

## COMMENTARY

# Competency analysis and educational strategies to meet the demand for a learning health system workforce

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## Abstract

Learning Health Systems (LHS) require a workforce with specific knowledge and skills to identify and address healthcare quality issues, develop solutions to address those issues, and sustain and spread improvements within and outside the organization. Educational programs are tasked with designing learning opportunities that can meet these organizational needs. This manuscript explores different mechanisms for addressing challenges to creating educational programs to prepare individuals who can work in and lead LHS. Strategies and recommendations for educational programs to support the LHS include the creation of a new program, collaborating across existing programs, and producing a set of instructional materials.

## KEYWORDS

competency, education, learning health system

## 1 | INTRODUCTION

The interest in Learning Health Systems (LHS used for both learning health system and learning health systems) has been growing over the years as many health systems embrace the concept of mining, analyzing, researching, and using the data in the clinical and administrative systems, including external claims data, to identify and address quality problems in healthcare. In part, this increase in interest has been fostered by the efforts of the Learning Health Community (LHC) over the last decade since the Institute of Medicine first described the concept in 2007.<sup>1,2</sup> The efforts of the LHC have been aided by other developments over this period that have not only increased the interest in the idea of an LHS, but have also provided the means to realize it.

First, the HITECH Act in 2009 spurred the adoption of EHRs so that now EHRs are almost universal in large healthcare systems and ambulatory settings.<sup>3</sup> EHRs facilitate the electronic data collection needed for an LHS and the EHR incentive program promoting Meaningful Use emphasized measures that were aimed at promoting quality.<sup>4</sup> Further legislation also incentivized value-based care and

improving quality of care.<sup>5</sup> These policies led healthcare systems to have the means (EHRs) and the motivation (Centers for Medicare and Medicaid Services [CMS] incentives) to focus on innovative approaches to improve quality.<sup>6,7</sup> However, without personnel with the knowledge and skills to both analyze the data and utilize the functionality of the EHR to actually improve quality, as opposed to using the EHR only to facilitate electronic data collection, the goals of the LHS cannot be reached. Fortunately, over the last decade, there has been a growth in accredited clinical and health informatics educational programs, spurred by the growth of the clinical informatics subspecialty and the Commission on Accreditation for Health Informatics and Information Management Education (CAHIIM) accreditation of health informatics educational programs.<sup>8-12</sup> In addition, now that most healthcare systems have implemented EHRs, these educational programs are increasingly focusing on meeting the growing demand for expertise in analytics and data science. Finally, there has been an increased interest by accrediting agencies on accrediting the growing number of programs focusing on preparing individuals for a focus in healthcare quality and safety.<sup>13,14</sup>

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With these building blocks in place, and the increasing interest in developing LHS, it is fitting to examine the challenges of preparing individuals with the expertise to lead LHS efforts. The Agency for Healthcare Research and Quality (AHRQ), utilizing the expertise of LHS Centers of Excellence, developed a set of LHS competencies.<sup>15,16</sup> The LHS core competencies were developed between August and December of 2016 using qualitative methods to elicit, refine, and prioritize them. Data obtained by an in-depth literature review formed the basis of the competencies, after which key informant interviews were conducted with LHS research content experts. Lastly, a panel of experts was convened to develop the competency framework. Initially, 91 competencies were identified across 10 domains. Through the use of Likert scales and Modified Delphi surveys, 33 core competencies were selected across seven domains. The seven LHS domains are system science, research questions and standards of scientific evidence, research methods, informatics, ethics of research and implementation in health systems, improvement and implementation science, and engagement, leadership, and research management.<sup>15</sup> In examining these competencies, it is apparent that they require *multiple disciplinary expertise*, yet traditional informatics and healthcare quality and safety educational programs usually are discipline-specific with accreditation criteria requiring that disciplinary focus.

Choi and Pak conducted an extensive analysis of the use of the terms multidisciplinary, interdisciplinary, and transdisciplinary.<sup>17</sup> They concluded that these terms are often used interchangeably, but suggested definitions that place these terms along a continuum where disciplinary boundaries are most distinct in multidisciplinary collaborations and least distinct in transdisciplinary ones. They suggested using the term “multiple disciplinary” when it is unclear or unknown what the relationship among the different disciplines is.<sup>17</sup> Because an LHS will most likely require all types of disciplinary relationships depending on the task, and because educational and training programs may also vary on the roles of individuals being trained, we use the generic term “multiple disciplinary” unless one of the other terms is explicitly referenced.

