WHEREAS, with the founding of the Virginia Tech Carilion School of Medicine (VTCSOM) in 2008, the Department of Interprofessionalism was established as an academic department of the medical school, and

WHEREAS, the Department has achieved national and international distinction in the areas of interprofessional health education, scholarship, and service to the profession of physician education by providing required instruction to VTCSOM medical students concerning interprofessional team care and related subjects, and

WHEREAS, the field of medical education is increasingly calling for medical schools to educate students on various aspects of the health systems in which they will eventually practice, including such topics as healthcare structures and processes, health systems finance and operations, population and public health, clinical informatics, healthcare policy, health disparities/inequities and health system improvement, and

WHEREAS, the Department is now embarking upon a reframing and expansion of its content area to include providing education in health systems science that will build upon existing content and include the afore-mentioned new content areas as well as emphasis on “innovation” (finding new, more effective ways to deliver care and solve problems) and “implementation science” (the study of methods to ensure that research findings are effectively translated into clinical care processes), and

WHEREAS, the nomenclature chosen for the proposed new name is consistent with the names of similar departments at US medical schools that are engaged in health systems science education, and

WHEREAS, the nomenclature chosen for the proposed new name reflects this broader educational mission but does not result in an overall increase in the total number of hours in the current VTCSOM medical school curriculum or any change in the requirements to earn the medical degree.
THEREFORE, LET IT BE IT RESOLVED, that the name of the Department of Interprofessionalism at VTCSOM be changed to the Department of Healthcare Innovation and Implementation Science, and the proposal forwarded to the President, Board of Visitors, and State Council of Higher Education for Virginia for approval.
1. Institution  Virginia Polytechnic Institute and State University

2. Nature of Proposed Change (i.e., to establish, reorganize, or terminate/close an institutional unit). Please indicate the change here. Attach a detailed description of the change as a separate document. Attach copies of the institution’s current and resultant organizational charts.
   Change the name of the Department of Interprofessionalism to Department of Healthcare Innovation and Implementation Science.

3. Purpose of Proposed Change. Please indicate the reason(s) for the change here. Attach a detailed description of the rationale for the change on a separate page.
   The proposed name represents the overall academic content that better reflects the instructional focus.

4. Type of Proposed Change (check one).

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<th>COMPLEX ☐</th>
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<td>Please explain how the change fits with the institution’s mission, curriculum, and funding on a separate page.</td>
<td>Please complete and submit Part I Supplemental Information and Part II Information for Non-exempt off-campus site.</td>
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5. Does this proposed change involve the establishment of an off-campus instructional site?

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<tr>
<th>NO ☒</th>
<th>YES ☐</th>
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<tr>
<td>If yes, does the proposal fit the criteria for a partially-exempt, non-exempt, or fully-exempt instructional site?</td>
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<th>NON-EXEMPT ☐</th>
<th>FULLY-EXEMPT ☐</th>
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</thead>
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<td>If partially-exempt, please attach documentation to support this status.</td>
<td>If non-exempt, please complete and submit Part II and Part III of this form.</td>
<td>If fully-exempt, please attach documentation to support this status.</td>
</tr>
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6. Date of Approval by Board of Visitors. (MM/DD/YYYY)

| ☐ | Check box if BOV approval is not needed. |

7. Proposed Effective Date of Organizational Change.

<table>
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<th>Date</th>
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</thead>
<tbody>
<tr>
<td>Executive Vice President and Provost</td>
<td>540-231-6122</td>
</tr>
<tr>
<td>Title</td>
<td>Phone</td>
</tr>
</tbody>
</table>
# Coversheet for New, Revised, and/or Discontinued Program

## General Information

<table>
<thead>
<tr>
<th>Proposal Date:</th>
<th>January 11, 2021</th>
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<tr>
<td>Department:</td>
<td>Department of Interprofessionalism, VTC School of Medicine</td>
</tr>
<tr>
<td>Program Name:</td>
<td>Department Name Change: to Department of Healthcare Innovation and Implementation Science</td>
</tr>
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</table>

- [ ] Degree
- [ ] Major
- [ ] Major Concentration/Option
- [ ] Minor*
- [ ] Graduate Certificate

**Department Contact:** David W. Musick, PhD, Senior Dean, Faculty Affairs

**Contact Email:** dwmusick@vt.edu

*Minor for Inclusion in Pathways GE – Complete “New and Revised Minor Form” ([https://www.pathways.prov.vt.edu/proposal-forms.html](https://www.pathways.prov.vt.edu/proposal-forms.html))

## Complete the following, as applicable

**A:** Attach letter of support from Department Head or Designee presenting whether the offering or continued offering of the program will require or generate the need for additional departmental and/or University resources (e.g., faculty, library, space, and/or technical support).

**B:** Attach letters/emails of support from Departments and/or Colleges for any non-department courses listed to satisfy a new program requirement.

**Effective Catalog:** Effective: Fall Semester 2021

## Check applicable box acknowledging that required documentation is included in proposal package:

- [ ] New — Documentation to establish new program: Need for program, whom program will serve, resource needs, administration
  
  **Note:** For a new degree, complete SCHEV documentation in parallel with University Governance review/approval process

  **First Term and Year to Enroll:** ____________  **First Term and Year to Graduate:** ____________

- [ ] > 20% Revision — Documentation summarizing revision changes, how changes will be communicated, and previously approved/stamped program requirements

- [ ] < 20% Revision — Upload into JIRA to the Office of the University Registrar for administrative review/approval
  
  **Note:** For a revised Degree (change in total program credit hours or degree core) – complete SCHEV documentation in parallel with University Governance process

- [ ] Discontinued — Documentation to justify program discontinuation, teach-out plan, and previously approved program requirements
  
  **Note:** For discontinued degree – Complete SCHEV documentation in parallel with University Governance review/approval process

  **Last Term and Year to Enroll:** ____________  **Last Term and Year to Graduate:** ____________

## Approval Signatures

<table>
<thead>
<tr>
<th>Department Representative:</th>
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<tbody>
<tr>
<td>College Curriculum Committee Representative:</td>
<td>[Signature]</td>
<td>Date: 1/22/21</td>
</tr>
<tr>
<td>College Dean or Designee:</td>
<td>[Signature]</td>
<td>Date: 1/25/21</td>
</tr>
</tbody>
</table>

---

Office of the University Registrar • Student Services Building, Suite 250, Virginia Tech
800 Washington St., SW • Blacksburg, VA 24061 • (540) 231-6252 • acadgov@vt.edu

Rev. 8/27/20
January 25, 2021

Dear Colleagues:

I am writing in support of the proposal requesting approval for the name change of our current “Department of Interprofessionalism” to the “Department of Healthcare Innovation and Implementation Science” here at the Virginia Tech Carilion School of Medicine. This name change is being proposed to more accurately describe the department’s programs and activities, and to reflect a rapidly growing interest nationwide in the science of health systems and healthcare delivery.

