Integrating Health Systems Science Education into a Medical School Curriculum: Challenges, Facilitators, and Strategies

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Virginia Tech Carilion School of Medicine
February 4th, 2020
Upon completion of this session, participants will be able to:

1. Identity the key challenges involved with integrating Health Systems Science education into a medical school curricula,
2. Articulate the concept of the “implementation dip” in curricular innovations,
3. Describe the Health Systems Science areas within accreditation standards, the graduation questionnaire, and board examination blueprints,
4. Articulate the issues that need to be considered in a systematic strategy for implementing Health Systems Science in medical education.
Language
The HSS Framework [12 domains]

- Systems thinking
- Leadership
- Health care structure and process
- Health system improvement
- Value in health care
- Population, public, and social determinants of health
- Clinical informatics and health technology
- Ethics and legal
- Change management and advocacy
- Teaming
- Systems thinking
- Patient, family and community
- Systems thinking
## The Comprehensive HSS Framework

### Schema Crosswalk of Health Systems Science Learning Areas With Systems-Related Competencies, Accreditation Items, Curricula and Textbooks.

<table>
<thead>
<tr>
<th>Health Systems Science Core Domains</th>
<th>Patient Experience and Context</th>
<th>Healthcare Delivery</th>
<th>Policy and Economics</th>
<th>Clinical Informatics and Health Technology</th>
<th>Population and Public Health</th>
<th>High-Value Care</th>
<th>Health System Improvement</th>
<th>Systems Thinking</th>
<th>Change Management</th>
<th>Ethics and Law</th>
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<th>Teamwork</th>
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<td>Pop Health: Creating Culture Wellness</td>
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The "*" and "**" designations represent degree of focus dedicated to area (***minor focus, **moderate high focus).
Why does a comprehensive HSS framework matter?

1. Ensures core competencies are not marginalized (e.g. HSS ≠ QI)
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
6. Catalyzes the new healthcare professionalism of systems citizens.

Gonzalo, Chang, Dekhtyar, Starr, Holmboe, D Wolpaw. Health Systems Science in Medical Education: Unifying the Components to Catalyze Transformation. Academic Medicine, 2019
Student Perceptions and Evaluations
The Pedagogical Challenge

Current Medical Student Priorities

- GME Acceptance
  “Best Residency Program”
- Grades and Board Exams
- Basic and Clinical Science Courses

Alternative Medical Student Priorities

- GME Transition
  “Best Doctor Possible”
- Patient-centered Skills
- Balance of Basic, Clinical, and Health Systems Sciences

At Odds

L. Dee Fink.
Implementation Dip

- Butler et al. It Feels Like a Lot of Extra Work: Resident Attitudes About QI and Implications for an Effective Learning Health Care System. Acad Med 2017
**Implementation Dip**

![Diagram showing the relationship between time, performance, duration of recovery, depth of decline, and change introduced.](image)

**References**


Herold DM, Fedor DB. Change the way you lead change: leadership strategies that really work. Stanford Business Books 2008


Butler et al. It Feels Like a Lot of Extra Work: Resident Attitudes About QI and Implications for an Effective Learning Healthcare System. Acad Med 2017


PennState College of Medicine
Unpacking Learner Tensions

Two-Pillar Approach to Education Mission

- HSS education is less important or of limited relevance in medical school
- Traditional professional identity of a physician
- Limited content breadth and depth
- Curricular time dedicated to basic and clinical sciences
- Fact based learning and need for short-term “use”

Three-Pillar Approach to Education Mission

- HSS education is critical learning during all phases of professional development
- Emerging Professional Identity of a Physician
- Expanded content breadth and depth
- Curricula time dedicated to basic, clinical, and health systems science
- Factual and complexity-based learning
Assessment and Evaluation
Student Assessment

**KNOWS**
- Fact Gathering
  - MCQs - NBME HSS Exam

**KNOWS HOW**
- Interpretation/Application
  - Case Presentations
  - OSCEs (IPE, High-value care)
  - Simulations

**SHOWS**
- Demonstration of Learning
  - Workplace-Based Assessment

**DOES**
- Performance Integrated into Practice
  - Workplace-Based Assessment

Cognition → Behavior
Assessment Methods

Take Home: knowledge is primary focus, ?clinical too small?