Certainly, one can utilize individuals from each of the relevant AHRQ LHS competency disciplines (eg, informatics, healthcare quality, research methods statistics, data science, etc.) on a team to develop an LHS, and many places are taking that approach. However, relying solely on this approach is analogous to creating an orchestra without a conductor. What is also needed are individuals knowledgeable enough about each of the competency disciplines necessary for successful LHS approaches who also possess the knowledge and skills to lead the efforts of the experts from these different disciplines and who recognize what must be done to accomplish the goals of an LHS.

The challenges to the creation of the needed multiple disciplinary training programs include lack of multiple disciplinary faculty expertise to educate the workforce, organizational obstacles to developing and recruiting for new educational programs, and job postings that do not align with the competencies needed. This manuscript explores different mechanisms for addressing the challenges.

## 2 | STRATEGIES FOR ADDRESSING COMPETENCIES

Given that many relevant educational programs are focused on a single discipline and leaders in LHS need multiple disciplinary training, there are several potential strategies for developing appropriate educational programs. Depending on the resources and organizational policies, the following are potential approaches.

1. *Develop a new LHS-focused degree program* that includes the content from each of the main disciplines most needed for producing a workforce that understands the multiple facets of an LHS and can recognize what specialists are needed and can communicate with them. For example, the University of Michigan Medical School has established a Department of Learning Health Sciences which offers masters and doctoral degrees in Health Infrastructure and Learning Systems.<sup>18</sup> The focus is the multiple disciplinary competencies needed for an LHS,<sup>15</sup> with an emphasis on the informatics and social and behavioral sciences that underlie the LHS infrastructure, as well as implementation science. The aim is to prepare both researchers and practitioners who can lead the development and improvement of the LHS sociotechnical infrastructure. The department has a large multiple disciplinary faculty and also draws on secondary faculty whose primary appointments are in a variety of other departments. The program benefits from the commitment of the medical school in promoting an LHS by establishing a department dedicated to that goal and a broad array of faculty willing to contribute to it. For institutions with similar resources, developing such a program is one way to meet the workforce needs. Unfortunately, however, most institutions have not developed the infrastructure and support for new educational programs. Developing a new LHS-focused degree program may be further limited to degree programs in academic medical centers, whereas graduates from other healthcare environments could also contribute to the LHS workforce.
2. Although starting an entirely new multiple disciplinary education program may not be feasible in many places, another approach is to *collaborate across existing separate educational programs* that train specialists in key competencies needed for an LHS. Programs in informatics, healthcare quality and safety, healthcare management and leadership, and biostatistics are examples of such programs. Students in a single disciplinary program who take courses in other disciplinary programs would gain needed LHS competencies and would also get experience in collaborating across disciplinary lines. This may also enhance the LHS knowledge and skills of those enrolled in the primary discipline. For example, an informatics program with a track on LHS might supplement core informatics courses by having students take LHS-relevant courses in other programs, such as biostatistics or healthcare quality and safety. A critical component of this strategy is having faculty continue to teach in their area of expertise so that students benefit from this expertise.

As an example, at the University of Alabama at Birmingham Department of Health Services Administration, we have graduate programs in both Health Informatics (HI) (with a data science or human factors focus, depending on the track) and Healthcare Quality and Safety (HQS). Although the AHRQ LHS competencies described above focus on LHS researchers, their broad top-level domains are appropriate for a variety of workforce roles.<sup>15,16</sup> Building on the AHRQ LHS competencies, we show alignment between the seven AHRQ competency domains and our HI and HQS accreditation organizations' standards. The HI standards were set by the American Medical Informatics Association and are in the form of foundational domains that include knowledge, skills, and attitudes to form the competency.<sup>9</sup> The HQS standards were set by the Commission on Accreditation of Healthcare Management Education as content domains, shaping the creation and application of program specific competency statements.<sup>14</sup> Table 1 below includes the relevant competencies from both programs.

