BMC Medical Education

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Building a health systems science bridge between medical school and the clinical learning environment via a pilot faculty development cohort program

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Abstract

Background Clinical faculty development focused on Health Systems Science (HSS) is crucial for integrating HSS concepts into medical education. The 2021 HSSIP Faculty Development program was created to support faculty in effectively creating and incorporating comprehensive HSS content into the clerkship experience.

Methods Nine clinical champions, selected for their diverse backgrounds and interest in HSS, participated from November 2021 through October 2022 in monthly day-long, in-person workshops, and bi-monthly self-directed sessions, covering both HSS domains and foundational learning in curriculum development. Using a community of practice model, clinical champions gained expertise in HSS domains and developed curricula throughout the year-long program. Evaluation methods included surveys and feedback, focusing on satisfaction, self-efficacy, and curricular content creation.

Results Post-engagement surveys showed increased comfort in teaching HSS content, with significant improvement in specific areas. Participants valued learning from experts and collaborating with peers but found virtual sessions challenging. Despite systemic challenges and time constraints, clinical champions successfully created and implemented HSS-focused curricular content. They also contributed to broader HSS education efforts, presenting scholarly work and integrating HSS into various educational activities.

Conclusions This study showcases an innovative approach to preparing faculty to integrate HSS into clinical education. Key lessons included the value of subject matter experts, community engagement, and the challenges of virtual participation. Despite limitations such as low response numbers and context-specific results, the program demonstrated the potential for broad HSS integration. Further research with more participants and more rigorous data collection protocols is needed to more fully understand the generalizability of such an innovation. The initiative serves as a model for other academic health centers.

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Keywords Health systems science, Faculty development, Curriculum development, Curriculum integration, Undergraduate medical education

Background

Clinical faculty serve an integral role in the education of undergraduate medical students [1–3]. Faculty development initiatives are constructed and implemented to support faculty in their complex roles as educators within academic health centers (AHC). Approaches to faculty development are varied in terms of purpose, scope, and perceptions of effectiveness. (4–5) These initiatives can enhance clinical educators' knowledge, skills, and attitudes, and improve their ability to train future medical practitioners effectively [6]. Tailored faculty development initiatives have been shown to provide educational and content support needed to successfully build meaningful curricular interventions and even enhance overall educational change efforts. (7–8) Conversely, for clinical faculty charged with curricular creation and modification focused on integrating new content and concepts, a lack of exposure to formal curriculum development training leads to barriers to delivering high-quality educational content [9].

One relatively new area of focus for potential content creation and integration within undergraduate medical education (UME) is Health Systems Science (HSS), developed through the American Medical Association (AMA) Education Consortium [10]. HSS, described as the third pillar of medical education, consists of 12 domains with patient, family, and community at the core [11]. The 12 domains are divided into three overarching domains (Core Functional, Foundational, and Linking) that operate using a systems thinking lens. The interconnected and interdependent nature of the HSS curricular framework creates awareness of the "whole" and supports a "holistic approach to medical care and health care issues." [12].

The integration of HSS into the medical curriculum has been the focus of many institutions, albeit often in fragmented and inconsistent ways [11]. Professional development for clinical faculty to support curriculum creation, integration, modeling, and assessing of HSS content within clerkship learning environments is lacking in medical education and scholarly literature to date, hindering efforts to effectively integrate HSS at the UME level [13]. Many times, HSS becomes part of medical education within an organization via an educator network that is fragmented in nature [13]. While some efforts exist to support faculty in the integration of HSS content to learners, they are often focused on only one or two HSS domains and do not necessarily include instruction on effective teaching and curricular development practices. The lack of cohesion and comprehensiveness can result in ineffective educational outcomes [11]. A longitudinal, comprehensive integration of the complete HSS curricular framework has yet to be reflected in existing literature.

It was with this information in mind that we created a faculty development program, based on a Community of Practice framework, to support increased knowledge acquisition across the entirety of the AMA HSS curricular framework and to prepare designated faculty to form a bridge between the HSS content that the students learn in medical school and its application within the clinical learning environment [14]. The Health Systems Science and Interprofessional Practice (HSSIP) Faculty Development (FD) program launched in November 2021 as a pilot initiative to support a collaborative and systematic revision of curricular content to support longitudinal grounding and the integration of the entire HSS framework across all four years of medical education [15]. The purpose of this manuscript is to describe the creation, implementation, and lessons learned from our efforts.