The immediate impetus for this name change request is the fact that our medical school has expanded its curriculum to include new content related to health systems science. Upon my arrival as Dean in July of 2019, one of my priorities was to begin work on this aspect of our curriculum. I appointed a multidisciplinary task force that worked for several months and made specific recommendations to our curriculum governance structure concerning this topic, and the resulting changes in our curriculum are underway. As required by university governance, our Medical Curriculum Committee has endorsed the departmental name change. It has also been vetted extensively among faculty members in the present department as well as the leadership of our school and our partner health system, Carilion Clinic. Further justification and details may be found in the attached summary.

The change of the department name requires a small amount of funding that will be provided by our college; we will request no funding from the university or the state to make the change. Further, the change will not alter the university’s mission but rather will support Virginia Tech’s commitment to “improving the quality of life and the human condition within the Commonwealth of Virginia and throughout the world” as reflected in our university mission statement.

Thank you for your consideration, and please allow me to answer any additional questions you may have.

Sincerely,

[Signature]

Lee A. Learman, MD, PhD
Dean, Virginia Tech Carilion School of Medicine
2 Riverside Circle, Roanoke, VA 24016
llearmen@vt.edu
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Institution
Virginia Polytechnic Institute and State University

Nature of Proposed Change
Virginia Tech proposes permission to change the name of the current Department of Interprofessionalism to the Department of Healthcare Innovation and Implementation Science. This change will be in title only and will not impact organizational structure of the university or the school. This change will not alter the university’s mission.

Background
The Department of Interprofessionalism was initially established in 2008 within the private-public partnership between the Virginia Tech Carilion School of Medicine and Virginia Tech. Upon the integration of the Virginia Tech Carilion School of Medicine within Virginia Tech in 2018, the Virginia Tech Carilion School of Medicine (VTCSOM) and subsequently, the Department of Interprofessionalism became part of Virginia Tech.

In the summer of 2020, the learning domain within the Department of Interprofessionalism was updated to reflect more comprehensive and contemporary content. After considering the breadth of the academic content of the program administered by the department, faculty and administrators determined that the name Department of Healthcare Innovation and Implementation Science would better represent the academic programming of the department.

Purpose of Proposed Change
The purpose of the proposed organizational change is to change the name of the department to better reflect the academic programming in the department.

Mission
The proposed organizational change will not alter or change Virginia Tech’s mission. The proposed new name aligns with the institution’s mission. The proposed name supports Virginia Tech’s commitment to “improving the quality of life and the human condition” as part of the programming offered by the department and the institution. The proposed name reflects the “inclusive community of knowledge” of faculty, programs, and students in the department.

Rationale for Proposed Change
The proposed name change is needed and will provide a more accurate description of the department’s overall academic content.

Over the past ten years, the field of medical education/physician training has increasingly called for medical schools to educate students regarding various aspects of the health systems in which
they will eventually practice. Such concepts as healthcare structures and processes, health systems finance and operations, value-based care, population and public health, clinical informatics, healthcare policy, health disparities/inequities, leadership and health system improvement have not traditionally been covered as part of the core medical curriculum, but are now being introduced into the curricula of increasing numbers of medical schools nationwide.

To that end, the VTCSOM updated the curricula in the Health Systems Science and Interprofessional Practice learning domain in 2020 to incorporate these concepts into the training received by the students. The proposed name change of the existing academic department at the VTCSOM coincides with this process. Building on its long tradition of interprofessional education in the health sciences, the current learning domain identified as “interprofessional education” will undergo a gradual expansion to include this new content focused on health systems science and interprofessional practice. The nomenclature chosen for the proposed name, i.e., healthcare innovation and implementation science, reflects the new focus on health systems. As applied to healthcare, “innovation” refers to finding new, more effective ways to deliver care and solve problems, resulting in improved health for individuals and communities. Related to healthcare innovation, “implementation science” is the study of methods used to ensure that research findings are effectively translated into clinical care processes, thus ensuring that new medical therapies and/or procedures become available to patients. Thus, the new departmental name will reflect the overall emphasis on health systems science, innovation and implementation science within the revised curriculum.

See Appendix A for a sample list of medical schools with departments and programs that include the expanded curriculum (i.e., health systems science).

Academic Programs

The proposed name change will not impact the curricular offerings of the VTCSOM. The department provides content and programming that is interwoven throughout the four-year curriculum but does not administer stand-alone academic credentials (e.g., degree programs, certificates). No degree programs will relocate to the department as a result of the proposed name change. There will be no changes to the medical degree program as a result of the proposed name change.

The department contributes the following curricular components to the overall medical education:

Introduction to Health Systems Science and Interprofessional Practice
Orientation to Health System Science and Interprofessional Practice and Systems Thinking
Health System Science and Population Health
Health System Science and Healthcare Policy
Health System Science and Leadership in Healthcare Improvement
Health System Science and Professional vs Team Advocacy

Health Systems Science and Interprofessional Practice: Teams
Healthcare Roles and Responsibilities/Professional Controversies and Challenges
Team Leadership in Health Care
Longitudinal Experiences in Health Systems Science

Health Systems Science and Interprofessional Practice: Population Health and Healthcare Delivery
Leading Causes of Death
Population-Based Diets & Clinical Nutrition
Social Determinants of Health
Integration of Public Health and Health Care Delivery
Health Care Delivery Systems
Organizational Ethics & Professionalism Issues in Health Systems Science
Medico-Legal Issues in Health Care

Health Systems Science and Interprofessional Practice: Safety and Quality
Clinical Informatics & Health Information Technology
Patient Safety 1
Patient Safety 2
Quality Improvement 1
Quality Improvement 2
Application of Foundational Skills to Health Systems Science
Health Care Team Challenges

Resources/Budget
There will be an initial expenditure of approximately $5,000 to be used for purchasing of stationary, business cards, and marketing costs associated with the proposed name change. This cost will be accommodated by funds presently available to the medical school as a result of cost savings within the travel budget accrued during the 2019-2020 academic/budget year.