Collaboration across programs might be done as an LHS track within each program or LHS-focused electives courses, depending on student background. As can be seen from Table 1, in some cases, both HI and HQS programs have similar competency domains. For instance, both programs have competencies related to human factors. In other cases, the two programs have complementary competencies. For example, the HI program does not explicitly list system science as a competency, and, although it may be included in multiple courses, it is not highly emphasized. The HQS program, on the other hand, includes competencies on safety and error science as well as systems thinking. Similarly, while the HQS program does not include competencies on research methods, there are courses in the HI program that address this competency. If a track within HI were to be developed, it might include the course related to system science from the HQS program and if the track were in HQS, students could take the HI research methods course. The HI and HQS programs are just examples of educational programs that could collaborate to address the full complement of LHS competencies. There are other educational programs that might also have relevant competencies, especially related to leadership, such as healthcare management.<sup>19</sup>

The collaborative approach is possible if there are multiple relevant programs in the same institution, if the courses do not have extensive pre-requisites, and if students are permitted to take cross-program courses. In smaller institutions which do not have a full range of relevant programs or in larger institutions where cross-program courses are not common, or where there is little collaboration across programs, other solutions would be needed.

3. A third possibility for developing an LHS workforce may be to *produce a set of instructional materials* that includes the necessary LHS content that could be adapted by non-expert faculty. Materials could be selected depending on what was needed for any existing education program. This approach may necessitate external funding, similar to the way that the Office of the National Coordinator for Health Information Technology (ONC) supported workforce training in informatics with different sets of materials depending

on the roles for which individuals were being trained.<sup>20,21</sup> Some of the selection of content could be based on individual student background. LHS-relevant materials could be developed into individualized electives based on student background and could be prepared as self-instructional materials so that faculty did not need to have the deep expertise to use them. The materials could also be used to augment faculty LHS expertise and potentially used for orientation of clinicians to relevant LHS concepts.

While Academic Medical Centers may be ideal environments to combine both education and application opportunities for an LHS workforce, these centers are not necessarily the only environment where training can occur. The approach of developing materials that can be used in multiple ways described above as part of the ONC Health IT training programs may provide a model that can be used by different sites for different roles for the LHS. For instance, some of the ONC educational programs occurred in community colleges while others were at the masters' and doctoral level. Even within the community college programs, the programs for the different roles used different combinations of the basic set of materials.<sup>20</sup> The needed LHS roles may differ for different organizations. A hospital or health system could work with its local community college or university to develop a unique curriculum or training program suited to that organization, thus ensuring that the participants are exposed to a common set of LHS competencies. Participants would include employees from across the organization including nursing, medical and other clinical personnel, as well as administrative employees from finance, quality and safety, strategy and marketing, and other departments. The benefit of a health system-developed training program is that the curriculum can be tailored to the unique needs of the organization and/or to the employee's role. Such a program would ensure that the multiple disciplinary workforce is able to understand, value, and implement key aspects of the LHS as the organization seeks to improve patient care.

### 3 | LEADERSHIP

Engaging in an LHS involves multiple types of contributions across the hospital and health system. At the very core is understanding that change needs to happen, primarily where data and information are transformed to enable learning and where learning is transformed into new actions. It has been well established in the literature that leaders, not only those with leadership roles and titles, must be agents of change in such initiatives.<sup>22-25</sup> Leadership and change management competencies are included in the AHRQ LHS competencies and in both the HI and HQS programs detailed above.

However, just as we think about competencies to educate clinicians, researchers, and others who work in an LHS, we must also think about how to train those whose role it will be to lead others as they apply the knowledge and wisdom gained from the LHS. A commitment and understanding of LHS are needed from leaders at all levels—formal C-suite individuals and clinical leaders, as well as middle managers, and less formal team leaders. The training and

TABLE 1 Alignment of health informatics and healthcare quality and safety competencies