Methods

Participant selection and cohort development

The HSSIP FD program employed a community of practice framework to educate and support clinical faculty as they grew in their understanding of applied HSSIP concepts. In short, communities of practice consist of a group of people sharing a common purpose around which they can increase their knowledge as they interact regularly [14]. Clinical champions ($n = 9$), selected by Department Chairs from eight of nine clinical departments (Surgery, Emergency Medicine, Radiology, Psychiatry, Internal Medicine, Obstetrics and Gynecology, Family Medicine, and Pediatrics) at the time of cohort development, participated in the program. The Internal Medicine Department selected two champions given the sub-specialty complexity of the department. One departmental chair elected not to name a champion given shifting priorities at the time. Clinical champions were selected by Department Chairs with an emphasis on diversity of clinical experience, background, individual interest, and emerging expertise in HSS concepts. Each clinical champion received 0.1 Full-time Equivalent (FTE) protected time for their engagement as a clinical champion (including the FD program). All clinical champions completed a participation agreement approved by the department chair and dean of the medical school, outlining expectations and responsibilities for the faculty development requirement (Appendix A). As part of their clinical champion role, participants were charged with developing HSSIP curriculum session(s) for the 3rd year

medical student clerkship for their designated departments. In the initial iteration of the program, the faculty development team designed the curricular content to meet the clinical champion's immediate UME needs. However, the FD team also ensured that content could be available and provided to other interested parties in the future, providing a more robust foundation for the expansion of content for those seeking continuing professional development, and filling a continuing medical education (CME) gap missing across HSS education as a whole. Overall, the HSSIP FD program was intended to develop skills to enable the clinical champions to effectively develop and implement HSS content throughout the clerkships.

The clinical champions participated as members of the HSSIP FD Cohort from November 2021 to October 2022. The principles of adult learning theory were applied in the development of the FD program, as well as in guiding participants in their own curricular development, emphasizing effective teaching strategies and curriculum development practices. (16–17) The HSSIP FD Cohort experience was structured to promote collaborative learning of both HSS content and pedagogy with the following faculty development goals in mind:

1. Support cohort participants' development as educators to lead knowledge creation and collaborative change around HSS concepts; and,
2. Guide participants to develop and deliver HSS curricular content, augmented through practical clinical application, and scalable across the healthcare system.

Program structure and content covered

In the summer of 2021, two of the HSSIP FD program leaders held individual meetings with each of the nine clinical champions to discuss their primary and secondary HSS domains of interest and to clarify the curricular deliverables required of them. All clinical champions participated in both pre-launch meetings. Each champion selected two HSS domains to integrate within their curricular content. Clinical champions selected a primary domain within which they perceived themselves to have an existing level of expertise, and/or which might have a significant impact within their particular clinical setting and a secondary domain that could provide complimentary content within the clerkship environment for their curricular deliverable. Two champions chose the same domain and were asked to work together to ensure their curricular intervention addressed the domain with a unique focus.

The HSSIP FD program consisted of 10 full "in-person" sessions and two self-directed sessions (Table 1). Each session was intended and designed for 8 h of engaged learning.

Clinical champions attended all scheduled full-day sessions and prepared for active engagement in the session by completing readings, assessments, and tasks as requested outside of the course time. Time requirements for preparatory work varied by session and by participant engagement. We designed each session to focus on one or more AMA HSS domain areas to provide both a broader knowledge base and an opportunity to drill down into how these concepts surface within the healthcare system. Monthly sessions also included the application of Kern's six-step approach to curriculum development and actively practicing creating HSS-aligned content for M3 (third-year undergraduate medical school) learners. We took particular care to align clinical clerkship HSS curriculum objectives with those already developed for the undergraduate medical education curriculum [10, 16].

A variety of content experts facilitated the HSS-focused sessions. They included individuals internal to the AHC, such as our Chief Financial Officer, those internal to the broader university system, and external national-level HSS subject matter experts. In addition to the content uniquely developed for the program, clinical champions attended 6 bimonthly, virtual one-hour sessions focused on foundational HSS content developed for a broader audience within the AHC (Table 2). Participation in these supplemental sessions served to expand HSS knowledge for clinical champions.

One of the authors (LA-J), who has significant expertise in curricular design, assessment, and implementation, taught the curriculum design sessions. Once these sessions were complete, the focus for the curricular component moved to participants actively creating curricular content within the parameters of institutional requirements, developing mechanisms for curriculum assessment, and planning for implementation. Of note, due to COVID reemergence in the area, in-person restrictions were reintroduced which resulted in January and February sessions (previously designed to be in-person) transitioning to a virtual format.