Knowledge-based exams
Program Evaluation

Level 1
Reaction

- Satisfaction
- Engagement
- Relevance
  - Surveys
  - Course Evaluations

Level 2
Learning

- Knowledge, Skills, Attitude
- Confidence
- Commitment
  - NBME HSS Exam, GQ

Level 3
Behavior

- Application
- Drivers
  - AMA-GME Milestones

Level 4
Results

- Outcomes
- Indicators
  - Patient Outcomes
  - Big Data
United States Medical Licensing Examination
1. Behavioral Health
   - Patient adherence
2. Epidemiology/Population Health
   - Epidemiology/population health
3. Social Sciences
   - Communication/cultural competence
   - Death/dying and palliative care
4. Systems-based practice
   - Complexity/systems thinking
   - Quality improvement
   - Patient Safety
   - Health care policy and economics

HSS vs. Biomedical Content

HSS = 6.9%
Biomedical = 93.1%
USMLE Content

Step 1 and Step 2 CK content changes

- At the direction of USMLE Management Committee and approved by USMLE Composite Committee
- Step 1: add questions assessing communication skills
- Step 2 CK: add questions on:
  - systems-based practice
  - patient safety
  - legal/ethical issues
  - professionalism
- Examination length will remain unchanged
- Updated USMME practice questions - early 2020

Sample topics (sub-competencies)

- Communication skills
  - Information gathering, e.g., exploring patient’s reaction to illness
- Legal/ethical issues
  - Recognizes patient’s right to refuse treatment or testing
  - Knows guidelines for treatment of minors
- Systems-based practice and patient safety
  - Health systems science principles
  - Strategies to reduce errors in transition of care
NBME HSS Examination
HEALTH SYSTEMS SCIENCE EXAMINATION

Score categories*

<table>
<thead>
<tr>
<th>Core Domains</th>
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<tr>
<td>Health Care Economics and Policy</td>
<td>8-12%</td>
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<tr>
<td>Health Care Structures and Processes</td>
<td>13-17%</td>
</tr>
<tr>
<td>High-Value Care (including Patient Safety)</td>
<td>23-27%</td>
</tr>
<tr>
<td>Informatics</td>
<td>8-12%</td>
</tr>
<tr>
<td>Population Health, Social Determinants, Health Disparities</td>
<td>23-27%</td>
</tr>
<tr>
<td>Quality Improvement</td>
<td>13-17%</td>
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</table>

<table>
<thead>
<tr>
<th>Cross-cutting Domains</th>
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<tbody>
<tr>
<td>Evidence-Based Practice</td>
<td>18-22%</td>
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<tr>
<td>Leadership and Change Management</td>
<td>8-12%</td>
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<tr>
<td>Patient-Centered Care</td>
<td>18-22%</td>
</tr>
<tr>
<td>Systems Thinking</td>
<td>28-32%</td>
</tr>
<tr>
<td>Teamwork and Communication</td>
<td>18-22%</td>
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</tbody>
</table>
One-way ANOVAs showed statistically significant difference between scores for the 3 test purpose groups.

After instruction had highest total test and content scores.
NBME HSS Exam Blueprint

- Establishes initial validity evidence

- Confirms hypothesis
  - Students who take the examination after instruction perform better

- Supports use as a programmatic measure of HSS curriculum effectiveness

- Supports use as a student measure of HSS knowledge and understanding
  - Students can be given formative feedback as HSS content is integrated
  - May be useful for informing decisions about student readiness for clinicals
Curricular Prioritization and Teaching Methods
Take Home: Prioritization is not yet clear (opportunity for I/S)
Instructional Methods

Take Home: Methods are varied; lecture is NOT the only method; ?clinical too small?
Accreditation
DCI - 3.5 LEARNING ENVIRONMENT/PROFESSIONALISM

‘A medical school ensures that the learning environment of its medical education program is conducive to the ongoing development of explicit and appropriate professional behaviors in its medical students, faculty, and staff at all locations and is one in which all individuals are treated with respect.’

