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Health systems science education: The new post-Flexner professionalism for the 21st century

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ABSTRACT

The foundations of medical education have drawn from the Flexner Report to prepare students for practice for over a century. These recommendations relied, however, upon a limited set of competencies and a relatively narrow view of the physician's role. There have been increasing calls and recommendations to expand those competencies and the professional identity of the physician to better meet the current and future needs of patients, health systems, and society. We propose a framework for the twenty-first century physician that includes an expectation of new competency in health systems science (HSS), creating 'system citizens' who are effective stewards of the health care system. Experiential educational strategies, in addition to knowledge-centered learning, are critically important for students to develop their professional identity as system citizens working alongside interprofessional colleagues. Challenges to HSS adoption range from competing priorities for learners, to the need for faculty development, to the necessity for buy-in by medical schools and their associated health care systems. Ultimately, success will depend on our ability to articulate, encourage, support, and evaluate system citizenship and its impact on health care and health care systems.

KEYWORDS

Professionalism; health systems science; system citizen; medical education

Introduction

For over a century, the foundation of medical education used to prepare medical students for practice has drawn from the recommendations of the Flexner Report (Flexner 1910). Despite being groundbreaking at the time, these recommendations relied upon a limited set of competencies and a relatively narrow view of medicine and have not evolved with the physician's changing role in increasingly complex health systems. In addition, the framework that Flexner professed, though considered benevolent, had immediate and enduring negative impacts on the training of African American physicians in the U.S. through its obstruction of opportunities for pursuing medical education (Steinecke and Terrell 2010). The past several years have seen increasing calls to expand beyond those original competencies and traditional physician professional roles to better meet the current and future needs of patients, health systems, and society (Skochelak 2010). Recommendations from both Frenk, et al. in the Lancet Commission on Education of Health Professionals for the twenty-first Century report of 2010 and Irby, et al. reflecting on the Carnegie Foundation's calls for reform in 1910 and 2010 highlight these issues (Frenk et al. 2010; Irby et al. 2010). As the Lancet Commission notes:

> Professional education has not kept pace with these challenges, largely because of fragmented, outdated, and static curricula that produce ill-equipped graduates. The problems are systemic: mismatch of competencies to patient and population needs; poor teamwork; persistent gender stratification of

Practice points

- New definitions of professionalism in medicine are needed and must include the importance of caring for the health system in congruence with the Triple Aim.
- Health systems science education and competencies should be required of all medical students and trainees.
- Health systems science education requires commitment from medical schools and their associated health systems.
- Challenges to HSS adoption include competing priorities for learners and the need for faculty development.
- Experiential educational strategies, in addition to knowledge-centered learning, are critically important for students to develop systems citizenship.
- The ultimate expression of a new professionalism is the demonstration of systems citizenship.

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> professional status; narrow technical focus without broader contextual understanding; episodic encounters rather than continuous care; predominant hospital orientation at the expense of primary care; quantitative and qualitative imbalances in the professional labour market; and weak leadership to improve health-system performance … What is clearly needed is a thorough and authoritative re-examination of health professional education, matching the ambitious work of a century ago. (Frenk et al. 2010)

The evolving professionalism in health care and medical education

Professionalism in medicine has traditionally been viewed as the expression of altruism and compassion by individual physicians with the medical knowledge and clinical skills to diagnose and treat specialty-specific diseases. The Lancet Commission goes on to advocate for 'a new professionalism that uses competencies as objective criteria for classification of health professionals and that develops a common set of values around social accountability'.

During the pre-Flexner period there was no standardization in physician education. In the post-Flexner period, the focus shifted toward increasing the scientific orientation and the quality of training and focusing on the development of physician-scientists. The view of medical practice, however, remained anchored in a doctor-patient dyad. Since the 1990s, there has been increasing evidence documenting unsafe systems in which care is received, the associations between the social determinants of health and patient outcomes, inequities in care, an increasing burden of chronic health care needs, and unsustainable increases in health care costs. This evidence highlights the need for a more inclusive approach, from a one-physician plus one-patient model toward a more comprehensive team-based population medicine model (Figure 1). Further, there is the recognition that these teams must function and understand the health system in order to be effective. The health care challenges just described have spawned a steady increase in the need for systems-related training for health care professionals, which was intensified by a widespread adoption of the Triple Aim as the ultimate goal of care (Berwick et al. 2008). The Triple Aim focuses on 'improving the individual experience of care; improving the health of populations; and reducing the per capita costs of care for populations'.