To aid in communication management and organization of cohort resources, program leaders created a password-protected website for the clinical champions. All participants were provided a copy of *Health Systems Science* and *Curriculum Development for Medical Education: A Six-Step Approach.* [10, 16] These texts provided supplemental content and select chapters were aligned with each of the monthly sessions. Clinical champions were also provided with an HSSIP Clinical Champion Orientation Manual that included:

- definitions encompassing each domain within the HSS framework,

Table 1 HSSIP faculty development monthly session content

Session Month	Health Systems Science Domain Covered	Curricular Creation Content Covered	Additional Content
November 2021 In-person Session (8 h total) Attendance = 9	Systems Thinking*	Mapping Health Systems Science in your Department	
December 2021 In-person Session (8 h total) Attendance = 9	Teaming and Leadership	Kern's Model - ● Problem Identification and General Needs Assessment ● Targeted Needs Assessment 30-minute curriculum check-in for progress M1 (first-year undergraduate medical school) and M2 (second-year undergraduate medical school) Health Systems Science Curriculum - Content Integration	Journal Club - Healthcare Finance
January 2022 Virtual Session (8 h total) Attendance = 9	Population and Social Determinants of Health	Kern's Model - ● Goals and Objectives ● Educational Strategies 30-minute curriculum check-in for progress	
February 2022 Virtual Session (8 h total) Attendance = 9	Patient Safety and Quality Improvement	Kern's Model - ● Implementation ● Evaluation and Feedback Building an assessment plan Student HSSIP Attitude and Preparedness Scale	Journal Club– Social Determinants of Health
March 2022 In-person Session (8 h total) Attendance = 9	Economics and Finance	Curriculum Plan and Write-up Finalization	Journal Club– Clinical Informatics
April 2022 In-person Session (8 h total) Attendance = 9	HSS Healthcare Policy, Advocacy, and Change Agency*	30-minute Curriculum Check-in for progress Presentation and Discussion of Curriculum Plans by participants	Journal Club– Social Determinants of Health
May 2022 In-person Session (8 h total) Attendance = 8	Ethics: Systems Approach, Ethical Framework implementation, Where we are heading.	No content	Journal Club– Legal and Ethical
June 2022 In-person Session (8 h total) Attendance = 7	Clinical Informatics and Technology	30-minute Curriculum Check-in for progress	Journal Club– Health Policy/ Economics
July 2022 Self-guided (8 h total)	No HSS content	No content	Clinical Champions work on Curricular Content Creation
August 2022 Self-guided (8 h total)	No HSS content	No content	Clinical Champions work on Curricular Content Creation
September 2022 In-person Session (8 h total) Attendance = 9	Value in Healthcare and the Future of HSS Education*	30-minute Curriculum Check-in for progress	Journal Club– Quality Improvement and Patient Safety
October 2022 In-person Session (8 h total) Attendance = 9	HSS Clerkship Pilot Presentations - What is working well, lessons learned in early implementation, and takeaways.		

*content provided by external national-level subject matter expert

- detailed guidance regarding each of the required sessions,
- introduction to the benefits of clinical champion cohort participation
- a comprehensive list of both cohort-based and HSS domain learning objectives, and,
- the HSSIP FD Cohort expectations and requirements document.

Table 2 Health systems science health professions educator series supplemental sessions

Session Month/Year	Health Systems Science Domain Covered
February 2022	Healthcare Economics
April 2022	Leveraging Cognitive Diversity to Address Complex Health Problems
June 2022	Health Literacy
August 2022	Community Partnerships and Population Health
October 2022	School of Medicine Student Wellbeing-Stress
December 2022	Systems Thinking

Participants each worked with a mentor (of their choosing) with HSS expertise and/or skills in curriculum development and assessment. We utilized a functional mentoring model for its structured approach to alignment with mentor expertise, skillset, limited time commitment, and defined outcome(s) [18]. Functional mentoring relies on selecting a mentor who has specific skills and expertise, in this case within HSS or teaching and curriculum creation. The mentoring relationship was time-bound to the completion of the curricular component. Clinical champions each self-identified a mentor whom they felt could best support their self-identified mentorship needs related to their deliverables. Mentors included internal and external HSS and/or curricular design and assessment experts. The faculty development team offered guidance as needed for participants who struggled to self-identify a mentor for any reason. Additionally, as a part of their participation, each participant selected an article, video, or other HSS-related content resource and facilitated a related discussion with their cohort peers. This "journal club" approach offered participants an opportunity to branch out into HSS content in ways that most resonated with them and to share this content with their peers. It also offered the opportunity for them to practice teaching HSS concepts to others.