CLER Focus Areas/Common Program Requirements

1. Patient Safety
2. Health Care Quality/Disparities
3. Care Transitions
4. Supervision
5. Fatigue Management, Mitigation, and Duty Hours
6. Professionalism
The Graduation Questionnaire
Graduation Questionnaire

• 2011 – 2018:
  “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).”

• 2018 HSS Task Force request to add:
  1. I have a fundamental understanding of the structure and process of the healthcare delivery system.
  2. I am adequately prepared to collaborate with interprofessional healthcare teams.
  3. I am adequately prepared to participate in health system improvement (e.g. quality improvement, population health improvement, patient safety).
  4. I understand the impact of health policy and medical economics on patient care and health systems.
  5. I understand the role of high value care (e.g. quality, safety, cost) in medical decision-making.
  6. I have the skills to address the social determinants that differentially influence the health status of patients and populations.
### 2019 Results of HSS Related Items on the AAMC Graduation Questionnaire

#### How often did you perform the following activities?

<table>
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<tr>
<th>Activity</th>
<th>Never</th>
<th>Once</th>
<th>2 to 5 times</th>
<th>&gt; 5 times</th>
<th>Count</th>
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<tr>
<td>Enter and discuss orders and prescriptions</td>
<td>5.4</td>
<td>5.4</td>
<td>26.2</td>
<td>63</td>
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<tr>
<td>Document a clinical encounter in the patient record</td>
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<td>1.7</td>
<td>13.4</td>
<td>83.6</td>
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<td>Give or receive a patient handover to transition care responsibility</td>
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<td>5.9</td>
<td>29.7</td>
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<td>Collaborate as a member of an interprofessional team</td>
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<td>2.4</td>
<td>16.3</td>
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<td>11.2</td>
<td>33.8</td>
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<td>67</td>
<td>12.3</td>
<td>11.3</td>
<td>9.3</td>
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#### How much do you agree about your preparedness for beginning a residency program?

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<th>Neutral</th>
<th>Agree</th>
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<td>24.3</td>
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<td>27.9</td>
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- **I have the communication skills necessary to interact with patients and health professionals:**
  - Old Item

- **I have basic skills in clinical decision making and the application of evidence based information to medical practice:**
  - Old 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):**
  - Old Item

- **I understand the ethical and professional values that are expected of the profession:**
  - Old Item

- **Apply the principles of high value care (e.g., quality, safety, cost) in medical decision making:**
  - Old Item

- **Address the social determinants that differentially influence the health status of patients:**
  - Old Item

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<th>Item</th>
<th>St. Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
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<td>4.1</td>
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<td>I understand the ethical and professional values that are expected of the profession</td>
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<td>1.4</td>
<td>24.1</td>
<td>74</td>
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<tr>
<td>Apply the principles of high value care (e.g., quality, safety, cost) in medical decision making</td>
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<td>5.2</td>
<td>16.1</td>
<td>40.2</td>
<td>37.2</td>
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<td>Address the social determinants that differentially influence the health status of patients</td>
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<td>1.8</td>
<td>7.8</td>
<td>38.6</td>
<td>51.3</td>
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Upon completion of this session, participants will be able to:

1. Identify the key challenges involved with integrating Health Systems Science education into a medical school curricula,
2. Articulate the concept of the “implementation dip” in curricular innovations,
3. Describe the Health Systems Science areas within accreditation standards, the graduation questionnaire, and board examination blueprints,
4. Articulate the issues that need to be considered in a systematic strategy for implementing Health Systems Science in medical education.
Thank you!
Comments from the “Frontlines”

**Importance of Learning HSS**
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 roles already exist.”

4. “Health Systems Science is not yet a true science.”