The American Medical Association accelerating change in medical education consortium

In response to the calls to evolve medical education, the American Medical Association (AMA) launched the Accelerating Change in Medical Education initiative in 2013 to address this complex challenge. As a part of this initiative, the AMA launched the Accelerating Change in Medical Education Consortium in 2013 with 11 schools and expanded to 32 schools in 2016. Between 2013 to 2018 a total of $12.5 million in grant funding was awarded to medical schools. The consortium has since extended to include graduate medical education. This supplement is primarily focused on activities during the first 5 years and among the original 32 schools. The final paper of this supplement discusses continuation of these efforts into GME.

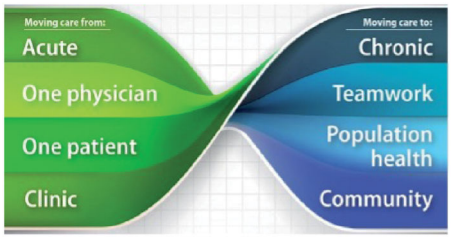

Figure 1. Transition of health care in the United States. The figure depicts four components of health care in the United States, with the corresponding transition from past or current state toward a future state. These components highlight the burning platform for change in the learning areas in medical education. Copyright American Medical Association. Used with permission.

A key driver of the AMA's initiative was the recognition that health care delivery had changed drastically with little substantial response from the medical education system. The original objectives of the Accelerating Change in Medical Education effort included (1) promoting exemplary methods to achieve patient safety, performance improvement, and patient-centered team-based care and (2) improving medical students' understanding of the health care system and health care financing. Later collaboration among the consortium members ultimately led to the consolidation of these two objectives into the broader construct of health systems science (HSS), defined as the study of how health care is delivered, how health care professionals work together to deliver that care, and how the health system can improve patient care and health care delivery.

Health systems science – the third pillar of medical education

One significant contribution of the AMA's initiative has been the framing and description of HSS as a third pillar of medical education (Skochelak et al. 2020). The twenty-first-century medical student, trainee, and physician must not only acquire HSS competencies and apply HSS insights when rendering care; it is essential that HSS generates an expanded view of their professional identity (Lucey and Souba 2010; Lucey 2013; Skochelak et al. 2020). For impactful change, individual clinicians and trainees need to approach patient health in a new manner, one that situates the patient in their community and health system.

HSS complements and integrates the basic and clinical sciences by leveraging systems thinking to provide students a view of the full complexity and context of a patient's health (Gonzalo, Haidet, et al. 2017a; Gonzalo, Dekhtyar, Starr, et al. 2017c; Skochelak et al. 2017; Gonzalo et al. 2020). The HSS framework provides an amalgamation and integration of previously scattered learning areas to create a synthetic view of this evolving new professionalism in health care (Figure 2). Systems-based issues such as quality improvement, health care delivery, structural and social determinants of health, and high-value care are independently important and have historically been taught in isolation, siloed from one another. The HSS framework provides an overarching model emphasizing the overlap and synergy between these systems factors and their critical connection to the basic and clinical sciences. Together, three scientific pillars of medicine – basic science, clinical science, and HSS – represent the breadth of the