Data collection methods

HSSIP FD Cohort program evaluation focused on three main areas: (1) clinical champion satisfaction, (2) improved self-efficacy in leading knowledge creation and collaborative change around HSS concepts, and (3) the creation and implementation of HSS-focused curricular content in the clinical setting.

Before beginning participation in the HSSIP FD Cohort program, clinical champions completed a pre-engagement survey, developed specifically for this program (Appendix B), to indicate their comfort level in teaching others about the HSS domains that comprise the AMA HSS framework. They repeated this survey at the end of the program. To evaluate the effectiveness of the faculty development programming, they also completed a feedback survey, developed specifically for this program (Appendix C), after each in-person session beginning in November 2021. The feedback survey consisted of open-ended questions, multiple-option, and Likert-scale responses. The survey sought to understand:

- what the clinical champions enjoyed most and least about their involvement in each of the sessions (open-ended).
- what aspects of the day were of most interest: Curriculum development/teaching content, group work with peers, HSS content covered by speaker(s), and Journal Club (multiple option response).
- their comfort level teaching others about HSS content (multiple option response).

Additionally, in fall 2022, after the conclusion of the cohort experience, clinical champions were given a brief post-engagement survey (Appendix B), developed for this program, to measure their comfort level teaching others about HSS.

Detailed record keeping of each step in the redesign and/or creation of HSS-focused curricular content for UME learners and subsequent implementation within the clinical setting was utilized to gauge progress toward the cohort objective of HSS-focused content recalibration and infusion. All HSS content created was reviewed by the Virginia Tech Carilion School of Medicine (VTC-SOM) Medical Curriculum Committee (MCC) and Block Integration Committee (BIC2) for academic rigor, compliance, and equitable integration. Additionally, clinical champion system-wide presentations and other scholarly endeavors focused on HSS concepts were tracked in the year following the cohort experience.

We provide data on self-assessment items in the pre- and post-engagement surveys using percentages. A Two-tailed T-test procedure was used to compare pre- and post-engagement survey responses to participants' level of comfort teaching others about HSS content. Statistical significance is defined as $p < 0.05$. Microsoft Excel was used for all statistical analysis and we collected, analyzed, and reported all survey data in the aggregate only. Pre- and post-engagement surveys and session feedback surveys also included open-ended questions and those responses were analyzed using a thematic analysis approach [19]. The Carilion Clinic (CC) Institutional Review Board (IRB) waived the need for consent to participate and deemed this pilot study exempt from further review.

Results

Clinical champions were nine selected individuals representing eight clinical departments across the AHC. On self-report demographic questions, 5 (56%) identified as male, and 4 (44%) identified as female. Faculty

Table 3 Health system science domain of focus

HSS Domain Name	Domain Type
Value In Health Care	Core Functional
Clinical Informatics And Health Technology	Core Functional
Population, Public, And Social Determinants Of Health	Core Functional
Health Care Policy And Economics	Core Functional
Ethics And Legal	Core Functional
Health Care Policy And Economics	Core Functional
Health System Improvement	Core Functional
Change Agency, Management, And Advocacy	Core Functional
Health Care Structure And Process	Core Functional

level consisted of 8 (89%) assistant professors and 1 (11%) professor at the onset of the cohort experience. Six (67%) participants identified as White and 3 (33%) identified as Other. Across the clinical champions, the HSS domains listed in Table 3 were identified during pre-launch meetings as domains of focus.

From these domains, clinical champions utilized HSS content shared via the monthly HSSIP FD sessions, curated content available on the cohort website, supplemental readings, and curricular creation session content, to develop curricula aligned with their chosen HSS content of focus. Clinical champions were asked at the outset of the faculty development initiative via the pre-engagement survey about their comfort level teaching HSS domain content and were asked again about comfort level teaching HSS domain content at completion of the initiative. Pre- and post-engagement survey responses are reported in Fig. 1.

Data in this figure reflects responses from the six clinical champions who completed both the pre- and post-engagement survey. There was statistically significant difference between pre-and post-engagement survey responses regarding comfort level teaching the following HSS content: value in healthcare; change agency, management, and advocacy; and leadership principles of teamwork and team science (t(5) = -3.16, $p = 0.02$); and systems thinking (t(5) = -5, $p = 0.00$).

We asked the clinical champions after each HSSIP FD session what aspect of the day's activities they found most interesting. Across the cohort experience, 81% of clinical champions ($n = 9$) found the HSS content delivered by internal and external presenters to be of interest and 66% found the curriculum development/teaching instruction to be of interest. When asked about group work with peers, 61% found this aspect of the day to be of interest. Finally, 51% of clinical champions found Journal Club activities to be of interest. Across the cohort experience, when asked what they liked most about the full-day sessions they attended, clinical champion responses aligned with three distinct themes: value in learning HSS-focused content from subject matter experts; interacting with cohort colleagues was critical; and HSS-focused discussions with subject matter experts and cohort peers enhanced learning. Responses to the question regarding what clinical champions liked least about the full-day sessions centered around two themes: the demands on clinician time created tension and the cohort experience suffered in an online environment.

