriculum developer's guide. 2014. The Association of American Medical Colleges. Washington, DC.
12. Crites GE, Ebert JR, Shuster RJ. Beyond the dual-degree: development of a five-year program in leadership for medical undergraduates. *Acad Med.* 2008;83(1):52-58.
13. Varkey P, Peloquin J, Reed D, Lindor K, Harris I. Leadership curriculum in undergraduate medical education: a study of student and faculty perspectives. *Med Teach.* 2009;31(3):244–50.
14. Abbas MR, Quince T, Wood DF, Benson J. Attitudes of medical students to medical leadership and management: a systematic review to inform curriculum development. *BMC Med Educ.* 2011;11(1):93.
15. The American Medical Association. Accelerating change in medical education grant projects. Retrived from http://www.ama-assn.org/sub/accelerating-change/grant-projects.shtml
16. Bass BM, Avolio B: Improving organisational effectiveness

through transformational leadership.Thousand Oaks, NJ. 1994. Sage.
17. Greenleaf RK: Servant leadership: a journey into the nature of legitimate power and greatness. Mahwah, NJ. 1977. Paulist Press.
18. Hersey P, Blanchard K. Management of organizational behaviour: utilizing human resources, ed 6. Englewood Cliffs, NJ . 1993. Prentice Hall.
19. Webb AMB, et al. A first step toward understanding best practices in leadership training in undergraduate medical education: a systematic review. *Acad Med*. 2014; 89(11):1563-1570.
20. Decker M. Competency integration in health management education. National Center for Healthcare Leadership. Chicago. 2006.
21. NHS Leadership Academy. *The Healthcare Leadership Model*, version 1.0. NHS Leadership Academy. Leeds. 2013.
22. Academy of Medical Royal Colleges. Medical Leadership Competency Framework: Enhancing Engagement in Medical Leadership. 3rd ed. Coventry, UK: NHS Institute for Innovation and Improvement; 2010.
23. McKenna M, Gartland M. Development of physician leadership competencies. *J Health Admin Educ*. 2004;21:343–354.
24. Taylor C, Taylor JC, Stoller JK. Exploring leadership competencies in established and aspiring physician leaders: an interview-based study. *J Gen Intern Med*. 2008; 23(6):748–54.
25. Varkey P, Peloquin J, Reed D, Lindor K, Harris I. Leadership curriculum in undergraduate medical education: a study of student and faculty perspectives. *Med Teach*. 2009;31(3):244–50.

Authors

Brian Clyne, MD, Associate Professor of Emergency Medicine, The Warren Alpert Medical School of Brown University, Providence, RI.

Brenda Rapoza, MBA, Primary Care-Population Medicine Program Coordinator, The Warren Alpert Medical School of Brown University, Providence, RI.

Paul George, MD, MPHE, Associate Professor of Family Medicine, The Warren Alpert Medical School of Brown University, Providence, RI.

Disclosures

Drs. Clyne and George and Ms. Rapoza receive grant funding from the American Medical Association's "Accelerating Change in Medical Education" Grant Initiative.

The Primary Care-Population Medicine program is supported, in part, by a grant from the American Medical Association's "Accelerating Change in Medical Education" program.

The Longitudinal Integrated Clerkship pilot is supported, in part, by a grant from the Rhode Island Foundation.

Correspondence

Brian Clyne, MD
Alpert Medical School of Brown University
Rhode Island Hospital
Claverick 2
Providence, RI 02903
401-444-9891
Fax 401-444-4307