**Practical Concerns**
1. “There is limited space in an already packed curriculum.”

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.”
USMLE CONTENT OUTLINE

Systems-based practice and patient safety

Complexity/systems thinking

Characteristics of a complex system and factors leading to complexity: how complexity leads to error

Sociotechnical systems: systems engineering; complexity theory; microsystems

Health care/organizational behavior and culture: environmental factors, workplace design and process; staffing; overcommitment, space, people, time, scheduling; standardization, reducing variance, simplification, metrics; safety culture; integration of care across settings; overutilization of resources (imaging studies, antibiotics, opioids); economic factors

Quality improvement/Improvement science principles - Variation and standardization: variation in process, practice; checklists, guidelines, and clinical pathways Reliability

Specific models of quality improvement: model for improvement: plan-do-study-act (PDSA), plan-do-check-act (PDCA); Lean, including recognition and types of waste; Six Sigma

Quality measurement Structure, process, outcome, and balancing measures; measurement tools: run and control charts; development and application of system and individual quality measures: core measures; physician quality report system (PQRS); event reporting system

Strategies to improve quality - Role of leadership; principles of change management in quality improvement: specific strategies

Attributes of high-quality health care - High-value/cost-conscious care: overutilization of resources, including diagnostic testing, medications Equitable care: access; patient-centered care Timely care

Patient Safety principles - Epidemiology of medical error; error categorization/definition: active vs latent errors; Swiss cheese model of error; preventable vs non-preventable; near miss events/safety hazards

Causes of error

Patient factors: understanding of medication use; health literacy; economic status; cultural factors (eg, religion); failure to make appointments; socioeconomic status

Physician factors: deficiency of knowledge; judgment errors; diagnostic errors; fatigue, sleep deprivation; bias – cognitive, availability, heuristic, anchoring, framing

Human factors (eg, cognitive, physical, environmental)

High reliability of organization (HRO) principles - change management and improvement science; conceptual models of improvement Reporting and monitoring for errors - event reporting systems

Communication with patients after adverse events (disclosure/transparency)
Specific types of error
- Transitions of care errors: handoffs and related communication; discontinuities; gaps; discharge; transfers
- Medication errors: ordering, transcribing, dispensing, administration; medication reconciliation
- Mathematical error
- Procedural errors: universal protocol (time out); wrong patient; wrong site; wrong procedure; retained foreign bodies; injury to structures: paracentesis; bowel perforation; thoracentesis; pneumothorax; central venous/arterial line injuries; arterial puncture and bleeding and venous thrombosis; lumbar puncture bleeding; paralysis
- Other errors: anesthesia-related errors; mathematical errors
- Health care-associated infections: nosocomial infection – eg, surgical site, ventilator associated, catheter-related; handwashing procedures or inadequate number of handwashing stations; central line-associated blood stream infections; surgical site infections; catheter-associated urinary tract infections; ventilator-associated pneumonia
- Documentation errors: electronic medical record (including voice-recognition software errors); record keeping; incorrect documentation (eg, wrong patient, wrong date, copying and pasting, pre-labeling)
- Patient identification errors
- Mislabeling: transfusion errors related to mislabeling; verification/two identifiers: lack of dual validation
- Diagnostic errors: errors in diagnostic studies; misinterpretation
- Monitoring errors: cardiac monitoring/telemetry
- Drug monitoring: (warfarin, antibiotics)
- Device-related errors: malfunction programming error; incorrect use

Strategies to reduce error
- Human factors engineering: situational awareness
- Error analysis tools: error/near miss analysis; failure modes and effect analysis; morbidity and mortality review; root cause analysis
- Safety behavior and culture: hierarchy of health care, flattening hierarchy, speak up to power; afraid to report, fear; psychological safety; closed-loop communication
- Teamwork: principles of highly effective teams; case management; physician teams, physician-physician communication; interprofessional/intraprofessional teams; strategies for communication among teams, including system-provider communication, physician-physician communication (eg, consultations), interprofessional communication, provider-patient communication

Health care policy and economics
- Health care disparities: race/ethnicity; numeracy/literacy; socioeconomic status; access to care: critical access systems; social justice

Health care economics/Health care financing: Types of insurance: Medicare, Medicaid, private insurance, self-pay
Navigating the insurance system: deductibles/co-pays; in-/out-of-network; preferred providers Reimbursement issues affecting safety and quality: emergency services – EMTALA; pay-for-performance
DIFFUSION OF INNOVATION MODEL

- Innovators: 2.5%
- Early Adopters: 13.5%
- Early Majority: 34%
- Late Majority: 34%
- Laggards: 16%

80:20
Med students, for preclinical years, what is the breakdown of your study resources? Lectures vs third party resources (sketchy, pathoma, b&b, etc)?