AHRQ competency domain	UAB Master of Science in Health Informatics (HI)	UAB Master of Science in Healthcare Quality and Safety (HQS)	Curricular gap
Systems Science	<p><i>Information Science and Technology.</i> Identify the applicable information science and technology concepts, methods, and tools to solve health informatics problems.</p> <p><i>Human Factors and Socio-technical Systems.</i> Draw on socio-technical knowledge regarding the social behavioral sciences and human factors engineering to apply to the design and implementation of information systems and technology. Apply social behavioral theories and human factors engineering to the design and evaluation of information systems and technology. Demonstrate consideration and respect for the role of users in the design and application of information systems and technology.</p> <p><i>Social, Behavioral, and Information Science and Technology Applied to Health.</i> Identify the theories, models, and tools from social, business, human factors, behavioral, and information sciences and technologies for designing, implementing, and evaluating health informatics solutions. Integrate and apply the theories, models, and tools from social, business, human factors, behavioral, and information sciences and technologies to design, implement, and evaluate health informatics solutions. Demonstrate an awareness of the interrelatedness of social, business, human factors, behavioral, and information sciences and technology in the design, implementation, and evaluation of health informatics solutions.</p>	<p><i>Human Factors.</i> Apply methods of systems analysis and user-centered design to the physical environment, processes, and systems to reduce errors, improve safety and quality.</p> <p><i>Safety &amp; Error Science.</i> Apply structured, evidence-based approaches to prevent, identify, and investigate gaps and errors associated with patient care.</p> <p><i>System Thinking.</i> Apply system thinking approaches to healthcare quality and safety projects and management-decision making.</p>	<p>HI does not explicitly have systems science and systems thinking as a competency, although it is addressed implicitly in several information science and systems competencies.</p>
Research Questions and Standards of Scientific Evidence	<p><i>Social, Behavioral, and Information Science and Technology Applied to Health.</i> Identify the theories, models, and tools from social, business, human factors, behavioral, and information sciences and technologies for designing, implementing, and evaluating health informatics solutions.</p> <p>Integrate and apply the theories, models, and tools from social, business, human factors, behavioral, and information sciences and technologies to design, implement, and evaluate health informatics solutions. Demonstrate an awareness of the interrelatedness of social, business, human factors, behavioral, and information sciences and technology in the design, implementation, and evaluation of health informatics solutions.</p>	<p><i>Evidence-Based Practice.</i> Apply evidence-based methods to plan and prioritize quality improvement efforts and measure. The impact of these efforts on patient and organizational outcomes.</p> <p><i>Measurement &amp; Process Evaluation.</i> Analyze, interpret, and communicate process and outcome data using qualitative and quantitative tools and methods.</p>	
Research Methods	<p><i>Health.</i> Describe the history, goals, methods (including data and information used and produced), and current challenges of the major health science fields. These include biology, genomics, clinical and translational science, healthcare delivery, personal health, and population health.</p> <p><i>Social, Behavioral, and Information Science and Technology Applied to Health.</i> Identify the theories, models, and tools from social, business, human factors, behavioral, and information sciences and technologies for designing, implementing, and evaluating health informatics solutions. Integrate and apply the theories, models, and tools from social, business, human factors, behavioral, and information sciences and technologies to design, implement, and evaluate health informatics solutions. Demonstrate an awareness of the interrelatedness of social, business, human factors, behavioral, and information sciences and technology in the design, implementation, and evaluation of health informatics solutions.</p>		<p>No competencies in the HQS curriculum directly tie to the AHRQ LHS research methods domain.</p>

TABLE 1 (Continued)