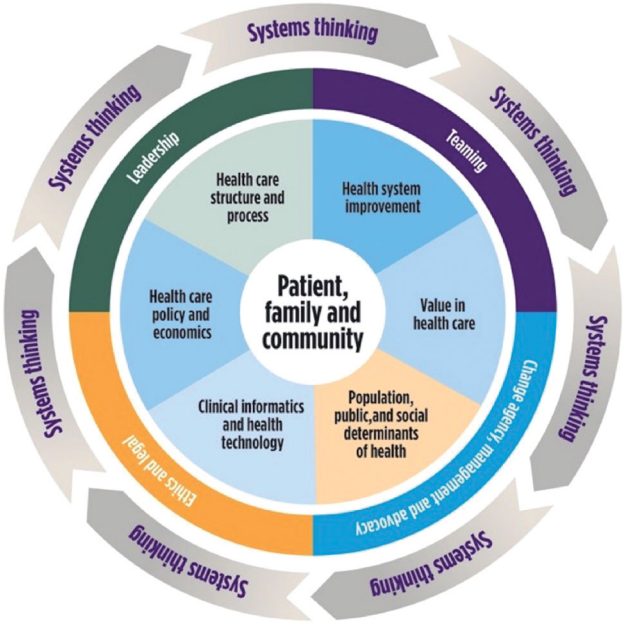

Figure 2. Health systems science curriculum framework. The figure depicts the 12 domains within the health systems science framework developed by the American Medical Association Accelerating Change in Education initiative. At the center are the patient, family, and community, since optimizing individual and population outcomes is the driving motivation. The seven domains around the center are core foundational learning areas. The four domains in the middle circular rim (e.g., leadership and teaming) are the cross-cutting domains, which intersect with all other learning areas. The systems thinking domain surrounds and encompasses the whole framework, demonstrating the importance of a systems-based framework which integrates all parts of the model. The individual domains and their integration are critical to the new curriculum and new professionalism model which emphasizes a comprehensive, systems, and team-based approach. Copyright American Medical Association. Used with permission.

well-trained physician, but no one pillar alone can fully meet the health needs of the individuals, communities, and populations served by the health system.

Clinicians and trainees must approach patient care with a holistic mindset. This evolving professionalism demands that each clinician assumes the role of a 'system citizen', viewing one's position within the context of the larger health system and practicing in a manner that is team-based, collaborative, and attuned to the HSS issues inherent to a patient's health (Senge 2006; Gonzalo and Singh 2019). System citizens understand the interdependency of all components of care delivery and view themselves as stewards of that health system (Brennan 2002; Gonzalo, Baxley, et al. 2017b; Gonzalo, Wolpaw, et al. 2018b). Importantly, system citizens embody a duty to contribute to continuous evolution of the health care system itself to help achieve optimal results for patients and populations. The professional identity of physicians must therefore expand to embrace this systems citizenship.

Consortium work in health systems science

The AMA Accelerating Change in Medical Education Consortium of medical schools has collaborated to generate the scholarship and tools necessary to advance HSS training and to prepare the landscape of professionalism in medical education to include systems citizenship. In addition to defining the HSS curricular framework, the consortium has collectively created and disseminated a range of resources, publications, and products. Table 1 provides a brief description of the key scholarly outputs created by the consortium in this area.

One of the central aims of the AMA Accelerating Change in Medical Education initiative in the area of HSS has been to encourage medical schools around the country to introduce HSS training. The implementation of HSS training in a school may start with limited lectures, workshops, and stand-alone courses. To truly drive a new professionalism also requires propagation of longitudinal integrated courses and experiences, special tracks, and rigorous assessment of HSS competency in the clinical environment. Nearly half of the schools in the consortium have created new curricula related to HSS, and many other U.S. schools are following suit. In addition, these schools have added new assessments to track the progress of student acquisition of HSS knowledge and experience. Table 2 shows a snapshot of early adopter medical schools that have created or advanced HSS-based learning. Consortium schools are creating new learning experiences embedded within health care systems that teach principles of HSS but also bring real value to the health care system. Training students to plan and execute quality improvement projects and to perform important functions that benefit patient-centered teams serve dual purposes: students learn about health care delivery by working in authentic settings, and they contribute to improving the health of patients in meaningful ways (Gonzalo, Dekhtyar, Hawkins, et al. 2017d; Gonzalo, Thompson, et al. 2017e).

Forging a new professionalism

A cornerstone of these emerging curricular innovations in HSS is embedding activities intentionally designed to foster systems citizenship. Historically, medical training has placed heavy emphasis on individual performance, acknowledged to be a contributing factor to the system dysfunction observed today. By advancing HSS, students are not simply trained in techniques of system improvement or cost-conscious care; they are expected to assume a sense of ownership for the systems in which they work and learn. Training in systems thinking – 'a philosophy, mindset, and set of tools that facilitate an individual's thought process to see the interrelatedness of the parts of a system and the cohesion across those parts' (Skochelak et al. 2020) – instills daily habits of work that reframe the role of the individual in the context of a larger whole. As the Lancet Commission explains,

> Professionals have to integrate the explosive growth of knowledge and technologies while grappling with expanding functions—super-specialisation, prevention, and complex care management in many sites, including different types of facilities alongside home-based and community-based care. (Frenk et al. 2010)

Many of the curricular innovations in HSS extend beyond traditional classroom and ward-based experiences to place students in other settings within the system. For example, via the patient navigator role implemented at Penn State College of Medicine and other schools, students focus on the path of the patient rather than on the activities of an isolated care team (McDermott et al. 2019). As student navigators provide information, educate patients, offer emotional support, and facilitate coordination of community care they are embedded in transitional care programs, primary care clinics, specialty-

Table 1. American Medical Association's Accelerating Change in Education Consortium collective scholarly outputs in health systems science (HSS) (2014–2020).