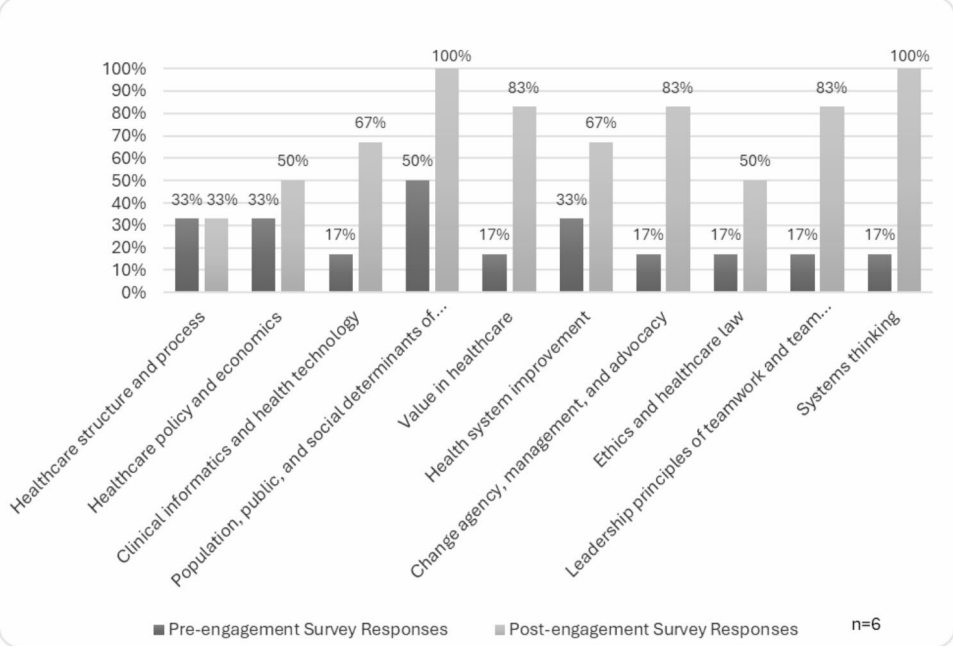

Fig. 1 Comfort Teaching HSS Domain Content

Value in learning from, and discussing HSS content with, subject matter experts

Not only were clinical champions interested in the content that was shared but they also noted the importance of having conversations with subject matter experts and digging into the content presented. Clinical champions noted that they were "inspired" by all the new information they were learning during the experience. Having connections to those within the AHC with primary roles in areas such as healthcare finance, clinical informatics, population and community health, for example, was "eye-opening", "stimulating" and "insightful."

Interacting with cohort colleagues was critical

The clinical champions shared that they valued the opportunity to interact and explore their thoughts, feelings, and vision with their peers. They also noted how inspiring it was to hear their colleagues' passion for particular domains comprising the HSS framework. Relying on their colleagues to bounce ideas off of and the opportunity to have lively, HSS-focused discussions in a safe environment were also noted. Clinical champions valued the diverse opinions of their colleagues and the approaches they were taking in the development of their curricular components. They were "inspired," "felt supported," "became encouraged," and felt a spirit of collaborative purpose as they worked together to learn and create a curriculum.

Demands on clinician time created tension

Clinical champions shared with us that even though time away from direct patient care was compensated, they still thought about patients, managed patient and clinical needs during cohort time, and could not fully disengage. The demands on their time carried over into the learning environment and the added pressure of multiple demands made it difficult at times for cohort members to find value in "just learning." Clinical champions shared that "considerable demands on our time presently," "time away from patient care," and "feeling like it could have been more productive" created tension during the day spent with the cohort.

Cohort experience suffered in an online environment

Clinical champions responded that [virtual] sessions, with lots of heavy content and curriculum creation, combined for days that felt long and cumbersome. "Virtual session made it harder to talk with cohort members in between sessions to share ideas" and "long days on Zoom are not as ideal for engagement" described the sentiments cohort members expressed. Clinical champions noted consuming heavy content, particularly in areas they were less than familiar with such as adult learning theory, was even more challenging in the virtual environment. One champion shared that the combination of "virtual" sessions and some "topics not my area is a lot to grasp" over the course of the day. Another champion voiced that it was "very difficult to be engaged with distractions at home and to be on Zoom for so many hours." Another champion shared that during the virtual session, it seemed as though there was "not enough time to chat with teammates about my curriculum to see if someone else has a better idea." Others reported they "missed in-person interactions" and they "got a lot of value from casual conversation with the cohort members" which they did not feel was possible in a virtual space. Having experienced the full-day session in person, falling back to a virtual format was not ideal and negatively impacted the cohort experience.