AHRQ competency domain	UAB Master of Science in Health Informatics (HI)	UAB Master of Science in Healthcare Quality and Safety (HQS)	Curricular gap
Informatics	<p><i>Health.</i> Describe the history, goals, methods (including data and information used and produced), and current challenges of the major health science fields. These include biology, genomics, clinical and translational science, healthcare delivery, personal health, and population health.</p> <p><i>Social, Behavioral, and Information Science and Technology Applied to Health.</i> Identify the theories, models, and tools from social, business, human factors, behavioral, and information sciences and technologies for designing, implementing, and evaluating health informatics solutions. Integrate and apply the theories, models, and tools from social, business, human factors, behavioral, and information sciences and technologies to design, implement, and evaluate health informatics solutions. Demonstrate an awareness of the interrelatedness of social, business, human factors, behavioral, and information sciences and technology in the design, implementation, and evaluation of health informatics solutions.</p>	<p><i>Health Informatics.</i> Apply knowledge of advantages and limitations of using health informatics and health information technology to address patient safety and quality concerns.</p>	
Ethics of Research and Implementation in Health Systems	<p><i>Professionalism.</i> Define and discuss ethical principles and the informatician's responsibility to the profession, their employers, and ultimately to the stakeholders of the informatics solutions they create and maintain. Demonstrate professional practices that incorporate ethical principles and values of the discipline. Demonstrate awareness of the value of information literacy and lifelong learning, maintenance of skills, and professional excellence.</p>	<p><i>Legal and Regulatory Issues.</i> Apply appropriate regulations and requirements within quality and safety necessary to ensure organizational compliance.</p>	
Improvement and Implementation Science	<p><i>Social and Behavioral Science.</i> Identify the effects of social, behavioral, legal, psychological, management, cognitive, and economic theories, methods, and models applicable to health informatics from multiple levels including individual, social group, and society.</p> <p><i>Human Factors and Socio-technical Systems.</i> Draw on socio-technical knowledge regarding the social behavioral sciences and human factors engineering to apply to the design and implementation of information systems and technology. Apply social behavioral theories and human factors engineering to the design and evaluation of information systems and technology. Demonstrate consideration and respect for the role of users in the design and application of information systems and technology.</p>	<p><i>Improvement Science and Quality Principles.</i> Apply evidence-based methods to plan and prioritize quality improvement efforts and measure the impact of these efforts on patient and organizational outcomes.</p> <p><i>Measurement &amp; Process Evaluation.</i> Analyze, interpret, and communicate process and outcome data using qualitative and quantitative tools and methods.</p> <p><i>Safety &amp; Error Science.</i> Apply structured, evidence-based approaches to prevent, identify, and investigate gaps and errors associated with patient care.</p>	
Engagement, Leadership, and Research Management	<p><i>Interprofessional Collaborative Practice.</i> Define and discuss the scope of practice and roles of different health professionals and stakeholders including patients, as well as the principles of team science and team dynamics to solve complex health and health information problems. Apply relationship-building skills and the principles of interprofessional communication in a responsive and responsible manner that supports a team approach to solve complex health and health information problems. Recognize the importance of mutual respect and shared values, as well as one's own role, the role of other professions and stakeholders including</p>	<p><i>Communication.</i> Use communication to build collaborative relationships, develop negotiating skills, and encourage team performance within organizations.</p> <p><i>Interprofessional Collaborative Work.</i> Apply interprofessional collaborative work principles when engaging others to achieve improvement goals.</p>	

(Continues)



TABLE 1 (Continued)

AHRQ competency domain	UAB Master of Science in Health Informatics (HI)	UAB Master of Science in Healthcare Quality and Safety (HQS)	Curricular gap
<p>patients, and the role of teamwork and team science to solve complex health and health information problems.</p> <p><i>Leadership</i></p> <p>Articulate the methods, concepts, tools, and characteristics of leading and leadership. Employ leadership and followership methods, concepts, and tools to motivate others toward accomplishing a health informatics vision. Demonstrate leadership behaviors for achieving a vision for health informatics solutions.</p>		<p><i>Leadership.</i> Apply models of leadership to create, manage, and lead teams to achieve organizational goals.</p> <p><i>Patient and Family – Centered Engagement.</i> Apply population health management strategies into healthcare quality and engage stakeholder groups in the development of strategies to improve healthcare quality and population health, including reductions in health and health care disparities.</p>	

educational approaches will vary according to the level and type of leader. Many of the leaders within healthcare institutions moving to embrace LHS may not enroll in a formal educational program and yet they have critical influence on LHS success.

For example, one of the central outcomes of an LHS is improving and sustaining quality of care. Previous studies describe the importance of culture as a critical component of healthcare quality improvement.<sup>26,27</sup> As such, in order for an LHS to truly be successful, a culture of change must be created, supported, and sustained, starting from the top of the organization and supported at every level.<sup>28-30</sup>

It is imperative that healthcare workers *at all levels* be given opportunities to lead the change that supports LHS success.<sup>31,32</sup> Creating, supporting, and sustaining a culture that allows the learning from an LHS to be implemented can be accomplished through identifying effective leaders at all levels to facilitate collaboration and change.<sup>24,25,33</sup> In short, everyone engaged in an LHS must be able to lead change and support a learning culture and all leaders in the organization must understand LHS concepts.

UAB Medicine Quality Academy is an educational program situated in the UAB Medical Center that identifies personnel at all levels within the healthcare system with leadership potential and provides them an opportunity to enroll in a semester-long program for graduate credit. The program articulates with the HQS graduate degree program. An internal study of Quality Academy graduates suggests that 78% felt they work in an environment where a quality culture is supported and sustained as compared to 63% of the general UAB Health System healthcare workers.<sup>34</sup> Many of the graduates of Quality Academy go on to take the Master's program in HQS, providing an even more intensively trained workforce. While the UAB Quality Academy and over 50 similar programs within health systems around the country have focused explicitly on healthcare quality and safety, these are education and training programs that may certainly benefit from additional content that specifically focuses on LHS competencies, organized in any of the ways we identified above.