HSS Textbook (1st and 2nd editions) – The first textbook of its kind provides foundational learning in all of the core HSS domain areas (Figure 1). The 2nd edition further explores the concept and skills in systems thinking and the application of HSS to situations such as the COVID-19 pandemic (Skochelak et al. 2017, 2020).

HSS Review Textbook – The HSS Review book provides several hundred, board-format multiple-choice examination questions. Using clinical and system-based vignettes, questions explore the core tenets of systems principles in all HSS domains, including social determinants of health, systems thinking, population health, health system improvement, and high-value care (Ehrenfeld and Gonzalo 2019).

NBME HSS Subject Examination – The National Board of Medical Examiners and the AMA Accelerating Change in Medical Education Consortium collaborated on developing a 100-item HSS examination. The structure of the questions is similar to standard board examination questions. The 'blueprint' of the examination includes the core HSS areas, inclusive of evidence-based medicine, patient safety, quality improvement, and teamwork. Subsequent iterations will expand the items to also include population health, high-value care.

HSS Learning Series – With the goal of providing evidence-based asynchronous learning methods for all health care clinicians, the AMA Accelerating Change in Medical Education Consortium created a series of 12 online interactive modules. The modules allow learners to engage in better understanding the core HSS concepts. (https://edhub.ama-assn.org/health-systems-science.)

HSS Scholars Program – Starting in 2018, the National HSS Scholars Program has been providing education for HSS education leaders at U.S. medical schools in the design, implementation, and evaluation of HSS curricula. Led by medical educators at medical schools in the AMA's consortium that are innovating in HSS, the program creates opportunities for networking and sharing best practices for medical curricula.

HSS Thematic Meetings – Each year, the AMA's Accelerating Change in Medical Education Consortium co-hosts thematic meetings to explore specific topics in greater depth. Since 2015, three thematic meetings have been held to explore HSS areas including: (1) HSS Along the UME to GME continuum (Penn State College of Medicine, Hershey, PA, 2018), Student-Led Conference on Leadership in Medical Education (University of Michigan, Ann Arbor, 2017), and Health Systems Science Assessment (University of Nebraska, originally scheduled for 2020 but moved to October 2021).

HSS Publications and Presentations – Across the AMA's Consortium, educators have published over 50 peer-reviewed articles and presented over 200 peer-reviewed abstracts at national meetings focused on HSS.

Table 2. Representative health systems science curriculum examples from U.S. medical schools.

Medical school	Brief description
Brody School of Medicine at East Carolina University	Required 4-year longitudinal HSS curriculum for all medical students integrated throughout the curriculum in relevant courses and all required clerkships. Introduction to interprofessional care, health systems, improvement science, and patient-centered care begins the first week of medical school, and additional concepts related to patient safety, value-based care, evidence-based medicine, population health, social determinants of heath, and systems thinking are expanded throughout the curriculum. Each clerkship provides clinical application of these concepts to reinforce learning. The curriculum culminates with expanded HSS sessions and advanced skills during the transition to residency capstone. An optional three-year distinction track was designed for students to gain deeper skills in HSS.
Emory University School of Medicine	Standardized instruction on quality improvement and patient safety across Emory's medical education continuum, which includes all of Emory's medical students, residents, fellows, faculty, affiliated physicians, and interprofessional colleagues. As part of this standardization, a set of related milestones for medical school, graduate medical education, and practicing physicians and a database of past and current quality improvement activities have been created to promote collaboration across the continuum.
Dell Medical School at University of Texas Austin	Four-year longitudinal leadership and interprofessional education (IPE) courses form the curricular backbone of HSS. Curriculum including value-based care, population and community-based care, social determinants, informatics, and health care structures and policies are woven throughout the leadership and IPE curriculum. Health care equity competencies have recently been added to expand the scope of the curriculum. Application and assessment of these competencies is assessed in pre-clerkship small group work, clerkships, and senior electives.
Mayo Clinic Alix School of Medicine	Required four-year longitudinal course in HSS (Science of Health Care Delivery) on two campuses (Minnesota and Arizona) with six HSS-related domains (leadership, high-value care, team-based care, person-centered care, population-centered care, and health policy, economics, and technology). Faculty use flipped classrooms, simulation, and experiential education strategies, and provide formative assessment as students apply concepts and skills.
Michigan State University College of Osteopathic Medicine	'First, Do No Harm' curriculum incorporates patient safety concepts longitudinally across undergraduate and graduate medical education. Planned learning activities begin in year one of medical school, continue during clerkship, and culminate with synthesis-level projects in the first year of residency, leveraging the Institution for Healthcare Improvement Open School online modules.
University of Chicago Pritzker School of Medicine	VISTA = Value, Improvement, Safety, and Team Advocates includes early hands on interprofessional team experiences, multidisciplinary discharge OSCE, patient safety horror room and event reporting training, screening for cost non-adherence, and ongoing value curricula
Penn State College of Medicine	All 12 HSS competencies are longitudinally integrated into all phases of the medical school curriculum. Complemented by an early experiential role within health systems, the first two years focus on systems thinking, delivery systems, high-value care, policy, interprofessional care, population/social determinants of health, evidence-based medicine, patient safety and improvement science, and operational excellence. Each clerkship provides clinical application to allow for spiraling of learning. The post-clerkship phase includes a two-week application course of all HSS concepts, culminating with team-based, specialty-specific projects. Remaining experiences include HSS electives and research work and a transition to residency course that involves several core HSS learning areas.
The Warren Alpert Medical School of Brown University	There is a required Health Systems Science course for all medical students during the first semester, with engagement in relevant clinical activities such as a Navigator program, free clinics, and homeless care. A subset of students in the dual degree (MD/ScM) Primary Care – Population Medicine program continue with HSS II, HSS III, leadership course, 3rd year longitudinal integrated clerkship (LIC) program with integrated HSS didactics, and additional research courses with a thesis requirement (topics related to HSS)