Print materials (stationary, business cards) $2,500
Marketing and publicity $2,500
Total $5,000

No additional expenses are required to implement the proposed name change. No new positions will be needed to implement the name change. Departmental administration, administrative support, and space will not be changed by the proposed name change. Changes to the website will be completed during the normal course of business as internal updates are completed. There are no signage costs associated with the proposed name change as departments do not have individual signage. Virginia Tech and the Virginia Tech Carilion School of Medicine have adequate and sufficient resources for the proposed organizational change to change the department’s name. No new resources will be requested from the state to initiate or sustain the organizational change to rename the Department of Interprofessionalism.

Appendix B presents the existing organizational structure of the School.
Appendix C presents the organizational structure of the School after the department name change.
Appendices
### Appendix A

**List of Medical Schools**

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<tr>
<th>Institution</th>
<th>Department/Unit</th>
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<td><a href="https://med.psu.edu/health-systems-science">https://med.psu.edu/health-systems-science</a></td>
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<td>Kaiser Permanente, School of Medicine</td>
<td>Department of Health Systems Science</td>
<td><a href="https://medschool.kp.org/about/offices-and-departments/department-of-health-systems-science">https://medschool.kp.org/about/offices-and-departments/department-of-health-systems-science</a></td>
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<td>Mayo Clinic, College of Medicine and Science</td>
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<td><a href="https://college.mayo.edu/academics/health-sciences-education/">https://college.mayo.edu/academics/health-sciences-education/</a></td>
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<tr>
<td>University of Houston, College of Medicine</td>
<td>Department of Health Systems and Population Sciences</td>
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<tr>
<td>University of Massachusetts, School of Medicine</td>
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<td><a href="https://www.umassmed.edu/oume/crriculum/health-systems-science/">https://www.umassmed.edu/oume/crriculum/health-systems-science/</a></td>
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<td><a href="https://medicine.umich.edu/dept/learning-health-sciences">https://medicine.umich.edu/dept/learning-health-sciences</a></td>
</tr>
<tr>
<td>Wake Forest University, School of Medicine</td>
<td>Department of Implementation Science</td>
<td><a href="https://school.wakehealth.edu/Departments/Implementation-Science">https://school.wakehealth.edu/Departments/Implementation-Science</a></td>
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</table>
Appendix C
Proposed Organizational Structure

Dept of Basic Science Education

Dept of Emergency Medicine

Dept of Family Medicine

Dept of Internal Medicine

Dept of Healthcare Innovation and Implementation Science

Dept of Obstetrics/Gynecology

Dept of Orthopaedics

Dept of Pediatrics

Dept of Psychiatry and Behavioral Health

Dept of Radiology

Dept of Surgery

Virginia Tech Carilion School of Medicine Dean
Attachment 1
Article of Support
Health Systems Science in Medical Education: Unifying the Components to Catalyze Transformation

Jed D. Gonzalo, MD, MSc, Anna Chang, MD, Michael Dekhtyar, MEd, Stephanie R. Starr, MD, Eric Holmboe, MD, and Daniel R. Wolpaw, MD

Abstract

Medical education exists in the service of patients and communities and must continually calibrate its focus to ensure the achievement of these goals. To close gaps in U.S. health outcomes, medical education is steadily evolving to better prepare providers with the knowledge and skills to lead patient- and systems-level improvements. Systems-related competencies, including high-value care, quality improvement, population health, informatics, and systems thinking, are needed to achieve this but are often curricular islands in medical education, dependent on local context, and have lacked a unifying framework. The third pillar of medical education—health systems science (HSS)—complements the basic and clinical sciences and integrates the full range of systems-related competencies. Despite the movement toward HSS, there remains uncertainty and significant inconsistency in the application of HSS concepts and nomenclature within health care and medical education. In this Article, the authors (1) explore the historical context of several key systems-related competency areas; (2) describe HSS and highlight a schema crosswalk between HSS and systems-related national competency recommendations, accreditation standards, national and local curricula, educator recommendations, and textbooks; and (3) articulate 6 rationales for the use and integration of a broad HSS framework within medical education. These rationales include: (1) ensuring core competencies are not marginalized, (2) accounting for related and integrated competencies in curricular design, (3) providing the foundation for comprehensive assessments and evaluations, (4) providing a clear learning pathway for the undergraduate–graduate–workforce continuum, (5) facilitating a shift toward a national standard, and (6) catalyzing a new professional identity as systems citizens. Continued movement toward a cohesive framework will better align the clinical and educational missions by cultivating the next generation of systems-minded health care professionals.

The evolution of the U.S. health care system and misalignment between desired outcomes, costs, and experience of care have stimulated a paradigm shift in health professions education.¹ This shift includes training that allows for learners to practice and lead in an evolving, complex health care landscape, with the goal of ensuring patients and populations receive high-quality care. Several medical education and health system leaders have recommended educational and clinical outcomes be coproduced with patients, health care professionals, health systems, and communities, and above all else, be “centered around the patient.”²,³ For medical education, the reexamination and reenvisioning of an expanding set of systems-related competencies require significant shifts in the process, content, and assessment of learning.⁴,⁵ Many of these competencies are not new, but educators struggle to operationalize them across the continuum from undergraduate medical education (UME) to graduate medical education (GME) to the professional workforce—for example, the Accreditation Council for Graduate Medical Education (ACGME) systems-based practice (SBP) competency.⁶ The ACGME’s Clinical Learning Environment Review Pathways to Excellence initiative has identified gaps in the health system’s ability to facilitate resident education in multiple SBP-related areas, including patient safety (PS), quality improvement (QI), and care transitions.⁷,⁸ Additionally, systems-related competencies, including high-value care, QI, population health, informatics, and systems thinking, are often relegated to isolated pockets in educational programs depending on local context, including curricular priorities and available expertise.⁹–¹¹ Such treatment of these competencies contributes to disjointed learning, potentially compromising clinical practice and professional development.¹²,¹³ Despite many recommendations to better prepare learners to lead in evolving health systems, an inertia for such change has limited significant transformation.¹⁴,¹⁵,¹⁶

