Evolution and Revolution in Medical Education: Health System Sciences (HSS)

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The Spring 2020 Webinar Audio Series (WAS) of the International Association of Medical Science Educators (IAMSE), was entitled “Evolution and Revolution in Medical Education: Health System Sciences” (HSS). HSS has emerged as the third pillar of medical education, alongside the other two pillars of basic and clinical sciences. This series explored the efforts to integrate the HSS curricula into medical education starting in the pre-clerkship and clerkships years and extending into residency. Between March 5, 2020, and April 2, 2020,¹ the five weekly Webinars were presented live by experts and thought leaders from various academic institutions to viewers throughout the USA and beyond.

The Third Pillar of Medical Education: Health Systems Science

Presenters: Ami DeWaters, MD, MSc, and Jed Gonzalo, MD, MSc; Penn State College of Medicine at Hershey Medical Center, Hershey, PA, USA

¹ Due to COVID-19 the last three webinars were held between August 13 and August 27, 2020

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Dr. Gonzalo started with an overview of the series sessions. While the presenters designed each of the five sessions as stand-alone sessions, they were integrated and built sequentially and developmentally throughout the series. The main goal was to shine a light on this third pillar of medical education so that other entities could find areas for improvement in their internal programs. The first two pillars of medical education, basic science and clinical science, have existed for well over a century. It is important to note that HSS, defined as “the principles, methods, and practice of improving quality outcomes, and cost of healthcare delivery for patients and populations within systems of medical care [1],” has also existed for a while and is not a fad, but here to stay. To support this claim, Dr. Gonzalo presented milestones between 1913 and the present that demonstrated its foundation. The main point of these milestones was to demonstrate that the HSS framework is built on evidence and is patient-centered.

Dr. Gonzalo presented HSS as a three-pillar model: as an interdependent and integrated framework that is integrated with the other two pillars of medical education. In order for

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the other two pillars to be utilized to improve patient outcomes, they need to be integrated with HSS and vice versa. The HSS Framework, established by the American Medical Association (AMA), is a series of circles or rims that is clearly centered on the patient [1, 2]. The first circle is made up of the six core domains that surround the patient: (1) health system improvement, (2) value in health care, (3) population, public, and social determinants of health, (4) clinical informatics and health technology, (5) health care policy and economics, and (6) health care structure and process. The next rim includes cross-cutting domains, such as (1) teaming, (2) change agency management and advocacy, (3) ethics and legal, and (4) leadership. The third and final rim is systems thinking, which is a critical, cohesive concept or domain area for the HSS framework.

This set of tools is a mindset, an attitude, that is required to cohesively see all the parts and interconnectedness of the system. Overall, the HSS framework contains 12 core domains and subdomains and is outlined in a schema crosswalk of all HSS domains. These domains were mapped with the GME competencies, the Clear Report, systems-based practice, and textbooks to see if other measures included HSS. While the schema crosswalk clearly indicates a large number of holes between HSS and the other measures, it also showed heavy areas of overlap, such as process or transition of care, social determinants of health, quality or patient safety, quality improvement, and teamwork or interprofessional education (IPE). This should not surprise us as these are areas where most US medical schools and residency programs tend to focus their time. The audience was then asked this question, “Why does this comprehensive HSS framework matter”? In a paper [3] by the authors, they outlined six tenants of the HSS framework. They are as follows: (1) ensures core competencies are not marginalized, (2) accounts for related competencies in curricular design, (3) establishes a foundation for comprehensive pedagogies, (4) provides a clear learning pathway for UME → GME → workforce, (5) facilitates a shift towards a national standard, and (6) catalyzes the new healthcare professionalism of systems citizens. Dr. Amy DeWaters discussed and outlined the four key implications for US Medical Education: value-added roles for medical students, the expanding educator bench of US medical schools, the clinical learning environment, and the new professionalism; systems citizens.

Health Systems Sciences: The Pre-clinical Years in Medical Education

Presenters: Anna Change, MD, Adrienne Green, MD, and Edgar Pierluissi, MD; University of California San Francisco, CA, USA