Systemic challenges and teaching HSS

Clinical champions were asked post-engagement what they perceived as the greatest difficulty in teaching HSS. While responses varied, a theme of systemic challenges emerged. The lack of time to devote to covering HSS in-depth and condensing the broad scope of HSS into time-constrained deliverables, coupled with a perceived lack of valued importance within the ranks of clinical faculty, were concerns. One champion noted, "there is perception that the problem is too great or 'cannot change' and that it's a waste of time trying to fix it". Another clinical champion reflected similar thoughts and shared, "I think we are making impactful steps in the best directions but the history is still there and there are still a lot of people that feel strongly against change".

At the conclusion of the cohort experience, all clinical champions had either redesigned or created relevant, engaging HSS-focused curricular content and had begun the implementation process of the new HSS-focused education in their core clerkship, focusing on their primary HSS domain of interest, ensuring that all domains were covered in the clinical year (Table 4).

Additionally, clinical champions spearheaded the integration of HSS content into other clerkship activities such as the students' passports and end-of-clerkship observed structured clinical examination (OSCE) cases. Clinical champions have been integral in the execution of the pre-clinical HSS curriculum, serving as faculty for educational sessions, as well as designing and implementing content for the longitudinal clerkship HSS curriculum, "Systems Sessions." In October 2022, five (56%) of the clinical champions shared HSS-focused scholarly posters at the AHC's annual Education Day. Six (67%) presented HSS sessions to their colleagues in the following year to a subsequent cohort of new faculty learning about HSS and three (33%) of the champions also presented in the HSS Health Professions Educator Series.

Table 4 HSSIP M3 clerkship didactics for academic year 2022-23

Clerkship	HSS Domain of Focus	Didactic Session Title
OBGYN	Social Determinants of Health and Health Equity	*Racial (in)Equity in OBGYN and Maternal Health*
Surgery	Quality Improvement and Patient Safety	*Health System Science and Surgical Quality Improvement*
Family Medicine	Value in Healthcare	*Subjective, Objective, Assessment, Plan, and Value (SOAP-V) Presentations. Exploring Value in Clinical Decision-making*
Emergency Medicine	Healthcare Policy and Economics Healthcare Structure and Process	*Go to the ER: How Health Policy & Health Economics Have Shaped Care Delivery in the United States*
Emergency Medicine	Social Determinants of Health and Health Equity	*Why Today? Social Determinants of Health (SDH) and Access to Care in a Complex System*
Internal Medicine	Ethics and Legal Patient, Family, and Community	*Ethical & Legal Aspects of Patient Care*
Radiology	Healthcare Policy and Economics	*Comparative Health Systems*
Pediatrics	Social Determinants of Health/Population Health	*Subjective, Objective, Assessment, Plan, and Safety (SOAP-S)*
Psychiatry	Clinical Informatics and Health Technology	*Essential Concepts in Medical Informatics for the Clinical Clerkships*

Discussion

This study illustrates a novel, comprehensive approach to preparing designated faculty to infuse HSS concepts into the clinical environment. The faculty development cohort program described demonstrates an effective approach to increasing clinical faculty knowledge and understanding across all HSS domains while concurrently preparing the cohort members to create curricular components to engage medical students across clerkships. The program was accomplished via a community of practice model cohort wherein designated clinical champions acquired and built upon the requisite skills to become HSS practitioners, educators, models to their peers, and change agents to scale an HSS mindset across VTCSOM and the CC healthcare delivery system.

Through this experience, the clinical champions developed into a core group of HSS leaders, broadly representative across departments, with enhanced skills to educate and guide learners across the medical education continuum in HSS concepts. In the course of meeting the intended objectives of the program, several "lessons learned" emerged.

Lessons Learned.