based clinics, underserved free clinics, and nursing homes. Navigating from the perspective of the patient and family is designed to instill in the student a sense of professional duty to ensure that all components of the health system are coordinated and serve those patients well.

HSS by definition involves interprofessional education, strengthening the medical student's awareness of the unique skill sets of other health professionals and approaches to leveraging the entire team's capability to advance optimal care. Many of the experiential learning opportunities being implemented in HSS programs are anchored in interprofessional teams, providing an authentic experience of collaborative practice, encouraging a shared vision of duty and addressing the Lancet Commission imperative to, '… promote a new professionalism that uses competencies as objective criteria for classification of health professionals and that develops a common set of values around social accountability' (Frenk et al. 2010).

It is not only students who need guidance to embrace a new professionalism. Most physicians currently in practice

Table 3. Key challenges to health systems science education and potential strategies to facilitate change.

Challenge	Strategies to address challenge
Comprehensive standardized, integrated curricula The development of HSS curricula is relatively new and must compete with other priorities and limited time in formal curricula.	• Integrate material from the basic and clinical sciences to include HSS insights • Longitudinal inclusion of HSS content through the 4 years of medical education and from UME to GME • Identification of most applicable content and skills for trainees across training phases • Leverage best-practice curricula across medical schools
Faculty knowledge/skills/comfort with HSS Most faculty learned in educational programs that focused on a two-pillar approach, which may limit the knowledge and skills of faculty responsible for the role modeling and teaching for trainees.	• Introduce faculty development interventions that address faculty knowledge and skills • Introduce HSS content education for existing/new faculty • Grasp opportunities to label existing HSS-related content/skills and help students make connections • Frame HSS as a new model of physician professionalism • Focus on synergies with basic/clinical sciences, often with 'on-the-job' informal training in HSS competencies • Improve faculty understanding and expertise in these areas
Trainee receptivity to HSS Trainees can view HSS learning areas as less important, or they can report lower satisfaction or engagement with concepts given competing priorities and the paucity of questions on the USMLE.	• Emphasize HSS as a third science and part of physician professionalism in student recruitment • Integrate HSS (curricula and assessment) with basic and clinical sciences • Build an HSS 'academic home' akin to those in basic and clinical sciences • Develop and track HSS-related student assessment and HSS-specific curriculum evaluation metrics • Support transparent collaboration between medical schools on a national level • Encourage students by demonstrating that mastery of HSS is critical to successful functioning in clinical settings
Hidden curriculum The cultural tensions in academic medicine and degree of support within the system influences traction gained by initiatives.	• Engage health system leaders, many of whom understand the importance of HSS intuitively, as teachers/mentors • Authentic application and role modeling of HSS competencies in clinical care • Overcome engrained culture of medical education by focusing on relevance to current and future challenges (e.g., COVID-19 and structural racism)
Buy-in and alignment of HSS within the health system For optimal success, HSS needs to be aligned across missions within the health system and have the buy-in of leadership at all levels; HSS must have a presence and a 'home' within a medical school to reach optimal impact.	• Promotion guidelines that reward HSS competency • Incentive structure for faculty to teach • Buy-in from academic health systems around goals and ensuring adequate resources and opportunities • Demonstrate return-on-investment
Competency assessments across education continuum Frameworks and tools for assessing HSS knowledge, attitudes, and skills, including workplace-based assessments	• Close collaboration with testing and assessment organizations • Sharing of assessment tools between medical schools • Utilization of competency and milestone frameworks
Value added to system and student education The impact of HSS initiatives on trainee learning and patient health is an ideal goal. The investment in starting and sustaining programs is significant, and work must address the impact of programs on systems and patients.	• Develop and assess educationally sensitive patient outcomes • Fund research teams and projects dedicated toward exploring system/patient-level outcomes