Expounding on the meaning of HSS, Dr. Pierluissi opened by introducing the audience to the three drivers of HSS in medical student education: quality, patient complexity, and cost. Regarding the quality of care, there are areas where American medicine does not deliver care that can be achieved, although there are areas of excellence in care. When compared to other wealthy countries, the USA ranked highly in clinical outcomes (1st), but did not do as well in other domains such as access (6th), perception of care (10th), and disparities in health care (11th) [4]. Patient complexity: As patients age, the number of patients with complex medical and psychosocial factors increases. This population of patients disproportionately accounts for poor health outcomes and health care costs [5]. In summary, as the number of patients with multimorbid, complex, and medical and psychosocial factors increases, health outcomes will depend more on teams and systems of care than the individual physician. Cost: The United States spends more on health care than other wealthy countries [6]. The cost of health care has consequences. According to the Washington Post, Americans may delay care for a serious health condition due to the cost of health care. One-third of Americans who file bankruptcy state the cost of health care was a contributing factor [7]. Much of the cost of health care is due to waste. HSS in early undergraduate medical education aims to reduce waste and to increase the value of care and future physicians will be better equipped to participate in and lead systems change that addresses these issues, not alone, but as part of a larger solution. Take-home point: *Because of the gaps in our health care systems, today's medical educators need to add HSS early in undergraduate medical education.*

Dr. Anna Chang introduced the audience to teaching HSS in pre-clerkship years by discussing four key concerns [8]. The concern was listed first, followed by the author's thoughts. (1) *It's too early to introduce pre-clerkship students to HSS.* The speakers felt it is not too early as medical students bring in a fresh perspective and motivation to make the world a better place. (2) *The medical student curriculum is already packed. Where do we put this?* Through a process of re-envisioning, integration, and thoughtful change management are strategies that make this important transformation feasible. (3) *Clinical faculty never learned this. Who will teach it?* The strategy of co-learning and expansion of the definition of “educator” has helped to address this gap. (4) *Health systems are still working to improve. How can educators partner to teach students?* Invite the students to join the faculty to improve this together! In addition to lectures and small classroom learning, there are a number of ways medical educators in the USA, Canada, and the UK have engaged medical students in experiential learning of HSS. HSS Experiential Learning Models include (1) students acting as patient navigators for individual patients, (2) students serving as medical scribes for individual clinicians, (3) students engaged as patient population health managers for groups of patients, and (4) students serving as

Quality improvement team members for health systems [9]. Take-home point: *There are models to integrate HSS into the classroom and experiential learning in the first two years of medical school.*

Dr. Adrienne Green wrapped up the webinar by asking “Why HSS?” from a CMO perspective. According to Dr. Green, formal experiential training is far more effective than learning by doing on the job and she wished she had this kind of training in medical school. Students enter medical school eager to contribute to positive change and for exposure to improvement strategies and policy implications. Early introduction and engagement in local health care value (quality/cost) work is key. Systems-based practice is a core competency for students, residents, fellows, and practicing physicians, so there is a need to build these skills for the long term, regardless of their site or type of practice. Take-home point: *Academic health system leaders perceive an alignment and value in having early medical students engaged in health systems improvement.*

Health Systems Science (HSS): The Clerkship Years in Medical School

Presenters: Mamta K. Singh, MD, MS, and Clifford Packer, MD; Case Western Reserve University School of Medicine, Cleveland, OH, USA

Dr. Singh began with an overview of the first 18 months of the curriculum at Case Western Reserve University School of Medicine (CWRU SOM), which includes an introduction to HSS. Rather than focus the discussion of HSS from the logistical point of view, Dr. Singh presented HSS from the philosophical perspective by asking “Why is learning HSS critical for our future physicians professional development?” The COVID-19 pandemic and racial protests have exposed many weaknesses in global health care systems such as inequities in COVID-19 deaths. Researchers have documented that the highest COVID-19 deaths have been consistently observed among those living in disadvantaged parts of society [10]. This disadvantage to patients comes in the form of poverty, crowding, or in populations of color. Now that we have recognized these system vulnerabilities, we must identify HSS’s responsibilities for addressing them. An excellent place to start is with the professional development of learners and faculty. Dr. Singh added a disclosure stating she is not trying to claim that an HSS curriculum is a panacea by which we fix all of society’s ills. With this said, the HSS curriculum provides educators with a road map by which they can start to expand the outlook of professional development for both faculty and learners. It helps to re-image the borders of physician’s responsibility. The health professionals that rose to the challenge during the recent pandemic did not learn these skills overnight: these are skills that are innate. As medical

educators built the systems to train health care professionals, it is important to note that they have these inherent “change agents” and need to ensure the curriculum is aligned with them.