1. Each domain in the HSS framework has value to clinical faculty and can be incorporated into a comprehensive HSS faculty development initiative.
2. Our clinical champions found value in learning from subject matter experts (including non-traditional presenters) who presented content aligned with HSS domains.
3. Participants valued engagement in the community of practice framework for this content. They expressed genuine appreciation for how this collective process of creating, sharing, and disseminating knowledge impacted individual experience which mirrors what is said about communities of practice related to other domains of interest. (20–21)
4. Virtual participation can present challenges for a community of practice that started with in-person engagement. Participants were less engaged and provided feedback to indicate they were less than enthusiastic about the change to virtual. They had been together in person for two sessions before the transition and were beginning to build relationships with one another. The virtual switch impacted community building and made long session days seem even longer.

Limitations

Although this program shows promise for future programs to model after, we identified some limitations of the study. Given the HSSIP Clinical Champion program was a pilot initiative with a small number of participants who were not required to answer data collection mechanisms, there were, as a result, low numbers of responses to surveys and other data collection mechanisms ($n \leq 9$). Thus, further research with more participants and more rigorous data collection protocols is needed to more fully understand the generalizability of such an innovation. We were also unable to conduct workplace-based assessments to evaluate behavioral change or the potential impact of HSS content infusion into the broader healthcare system due to factors such as lacking adequate numbers of, and time allocation for, assessors as well as the complex nature of capturing content integration across a diverse clinical environment. However, this level of assessment may have strengthened initial findings. In retrospect, conducting follow-up surveys at strategic time intervals post-cohort involvement or conducting a follow-up case study with the clinical champions may provide additional information regarding any long-term effects of participating in the faculty development initiative.

This pilot program represents what was possible within one AHC and the results and outcomes will likely vary within different contexts, systems, and participants. In short, what is implementable within one AHC may not

be so at another. The need for curricular expansion to further incorporate HSS longitudinally was one, that while imperative to the VTCSOM and CC system, may not fit the systemic needs of other AHCs. Additionally, compensating clinical faculty time made it possible for participants to sustain their involvement and feel a sense of value for their efforts amid both ever-competing demands and the exploitative expectations of uncompensated contributions [22–24]. This level of time compensation may not be possible at other AHCs.

In summary, creating the supporting structure, providing the necessary logistical components, and adequately compensating clinical time was a resource-heavy undertaking that may not be feasible for all organizations and certainly not doable at the scale shared in this study without extensive planning, collaboration, and buy-in at the highest levels of an organization.

Focusing future iterations on incorporating and measuring outcomes that illustrate behavioral changes to both teaching HSS-focused content and practical clinical application would provide additional clarity around the effectiveness of the program.

Conclusion

This HSSIP FD cohort demonstrated the inherent value in HSS knowledge acquisition and continued growth so that longitudinal implementation throughout the clinical environment could occur. Additionally, the creation of this HSS-focused curricular content provided a structure for a future foundational expansion of content for those seeking continuing professional development in this area. It also filled a critical gap by connecting HSS content taught within the medical school classroom to learner experiences within the clinical environment. We hope that the inaugural year of this HSS-focused faculty development initiative will serve as an example of what is possible and will lead other AHCs to consider innovative faculty development approaches in the integration of HSS.

Abbreviations

AHC	Academic health center
AMA	American medical association
BIC2	Block integration committee 2
CC	Carilion clinic
CME	Continuing medical education
FD	Faculty development
FTE	Full-time equivalent
HSS	Health systems science
HSSIP	Health systems science and interprofessional practice
IRB	Institutional review board
M1	First-year undergraduate medical school
M2	Second-year undergraduate medical school
M3	Third-year undergraduate medical school
MCC	Medical curriculum committee
SOAP	S-Subjective, objective, assessment, plan, and safety
SOAP	V-Subjective, objective, assessment, plan, and value
UME	Undergraduate medical education
VTCSOM	Virginia tech carilion school of medicine

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12909-025-06954-w.

Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Acknowledgements

Not applicable.

Author contributions

SH drafted all sections of the manuscript, analyzed and interpreted the data, and incorporated all revisions into the final manuscript. LA-J co-authored the Methods section and reviewed and revised each section of the manuscript. MR contributed to reviewing and revising each section of the manuscript. NK provided specific details to the methods section and reviewed all sections of the manuscript. SP reviewed the final draft of the manuscript and provided guidance and suggested revisions that were incorporated into the final manuscript. SW co-authored the Discussion and Conclusion and revised the manuscript for voice and flow. All authors read and approved the final manuscript.

Funding

The International Association of Medical Science Educators (IAMSE) provided funding for this project via an Educational Scholarship Grant.

Data availability

The data that support the findings of this study are available from the authors upon reasonable request.