#### 4 | HONING LHS COMPETENCY DEVELOPMENT

As evidenced by this special issue, the way we ideate, develop, educate, and execute LHS is maturing and changing. Part of that maturation is gaining the understanding that what we started with may not be enough to advance the initiative, in this case, LHS. For example, when the AHRQ LHS competencies were developed, they were thought to be comprehensive, at least for researchers. However, there are areas that are missing from the AHRQ competencies, and perhaps from many programmatic competencies that likely were not even a consideration before the pre-COVID-19 pandemic. The pandemic will likely be viewed for decades as a pivotal event that changed the way we think about healthcare delivery and the role of the consumer in that delivery. Some examples include epidemiology, system codes to

ensure accurate and adequate data interpretation, and dissemination of the recommended changes so that they can be recognized and/or adopted as applicable throughout the organization and spread to other organizations. A more explicit focus on dissemination would be especially helpful for LHS workforce development.

In addition, health systems must continually seek to become patient centered, meaning improvements should meet the cultural, socioeconomic, and other needs of patients, and should encourage patients to be more engaged in their care. As health systems look toward increasing patient engagement, as well as management, and advocacy over their own healthcare, attention to the patient should be incorporated into the competencies. More health technology is now in the hands of consumers, and they are given greater access to their health information within hospital information systems, leading to the designation of “e-patients.”<sup>35</sup> The information is used by consumers to drive healthcare decisions and by clinicians to deliver healthcare.<sup>36</sup> The data collected from patients and their providers should allow delivery organizations to understand the unique needs of specific populations, such as those who have chronic health conditions, or are under-resourced. In essence, future competency development must include consideration of how new technologies, delivery system improvements, and associated data can best promote and support the maturation of patient-centered care.

We continue to reevaluate and enhance the UAB HI and HQS program competencies, within the constraints imposed by accreditation requirements. Both degree programs require applied capstone projects and LHS competencies can be appropriately addressed within students' applied projects, even if they are not addressed explicitly in individual courses. This use of integrative applied capstone projects can be useful both for students to synthesize their learning to meet required competencies and for LHS as well. As LHS continue to advance, there are new opportunities to work closely with educational programs to develop a pipeline of capstone projects such that the capstone projects originate and are incubated within the LHS infrastructure, creating a natural process for system-wide dissemination, learning, and application. This collaboration with active LHS represents an area of future exploration for educating an LHS workforce.

Absent a workforce with appropriate multiple disciplinary training, institutions bring together workers with layered or single disciplinary expertise such that, as a collective, they form effective, multiple disciplinary teams to address LHS needs. However, advancement of LHS will soon require leaders and a workforce with broader knowledge and skills appropriate for increasing the LHS reach and impact within and across the organization. Unfortunately, when organizations try to hire for newly emerging fields, they often rely on outdated job postings that do not accurately capture the knowledge and skills that are required. The field of informatics has faced that issue and addressed it in part by publishing descriptions of the needed competencies.<sup>12,37,38</sup> As LHS mature, and the needed competencies are refined, it is imperative that job descriptions reflect the multiple disciplinary competencies that are needed.

## 5 | CONCLUSION

This paper suggests various mechanisms for addressing challenges to educate an LHS workforce. The current educational competencies of two graduate programs at the University of Alabama at Birmingham are examples of educational competencies that are aligned with AHRQ's LHS competencies. In aligning the competencies, it was apparent that the two disciplines, Health Informatics and Healthcare Quality and Safety, which are both central components to an effective LHS, had both overlapping and complementary alignment with LHS competencies. An environment where there are multiple relevant educational programs, such as HI and HQS, could be beneficial in training a workforce with appropriate breadth and depth of knowledge and skills needed for a successful LHS. Both the HI and the HQS programs at UAB have leadership baked into every course as well as additional professional development to further develop leaders. As we think about the workforce development needed to support an LHS, we suggest that there are three potential avenues for training: (a) develop a new educational program, (b) collaborate across separate existing programs, or (c) produce a set of instructional materials. While the different approaches have their advantages and are not mutually exclusive, the importance of having a trained LHS workforce cannot be overstated. Finally, to address LHS growth and maturity, it will be essential to revisit the LHS competencies and educational programs to ensure that they are meeting the needs of advancing LHS within an organization and across the US.

## CONFLICT OF INTEREST

None of the authors have any relevant conflicts of interest to declare.

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