The third pillar of medical education, health systems science (HSS), provides a comprehensive framework to accelerate this change and integrate the full range of systems-related competencies.⁶ HSS is necessary to ensure the basic and clinical sciences reach their full potential in terms of impacting patient health and achieving the Quadruple Aim.¹⁷,¹⁸ The HSS framework cohesively unites previously scattered systems-related competencies and is now being used by dozens of medical school and residency programs and is informing national initiatives.¹⁹–₂¹ Despite this movement, there remain uncertainty and significant inconsistency in the application of HSS concepts and nomenclature within health care and medical education. For example, some still equate HSS with specific content areas (e.g., QI).¹⁴ These understandable
tensions occur within educational settings in which faculty and learners have numerous competing priorities, creating challenges for the integration of new HSS content.12,21-23 These struggles highlight the need for a unified framework, which can be clarified by examining the historical context in which systems-related learning has occurred and the similarities and differences between HSS and related content.24

In this Article, we (1) explore the historical context of several key systems-related competency areas; (2) describe HSS and highlight a schema crosstalk between HSS and systems-related national competency recommendations, accreditation standards, national and local curricula, educator recommendations, and textbooks; and (3) articulate 6 rationales for the use and integration of a broad HSS framework within medical education. Our primary goal is to provide the rationale and guidance for unifying related yet distinctly different systems-related components into the HSS framework to catalyze medical education, as well as health care delivery, transformation. We pursued this work because we believe the lack of a shared mental model is hampering medical education and health care reform.

**History, Landscape, and Rationale for HSS**

To understand the unique nature of and need for an HSS framework, we begin with the history of several key systems-related competencies. The topics in the following sections are included within HSS, but not all HSS topics are reviewed here. While each individual competency area is critical for the transformation of medical education, focusing solely on any one area (e.g., high-value care) marginalizes other critical HSS competencies, which are necessary for a larger professional identity as "systems citizens" (described below).4 We propose a unified framework that spans the UME–GME–workforce continuum.

**SBP**

SBP, and the closely related practice-based learning and improvement, originated in the late 1990s via the ACGME Core Competency Project, which followed the Harvard Medical Practice Study’s revelation of unsafe conditions in clinical care.27-30 SBP requires residents to “demonstrate an awareness of and responsiveness to the larger context and system of health care, and the ability to effectively call on other resources in the system to provide optimal health care.”27 Several SBP-related competencies capture a broad scope of physician practice, including interprofessional collaboration, care coordination, cost-conscious care, and systems error identification.31,32 Establishing the SBP competency was a significant step forward, but program directors have encountered challenges in operationalizing and evaluating SBP in clinical learning environments.33,34 However, even with the introduction of SBP milestones, studies exploring similarities across GME programs identified few HSS-related themes (e.g., economics, health care delivery, community engagement).29,30 These themes do not provide a comprehensive core of the systems-related competencies reflected in the larger HSS framework. Despite these gaps and challenges, SBP has created space for the systems-related learning agenda, which we believe can be better informed by HSS to ensure graduates are prepared to meet society’s needs.

**QI/PS**

In the late 1990s, the Institute of Medicine (now the National Academy of Medicine) increased focus on QI/PS as core competencies in medical education by reporting on quality and safety events, including diagnostic and other medical errors.34-36 The QI/PS agenda is reflected in one of the Association of American Medical Colleges (AAMC) 13 Core Entrustable Professional Activities (Core EPAs) for Entering Residency and is a core GME requirement.37-41 Further, the Institute for Healthcare Improvement’s Model for Improvement and Open School curriculum includes several HSS areas (e.g., health care processes, variation and measurement, customer knowledge, leadership, collaboration, social context).41 With this rising awareness, local and national faculty development efforts in QI/PS are increasing. Both local (e.g., the Brody School of Medicine’s Teachers for Quality Academy) and national (e.g., the Society of Hospital Medicine’s Quality & Safety Educators Academy) programs help educators develop QI/PS competencies and change management skills, with the goal of application in local environments.39,42

**Interprofessional education**

The history of interprofessional education (IPE) and interprofessional collaborative care (IPCC) dates to the 1960s in Europe, with steady integration since then into U.S. medical education. With the push to minimize “professional silos,” educators have developed curricula to increase learning from, with, and about colleagues from different health professions.43-45 The Liaison Committee on Medical Education (LCME) IPE requirement, targeted funding from the Josiah Macy Jr. Foundation, and the creation of a research and practice network (National Center for Interprofessional Practice and Education) have advanced this educational agenda.46-47 IPE and IPCC are applied in a variety of contexts, including QI/PS, population health, and specialty-specific areas.48 However, IPE has been a challenge to operationalize and assess within clinical learning environments. As a result, IPE is a key focus area that integrates across multiple HSS areas and cannot stand alone. That is, the IPE competencies are mutually strengthened, enhanced, and most meaningful in the larger HSS context.49

**Social determinants of health**

Some aspects of the social determinants of health (SDH) have been part of the medical interview for decades.50 For example, a primary focus of taking a patient’s social history has been to identify risk factors like substance use, occupational exposures, high-risk sexual behavior, and living situation. Over the past 20 years, there has been an increasing awareness of other factors related to health outcomes (e.g., food insecurity, adverse childhood experiences, zip code).51-53 Some data suggest the SDH have more impact on U.S. health outcomes than behavior, genetics, or health care delivery.54 In 2007, the AAMC recommended medical schools increase SDH and behavioral health curricula.55 A new England Journal of Medicine series entitled “Case Studies in Social Medicine” promises to make an important contribution to this HSS area, using patient cases to explore how social structures affect health, with the authors of one of the studies in this series arguing for increased educational focus on social factors to improve patient outcomes.56

**Population health**

Related to the SDH, there is increasing literature focused on public, population,
and global health. Many UME programs focus explicitly on addressing community needs, and both UME and GME programs have worked to advance learner competence in population health. Global health programs are popular in UME, with nearly 40% of U.S. medical schools sponsoring opportunities for foreign travel. While these areas are important, they are strengthened by the more comprehensive and interrelated framework of HSS. Engaging with the SDH; public, population, and global health; cultural humility; structural biases; and stereotypes while also considering health care delivery, policy, economics, and informatics provides a meaningful context for applying systems thinking and improving outcomes.