Main points of Dr. Singh’s presentation include:

1. HSS curriculum at CWRU SOM: HSS is not just a third pillar at CWRU SOM, but is integrated with the basic and clinical sciences. Tenants of HSS integration: (a) Longitudinal, developmental curriculum. (b) How to improve health care quality, increase the value of provided care, enhance patient safety, deliver population-based medical care, and work collaboratively in teams. (c) How to advocate for patients and communities and recognize the socio-ecological determinants of health, health care policy, and health care economics. (d) Demonstrate systems-based competency. (e) Development of change agents.
2. HSS assessment: Assessment drives learning. What are some important ways that we can see if our students are actually learning the concepts behind HSS. Are the students able to reflect? Are they able to adapt? Can the students think at the systems level? Using the portfolio method, which all students completed during years 1–3, students give examples of when they have thought about the HSS curriculum and reflected on it.

Dr. Packer presented the CWRU SOM SOAP-V, or the SOAP note with value added. The rationale being it was not only an opportunity for students to learn, but by using SOAP-V, they could practice high-valued care in authentic patient experiences. The beauty of SOAP-V, in addition to its simplicity, is that it can be used with minimal to no faculty training, it can be attached to authentic patient experiences, and it would be ebbed in the normal workflow. A plot of Life Expectancy vs. Cost of Care shows the US health care spending is 2–4 times higher per capita than other developed nations, yet outcomes such as life expectancy are lower than many other developed countries. So why is this happening and how can it be fixed? SOAP-V takes a bottom-up approach starting with medical students to address this.

An Overview of High-Valued Care

An example of a high-value test or treatment is when the benefits outweigh the risks. Benefits include improving outcomes, changing management, and meeting patient’s goals. Risks include causing harm to patients, cost to patients, and cost to the system. In developing SOAP-V, the decision was made to boil it down to three main points: (1) *Evidence of value*: before ordering a test, consider whether the result would change management. Before ordering treatment, consider the evidence for the treatment vs. no treatment or an

alternative treatment. (2) *Patient values*: Consider discussing with the patient their goals and values. Does the patient recognize the potential harm of the test/treatment compared to alternatives? (3) *Relative cost*: Consider the approximate cost of the test/treatment. Are there less costly alternatives with similar benefits? Cost information can be found at Healthcarebluebook.com and iTriage, a mobile app. There is evidence that if medical students are exposed to high-value care early in their training, they will carry this information with them into their careers [11].

Preparing Faculty to Teach Health System Science (HSS) in the Clinical Learning Environment

Presenters: Luan Lawson, MD, MAEd; Brody School of Medicine at East Carolina University, city, NC, USA, and Kelly Caverzagie, MD; University of Nebraska College of Medicine, Omaha, NE, USA

HSS is an innovative, comprehensive, and holistic framework. Within the framework lies the wheel of patient, family, and community, domains that previously existed within faculties and health care systems and include experts in each. However, having these domains siloed in the various individual places does not help with the comprehensive framework for how physicians navigate the changing landscape of healthcare, especially post-COVID. The speakers noted that previous sessions in the series explained a need for educational change.

There have been significant deficiencies noted in both UME and GME teaching, such as (1) teaching systems-based practice, (2) How to incorporate cost and high-value care, (3) how to use evidence-based care, (4) students need to learn how to be both leaders and followers in interprofessional teams, (5) safety and improvement science, and (6) how to respond to errors. Clinical teachers face complex challenges by teaching while simultaneously learning about redesigning clinical delivery systems, delivering care, and working more closely in interprofessional teams and healthcare delivery systems [12].

Dr. Lawson presented these general principles for faculty development: (1) Employ effective change management strategies. We need to be thoughtful of some things. We require significant planning, such as institutional culture and content, overcoming barriers, promoting buy-in, involving experts in the design, multidisciplinary faculty, and risk-taking role models [13]. (2) Employ sound educational practice. HSS provides us with ample opportunities to employ sound educational practices. HSS is not stagnant, as it requires an interplay of multiple domains and multiple healthcare providers. (3) Accountable practice. We need to figure out how to align our educational roles, our institution's needs, and the

excellence that we expect from our faculty participating in these types of programs. Funding is an important component and must be adaptable.

What challenges lie ahead for the developing faculty? First is a perceived faculty lack of expertise followed by logistics and the realities of teaching HSS. Educators also face challenges with faculty buy-in and the health system. The speakers suggested faculty embrace unique expertise, including lived experiences. Second, frame expectations for the faculty and align curricular structures and assessments. Be prepared to offer formal incentives and leverage faculty professional identity while engaging the health system.