have not been exposed to foundational training in HSS. As medical schools create educational programs in HSS, they must simultaneously generate a pool of faculty members to deliver those programs and model behavior in clinical learning environments. Both the Brody School of Medicine at East Carolina University and Emory University School of Medicine focused their early efforts on this faculty development (Lawson et al. 2019). Medical faculty are trained in systems skills with other health professionals. Additionally, clinicians who host students in their clinics for experiential learning but are not responsible for HSS training are exposed indirectly to these concepts. As students within those clinics complete various assignments designed to promote a systems perspective, they may act as change agents demonstrating a new professionalism to their supervising practitioners.

Lessons learned

There have been numerous successes, but some significant challenges to HSS education remain. The AMA consortium provides a safe space for medical schools to learn, explore, share, and engage in iterative improvement. The degree and breadth of HSS education programs across the consortium schools generates numerous lessons learned that can inform the work of other educators and medical schools attempting implementation and can help all overcome challenges. Synthesizing results from prior work, Table 3 highlights seven key challenges to HSS education and strategies that schools can deploy to overcome them (Gonzalo et al. 2016; Gonzalo et al. 2017e; Gonzalo, Caverzagie, et al. 2018a; Ehrenfeld and Gonzalo 2019). Issues such as developing core HSS curricula, trainee engagement, faculty development, addressing the hidden curriculum, aligning with health system needs, and showing value from student work all need to be considered at local and national levels when implementing HSS initiatives. National efforts are needed to help address some of the challenges, such as improving alignment between undergraduate medical education (UME) and graduate medical education (GME) with regard to HSS education in the context of accreditation requirements, high-stakes assessments, and the transition of learners from UME to GME.

Some of the challenges outlined reflect hesitancy to embrace this new professionalism. Skepticism of students, residents, or faculty members regarding the value of HSS training, particularly its value relative to the historical pillars of basic science and clinical science, may represent a desire to retain a more traditional view of professionalism, with its strong roots in the doctor-patient dyad and personal accountability of the physician. While there is merit to preserving the core of this traditional view, it may be necessary to break old mental models in order to foster a new professionalism aligned with current realities of practice. Each provider is called upon to stretch one's sense of professional duty to encompass systems citizenship.

Future directions

HSS should not be viewed as a static set of domains and processes. It is a dynamic, developmental, contextually based paradigm that will undergo transitions as its domains themselves change, evolve, or are newly created. Physicians and other health care professionals, engaged in lifelong learning, will need to incorporate these developments in their practice of medicine as quickly and seamlessly as possible. The gap between changes in the health care system and developments in health professional education must be as narrow as possible, and the catalyst for transformation may come from either direction.

Much remains to be done to expand HSS to reach all medical students, trainees, and practitioners in order to ingrain this new professionalism based on systems citizenship. Striving for the seamless integration of HSS with the basic and clinical sciences in curricular content, experiential learning, and assessment is the first step. We envision a 'common core' across all allopathic and osteopathic medical schools, and across all health professions education. The introduction of HSS into all qualifying examinations (e.g., USMLE Steps) and its elevation in priorities for selection to GME positions will drive perceived value among medical trainees. There must be a continuum across the educational spectrum between UME and GME and into independent practice. The most recent expansion of the consortium to include GME has promoted greater experimentation with the UME-GME continuum of HSS. This should be matched by lifelong learning for all health professionals – both for new graduates and those in the field. Further development of HSS outcomes research is needed to determine needs, impacts, and efficacy of training. Finally, we must articulate, encourage, and evaluate the system citizen as a new expression of professional identity and the impact this will have upon health care and health care systems.

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