7% 100% lecture
21% 75% lecture, 25% TPR
21% 50% lecture, 50% TPR
51% 25% lecture, 75% TPR

14 votes - 5 days left

7:49 AM - 19 Jan 2020

3 Likes

Corey Kronman @CoreyKronman · 19h
Replying to @ToanTDo
Is there a 100% TPR option

Toan Do, MEd @ToanTDo · 19h
I ran out of possible tabs, but I would be in the 100% TPR as well :}
**Background/Methodology**

- Data needed to understand current and future usage of HSS curriculum and exam
- Online survey
- N=26 consortium school respondents; 37 non-consortium school respondents
- Comparisons of consortium versus non-consortium school results

**Very high awareness of HSS curriculum**

But implementation by topic is varied ... ... as is implementation timing/cohort

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### Is some aspect of HSS part of the curriculum at your school?

<table>
<thead>
<tr>
<th></th>
<th>Consortium</th>
<th>Non-consortium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not sure</td>
<td>100%</td>
<td>10%</td>
</tr>
<tr>
<td>No</td>
<td>3%</td>
<td>86%</td>
</tr>
<tr>
<td>Yes</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

**When HSS Is Taught Currently**

<table>
<thead>
<tr>
<th>HSS Topic</th>
<th>Consortium</th>
<th>Non-consortium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teamwork and Communication</td>
<td>100% ↑</td>
<td>83%</td>
</tr>
<tr>
<td>High Value Care (including Patient Safety)</td>
<td>96% ↑</td>
<td>79%</td>
</tr>
<tr>
<td>Population Health, Social Determinants, Health Disparities</td>
<td>96% ↑</td>
<td>90%</td>
</tr>
<tr>
<td>Quality Improvement</td>
<td>96%</td>
<td>83%</td>
</tr>
<tr>
<td>Evidence-Based Practice</td>
<td>96%</td>
<td>93%</td>
</tr>
<tr>
<td>Patient-Centered Care</td>
<td>96% ↑</td>
<td>72%</td>
</tr>
<tr>
<td>Health Care Structures and Processes</td>
<td>91% ↑</td>
<td>66%</td>
</tr>
<tr>
<td>Systems Thinking</td>
<td>91% ↑</td>
<td>41%</td>
</tr>
<tr>
<td>Health Care Economics and Policy</td>
<td>87%</td>
<td>69%</td>
</tr>
<tr>
<td>Informatics</td>
<td>78%</td>
<td>52%</td>
</tr>
<tr>
<td>Leadership and Change Management</td>
<td>70%</td>
<td>45%</td>
</tr>
</tbody>
</table>

↑↓ = Significant difference at the α=.10 level
HSS unlikely to be taught in one class

All HSS content in one independent class

- Consortium: 18% Extremely likely, 46% Very likely, 32% Somewhat likely, 33% Not very likely, 5% Not at all likely
- Non-consortium: 18% Extremely likely, 46% Very likely, 32% Somewhat likely, 33% Not very likely, 5% Not at all likely

HSS more likely to be integrated with clerkships

Integrated with Clinical Clerkships

- Consortium: 59% Extremely likely, 36% Very likely, 32% Somewhat likely, 28% Not very likely, 28% Not at all likely
- Non-consortium: 59% Extremely likely, 36% Very likely, 32% Somewhat likely, 28% Not very likely, 28% Not at all likely

Fit with curriculum and longitudinal comparisons more important than annual refresh of content

- Ability to customize content to fit curriculum: 40% 1st, 19% 2nd, 27% 3rd, 17% 4th
- Longitudinal comparative data for your school: 35% 1st, 33% 2nd, 19% 3rd, 18% 4th
- Comparative data to other schools: 23% 1st, 27% 2nd, 27% 3rd, 23% 4th
- Refresh of exam questions annually: 29% 1st, 21% 2nd, 27% 3rd, 50% 4th

Base: all responding
No significant difference between groups
N=48
The Clinical Learning Environment

Definition: The learning environment refers to the social interactions, organizational culture and structures, and physical and virtual spaces that surround and shape the learners’ experiences, perceptions, and learning.