High-value care
In response to increasing health care costs, medical education has increasingly emphasized the "value" of care over the past decade. Studies have shown the impact of health care utilization practices and related faculty behaviors on trainees, with the effects persisting for decades into practice. Value competencies were published in 2015 for use across the professional life span of physicians, nurses, pharmacists, and dentists. The AAMC Core EPAs (i.e., entrustable professional activity) include the ability to be cost-effective when choosing diagnostic tests and treatment interventions. ACGME Common Program Requirements expect all graduates to incorporate cost awareness and risk–benefit analysis into patient and/or population-based care. Additionally, the American College of Physicians and the Alliance for Academic Internal Medicine defined 5 steps in teaching high-value care, which highlight evidence-based medicine, "safely doing less" conversations with patients, and shared decision making. National initiatives (e.g., the Lown Institute's Right Care Series, High Value Practice Academic Alliance, Costs of Care) have advanced learning in high-value care. Learners across the educational continuum must integrate evidence-based medicine with patient and team conversations and recognize macrosystem forces and ethical considerations as they provide high-value care in changing clinical environments. To do this well, learners will need competence in several HSS areas.

HSS: The Third Pillar of Medical Education
The HSS framework encompasses 12 distinct competency areas and is unified and interrelated in the same manner as the basic and clinical sciences (Chart 1). Although each systems-related area is a critical learning area for UME, GME, and professional workforce development, we argue that applying each independently will not result in a cohesive educational program or ideal educational outcomes. Learners require a comprehensive framework on which to "hang," integrate, and apply concepts. The systems-related areas require clear articulation, a shared mental model (ideally using a systems-thinking lens), and application via effective collaboration with diverse health professionals in clinical practice. Just as the basic sciences include more than immunology or molecular biology, HSS encompasses multiple concepts and perspectives into a larger, more cohesive whole. A trainee can be taught the basic and clinical science to accurately diagnose and treat myocardial infarction. But how should the approach be operationalized if the patient is an immigrant with different traditional health beliefs (patient experience and context), does not have a home (SDH), and represents a population of patients with similar health gaps occurring within a community (population and community health)? How does a trainee ensure each patient's needs are addressed at each transition across the care continuum (health care delivery)? How can trainees learn to see and navigate health care systems and effectively identify levers they can influence or change (via QI/PS, advocacy, policy) to improve health? While the traditional 2-pillar model of medical education has served health care well in the Flexnerian era, new understandings of health and disease require the addition of a third pillar—HSS. Educational programs should ensure basic science, clinical science, and HSS learning are optimally integrated, ideally conceptualized by learners, and operationalized using the HSS framework.

Schema Crosswalk
We developed and performed a schema crosswalk to elucidate the similarities, differences, and gaps in commonly used systems-based frameworks from a representative sample of national competency recommendations and accreditation standards (Chart 2) and national and local curricula, educator recommendations, and textbooks (Chart 3). Our data analysis methods are described in Supplemental Digital Appendix 1 (at http://links.lww.com/ACADMED/A906). We performed this crosswalk to systematically articulate gaps and similar and overlapping elements between the multiple systems-based frameworks and HSS. We believed this analysis would highlight the significant and nuanced differences between HSS and other systems-based frameworks. Notably, most examples demonstrate limited overlap with HSS, the most commonly represented areas include teamwork, quality (including PS, effectiveness, efficiency, timeliness, patient-centered care, and equitable care), QI principles, and SDH. Although several of the examples closely capture the breadth of HSS, they generally only focus on certain HSS subdomains or address an HSS area superficially (e.g., one item on the AAMC Graduation Questionnaire [GQ]). Similar crosswalk processes can be used by educators to identify strengths or gaps in curricula. Collectively, this crosswalk includes all critical systems-related competency "puzzle pieces," which can facilitate the translation of conceptual goals into education design, program evaluation, and clinical practice.

A Call for a Unified Framework in Medical Education
We believe a more comprehensive, unified framework is needed to effectively align the medical education continuum with the Quadruple Aim (i.e., to better align the clinical and educational missions by cultivating the next generation of systems-minded health care professionals) and that there is now opportunity and momentum for operationalizing this vision. We believe HSS is ideal for facilitating this alignment, though we recognize it will require iterative improvements. Following are 6 rationales that support and justify the use of HSS as a unified framework for medical education.

Rationale 1: A unified framework ensures core competencies are not marginalized
A comprehensive framework makes all of the desired knowledge, attitudes, and skills transparent for programs, evaluators,
<table>
<thead>
<tr>
<th>Selected basic sciences*</th>
<th>Selected clinical sciences*</th>
<th>Health systems sciences*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatomy and embryology</td>
<td>Communication</td>
<td>Patient experience and context</td>
</tr>
<tr>
<td>Biochemistry and molecular biology</td>
<td>History taking</td>
<td>Patient experience and values</td>
</tr>
<tr>
<td>Biology of cells</td>
<td>Physical examination</td>
<td>Patient behaviors and motivations</td>
</tr>
<tr>
<td>Biology of tissue response to disease</td>
<td>Clinical and diagnostic reasoning and diagnosis</td>
<td>Health care delivery</td>
</tr>
<tr>
<td>Histology</td>
<td>Evidence-based medicine and biostatistics</td>
<td>Structures of delivery</td>
</tr>
<tr>
<td>Human development and genetics</td>
<td>Behavioral health</td>
<td>Processes of delivery</td>
</tr>
<tr>
<td>Immunology</td>
<td>Clinical medicine areas</td>
<td>Health care policy and economics</td>
</tr>
<tr>
<td>Microbial biology</td>
<td>Adult ambulatory medicine</td>
<td>Policy</td>
</tr>
<tr>
<td>Pathology</td>
<td>Emergency medicine</td>
<td>Population health, public health, and social determinants of health</td>
</tr>
<tr>
<td>Pharmacology</td>
<td>Internal medicine</td>
<td>Social determinants of health</td>
</tr>
<tr>
<td>Physiology</td>
<td>Obstetrics and gynecology</td>
<td>Public health</td>
</tr>
<tr>
<td></td>
<td>Pediatrics</td>
<td>Population health and improvement</td>
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<tr>
<td></td>
<td>Psychiatry</td>
<td>Clinical informatics and health technology</td>
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<tr>
<td></td>
<td>Surgery</td>
<td>Informatics and data analytics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decision support and evidence-based medicine</td>
</tr>
<tr>
<td></td>
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<td>Technology and tools</td>
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<td></td>
<td></td>
<td>Value in health care</td>
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<tr>
<td></td>
<td></td>
<td>Quality principles and dimensions</td>
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<td></td>
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<td>Cost and waste</td>
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<td>Evaluation and metrics</td>
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<td>Improvement</td>
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<td>Data and measurement</td>
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<tr>
<td></td>
<td></td>
<td>Innovation and scholarship</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Systems thinking</td>
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<tr>
<td></td>
<td></td>
<td>Change agency, change management, and advocacy</td>
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<td>Ethics and legal</td>
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<td></td>
<td>Leadership</td>
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<td></td>
<td></td>
<td>Learning and teamwork</td>
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</table>