Declarations

Ethics approval and consent to participate

This study was determined by the Carilion Clinic Institutional Review Board (IRB) to be exempt from IRB review under DHHS regulatory Category 2(ii). The need for consent to participate was waived by the Carilion Clinic IRB.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 20 June 2024 / Accepted: 5 March 2025
Published online: 18 March 2025

References

1. Alexandraki I, Rosasco R, Mooradian AD. An evaluation of faculty development programs for Clinician–Educators: A scoping review. Acad Med. 2021;96(4):599–606.
2. Leslie K, Baker L, Egan-Lee E, Esdaile M, Reeves S. Advancing faculty development in medical education: a systematic review. Acad Med. 2013;88(7):1038–45.
3. Roberts LW. Recognizing the academic contributions of clinician educators. Acad Med. 2024;99(6):587–8.

4. Steinert Y. (2010). Faculty development: From workshops to communities of practice. Medical Teacher. 2010;32(5):425–428.
5. Steinert Y, Mann K, Anderson B, Barnett BM, Centeno A, Naismith L, Dolmans D. A systematic review of faculty development initiatives designed to enhance teaching effectiveness: A 10-year update: BEME guide 40. Med Teach. 2016;38(8):769–86.
6. Skeff K, Stratos G, Mygdal W, DeWitt TA, Manfred L, Quirk M, Roberts K, Greenberg L, Bland CJ. Faculty development a resource for clinical teachers. J Gen Intern Med. 1997;12:S56–63.
7. Irby D. Excellence in clinical teaching: knowledge transformation and development required. Med Educ. 2014;48(8):776–84.
8. Elmberger A, Blitz J, Björck E, Nieminen J, Laksov K. Faculty development participants' experiences of working with change in clinical settings. Med Educ. 2022;57(7):679–88.
9. Toor R, Cerimele J, Farnum M, Ratzliff A. Longitudinal faculty development in curriculum design: our experience in the integrated care training program. Acad Psychiatry. 2020;44(2):761–5.
10. Skochelak S, Hammoud M, Lomis K, editors. Health systems science. 2nd ed. Elsevier. 2020.
11. Gonzalo JD, Chang A, Dekhtyar M, Starr SR, Holmboe E, Wolpaw DR. Health systems science in medical education: unifying the components to catalyze transformation. Acad Med. 2020;95(9):1362–72.
12. Gonzalo JD, Haidet P, Papp KK, Wolpaw DR, Moser E, Wittenstein RD, et al. Educating for the 21st-century health care system: an interdependent framework of basic, clinical, and systems sciences. Acad Med. 2017;92(1):35–9.
13. Gonzalo JD, Ogrinc G. Health systems science: the broccoli of undergraduate medical education. Acad Med. 2019;94(10):1425–32.
14. Wenger E, McDermott R, Snyder W. Cultivating communities of practice: A guide to managing knowledge. Harvard Business School Press. 2002.
15. Musick DW, Vari RC, Kraemer MS, Trinkle DB, Vari PM, Smith JC, Learman LA. Building health systems science education from the core domain of interprofessional education at Virginia tech carilion school of medicine. Med Sci Educ. 2020;31:215–22.
16. Thomas PA, Kern DE, Hughes MT, Chen BY. Curriculum development for medical education: A Six-Step approach. Johns Hopkins University. 2016.
17. Knowles MS. Andragogy in action: applying modern principles of adult learning. 1st ed. Joesy-Bass. 1984.
18. Gusic M, Thorndyke L. Functional mentoring. In: Fornari A, Shah DT, editors. Mentoring in health professions education. IAMSE Manuals. Springer 2022;73–9.
19. Kiger ME, Varpio L. Thematic analysis of qualitative data: AMEE Guide No. 131. Medical Teacher, 2020;42(8):846–854.
20. Shea S, Nickerson KG, Tenenbaum J, Morris Q, Rabinowitz D, O'Donnell K, Perez E, Weisfeldt ML. Compensation to a department of medicine and its faculty members for the teaching of medical students and house staff. N Engl J Med. 1996;334(3):162–7.
21. Brenner A, Beresin E, Coverdale JH, Louie AK, Balon R, Guerrero APS, Roberts LW. Time to teach: addressing the pressure on faculty time for education. Acad Psychiatry. 2017;42:5–10.
22. Woolliscroft JO, Van Harrison R, Anderson MB. Faculty views of reimbursement changes and clinical training: A survey of Award-Winning clinical teachers. Teach Learn Med. 2009;14(2):77–86.
23. de Carvalho-Filho MA, Tio RA, Steinert Y. Twelve tips for implementing a community of practice for faculty development. Med Teach. 2020;42(2):143–9.
24. Abigail LKM. Do communities of practice enhance faculty development? Health Professions Educ. 2016;2(2):61–74.

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