Health Systems Science is the Broccoli of US Medical Education: Tackling the Key Challenges of Implementation

Presenters: Jed Gonzalo, MD, MSc; Penn State College of Medicine, Hershey, PA, USA, and Stephanie Starr, MD; Mayo Clinic Alix School of Medicine

The fifth and final session of this series reunited Dr. Jed Gonzalo with the audience and presented Dr. Stephanie Starr as they introduced the top 7 selected key challenges for HSS education. First were the nomenclature and language. The evidence around any one of the 12 different areas of HSS has been around for decades. For example, patient safety and quality improvement have been around for decades. With this said, the last 7 years have seen all of these areas coalescing into one strategic and comprehensive framework. The definition that we typically assign to HSS includes “The methods, the processes and the principals involved with improving outcomes, and the quality and cost of care of patients of populations within a larger context of systems of care.” The nomenclature issues involve some schools stating they may integrate the social determinants of health or quality of care, but these are only two components of HSS. To fully integrate HSS into medical education, all 12 components must be integrated.

The second issue was curriculum timing, sequence, and integration which includes the total footprint of incorporating HSS. There is a lack of consensus of HSS competencies pieces in the Association of American Medical Colleges (AAMC) Core Entrustable Professional Activities (EPAs), Liaison Committee for Medical Education (LCME) and discussion in the field about the appropriate way to implement new material into a curriculum and in what order. Educators want students to seamlessly experience all three science strands across their 4 years but this presents quite a challenge.

The third issue looked at student perceptions of adding HSS into an existing curriculum that was in a study done before implementation. The study's focus was to determine and identify the pedagogical challenges to be overcome before

shifting from a two-pillar to a three-pillar approach. This study looked at student perceptions of both models and found that the two areas were at odds.

A study by Gonzalo et al. examined faculty comments and concerns about the importance of learning HSS, which is issue four [8]: (1) “If medical education isn’t broke, don’t fix it.” (2) “HSS is too complex and best learned in residency or practice.” (3) “Early students do not have skills to contribute to health care, and the value-added roles already exist.” The roles of medical education are not focused on the future. The role of medical education is now and can make a difference today! (4) “Health Systems Science is not yet a true science.” The study also examined practical concerns from the faculty such as the following: 1) “There is limited space in an already packed curriculum.” Most of HSS may be already present in our curriculum. It just needs to be relabeled. (2) “Few faculty have the knowledge and skills to teach HSS.” (3) “Accreditation agencies and licensing boards do not support medical education transformation.” (4) “Evolving health systems are not ready to partner with schools with HSS curricula.” According to the speakers, some pre-clinical and clinical faculty are currently teaching off label components of HSS and new educator roles may need to be created or reimaged [14].

The fifth issued addressed the issues with how do you assess students? Assessment is not an easy thing to do and the speakers stated they do not have all the answers. Gonzalo and Starr also addressed learner assessment and best practices. Their suggestion was to begin with Miller’s Pyramid of Cogitation and Behavior that shows the different levels a student or trainee might be able to demonstrate. Gonzalo estimated that ~ 80% of medical students are in the first two levels of the triangle (knows and knows how) with the remaining ~ 20% in the upper two levels (shows and does). It was also noted that while there are HSS questions appearing on the United States Medical Licensing Examination (USMLE) examinations, most of our assessments do not assess the students’ knowledge in the 12 competencies of HSS domains. There is still a lot of work that needs to be done in the area regarding assessment.

The next issue looks at the clinical learning environment, which refers to “the social interactions, organizational culture and structures, and physical and virtual spaces that surround and shape the learners’ experiences, perceptions, and learning” [15]. Within the clinical learning environment, there is a closer gradient of HSS concept knowledge and skills between faculty and learners. Therefore, the students are teaching the faculty, as well as faculty teaching students. There is a direct connection between assessment and the clinical learning environment [16]. A lot of work in HSS is now focused on evolving the clinical learning environment to incorporate HSS.

The last issue is program evaluation. This is looking not only beyond the level of the individual learner but also from

the programmatic standpoint. It is not easy to innovate in a medical school curriculum. Students may push back if they do not see an obvious benefit to novel content. The authors mapped out some of these issues: Level 1 Reaction: Satisfaction Engagement Relevance (Surveys and Course Evaluations). Level 2 Learning: Knowledge, Skills, Attitude Confidence Commitment (NBME HSS Exam Grad. Questionnaire). Level 3 Behavior: Application Drivers (Course Assessment, Clinical Assessment, AMA-GME Milestones). Level 4 Results: Outcomes Indicators (Patient Outcomes Big Data). Work remains to be done in this area as well, especially in the Outcomes Indicators piece.

At the end of the webinar, the speakers presented vignettes from institutions that had reached out to them for consultations and which were at various stages of bringing HSS into their curriculum. Lastly, HSS is not just an education framework. It is actually a framework that unifies all health care.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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