*Framework derived, in part, from the Liaison Committee on Medical Education Standards and the United States Medical Licensing Examination physician tasks and competencies.19,20,21

and learners. A program focusing on a subset of HSS competencies without clear integration with the larger learning agenda runs the risk of marginalizing competencies, omitting learning required for professional development, or missing important connections to competencies addressed elsewhere in the curriculum. In such a program, any necessary competencies that are not clearly labeled or integrated may be overlooked or de-emphasized. Engle created the biopsychosocial model years ago because patients require more than an accounting of their pathophysiology and biomedical management.27 What is new in the HSS framework, however, is a progressive understanding of the breadth and depth of the systems factors, collaboration, and systems-thinking skills essential to improving health for patients and communities. Effectively improving glycemic control for a patient population (e.g., all clinic patients with a hemoglobin A1C > 9.0%) includes core principles of population health, SDH, care delivery, informatics, change management, systems thinking, and QI. If medical education is going to make real progress in closing gaps in health outcomes, individual systems areas (e.g., QI/PS, value) must be explicitly integrated as part of the larger HSS framework rather than presented as separate fields.4 The new Kaiser Permanente School of Medicine (in Pasadena, California) is an example that demonstrates how broad-based organizational structures are shifting toward HSS. This new medical school
### Chart 2

**Schema Crosswalk of Health Systems Science (HSS) Learning Areas With Systems-Related National Competency Recommendations and Accreditation Standards**

<table>
<thead>
<tr>
<th>Representative examples</th>
<th>HSS domains and subdomains</th>
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<tbody>
<tr>
<td></td>
<td>PEC</td>
</tr>
<tr>
<td>AAMC Core EPAs for Entering Residency$^{116}$</td>
<td>*</td>
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<tr>
<td>Competency domains for health professions$^{111}$</td>
<td>*</td>
</tr>
<tr>
<td>Interprofessional education/collaborative care competencies$^{68}$</td>
<td>*</td>
</tr>
<tr>
<td>IHI knowledge domains for improvement$^{112}$</td>
<td>*</td>
</tr>
<tr>
<td>AAMC QIPS competencies$^{60}$</td>
<td>*</td>
</tr>
<tr>
<td>AAMC GQ (1998–2004)$^{115}$</td>
<td>*</td>
</tr>
<tr>
<td>AAMC GQ (2005–2009)$^{115}$</td>
<td>*</td>
</tr>
<tr>
<td>AAMC GQ (2010–2017)$^{115}$</td>
<td>*</td>
</tr>
<tr>
<td>LCME Data Collection Instrument $^{109}$</td>
<td>*</td>
</tr>
<tr>
<td>USMLE physician tasks and competencies$^{99}$</td>
<td>*</td>
</tr>
<tr>
<td>USMLE content outline$^{113}$</td>
<td>*</td>
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</tbody>
</table>

### UME competency recommendations and accreditation standards

### GME competency recommendations and accreditation standards

| ACME GME SPB competency domain$^{111,116}$ | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| ACME GME SPB: ICS, PBLU, and PRO milestones$^{12}$ | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| ACME GME Common Program Requirements$^{62}$ | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| ACME GME Core Pathways to Excellence$^{3}$ | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |

**Abbreviations:** AAMC, Association of American Medical Colleges; ACME, Accreditation Council for Graduate Medical Education; CHT, clinical informatics and health technology; L, leadership; CEB, Clinical Education Board; HSS, health systems science; CMA, change management and advocacy; EL, ethics and legal; EPAs, entrustable professional activities; GME, graduate medical education; Q, quality improvement; QI, quality improvement and patient safety; SPB, systems-based practice; ST, systems thinking; TW, teamwork, teaming, and collaboration; UME, undergraduate medical education; USMLE, United States Medical Licensing Examination.

$^{*}$Supplemental Digital Appendix 1 (at http://links.lww.com/ACADMED/A906) describes methods used in performing the schema crosswalk; the * and ** designations were determined by investigators and represent degree of focus dedicated to an HSS area (i.e., * = minor focus, ** = moderate or high focus).

$^{1}$Source: Association of American Medical Colleges Data Warehouse Codebooks, Graduation Questionnaire. Used with special permission.

$^{2}$Questions on the AAMC GQ only included items related to perceived readiness for residency or to the time devoted to topics in curricula (and excluded binary items related to whether a concept or item was "used" in their experience).
### Chart 3

**Schema Crosswalk of Health Systems Science (HSS) Learning Areas With Systems-Related National and Local Curricula, Educator Recommendations, and Textbooks**

<table>
<thead>
<tr>
<th>Representative examples</th>
<th>HSS domains and subdomains</th>
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<td>FEC</td>
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<tr>
<td><strong>National and local curricula</strong></td>
<td></td>
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<tr>
<td>IHI Open School curriculum(^{115})</td>
<td>**</td>
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<tr>
<td>ACP High Value Care Curriculum(^{116})</td>
<td>*</td>
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<tr>
<td>Quality &amp; Safety Educators Academy(^{47})</td>
<td></td>
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<tr>
<td>Harvard Medical School social medicine course(^{40})</td>
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</tr>
<tr>
<td>Teachers of Quality Academy(^{117})</td>
<td></td>
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<tr>
<td>Mayo Clinic Alix SOM Science of HCD curriculum(^{118})</td>
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<tr>
<td><strong>Educator recommendations</strong></td>
<td></td>
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<tr>
<td>UME health policy curricula(^{119,120})</td>
<td></td>
</tr>
<tr>
<td>Clinical Prevention and Population Health Curriculum Framework(^{121})</td>
<td></td>
</tr>
<tr>
<td>Population health curricular framework(^{122})</td>
<td>**</td>
</tr>
<tr>
<td>UME-2T initiative(^{123})</td>
<td>*</td>
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<tr>
<td><strong>Textbooks</strong></td>
<td></td>
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<tr>
<td>Population Health: Creating a Culture of Wellness(^{124})</td>
<td></td>
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<tr>
<td>Understanding Patient Safety(^{125})</td>
<td></td>
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<tr>
<td>Understanding Value-Based Healthcare(^{49})</td>
<td></td>
</tr>
<tr>
<td>Health Systems Science and Health Systems Science Review(^{126})</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: ACP, American College of Physicians; CIHT, clinical informatics and health technology (I, informatics; D, decision support; T, technology); CMA, change management and advocacy; EL, ethics and legal; HCD, health care delivery (S, structure; P, process); HSI, health system improvement (O, quality improvement principles; D, data and measurement; S, innovation and scholarship); HVC, high-value care (I, quality [including patient safety, effectiveness, efficiency, timeliness, patient-centered care, and equitable care]; C, cost and waste; E, evaluation and metrics); IHI, Institute for Healthcare Improvement; L, leadership; PE, policy and economics (P, policy; E, economics and payment); PEC, patient experience and context (P, patient experience; B, behaviors and motivation); PPH, population, public, and social determinants of health (SDH, social determinants of health; Pu, public health; PHI, population health and improvement); SOM, School of Medicine; ST, systems thinking; TW, teamwork, teaming, and collaboration; UME, undergraduate medical education.

*Supplemental Digital Appendix 1 (at http://links.lww.com/JACAM/A906) describes methods used in performing the schema crosswalk; the * and ** designations were determined by investigators and represent degree of focus dedicated to an HSS area (i.e., * = minor focus, ** = moderate or high focus).
has 3 main departments: foundational science, clinical science, and HSS.\textsuperscript{79,80} This forward-thinking organizational structure represents an important validation of HSS as an equal partner in medical education and patient care.\textsuperscript{81}

While HSS captures the breadth of systems learning, a clear HSS framework with articulated milestones is critical for designing educational programs and evaluation methods but does not yet exist.\textsuperscript{82} In addition to integrated HSS competencies, there is also the need for best learning and assessment strategies for basic science, clinical science, and HSS across the life span of the educational continuum.\textsuperscript{83} More work is needed to advance the use of HSS as a comprehensive framework.

**Rationale 2: A unified framework accounts for related and integrated competencies in curricular design**

Curriculum designers need a comprehensive framework to develop optimal strategies for learning. Educators would ideally have a firm understanding of conceptual building blocks (e.g., value as a combination of quality and cost), an evidence-informed approach to curricular design that ensures the optimal developmental sequence of concepts, a spiral approach to applying concepts across disciplines, coursework (on the basic and clinical sciences and humanities), and clinical contexts aligned with Bloom's taxonomy.\textsuperscript{84} For example, population health may be most optimally integrated into the curriculum after a systematic sequence of learning in health care delivery, SDH, systems thinking, and informatics. Learners' exploration of critical issues related to population factors requires this larger framework and the common nomenclature gained from already having knowledge of these other areas.\textsuperscript{85}

Some UME curricula include short immersion courses focused on leadership, IPE, or patient handoffs between care settings. These courses often have different directors, and their learning goals may not align with an existing core competency map that facilitates connections across HSS competencies. As a result of this and similar missed connections, there may be unintentional redundancy and deficiencies in HSS curricula. With the emergence of dean- and director-level HSS positions along with national initiatives and grant programs by the American Medical Association (AMA), ACGME, and Kern Institute, UME and GME programs are developing the infrastructure to integrate all HSS competencies across the educational continuum.\textsuperscript{86–88}

**Rationale 3: A unified framework provides the foundation for comprehensive assessments and evaluations**

The goal of synthesizing basic science, clinical science, and HSS competencies is difficult to achieve if curricular development and assessment occur in silos and include basic science, clinical science, and an amalgam of other curricular topics. With little consensus on how to best integrate new education frameworks along the continuum of medical education, educators and learners need a unified nomenclature that more aptly fits current education and health care systems.\textsuperscript{87} If orphan curricular areas remain fragmented, assessments and evaluations may not align with the core competencies of the larger HSS framework.

For example, when the Penn State College of Medicine created a student patient navigator program for first-year medical students (linking students with interprofessional clinicians in diverse clinical settings to contribute to improving patient outcomes), the program required a systematic evaluation and assessment plan that reflected student learning and program goals.\textsuperscript{88–90} Expectations for student contributions were broad, including collaborating with other health care professionals to identify barriers to care (e.g., health care structures and processes, SDH, IPCC) and understanding and navigating health systems issues (e.g., population health, policy, economics).\textsuperscript{89} Brining these related areas together in a comprehensive HSS framework created the opportunity to collaborate with other educators on a meaningful approach to assessment and evaluation.\textsuperscript{90} Similar education efforts will require a common understanding of HSS and adoption of a common language.

**Rationale 4: A unified framework provides a clear learning pathway for the UME–GME–workforce continuum**

Learner progression from classroom to clinical settings, from medical school to residency, and from residency to the physician workforce can be enhanced with a comprehensive framework of competencies.\textsuperscript{89} Educational handoffs at critical training transitions lack standardized competencies and expectations, and there are differing priorities for these handoffs across UME stakeholders, GME stakeholders, and accrediting bodies.\textsuperscript{79,91} The LCME Standards and Data Collection Instrument (DCI, with supporting data from the AAMC GQ) are not fully aligned with the AAMC Core EPAs or ACGME SBP milestones, potentiating gaps in these transitions. For example, a graduating student may leave medical school with a solid background in population health, only to enter a residency program that focuses solely on QI/PS. The lack of widespread HSS framework use throughout the UME–GME–workforce continuum creates additional learner vulnerabilities during high-stress transitions and threatens optimal professional development.

It is considered unacceptable for a medical school to graduate a student who cannot care for patients with acute myocardial infarctions, but it is acceptable to graduate a student who cannot care for patients with acute abdomens. Why, in the context of 21st-century health care, is it acceptable for a student to know about QI/PS but not about health informatics, population health, or value? Why is it acceptable for a student to perform clinical reasoning well but not systems thinking? While distinct UME–GME and GME–workforce transitions will likely remain within medical education, medical education can adopt a comprehensive HSS framework that informs educational programs at all levels, ensuring a common language for improving educational transitions.

**Rationale 5: A unified framework facilitates a shift toward a national standard**

The HSS framework provides the foundation for future work on core and elective systems-related competencies in medical education.\textsuperscript{92} A clearly articulated set of goals across all HSS areas will allow programs to integrate the most highly prioritized competencies in an effective, developmental sequence and allocate appropriate time and curricular
space.\textsuperscript{231} Current UME frameworks for systems-related competencies include the AAMC Core EPAs (which address care transitions and PS), AAMC QI/PS competencies (which address quality, data transparency, and measurement), and locally developed competency maps.\textsuperscript{20} This lack of a comprehensive UME framework limits larger-scale prioritization of what should be expected of graduating learners from U.S. medical schools. With a nationally agreed-on HSS framework and integration into expectations for educational programs, educators can begin to standardize expectations for UME and facilitate the necessary cultural shift for addressing mixed student receptivity to HSS.\textsuperscript{13,24} Additionally, a unifying HSS framework can help each specialty (e.g., pediatrics, addiction medicine, surgery) develop aspirational milestones unique to their trainees. Accrediting organizations (e.g., LCME), supportive organizations (e.g., AAMC), and licensing boards (e.g., National Board of Medical Examiners [NBME]) can accelerate or hinder the development of national standards. About a decade ago, the AAMC QG included several systems-related items focused on economics, health care systems, managed care, and care delivery.\textsuperscript{67} In 2011, these items were replaced with one item: “I have a fundamental understanding of the issues in social sciences of medicine (e.g., ethics, humanism, professionalism, organization and structure of the health care system).”\textsuperscript{69} Then, in 2019, this item was supplemented with 3 HSS items (see Supplemental Digital Appendix 2 at http://links.lww.com/ACADMED/A906).\textsuperscript{99} Additionally, the required LCME DCI has limited sections focused on HSS and only \textasciitilde{}6% of the content in the United States Medical Licensing Examination (USMLE) outline is HSS-related.\textsuperscript{99} In 2019, the NBME and AMA codified a new HSS subject examination for UME.\textsuperscript{100} Further modifications to the DCI, QG, and USMLE to include additional HSS content could accelerate formal integration of HSS into the mainstream of medical education. Lastly, professional workforce development may benefit from the HSS framework as it could articulate critical learning areas for physicians and other health professionals to simultaneously transform health care delivery and the education of trainees within clinical learning environments.\textsuperscript{75,92}

**Rationale 6:** A unified framework catalyzes a new professional identity as “systems citizens”

HSS provides a core framework for technical skill development for physicians (and potentially other health professionals such as nurses, therapists, and pharmacists). HSS also catalyzes an equally important shift toward a new “systems citizens” professional identity that extends beyond physicians' characteristics and traits (e.g., altruism, trustworthiness, compassion, respect for others).\textsuperscript{101–104} A concept first established by Senge in relation to societies, situated by Hafferty in the context of health care, and applied by several of our works, systems citizens are health care professionals who are in a symbiotic relationship with the health care system (not operating within an isolated microenvironment focused on the biomedical sciences).\textsuperscript{3,13,91,108–107} Systems citizenship requires physicians to be stewards, ambassadors, and trustees, ensuring collaborative relationships within and between systems to achieve ideal patient outcomes.\textsuperscript{105} Educators’ goals should not be to develop physicians with biomedical acumen who possess inconsistent working knowledge and interest in HSS. Educators should be aiming for a professional identity that promotes physicians as citizens of a health care “country,” where they share with patients and communities the responsibility of and coproduce health care delivery transformation.\textsuperscript{3,108} HSS includes the core competencies that systems citizens require and provides the shared language for this evolving professional identity.\textsuperscript{83}

**Conclusions**

Dispersed systems-related competencies have variably been a part of U.S. medical education for several decades. Rapid advances in how the medical community understands complex determinants of health in patients and populations have fueled the need to organize and expand these competencies into a unified comprehensive framework—the HSS framework. This framework addresses important gaps in medical education and provides the nomenclature for patient-centered practice and physician leadership within medical education and health care. Accelerating the transition to HSS as a full partner with the basic and clinical sciences will, among other things, enhance alignment along the UME–GME–workforce continuum, support a standardized set of prioritized competencies, and catalyze the development of systems citizens.

**Acknowledgments:** The authors would like to acknowledge the clinicians, educators, system leaders, students, and other collaborators who have invested their time to contribute to the educational mission at the authors' medical schools, and David Matthew (Association of American Medical Colleges [AAMC]) for providing the AAMC Graduation Questionnaire (GQ) Data Warehouse Codebooks and his assistance with descriptions of AAMC GQ-related content in the paper.

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**Ethical approval:** Reported as not applicable.

**Disclaimers:** The content of and views expressed in this paper reflect the views of the authors and do not necessarily represent the views of the AMA, Joseph Macy Jr. Foundation, or other participants in the Accelerating Change in Medical Education initiative.

**Data:** The AAMC GQ data from prior years were obtained in collaboration with the AAMC and analyzed with their permission. The data team from the AAMC reviewed and approved the manuscript before publication.

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References


References cited only in the charts


April 2, 2021

To: Vice President of Policy and Governance

The Staff Senate Committee on Policy and Issues has reviewed and approves CGPSP Resolution 2020-2021E. The Staff Senate is in support of this resolution.

Thank you,
LaTawnya Burleson, Chair Staff Senate Policies and Issues Committee